Cost Benefit Analysis of a Regional Arterial PPP Toll Road Project
A Case Study of the Proposed R-1 Toll Road

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ABSTRACT

Road infrastructure is of vital importance. Roads facilitate the movement of people, goods, services and resources within an economy. Traditionally, public infrastructure such as roads has been provided using national budgetary resources. Over time participation of the private sector in the procurement and provision of road infrastructure has increased. Public authorities have been partnering with the private sector due to the limitation of capital to undertake required road projects.

Public-Private Partnerships (PPPs) of various forms have been used extensively in road transportation projects as an alternative to state and local government procurement and provision of road infrastructure.

The primary objective of this thesis is to undertake a holistic assessment of a proposed PPP toll road project in the Southern African country of Zimbabwe; using Cost-Benefit Analysis (CBA).

Keywords: Infrastructure, Toll Road, Public-Private Partnership, Cost Benefit Analysis, Zimbabwe

ÖZ

Karayolu altyapısı büyük önem taşımaktadır. Karayolları insanların, malların, hizmetlerin ve üretim faktörlerinin ekonomi içindeki hareketlerini kolaylaştırır. Geleneksel olarak, karayolları gibi açık altyapılar ulusal bütçe kaynakları kullanılarak sağlanmaktaydı. Zaman içinde özel sektörün karayolları alımı ve tedariğine katılımı, altyapıyı arttırdı. Yetkili Kamu makamları gerekli yol projelerini üstlenecek sermayenin sınırlı olmasından dolayı özel sektörle ortaklık yapmaktadır.

Eyalet ve yerel yönetimin karayolu alımı ve tedariğine alternatif olarak, Kamu - Özel Ortaklıkları (PPPs), çeşitli biçimlerde, karayolu ulaştırma projelerinin yapımında sıklıkla kullanılmıştır.

Bu tezin temel amacı, Fayda-Maliyet Analizini (CBA) kullanarak Günay Afrika ülkesi Zimbabve'de, Kamu - özel ortaklığında (PPP) önerilen ücretli yol projesinin bütünsel değerlendirmesini yapmaktır.

Anahtar Kelimeler: Altyapı, Ücretli Yol, Kamu-Özel Ortaklığı, Fayda Maliyet Analizi, Zimbabve

To My Beloved Family

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LIST OF ABBREVIATIONS

ACS	Accident Cost Savings
ADSCR	Annual Debt Service Coverage Ratio
ADT	Average Daily Traffic
BOT	Build Operate Transfer
CBA	Cost Benefit Analysis
CSCF	Commodity Specific Conversion Factor
DCF	Discounted Cash Flow
DCFM	Discounted Cash Flow Model
EOCK	Economic Opportunity Cost of Capital
ERR	Economic Rate of Return
FAST	Flexible, Appropriate, Structured and Transparent
FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
GDP	Gross Domestic Product
GoZ	Government of Zimbabwe
GRDP	Gross Regional Domestic Product
HDM	Highway Development and Management
IIA	Integrated Investment Appraisal
IRR	Internal Rate of Return
LLCR	Loan Life Coverage Ratio

MIRR	Modified Internal Rate of Return
MoTID	Ministry of Transport and Infrastructure Development
NPV	Net Present Value
PPIAF	Public-Private Infrastructure Advisory Facility
PPP	Public-Private Partnership
PV	Present Value
RRR	Required Rate of Return
RSA	Revenue Sharing Agreement
RUC	Road User Costs
SADC	Southern African Development Community
TTS	Travel Time Savings
VOC	Vehicle Operating Costs
VoT	Value of Time
ZIMRA	Zimbabwe Revenue Authority
ZINARA	Zimbabwe National Road Administration

Chapter 1

INTRODUCTION

1.1 Background

Transportation infrastructure is of vital importance for the development of a country. Transportation facilitates the movement of people, goods, services and resources within an economy. Like the circulatory system of the human body, transportation networks allow for the proper functioning of an economy as both human and capital resources are distributed from their source areas to areas of employment. Transportation also facilitates the delivery of products and services to markets.

Traditionally public infrastructure such as transportation has been provided using state and local government budgets. Over time participation of the private sector in the procurement and provision of transportation infrastructure has increased most notably in the roads sector. Public authorities have been partnering with the private sector due to the limitation of capital to undertake the required transportation projects and inefficacies of public authorities in the provision and maintenance of transportation infrastructure. Public-Private Partnerships (PPPs) of various forms have been used extensively in road transportation projects as an alternative to state and local government procurement and provision of road infrastructure.

1.2 The aim of the Study

The primary objective of this thesis is to undertake a holistic assessment of a proposed PPP toll road project in the Southern African country of Zimbabwe. This assessment will be conducted using Cost-Benefit Analysis (CBA).

1.3 Structure of the Thesis

The thesis is structured as follows;

i. **Chapter 2:** Literature Review of the current road infrastructure as well as infrastructure procurement methods in Zimbabwe.
ii. **Chapter 3:** Overview of the proposed toll road project.
iii. **Chapter 4:** A detailed review of the Methodology used to assess the project.
iv. **Chapter 5:** In-depth Financial Analysis of the toll road project.
v. **Chapter 6:** In-depth Economic Analysis of the toll road project.
vi. **Chapter 7:** In-depth Stakeholder Analysis of the toll road project.
vii. **Chapter 8:** An assessment of the toll road project's risks using Risk Analysis techniques.
viii. **Chapter 9:** Concluding remarks on the assessment outcomes of the toll road project.

Chapter 2

LITERATURE REVIEW

2.1 Zimbabwe’s Transportation Sector

Zimbabwe is a landlocked country. The primary modes of transportation used in the country comprise aviation, pipelines, railways and roads. However, road transportation is the most prominent mode of transportation; due to the country being landlocked.

2.3 Zimbabwe’s Road Infrastructure

Zimbabwe’s arterial road network totals well over 76,241 kilometres, of which 9,256 kilometres are bitumen paved roads (African Development Fund, 2013). The tarred roads constitute to around 12% of the total road network. The state and condition of this road network has been rapidly deteriorating over the years due to irregular and inadequate maintenance; mostly as a result of a constrained fiscal budget. Zimbabwe’s road infrastructure has one of the least maintained road networks, with 34% and 14% of the road network being classified to be in fair and good condition respectively (Africa Infrastructure Country Diagnostic, 2011). In light of the AICD report, 52% of Zimbabwe’s roads are in bad shape. Rehabilitating these roads that are in poor condition as well as maintaining those that are in decent shape will require a lot of monetary resources. Estimates highlighted by various tabloids put the necessary funding between US$ 12-24 billion. This is a steep cost that the Government of Zimbabwe (GoZ) may not be able to foot using its coffers.

2.4 Road Infrastructure Procurement

Before 2000 to 2001 institutional reforms in Zimbabwe's road sector, the financing of the construction and maintenance of road infrastructure was carried out by the government using the national budget (Africa Infrastructure Country Diagnostic, 2011). The road sector reforms shifted the road sector project funding from the national budget in favour of the use of road user fees which would go into the road fund which is managed by the Zimbabwe National Road Administration (ZINARA). Despite the setting up of a road fund, resources collected have never been sufficient to keep up with maintenance and construction needs.

2.5 Plans to Develop Road Infrastructure

As road infrastructure is vital to the economic growth of Zimbabwe, the GoZ has initiated a programme targeted at improving the country's inadequate road network through the Zimbabwe Agenda for Socio-Economic Transformation (Zim Asset, 2013). Under Zim Asset some road interventions have been proposed which are outlined below:

1. The rehabilitation, improvement and construction of state of the art road infrastructure that meets the regional standards set out by the Southern African Development Community (SADC).
2. The use of alternative infrastructure procurement methods; such as Public-Private Partnerships (PPPs).
3. The Mobilization of resources to maintain road infrastructure by employing the user pay principle; in which case road users will face toll charges for using road infrastructure.

Chapter 3

PROJECT OVERVIEW

3.1 Introduction

The R-1 road is an arterial road the forms part of the North-South Corridor, which is a significant import/export route in Central and Southern Africa. The R-1 links Zimbabwe to Zambia in the northern part of the country and South Africa to the south. Figure 1, shows a map of the R-1 Road.

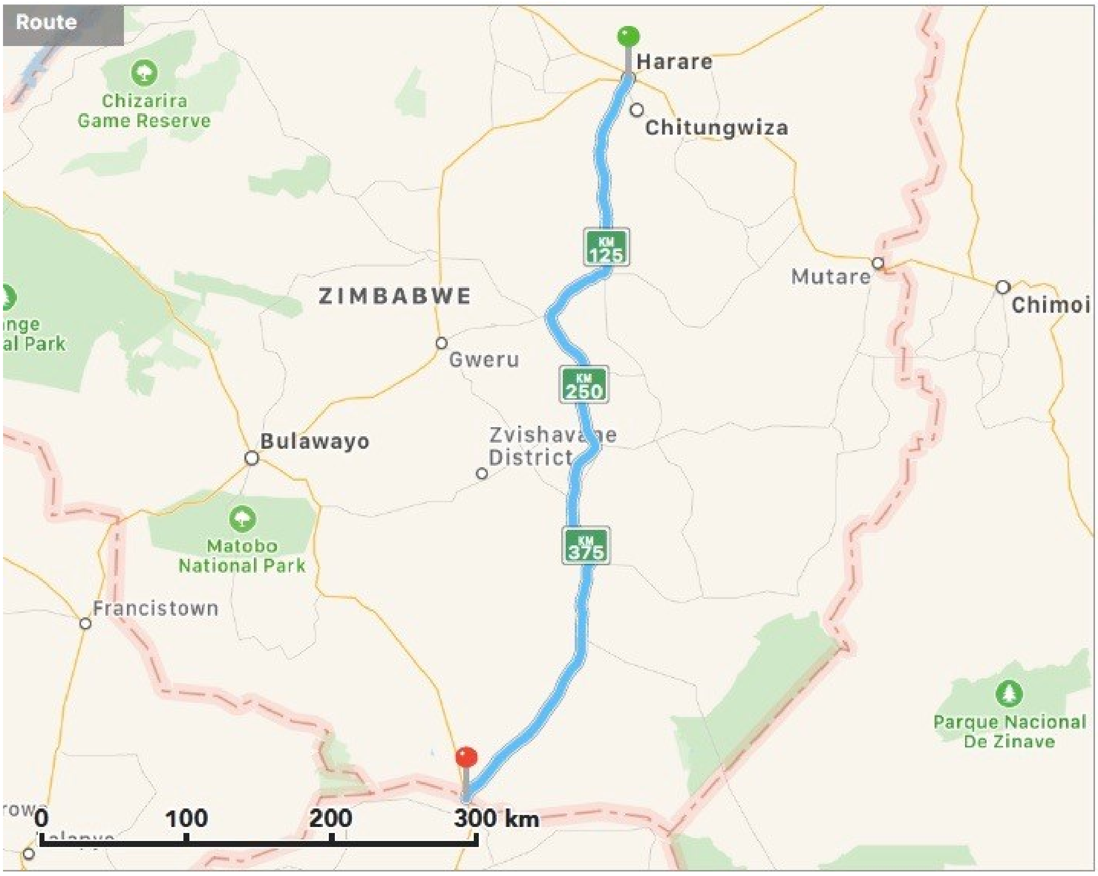


Figure 1: Map of the R-1 Road

The road is one of the busiest routes in the country facilitating the passage of an average of 26,000 vehicles per day. The road was constructed well over 50 years ago. When the road was built, it was designed to have a service life of 20 years, meaning that it has outlived its design life. Due to the wear and tear caused by traffic flowing on the road, most especially heavy goods vehicles (HGVs) and a lack of regular repair and maintenance to keep the road in a decent condition, the road is increasing dilapidating; this has led to rising costs of operating vehicles, as well as increased travel time. Also, the challenges faced on the R-1 have been further compounded by the increased frequency of road accidents. The GoZ is prioritizing the rehabilitation of the R-1 due to its importance as a road link that facilitates regional road traffic.

3.2 Road Conditions "Without" The Project

The R-1 is currently a single carriageway two-lane road. The cross-section of the road averages around 10 meters along the whole length of the road. However, the width of the road has been eroding due to the shoulders of the road breaking from wear and tear as well as the effects of weather conditions such as rainfall. Additionally, the road pavement has surpassed the recommended International Roughness Index (IRI), which has led to poor ride quality.

3.3 Project Scope

The R-1 road spans a length totalling 585 kilometres. However, only 570 kilometres will be part of the rehabilitation and construction of the R-1 toll road project as other parts of the road have already been improved. The road project is proposed to be implemented as PPP under a Build, Operate, and Transfer (BOT) arrangement, with the private sector concessionaire being awarded a 23-year concession. The road which was not previously tolled will commence the collection of user tolls once it is completed and become fully operational.

3.4 Road Conditions "With" The Project

As the R-1 is a part of SADC's regional road network, it must be built in line with the regional body's road standards. Some of the standards that the R-1 should comply with are outlined below:

1. The average cross-section of a single carriageway two-lane road should be no less than 12.5 meters.
2. The road pavement should have a structural capacity of 18 million ESALs.[1]
3. A free flow design speed of 120 kilometres per hour.
4. Passing lanes were deemed necessary.
5. The widening of bridge structures as required.
6. Bypasses were necessary.
7. Removal of sharp and dangerous curves.

Two alternative investment scales have been proposed for the rehabilitation and construction of the R-1 toll road. The investment alternatives are as follows:

A. **Ultimate Investment Scale**: This option comprises of a four-lane dual carriageway. This will require the rehabilitation and improvement of the existing two-lane single carriageway and the construction of a new two-lane single carriageway parallel to the existing one.

B. **Moderate Investment Scale**: This option comprises the rehabilitation of the existing two-lane single carriageway to meet the standards outlined in the preceding section. In addition, a section of a four-lane dual carriageway totalling 5 kilometres in length will be constructed at identified key junctions.

1 ESAL is the acronym for Equivalent Standard Axle Load, which measures the damage caused by axels carrying different loads on a road pavement. ESAL is a cumulative statistic that represents a stream of traffic of different axle loads.

Chapter 4

METHODOLOGY

4.1 CBA

The CBA framework was applied in appraising the R-1Toll Road Project. CBA is a systematic method of evaluating the costs versus the benefits of undertaking a given intervention (program, project or policy) to determine the overall net impact it has on society and or provide a basis of comparing alternative interventions. CBA entails the monetization of all the costs and benefits of an intervention to allow for a consistent comparison between costs and benefits using a single unit of measure.

As an investment decision tool, CBA is used to determine the financial and socio-economic soundness of undertaking a given project. The justification for proceeding with the project is provided if the benefits outweigh the costs, taking into account the opportunity cost of resources used and the time value of money. Simply put CBA measures the net benefits of undertaking the investment in present value terms. The present value of net benefits is equal to the present value of benefits minus the present value of costs.

$$PV\ of\ Net\ Benefits = PV\ of\ Benefits - PV\ of\ Costs$$

4.1.1 Discounted Cash Flow Model

The CBA of the R-1 Toll Road Project was conducted using the Discounted Cash Flow Model (DCFM). The DCFM is a method widely employed to derive the net value of an asset (company or project). This net value is derived from the projections of the future cash inflows (revenues/benefits) and cash outflows (expenditures/costs) that will be generated and or incurred by the project in future periods. The net cash flow within a given period is equal to the cash inflows minus the cash outflows. The future net cash flows generated by the project are discounted to their present values using the opportunity cost of capital, they are then summed up to arrive at the Net Present Value (NPV). The DCFM method was used to compute the NPV of the project, which is synonymous with the PV of Net Benefits. NPV is an investment decision criterion that can be used to judge both the financial and socio-economic prospects of undertaking a project; a positive NPV indicates the project's benefits outweigh the costs.

4.1.2 Discount Rates

Discount rates are an important consideration when conducting a CBA, not only are they used to discount future cash flows in a DCFM to their PVs. Their most important use comes in accounting for the marginal social rate of time preference, the opportunity cost of capital and the costs associated with domestic and foreign borrowing.

Discount rates are used to ration the use of capital resources. If the financial or economic rate of return generated by a project is lower than the required rate of return, then these funds are better used elsewhere. For financial analysis, there are two discount rates that can be used depending on which perspective you are looking at. The first perspective is that of the sponsor/equity holder. With respect to the sponsor the discount rate represents the risk-adjusted Required Rate of Return (RRR) that will induce the sponsor to inject funds into the project, if the NPV generated by the project, discounted at the RRR is negative, or the Internal Rate of Return (IRR) is less than the RRR then the sponsor will not be willing to fund the project. This issue is of immense importance in projects such as the R-1 Toll Road which seek to provide public infrastructure using private sector funding. For the purposes of this CBA, a RRR of 12% was used as it reflects the estimated average real rate of return that private investors require.

The second perspective is that of the public sector trying to measure the financial viability of the project. In this case, it is suggested that the rate used for economic analysis be applied here as this is a good proxy of the opportunity cost of capital that will be incurred if the public sector were to fund the project using its own funds or debt from local and or international lending institutions.

Capital resources are scarce and should be put to their best use given the various alternative uses for those funds. When it comes to economic analysis, the Economic Opportunity Cost of Capital (EOCK), which is a weighted average cost of funds should be used. In this CBA the EOCK used is,12%.

4.1.3 Cash Flow Modelling using Microsoft Excel

Microsoft Excel was utilized to develop the DCFM used to analyze the feasibility of undertaking the proposed R-1 Toll Road Project. The Flexible, Appropriate, Structured and Transparent (FAST) Financial Modelling Standard was applied to the development of the DCFM. The FAST Standard is a well-known Standard used to build robust, reliable and transparent models; it is used by many prominent multinational and multilateral organizations to construct models used in the valuation of various kinds of transactions.

4.2 Integrated Investment Appraisal

The appraisal of most projects is purely financial and excludes the socio-economic aspects. This kind of approach to investment appraisal is satisfactory for private sector projects were the incentive and motivation behind developing the project is purely profit-making. In the case of public sector projects; such as the provision of road infrastructure, the social and economic impacts of the project should also be included in the appraisal of the project to better equip decision makers about the social net effects the project will have. Integrated Investment Appraisal (IIA) is a method used to evaluate both the financial and socio-economic effects of a project as well as the risks inherent within the project. IIA's holistic approach of integrating the financial, economic, stakeholder and risk components of a project allows for the estimation of the project's impacts from various perspectives. IIA methodology was applied to the CBA of the R-1 Toll Road Project, allowing for all the different aspects that may affect the financial and socio-economic viability and sustainability of undertaking the project to be properly assessed given their intricate interactions.

4.3 Project Appraisal Framework

The rehabilitation, improvement and construction of the R-1 Highway does not entail the development of road infrastructure from scratch; rather it builds upon existing infrastructure. Any new infrastructure added as a result of the R-1 Road Project will augment the existing stock of assets. Therefore, the correct approach in appraising a brownfield project such as this one is to evaluate the incremental impact of adding on the project to the existing road infrastructure. This entails the conceptualization of two states of nature:

1. "with the project"
2. "without the project"

The first state identifies the benefits and costs that are likely to prevail if the project is implemented, whereas, the second state identifies the benefits and costs that are likely to prevail if the project were not undertaken. The incremental impact is measured by subtracting the net benefits of the “without” case from the “with” case. This distinction between the “with”/“without” scenario is clearly and consistently maintained throughout the analysis, so that the additional benefits and costs that arise as a result of undertaking the project can be properly identified and quantified. The “without” scenario does not mean that nothing will be done to the existing road; the “without” case entails a situation in which the road is kept in its optimal condition; in other words, the costs and benefits of maintaining the road should be part and parcel of the “without the project” scenario.

4.4 Financial Analysis

The first step in the IIA of the R-1 Toll Road Project is to evaluate the feasibility of undertaking the project. This entails estimating the profitability of constructing and operating the toll road over the stipulated 23-year concession period. Financial analysis is a crucial element as it allows the project’s sponsor to measure the project’s ability to recover capital expenditures and operating expenditures while still providing an acceptable return to the equity holders. Financial analysis is conducted using the Incremental Cash Flow Statement. The two main measures of profitability used to assess the project’s viability and sustainability from the sponsor/equity point of view, are the Financial Net Present Value (FNPV) and the Financial Internal Rate of Return (FIRR). For the project to be palatable for the sponsors, it must provide a positive FNPV and have an FIRR that is greater than the required rate of return.

As the project will require a portion of its projected capital expenditure to be financed using credit from a lending institution, the lending institution will also have an interest in the potential viability and sustainability of the project. The lending institution’s main concern is the ability of the project to meet its debt repayment obligations over the tenure of the loan. From the lender's point of view, the Annual Debt Service Coverage Ratios (ADSCRs) and the Loan Life Coverage Ratios (LLCRs) are a useful gauge of the project's potential to service the loan. Any ADSCR or LLCR below a given benchmark set by the lending institution signify potential problems and risks for the lender.

The government also has a keen interest in the financial prospects of the project. One of the key interests of the government is to balance the profitability of the sponsor with the provision of road infrastructure at an affordable rate to road users. Given the FNPV and FIRR from the financial analysis, the government may take measures to incentivize the project, such as the provision of tax breaks and holidays, grants, subsidies and or guarantees.

4.5 Economic Analysis

Unlike financial analysis which measures the viability and sustainability of the project from the point of view of a handful of the project's stakeholders (mainly sponsors and lenders), economic analysis measures the net socio-economic impact the project will have on the economy and the society as a whole. Additionally, the measurement of the project's costs and benefits in economic analysis is not based on the market value of inputs and outputs as is done in financial analysis.

For economic analysis, the economic/shadow prices of inputs and outputs are used. Economic prices differ from market prices as they omit market distortions such as taxes, subsidies, import duties and tariffs, and price controls. Market distortions are removed from economic prices as they are transfers and therefore, they do not represent resource costs. The first step in conducting economic analysis is to convert all of the projects benefits and costs from the financial analysis into their economic equivalents.

This is done using Commodity Specific Conversion Factors (CSCFs). The second step is to construct an Incremental Economic Resource Flow Statement, which is used to compute the Economic Net Present Value (ENPV) and the Economic Rate of Return (ERR), the two metrics used to measure net socio-economic impact of the project. A positive ENPV shows that there is a net increase in the wealth and welfare of the economy and society as a whole. An ERR that is greater than the EOCK is synonymous to the conclusions drawn from a positive FNPV as discussed in the preceding section on financial analysis.

4.6 Stakeholder Analysis

Stakeholder analysis which is also known as distributional analysis is used to identify which stakeholders gain or lose as a result of the project. The gains and losses are quantified and allocated to the respective stakeholders. Stakeholder impacts are easily identified using the IIA method, as they are simply the result of subtracting the incremental financial costs and benefits from their incremental economic costs and benefits. Stakeholder impacts are also known as externalities and can have a significant part to play in the decision making of a proposed project such as the R-1 Toll Road.

It is important that the project's sponsors and government pay serious attention to them, as disgruntled stakeholders can stop the implementation of even the best of projects. Stakeholder analysis, therefore, functions as a barometer to measure if all stakeholders' interests are being met and what can be done to incentivize or compensate those that stand to lose from the project.

4.7 Risk Analysis

The DCFM used in the IIA is a deterministic base case that is subject to change based on the accuracy of the inputs and assumptions used to construct the model, as well as an ever-changing macroeconomic environment. This means that the financial, economic and stakeholder outcomes arrived at using the DCFM are not know with 100% certainty. There is a need to not only to identify the potential challenges and risks that may negatively impact the project and make it unviable and unsustainable, but a requirement to find ways to mitigate and manage the risks.

The identification of risky variables can be accomplished using sensitivity analysis. Sensitivity analysis simply seeks to uncover how a given model output such as FNPV changes as an input variable such as the toll rate is changed by a given percentage. Small percentage changes in an input that result in large changes in the output indicate that the input is a risky variable that can significantly alter the overall outcome of the project.

Sensitivity analysis is limited in that it only allows the testing of one variable at a time. Risk analysis, on the other hand, is more useful that sensitivity analysis as it allows for the testing of many variables simultaneously as well as the correlations between these variables. Risk analysis can be conducted using simulation software such as Monte

Carlo which works seamlessly with Microsoft Excel-based models. Monte Carlo simulations turn deterministic models into probabilistic models which are more dependable as they allow end users and decision makers to have a sense of the probability of obtaining a given outcome from undertaking a project. Monte Carlo Simulations also have the added advantage of testing how risk mitigation measures such as the employment of contracts as minimum revenue guarantees (MRGs) used in PPP toll road project affect the outcomes of the project. Both sensitivity and risk analysis were utilized to measure various risk impacts and risk management tools such as the MRG and the Revenue Sharing Agreement (RSA).

Chapter 5

FINANCIAL ANALYSIS

5.1 Introduction

One of the key pillars of an IIA of a project is the financial analysis. Financial analysis was undertaken to ascertain the viability as well as sustainability of implementing the R-1 toll road project. Financial analysis is of crucial importance in a PPP arrangement. The private sector's incentive is generating a rate of return that is greater than or equal to the required rate of return. While on the other hand, banking institutions that provide financing to the project, are keen to know if the project generates returns sufficient enough to cover its debt obligations.

As a PPP toll road, the R-1 will generate a revenue stream throughout its operational life. However, the R-1 toll road project will incur capital expenditures during the construction of the road, as well as operating and maintenance expenditures during the operational life cycle of the project. The aim of the financial analysis is to weigh the project's revenues (cash inflows) against its expenditures (cash outflows), to determine if the net cash flows (cash inflows minus cash outflows) over the life of the project are adequate in terms of recouping capital expenditures, as well as providing equity holders with an acceptable rate of return. Furthermore, the net cash flow is useful from the banker's point of view, as it is used to assess the project's ability to repay debt financing (principal and interest).

To measure the financial impact of the project on the equity holders and the financial institutions providing debt financing, two distinct cash flow statements were constructed for each of these stakeholders. The cash flow statement from the point of view of the financial institutions explicitly excludes debt financing and debt repayment, so as to measure the strength of the project's net cash flow to carry the debt obligation. The cash flow statement from the point of view of the equity holders includes both debt financing and debt repayment so as to accurately measure the returns to equity net of the cost of debt financing. By making use of the cash flows from the equity and lenders point of view, the returns to equity and the project's ability to cover its debt obligations were estimated and are presented in section 5.5.1 and 5.5.2 respectively.

The financial analysis of the R-1 toll road project starts by outlining the input parameters and assumptions used to conduct the analysis (section 5.2). The three alternative scales of investment at which the R-1 toll road project can be implemented, their technical details and their respective capital investment costs are detailed in section 5.2.2. These investment scales serve to identify the optimal scale of investment of the R-1 toll road project. The proposed project financing structure is presented in section 5.2.3, while the operations and maintenance costs are given in section 5.2.4. Road traffic projections on the R-1 toll road as well as toll revenue forecasts over the project's operational life are discussed in detail in section 5.3. After defining all of these assumptions which are crucial to the financial assessment of the R-1 road project, the projected incremental cash flow statements from the equity and lenders point of views are presented and discussed in section 5.4. The financial analysis concludes with section 5.5 which outlines the results of the financial analysis as well as a discussion of whether the project is a financially sound investment to undertake from the perspective of both the equity holders and the lenders.

5.2 Input Parameters and Assumptions

5.2.1 General Parameters and Assumptions

This section outlines the more general parameters and assumptions utilized to construct the financial model of the R-1 toll road project.

Project Timing

The R-1 toll road project was assumed to have a 23-year concession, starting in 2017 and ending in 2039. The first three years (2017-2019) were set aside for the rehabilitation, improvement and construction of the road. The project is assumed to open up to traffic in 2020 and operate under the management of the concessionaire until 2038, during this period of 19 years the project will collect tolls and ensure the road is maintained in good working condition. 2039 has been reserved as the liquidation period, during this period the project will undertake major maintenance before transferring the road infrastructure to the Ministry of Transport and Infrastructural Development (MoTID).

Road Length

The total length of the R-1 road that will undergo rehabilitation, improvement and construction equates to 570 kilometres. Eight toll plazas will be constructed and put to use during the project's operations period. The distances covered by each toll plaza are presented in Table 1. Road tolls will be charged based on the distance travelled on a per kilometre basis. Details of the per kilometre toll charges are outlined in Table 5.

Table 1: Distance Covered by each Toll Plaza

Toll Plaza1: Excelsior	68.00	Km
Toll Plaza 2: Chivhu North	60.00	Km
Toll Plaza 3: Chivhu South	54.00	Km
Toll Plaza 4: Masvingo North	99.00	Km
Toll Plaza 5: Masvingo South	48.00	Km
Toll Plaza 6: Ngundu North	48.00	Km
Toll Plaza 7: Ngundu South	94.00	Km
Toll Plaza 8: Lutumba	99.00	Km
Total Distance of R-1	**570.00**	Km

5.2.2 Project Scale and Capital Expenditure

The alternative investment options proposed for the rehabilitation, improvement, and construction of the R-1 toll road that adhere to the regional standards defined by SADC are outlined in section 3.4.

The projected capital expenditure costs of each of these options are presented in Table 2 in 2017 prices. The financial viability and sustainability of undertaking the R-1 toll road project at the different scales presented above are discussed in section 5.5.

Table 2: CAPEX of the R-1 Toll Road Project at Different Investment Scales

		Ultimate Scale	**Moderate Scale**
Cost of Road Works	USD 'M	1,156.38	524.58
Cost of Bridges and Approaches	USD 'M	162.36	47.57
Cost of Installing Lighting	USD 'M	3.12	4.57
Cost of Installing Traffic Signals	USD 'M	6.18	8.25
Cost of Toll Plazas	USD 'M	15.22	9.51
Cost of Weighbridges	USD 'M	14.27	14.27
Cost of Truck Stops	USD 'M	6.66	6.66
Total Capital Cost	**USD 'M**	**1,364.19**	**615.40**

5.2.3 Project Financing

The proposed financing structure is that senior debt will contribute 60% of the total capital expenditure, while equity will contribute 40%. The following are the assumed loan terms and conditions, used to construct the debt repayment profile:

- The loan will be drawn down over a period of 3 years, which corresponds to the construction period. 40% of the loan is assumed to be drawn-down in the first year of construction, while the remaining 60% is drawn-down in equal proportions during the second and third years of construction.
- The loan repayment period, during which the principal and interest will be paid is assumed to be 13 years. The interest payments are expected to attract a real rate of interest equivalent to 4% per annum. Interest payment accrued during the construction period will be capitalized.
- The loan is also expected to attract a financing cost of 7.75% of the initial principal. This financing cost is made up of two components; a commitment fee of 0.75% and an upfront fee of 7%.

5.2.4 Project Operating and Maintenance Expenditure

"Without" the R-1 toll road project, it is anticipated that the road will undergo maintenance to keep it in good working condition. It is estimated that on an annual basis the road would require around US$ 2,560 per kilometre for routine maintenance. On the other hand, major maintenance is assumed to be conducted once every decade and is expected to cost around US$ 600,000 per kilometre. The maintenance costs "with" the R-1 toll road project are presented in Table 3. Routine maintenance with the R-1 road project will be carried out on an annual basis, while periodic maintenance will be undertaken once every decade and major maintenance occurs once during the liquidation period.

Table 3: Maintenance Expenditure "with' the R-1 Road Project

		Ultimate Scale	Moderate Scale
Routine Maintenance - with R-1 road project	M' USD/km	0.010	0.005
Periodic Maintenance per - with R-1 road project	M' USD/km	0.170	0.107
Major Maintenance - with R-1 road project	M' USD/km	1.440	0.911

The annual operating costs of the R-1 road project which mainly consist of running the toll plazas and paying the workforce are set at 12.50% of the annual total toll revenues. In terms of working capital, the project will not maintain any accounts receivable as all the toll fees will be on a cash rather than a credit basis. However, the project will reserve a cash balance equal to 4% of the annual total toll revenues for various operational expenditures and will receive certain goods it needs for maintenance activities on credit; the accounts payable is projected to account for 8% of the total annual operating and maintenance expenditures. As far as taxation is concerned the project is expected to receive a corporate income tax exemption for the first five years of operations, as of the 6th year of operations the project will be liable to a concession corporate income tax rate of 15%. The project is assumed to face an AIDS levy on income tax equal to 3% as well as VAT of 15%.

5.2.5 Base Traffic and Road User Costs

Base Traffic

The base traffic data used to forecast traffic and revenue over the project's operational life is from estimates that were made in 2016, which are based on a traffic count surveys conducted by BHRE Association in 2012. The Average Daily Traffic (ADT) expected to travel along each toll plaza section of the R-1 toll road as of 2016; which is categorized by vehicle class and traffic growth scenario is presented in Table 4. The traffic growth scenarios were computed as follows:

a) Base case scenario “likely growth,”

b) Optimistic case scenario “high growth”

c) Worst case scenario “minimum growth.”

Further details on these traffic growth scenarios are provided in section 5.3.

Road User Costs (RUCs)

RUCs consist of vehicle operating costs (VOCs), the value of time (VoT), and accident costs for the “without” project scenario. For the “with” project scenario, all the preceding costs will apply as well as an additional road user charge in the form of a toll. The impact that the toll road project will have on road users of all vehicle classes is computed by finding the difference between the RUCs “with” the road project and the RUCs “without” the road project. The estimated RUCs “with” and “without” the project are presented in Table 5.

Table 4: Base Annual Daily Traffic for Each Traffic Growth Scenario

Toll Plaza	ADT by Vehicle Class	High Growth	Likely Growth	Low Growth
Excelsior North	Cars	4118	3,294	2,471
	Buses and Light Goods Trucks	486	389	292
	Heavy Goods Trucks	688	550	413
	Semi-trailer Trucks	849	679	509
Chivhu North	Cars	3,368	2,694	2,021
	Buses and Light Goods Trucks	419	335	251
	Heavy Goods Trucks	529	423	317
	Semi-trailer Trucks	874	699	524
Chivhu South	Cars	1,921	1,537	1,153
	Buses and Light Goods Trucks	261	209	157
	Heavy Goods Trucks	433	346	260
	Semi-trailer Trucks	848	678	509
Masvingo North	Cars	2,171	1,737	1,303
	Buses and Light Goods Trucks	330	264	198
	Heavy Goods Trucks	316	253	190
	Semi-trailer Trucks	789	631	473
Masvingo South	Cars	1,833	1,466	1,100
	Buses and Light Goods Trucks	311	249	187
	Heavy Goods Trucks	381	305	229
	Semi-trailer Trucks	719	575	431
Ngundu North	Cars	1,759	1,407	1,055
	Buses and Light Goods Trucks	286	229	172
	Heavy Goods Trucks	423	338	254
	Semi-trailer Trucks	979	783	587
Ngundu South	Cars	1,923	1,538	1,154
	Buses and Light Goods Trucks	261	209	157
	Heavy Goods Trucks	475	380	285
	Semi-trailer Trucks	900	720	540
Lutumba	Cars	2,235	1,788	1,341
	Buses and Light Goods Trucks	340	272	204
	Heavy Goods Trucks	568	454	341
	Semi-trailer Trucks	714	571	428

As can be observed in Table 5, even though the road users will face toll fees “with” the road project, the overall RUCs “with” the project will be less than those “without”, this is due to the significant savings that are expected as a result of the road with respect to VOCs, VoT, and accident costs.

Table 5: Road User Costs - "without" and "with" the R-1 Toll Road Project

		“without”	“with”
VOC – Cars	USD/km	0.220	0.117
VOC - Buses and Light Goods Trucks	USD/km	0.490	0.333
VOC - Heavy Goods Trucks	USD/km	0.930	0.737
VOC - Semi-trailer Trucks	USD/km	1.600	1.363
VoT - Cars	USD/km	0.040	0.035
VoT - Buses and Light Goods Trucks	USD/km	0.110	0.085
VoT - Heavy Goods Trucks	USD/km	0.210	0.084
VoT - Semi-trailer Trucks	USD/km	0.353	0.063
Accident Costs – Cars	USD/km	0.013	0.008
Accident Costs - Buses and Light Goods Trucks	USD/km	0.035	0.027
Accident Costs - Heavy Goods Trucks	USD/km	0.070	0.029
Accident Costs - Semi-trailer Trucks	USD/km	0.114	0.021
Toll Fee – Cars	USD/km	-	0.070
Toll Fee – Buses and Light Goods Trucks	USD/km	-	0.175
Toll Fee – Heavy Goods Trucks	USD/km	-	0.224
Toll Fee – Semi-trailer Trucks	USD/km	-	0.266
RUC – Cars	**USD/km**	**0.273**	**0.230**
RUC - Buses and Light Goods Trucks	**USD/km**	**0.635**	**0.620**
RUC - Heavy Goods Trucks	**USD/km**	**1.210**	**1.074**
RUC - Semi-trailer Trucks	**USD/km**	**2.067**	**1.713**

5.2.6 Macro-Economic Factors

The project is subject to various exogenous factors that can positively or negatively impact the project such as macroeconomic factors. The two major macroeconomic factors that have been identified to most likely have a significant impact on the project are inflation (domestic and foreign) and the Gross Domestic Product (GDP). At the time of the analysis, the domestic inflation in Zimbabwe was found to be 0.91% in 2017, while that of the USA was 2%.

GDP was used to forecast the growth in traffic over the project's life. As a regional road, the traffic travelling on the R-1 road is from various countries within the Southern African Development Community (SADC). Origin and destination data collected during the 2012 traffic survey identified that the majority of traffic travelling on the R-1 (89%) is local traffic, while the remaining 11% is foreign traffic from the Democratic Republic of Congo (DRC), Malawi, Mozambique, Tanzania, South Africa, and Zambia. As some of the traffic travelling along the R-1 is from a number of countries within SADC, a weighted average GDP, coined the Gross Regional Domestic Product (GRDP) was used as the traffic growth rate as it would more accurately reflect the composition of traffic on the R-1. Trade data (the total value of imports and exports) between Zimbabwe and the aforementioned countries was used as weights in computing the GRDP. The annual GRDP figures utilized in forecasting traffic growth on the R-1 toll road are presented in Table 6.

Table 6: Gross Regional Domestic Product

		2017	2018	2019	2020	2021	2022 - 38
Gross Regional Domestic Product	%	3.28%	3.36%	3.96%	4.43%	4.53%	4.71%

5.2.7 Required Rate of Return

The required rate of return (RRR) for the equity holders was assumed to be 12% in real terms.

5.3 Traffic and Revenue Forecasts

The cornerstone of any PPP toll road project is the traffic forecast, as it is the basis of revenue projections which are utilized in determining the financial prospects of the toll road project; as well as negotiating financing for the project be it in the form of a subsidy from the government or a loan from a lending institution (PPIAF, 2016). Hence, producing a reliable traffic forecast is of crucial importance as a toll road project's viability and sustainability hang on the accurate prediction of traffic growth in the future. Unfortunately, traffic forecasting is not an exact science, it is rather quite subjective; predicting traffic growth into future periods is based on a lot of assumptions (PPIAF, 2016). The assumptions used are subject to various kinds of errors and biases. Furthermore predictions of the future are subject to the uncertainty of how things will turn out. This means that traffic and revenue forecasts for toll roads should be approached with caution; as history shows, there are significant variations between traffic and revenue forecasts and actual observations once the toll roads become operational. A study conducted by Standard & Poor's on privately funded toll road projects around the globe between 2002 and 2005, established that on average traffic forecasts of these toll road projects overestimated traffic levels by 23% (Bain, Robert, Polakovic, and Lidia, 2005). To avoid this optimism bias as well as to minimize errors in traffic forecasts the PPIAF recommends that initial traffic forecasts should be made using scenario analysis (PPIAF, 2016). This allows for a range of traffic forecasts rather than a single deterministic forecast which is likely to vary widely with actual observations. Scenario analysis also allows for the project's stakeholders (mainly the equity holders, lending institutions and the relevant government) to make an initial assessment of the financial risk of the project given a change in traffic growth assumptions.

The traffic forecasts on the R-1 toll road were conducted using three different traffic growth scenarios:

i. Scenario A – "Likely Growth": The best case estimate, which is also the base case for the appraisal of the R-1 toll road project is based on the most likely growth pattern given the observations made during the traffic survey conducted in 2012.

ii. Scenario B – "High Growth": Given the average optimism bias of 23% established in the traffic forecasting risk study conducted by Standard and Poor's; traffic in the "high growth" scenario is assumed to be 25% higher than the "likely growth" scenario.

iii. Scenario C – "Low Growth": In this scenario traffic is assumed to be 25% less than the "likely growth" scenario.

The resulting traffic forecast for the R-1 toll road given these three scenarios is presented in Figure 2.

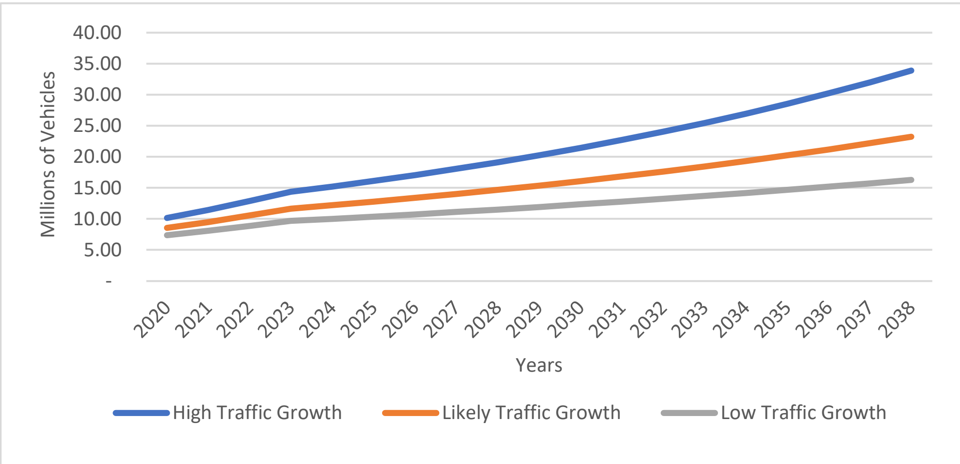


Figure 2: Traffic Projections using Different Growth Rate Assumptions

The R-1 traffic forecast also took into account the effect of the introduction of a toll charge on road users. The imposition of a toll on previously un-tolled roads can lead to adverse behaviour of road users which can affect the viability and sustainability of the road project, such as a drop in road traffic; which can negatively impact the concessionaire's revenues (Jones and Hervick, 1992). Price elasticities of demand were used to measure the response of road users to toll charges by comparing the total RUC's with and without the toll charge.[2] The traffic forecast was adjusted to account for the impact of the introduction of a toll charge. According to the PPIAF, traffic forecast errors mainly stem from the inability of traffic demand models' inadequacies to measure how traffic will react to the introduction of tolls.

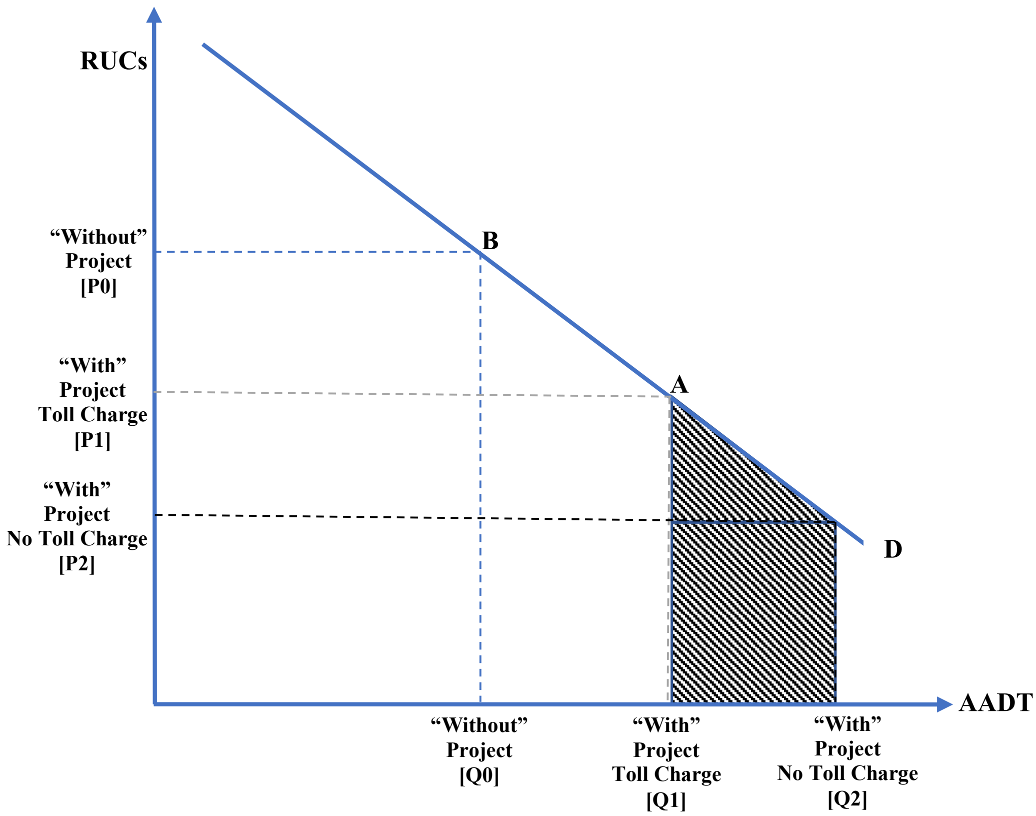


Figure 3: Travel Demand Conditions

2 The price elasticities adopted for the R-1 toll road project model are, -0.40, -0.30, -0.20, and -0.20; for cars, buses and light goods trucks, heavy goods trucks, and semi-trucks respectively.

Figure 3; illustrates the traffic demand situation envisaged for the R-1 toll road project. The traffic demand model developed for the R-1 toll road project assumed that due to the introduction of the toll charge some of the traffic would stop using this route, as shown by the area AQ1Q2D. However, another portion of traffic would be induced to travel along the R-1 toll road due to savings in VOCs as well as travel time savings (TTS), as illustrated by the area BQ0Q1A; both the savings in VOCs and TTS are significantly higher than imposed toll charge as illustrated in Table 5.

5.3.1 Revenue Guarantee

The prevailing concession agreement includes a revenue guarantee for the equity holders (concessionaire) in the form of a Revenue Sharing Agreement (RSA). The RSA agreement, guarantees that if actual traffic levels on the R-1 toll road are lower than the anticipated "likely traffic growth" scenario, the Government of Zimbabwe (GoZ) will fully compensate the concessionaire for the loss in revenue; however, if the actual traffic levels are 5% or more than the "likely growth" scenario, the concessionaire and the GoZ will share any excess revenue generated by the project.[3] The RSA shifts the risk of low traffic volume from the concessionaire to the GoZ, making the project attractive from the equity holders point of view. However, the RSA leaves the GoZ open to a potential contingent liability. Additionally, sharing revenue with the GoZ will lower the concessionaire's returns. An assessment was made to determine the likely impacts of the RSA on GoZ and the concessionaire in the presence of variable traffic.

[3] As the concession agreement was still in the draft and negotiation phases at the time that this study was completed, there was no indication in the RSA agreement as to how the excess revenue generated by the project would be shared between the concessionaire and the GoZ. For the purposes of this study, the split with respect to any excess revenue was assumed to be 50:50.

5.4 Cash Flow Statements

This section of the financial analysis presents the cash flow statements from both the equity holders' and the lender's points of view that were constructed using the data and assumptions provided in the preceding sections. These cash flow statements were used to assess the financial viability and sustainability of the R-1 toll road project.

The cash flow statement from the lender's point of view is presented in Table 7, while that from the equity holders' point of view is presented in Table 8.[4] An assessment of the financial returns from the equity and lenders point of view is made in section 5.5.

4 These cash flow are representative of the base case scenario which is composed of the moderate scale investment and likely traffic growth scenarios.

Table 7: Cash Flow Statement from the Lenders Point of View

		2017	2018	2019	2020	2021	2022...	...2033	2034	2035	2036	2037	2038	2039
Inflows														
Total Toll Revenue, Cars	USD 'M	-	-	-	29.36	30.80	32.53	49.37	49.37	49.37	49.37	49.37	49.37	-
Total Toll Revenue, Buses and Light Goods Trucks	USD 'M	-	-	-	6.66	6.99	7.38	11.20	11.20	11.20	11.20	11.20	11.20	-
Total Toll Revenue, Heavy Goods Trucks	USD 'M	-	-	-	16.00	16.79	17.73	26.90	26.90	26.90	26.90	26.90	26.90	-
Total Toll Revenue, Semi-Trailer Trucks	USD 'M	-	-	-	33.46	35.11	37.08	56.27	56.27	56.27	56.27	56.27	56.27	-
Government Revenue Guarantee	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Changes in AR	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Residual Value	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	217.31
Total Inflows	USD 'M	-	-	-	85.48	89.69	94.72	143.75	143.75	143.75	143.75	143.75	143.75	217.31
Outflows														
Total Road Construction Costs -[including DSRA]	USD 'M	288.36	199.01	230.00	-	-	-	-	-	-	-	-	-	-
Total Operating Expenditure	USD 'M	-	-	-	10.69	11.21	11.84	17.97	17.97	17.97	17.97	17.97	17.97	-
Total Maintenance Expenditure, with Road Improvemer	USD 'M	-	-	-	3.02	3.02	3.02	3.02	3.02	3.02	61.12	3.02	3.02	519.30
Revenue Shared with the Government	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Changes in AP	USD 'M	-	-	-	(1.10)	(0.05)	(0.06)	(0.02)	(0.02)	(0.02)	(4.66)	4.59	(0.02)	(39.88)
Changes in CB	USD 'M	-	-	-	3.42	0.20	0.23	0.05	0.05	0.05	0.05	0.05	0.05	(5.70)
Net VAT Liability	USD 'M	-	-	-	9.36	9.84	10.42	16.01	16.01	16.01	8.43	16.01	16.01	(67.73)
Total Tax Liability	USD 'M	-	-	-	-	-	-	13.27	13.30	13.33	5.55	13.38	13.41	-
Total Outflows	USD 'M	288.36	199.01	230.00	25.39	24.22	25.45	50.31	50.34	50.37	88.46	55.03	50.45	405.98
Net Cashflow Available for Debt Service [NCFADS], Real	USD 'M	**(288.36)**	**(199.01)**	**(230.00)**	**60.09**	**65.46**	**69.26**	**93.44**	**93.41**	**93.38**	**55.28**	**88.72**	**93.29**	**(188.67)**

Table 8: Cash Flow Statement from the Equity Holders Point of View

		2017	2018	2019	2020	2021	2022…	…2033	2034	2035	2036	2037	2038	2039
Inflows														
Total Toll Revenue, Cars	USD 'M	-	-	-	29.36	30.80	32.53	49.37	49.37	49.37	49.37	49.37	49.37	-
Total Toll Revenue, Buses and Light Goods Trucks	USD 'M	-	-	-	6.66	6.99	7.38	11.20	11.20	11.20	11.20	11.20	11.20	-
Total Toll Revenue, Heavy Goods Trucks	USD 'M	-	-	-	16.00	16.79	17.73	26.90	26.90	26.90	26.90	26.90	26.90	-
Total Toll Revenue, Semi-Trailer Trucks	USD 'M	-	-	-	33.46	35.11	37.08	56.27	56.27	56.27	56.27	56.27	56.27	-
Government Revenue Guarantee	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Changes in AR	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Residual Value	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	217.31
Total Inflows	USD 'M	-	-	-	85.48	89.69	94.72	143.75	143.75	143.75	143.75	143.75	143.75	217.31
Outflows														
Total Road Construction Costs -[including DSRA]	USD 'M	288.36	199.01	230.00	-	-	-	-	-	-	-	-	-	-
Total Operating Expenditure	USD 'M	-	-	-	10.69	11.21	11.84	17.97	17.97	17.97	17.97	17.97	17.97	-
Total Maintenance Expenditure, with Road Improvemer	USD 'M	-	-	-	3.02	3.02	3.02	3.02	3.02	3.02	61.12	3.02	3.02	519.30
Revenue Shared with the Government	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Changes in AP	USD 'M	-	-	-	(1.10)	(0.05)	(0.06)	(0.02)	(0.02)	(0.02)	(4.66)	4.59	(0.02)	(39.88)
Changes in CB	USD 'M	-	-	-	3.42	0.20	0.23	0.05	0.05	0.05	0.05	0.05	0.05	(5.70)
Net VAT Liability	USD 'M	-	-	-	9.36	9.84	10.42	16.01	16.01	16.01	8.43	16.01	16.01	(67.73)
Total Tax Liability	USD 'M	-	-	-	-	-	-	13.27	13.30	13.33	5.55	13.38	13.41	-
Total Outflows	USD 'M	288.36	199.01	230.00	25.39	24.22	25.45	50.31	50.34	50.37	88.46	55.03	50.45	405.98
Financing of the Project														
[+] Senior Debt Contribution towards Total Construction Co	USD 'M	173.01	119.40	138.00	-	-	-	-	-	-	-	-	-	-
[-] Total Debt Repayment Scheduled	USD 'M	-	-	-	49.05	47.23	45.44	-	-	-	-	-	-	-
DSRA														
[+] DSRA at Year End, Balance Carried Forward	USD 'M	-	-	25.76	27.06	28.42	29.86	-	-	-	-	-	-	-
Net Cashflow After Financing, Real	USD 'M	**(115.34)**	**(79.60)**	**(66.24)**	**38.09**	**46.66**	**53.68**	**93.44**	**93.41**	**93.38**	**55.28**	**88.72**	**93.29**	**(188.67)**

5.5 Financial Viability and Suitability

The three main stakeholders with a financial interest in the R-1 toll road project are the equity holders, the lenders and the Government of Zimbabwe. An assessment of the financial outcomes of the financial analysis are presented in the next two sections; from the point of view of the equity holders, lenders and the Government of Zimbabwe. Furthermore, the financial analysis results presented here also take into account the different investment scales of the R-1 toll road project, as well as the various traffic growth scenarios considered in the financial assessment of this project which were discussed in sections 5.5.2 and 5.5.3 respectively.

5.5.1 Financial Analysis Results – Equity Holder's Point of View

The results of the financial analysis of an investment in the R-1 toll road project at different investment scales and traffic growth assumptions, from the perspective of the equity holders, are presented in Table 9 and 10. Given that at any specific point, two project scenarios are being considered in the appraisal of the R-1 toll road; a two-way results matrix was constructed to better show all the possible financial outcomes of undertaking the R-1 toll road project.

The results matrices show that six possible outcomes may result from implementing the R-1 toll road project, which depends directly on the scale of investment at which the road is constructed, the level of traffic that will be present once the road becomes operational; as well as the RSA.

Table 9: Results Matrix from Equity Holder's Point of View – "with RSA"

		Traffic Growth Scenarios					
		High Traffic Growth		Likely Traffic Growth Base Case		Low Traffic Growth	
	Financial Decision Metrics	FNPV M'USD	MIRR %	FNPV M'USD	MIRR %	FNPV M'USD	MIRR %
Investment Scale Scenarios	Ultimate Scale	-1,393.45	-1.70%	-1,363.48	-1.57%	-1,686.81	-2.98%
	Moderate Scale - Base Case	127.01	14.08%	133.43	14.16%	54.43	12.99%

Table 10: Results Matrix from Equity Holder's Point of View - "no RSA"

		Traffic Growth Scenarios					
		High Traffic Growth		Likely Traffic Growth Base Case		Low Traffic Growth	
	Financial Decision Metrics	FNPV M'USD	MIRR %	FNPV M'USD	MIRR %	FNPV M'USD	MIRR %
Investment Scale Scenarios	Ultimate Scale	-806.00	-1.43%	-1,363.48	-1.57%	-2,005.82	-4.46%
	Moderate Scale - Base Case	247.86	15.51%	133.43	14.16%	-47.07	10.99%

Scenario Matrix A: Moderate Investment Scale at Likely Traffic Growth (Base Case Scenario)

Only the moderate investment scale generates a positive return. As highlighted in Table 9 in the base case (which assumes a moderate investment scale, likely growth in traffic and a RSA), the FNPV is expected to be US$ 133.43 million, while the Modified Internal Rate of Return (MIRR) is 14.16%, which is higher than the 12% RRR.[5]

Scenario Matrix B: Moderate Investment Scale at High Traffic Growth (Base Case Scenario)

In the case of the moderate investment scale given high traffic growth, the FNPV is lower and so too is the MIRR. With respect to FNPV, it isexpected to be US$ 127.01 million, while the MIRR is 14.08% as shown in Table 9. The lower returns, in this

[5] Modified Internal Rate of Return (MIRR) was used to measure the financial returns to the equity holders as opposed to the widely and more commonly used metric, Internal Rate of Return (IRR). IRR has a number of drawbacks, chief among which is that it generates multiple rates of return in the case of an irregular cash flows. To avoid the pitfalls of IRR, the MIRR was used instead of IRR (ACCA, n.d.)

case, are as a result of the concessionaire sharing the excess revenue with the GoZ, due to a higher turnout in traffic than initially anticipated. If the RSA is not put in place the returns to the concessionaire will increase significantly as illustrated in Table 10; the FNPV would be US$ 247.86 million while the MIRR would be 15.51%. Hence the sharing of revenue ensures the concessionaire does not obtain abnormal returns.

Scenario Matrix C: Moderate Investment Scale at Low Traffic Growth (Base Case Scenario)

It should be noted that positive returns in the case of the moderate investment scale can only be obtained if the level of traffic is not lower than that forecasted in the likely growth scenario and if the RSA is implemented. If low traffic growth is experienced once the R-1 toll road becomes operational, this is likely to result in returns that are lower than what equity holders expect. As shown in Table 10, the FNPV of the moderate investment scale will be less than zero, resulting in an FNPV of US$ (47.07) million and MIRR of 10.99%. However, the financial return to the concessionaire will be positive if the RSA is put in place, as it stipulates that the concessionaire should be compensated for any losses in revenue if traffic is lower than anticipated. In the case the GoZ hold up its obligations of guaranteeing the concessionaire's revenue if traffic turns out to be low, the returns with respect to the concessionaire would be; an FNPV of US$ 54.43 million and MIRR of 12.99%. Guaranteeing traffic is essential to attracting a private concessionaire. However, it leaves the GoZ with a contingent liability.

Scenario Matrix D, E & F: Ultimate Investment Scale at Likely, High, and Low Traffic Growth

At the ultimate investment scale, the return on investment is negative at all the different traffic growth scenarios. The FNPV in the case of a RSA is estimated to be US$

(1,393.45) million, US$ (1,363.48) million, and US$ (1,686.81) million when considering the low, likely, and high traffic growth respectively; while the MIRR is -1.70%, -1.57%, and -2.98% respectively.

In the case weere the RSA is not put in place, the FNPV and MIRR in the case of high traffic growth would be US$ 806.00 and -1.43% respectively. The returns are higher in this case because the concessionaire does not have to share revenue with the GoZ. In the case of low traffic growth, the FNPV and MIRR would be US$ (2,005.82) and -4.46%; these returns are low because without the RSA there is no guarantee for low traffic which would compensate the concessionaire for obtaining lower than expected revenues.

With the exception of the low traffic growth scenario with no RSA, the returns to equity holders at the moderate investment scale are all positive as compared to the ultimate investment scale; this is largely due to the lower initial investment costs in the case of the moderate investment scale in comparison to those of the ultimate investment scale. The capital expenditure in the moderate investment scale is 55% lower than that of the ultimate scale. Furthermore, the maintenance costs with regards to the moderate scale are 37% lower than those in the ultimate investment scale.

5.5.2 Financial Analysis Results - Lender's Point of View

The main concern of the lender is the recovering the principal loaned out to the project for the construction of the R-1 toll road. The ability of the project to repay the principal payments as well as the interest payments on an annual basis is measured by computing the Annual Debt Service Coverage Ratios (ADSCRs).[6] The project's ability to service

[6] ADSCR is computed as follows; $\text{ADSCR} = \frac{\text{Annual Net Cash Flow Available for Debt Service}}{\text{Annual Total Dabt Repayment (Principal+Interest)}}$

its debt over the course of the life of the loan is used to measure the overall strength of the project to carry the debt even when it is unable to do so during any particular year; the Loan Life Coverage Ratio (LLCR) is computed to measure this ability.[7] The two debt service metrics described above are utilized by the lenders to measure the attractiveness of providing financing to the project. The result of the ADSCRs computed for the R-1 toll road project given for the moderate investment scale at different traffic growth scenarios are presented in Figure 4.

Figure 4 only presents the ADSCRs for the first five years of the project's operational life and debt repayment period, as this is the period when a project is likely to face the most difficulty paying its debt obligations as cash inflows are still low and by comparison debt payments are relatively higher.

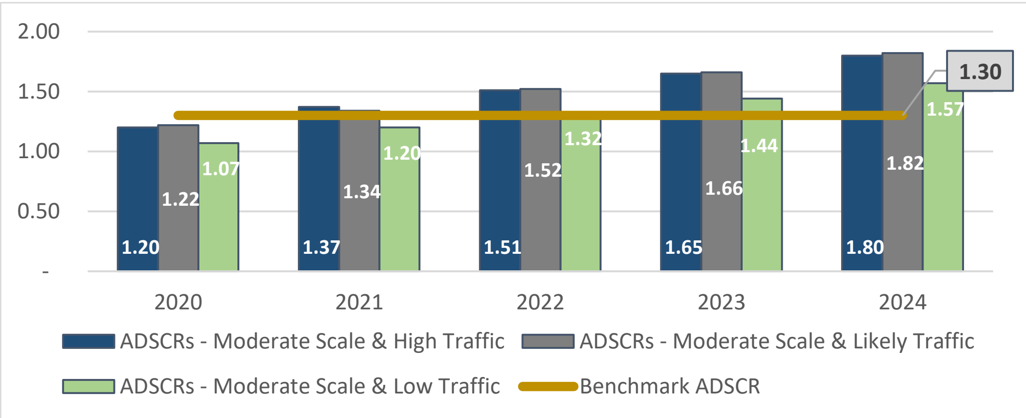


Figure 4: Debt Service Coverage Ratios of the R-1 Toll Road

Given that the results in the preceding section on the financial returns from the perspective of the equity holders; revealed that only the moderate investment scale is

[7] LLCR is computed as follows; $LLCR = \frac{\text{PV of Net Cash Flow Available for Debt Service}}{\text{PV of Total Dabt Repayment (Principal+Interest)}}$

the most feasible option at which to implement the R-1 toll road project, the results of the ADSCRs were computed only for the aforementioned investment scale.

When the R-1 toll road opens up to traffic in the year 2020, the ADSCRs measured against a benchmark of 1.30x, reveal that the project will not have sufficient funds to cover its debt obligations at a likely traffic growth, within the first year of operations. In the case of low traffic growth, this period extends to two years. [8] While in the case of high traffic growth the project would only struggle to meet its debt obligations in the first year of operations.

The ability of the R-1 toll project to service the loan facility provided by the lenders rests on the volume of traffic that will travel on the road once it becomes operational. The ADSCRs in Figure 4 shows that during the first two to three years of the toll road's operations, the project would only be able to meet its debt obligations if a moderate or high volume of traffic exists once the road opens up. As of the fourth year of operations, the situation is likely to improve as the project's ability to repay its outstanding debt increases, given that the ADSCRs in Figure 4 in the case of all traffic growth scenarios are greater than the benchmark.

[8] Lenders require that a project's ADSCR meet a certain threshold, they do not set the benchmark ADSCR threshold at 1.00x; rather they set it above 1.00x to provide them with a room for comfort. For most infrastructure projects, banks require an ADSCR equal to or greater than 1.30x for 75% - 100% of the projected ADSCRs.

Given that the first two to three years of the project present the greatest risk for the lenders in terms of recovering the funds loaned out to the project, a look at the project's LLCRs shows that over the course of the loan repayment period the project is able to cover its debt obligations. Figure 5, reveals that the LLCRs of the project during the first three years of the projects operational life all significantly greater than the benchmark even in the case of low traffic volume on the R-1 toll road. Hence, the lenders should not dismiss the project due to the risks presented in the first few years of operations but should look at how to improve the projects ability to meet its debt obligations in those years by restructuring the terms of the loan in a way that eases the debt burden in the first few years of operations given that the project has the capacity to service its debt over the course of the repayment period at all projected levels of traffic.

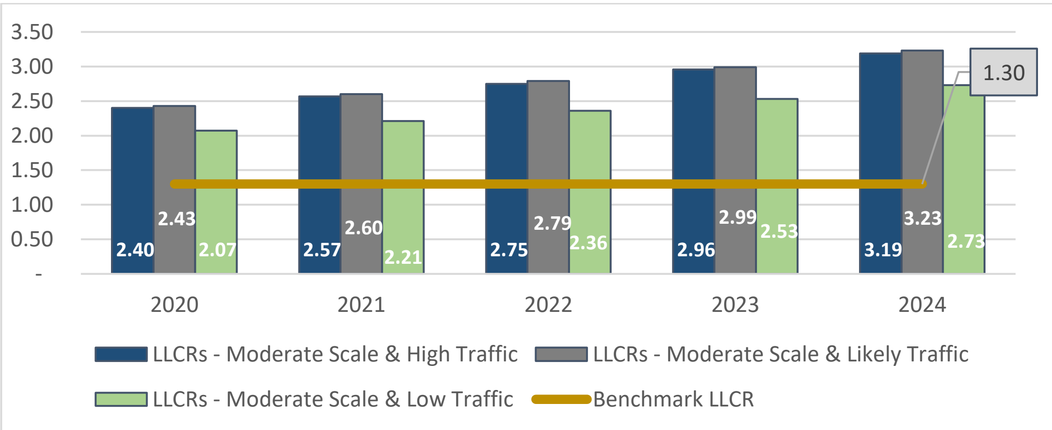


Figure 5: Loan Life Coverage Ratios of the R-1 Toll Road

5.5.3 Investment Decision

The results of the financial analysis from the perspectives of both the equity holders and the lenders presented in the preceding sections demonstrate that the R-1 toll road is prospectively a feasible undertaking if implemented at the moderate investment scale. It should be noted that the moderate investment scale in all the traffic scenarios will maximize the equity holders returns as both the FNPV and MIRR are higher as compared to the ultimate investment scale; due the lower capital and maintenance expenditures in the case of the moderate investment scale relative to the ultimate investment scale. However, there is a risk that if traffic levels are lower than projected, the returns to the equity holders would be negative; even though the project has the overall ability to repay its debt in such a scenario. However, due to the RSA, the risk of low traffic volume will be shifted from the concessionaire to the GoZ, making the project attractive from the equity holders point of view. However, the RSA leaves the GoZ open to a potential contingent liability and the potential of an upside revenue inflow if traffic is higher than anticipated. The impact of the RSA on both the GoZ and the concessionaire will be explored further in the risk analysis section.

Chapter 6

ECONOMIC ANALYSIS

6.1 Introduction

The second key pillar to conducting an IIA of a project is the economic analysis. An economic study is undertaken to ascertain the socio-economic effects of implementing the R-1 toll road project. Unlike the financial analysis which focuses on measuring the benefits accruing to a few stakeholders who have a financial interest in the project, the economic analysis estimates the stream of benefits accruing to society as a whole (the economy).

Road projects generate various benefits for road users, chief among which are;

1. Vehicle Operating Cost (VOC) Savings,
2. Travel Time Savings (TTS), and,
3. Accident Cost Savings (ACS)

Additional benefits to the road network can be generated through a reduction in the cost of maintaining roads within the network due to the road infrastructure improvements made by the project. The benefits generated by the R-1 toll project for the economy of Zimbabwe are discussed in this section.

The socio-economic impact of the project is measured using the DCFM. The total investment point of view Cash Flow Statement developed in the financial analysis is converted to a Resource Flow Statement. A conversion is required because financial values do not always reflect the real economic value of project resources (both inputs and outputs), due to the presence of distortions in market prices such as; taxes, subsidies, and transfers. Therefore, the distortions present in each of the prices/values of project inputs and outputs used while conducting the financial analysis must be removed. This is done by apply Commodity Specific Conversion Factors (CSCFs) to each of the components of the Cash Flow Statement, which translate financial values (distorted) into their economic equivalents (undistorted). The CSCFs estimated and used in the construction of the R-1 toll road project are presented in Annex A.

6.2 Valuation of Economic Benefits

The rehabilitation, improvement, and construction of the R-1 road will result in road users benefiting from using the enhanced road. Each of the benefits accruing to road users is discussed in a little more detail in the subsequent sections.[9]

6.2.1 Vehicle Operating Cost Savings (VOCs)

Road users face various costs when operating their vehicles. These costs include the cost of fuel and the cost of vehicle maintenance. Together these costs constitute what is known as VOCs. Road conditions have a direct influence on the VOCs faced by road users. Roads in poor conditions; such as those with potholes, result in higher costs as vehicle owners have to repair their cars more frequently due to the damaged induced by the roughness of road pavement. Additionally, congested roads can lead to higher fuel costs. Improvements to road pavements and the flow of traffic lead to a reduction in VOCs yielding to road users. As a result of the R-1 toll road project, VOC savings are expected to accrue to the vehicles travelling along this route. The VOC estimates

9 All of the data used with respect to the assumptions of VOCs, VoTs, as well as accident costs were extrapolated from a feasibility study conducted by BHRE Association in June of 2013. It should be noted that the feasibility study derived the estimates of road user benefits using the Highway Development and Management System (HDM 4) modeling tools. HDM 4 is able to predict life cycle road user costs, given the specific conditions of a particular road such as; pavement conditions, road roughness, traffic loading, maintenance activities, rate of accidents, congestion, travel speeds, etc.

as well as the anticipated savings for each vehicle class using the R-1 toll road project are summarized in Table 11.

Table 11: VOC Savings on the R-1 Toll Road

		"without"	"with"	Savings
VOC - Cars	USD/km	0.220	0.117	0.103
VOC - Buses and Light Goods Trucks	USD/km	0.490	0.333	0.157
VOC - Heavy Goods Trucks	USD/km	0.930	0.737	0.193
VOC - Semi-trailer Trucks	USD/km	1.600	1.363	0.237

6.2.2 Travel Time Savings (TTS)

Time is a valuable asset. Time spent travelling for both business and leisure purposes represents an opportunity cost as it can be utilized on other activities. The value of time can be quantified in monetary terms. For road users who travel for work purposes, the value of their time with regards to reaching their workplaces on time can be valued using their hourly wage rate. Similarly, the value of road users travelling for non-work purposes can be valued at a fraction of the value of the hourly wage rate. Additionally, the time that cargo spends in transit between its origin and destination can be assigned a monetary value based on opportunity cost of the goods being transported as well as the amortization of freight trucks. The travel time of passengers as well as cargo is a function of the speed at which vehicles can travel along a given route. Roads that are in conditions of disrepair or which are otherwise congested lead to lower travelling speeds, which in turn lead to more time spent on the road. Improvements in road conditions and the flow of traffic lead to traffic travelling faster and less time being spent on the road; which frees up travellers to use their time for other activities and leads to economic efficiencies as far as labour productivity and trade are concerned.

As a result of the R-1 toll road being designed to allow traffic to travel much faster, TTS are expected to accrue to road users as shown in Table 12.

Table 12: Travel Time Savings on the R-1 Toll Road

		"without"	"with"	TTS
VoT - Cars	USD/km	0.040	0.035	0.005
VoT - Buses and Light Goods Trucks	USD/km	0.110	0.085	0.025
VoT - Heavy Goods Trucks	USD/km	0.210	0.084	0.126
VoT - Semi-trailer Trucks	USD/km	0.353	0.063	0.290

6.2.3 Accident Cost Savings (ACS)

Road accidents are costly; they result in numerous costs that are incurred by a host of different parties. Some of the costs associated with a road accident are:

a. Casualty costs: which constitute the cost of medical treatment for those who survive and the cost of a loss of life for those who do not make it
b. Property damages: this is inclusive of damages to vehicles and other assets such as the road itself and adjacent buildings
c. Administration costs: these include the cost of insurance payouts as well as other formalities such as police investigations and reports

Though road incidents are a function of road conditions, the state of vehicles travelling along a given road and the behaviour and errors of drivers; they can be reduced by improving the conditions of the road. The frequency of road accidents on the R-1 has accelerated due to declining conditions of the road in the "without" project scenario. "With" the project, road conditions are expected to improve tremendously, leading to a lower frequency in road incidents as well as the to the reduction of accident costs.

Accident costs for both "with" and "without" the road project, as well as the associated savings for each vehicle class are summarized in Table 13.

Table 13: Accident Cost Savings on the R-1 Toll Road Project

		"without"	"with"	Savings
Accident Costs - Cars	USD/km	0.013	0.008	0.005
Accident Costs - Buses and Light Goods Trucks	USD/km	0.035	0.027	0.008
Accident Costs - Heavy Goods Trucks	USD/km	0.070	0.029	0.041
Accident Costs - Semi-trailer Trucks	USD/km	0.114	0.021	0.093

6.3 Input Assumptions and Parameters

Input assumptions and parameters gathered for economic analysis are summarized in the list below:

1. Foreign Exchange Premium (FEP): 7.50%
2. The premium on Non-Tradable Outlays: 1.00%
3. Value Added Tax: 15.00%
4. Effective Tax Rate: 12.00%
5. Port Handling Charges (as a percentage of CIF Price): 5.00%
6. Cost of domestic freight (as a percentage of CIF Price): 5.00%
7. Various Import Tariffs on the Project's Inputs were collected from the Zimbabwe Revenue Authority (ZIMRA).

The aforementioned assumptions and parameters represent the various distortions that were identified with respect to the project's cash flow items. Using these distortions and the financial cash flow values, the project's CSCFs for each cash flow item were estimated and utilized to develop the project's Resource Flow Statement. CSCFs are calculated as flows;

$$CSCF = \frac{Economic\ Value}{Financial\ Value}$$

A summary of the estimations of the CSCFs of the R-1 toll road project are given in Table 14.

Table 14: Summary of Conversion Factors

Toll Revenue	-
Government Revenue Guarantee	-
Revenue Shared with the Government	-
Residual Value	0.90
Road Construction	0.90
Toll Road Operations	0.80
Maintenance Costs	0.85
Vehicle Operating Costs	0.80
Value of Time	1.00
Accident Costs	1.00
Corporate Tax Liabilities	-
Change in Accounts Payable	0.83
Change in Cash Balance	1.00

Toll Revenues, government revenue guarantee, revenue shared with the government and corporate tax liabilities are all transfer payments. Transfers do not have any economic impact, and therefore their value is zero as signified by the respective CSCFs shown in Table 14.

The financial cost of road construction is composed of labour and the materials and equipment used to construct the road. The aggregate distortions were found to be equal to 10% of the financial cost. Hence, the road and its residual have an economic value equal to 90% of the financial value. Some of the distortions that are present in the financial cost of road construction are; import tariffs, VAT and income taxes.

Removing these distortions results in a conversion factor of 0.90, as illustrated in Table 14.

Operating costs are composed of labour, utilities and transportation; while maintenance costs comprise of labour and materials. The main distortions present in the financial value of the toll road's operating and maintenance costs are income taxes and VAT. Removing these and other distortions result in an economic value that is 80% and 85% of the financial value of operating and maintenance costs respectively, which correspond a CSCF of 0.80 for operating costs and 0.85 for maintenance costs, as illustrated in Table 14.

VOCs, which comprise of fuel, replacement of tires and the cost of repairs and maintenance; have their financial value distorted by various import duties on spare parts, tires and fuel. Additionally, income taxes also increase the financial cost of repairs and maintenance. The aggregate distortion was found to be approximately 20% of the financial value. Hence a CSCF of 0.80 is used as the economic value of VOCs are equal to 80% of their financial value.

Accounts payables are composed of outstanding balances on operating and maintenance costs. Therefore, the CSCF for accounts payable was estimated as the average of the CSCFs for operating and maintenance expenditures, which is equal to 0.83. The VoT, accident costs and cash balances were assumed to have no distortions; meaning that the financial value is equal to the economic value. Hence the CSCF of these items is equivalent to 1.

6.4 Economic Resource Flow Statement

The economic resource flow statement for the R-1 toll road project was constructed using the conversion factors presented in Table 14. The economic resource flow statement is presented in Table 15.

Table 15: Economic Resource Flow Statement

		2017	2018	2019	2020	2021	2022...	...2033	2034	2035	2036	2037	2038	2039
Benefits														
Changes in AR	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Residual Value	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	196.09
VOC Savings														
VOC Savings , Cars	USD 'M	-	-	-	39.60	41.54	43.87	66.59	66.59	66.59	66.59	66.59	66.59	-
VOC Savings, Buses and Light Goods Trucks	USD 'M	-	-	-	8.42	8.84	9.33	14.16	14.16	14.16	14.16	14.16	14.16	-
VOC Savings, Heavy Goods Trucks	USD 'M	-	-	-	14.71	15.43	16.29	24.73	24.73	24.73	24.73	24.73	24.73	-
VOC Savings, Semi-trailer Trucks	USD 'M	-	-	-	31.19	32.72	34.56	52.45	52.45	52.45	52.45	52.45	52.45	-
VoT Savings														
VoT Savings , Cars	USD 'M	-	-	-	2.53	2.66	2.80	4.26	4.26	4.26	4.26	4.26	4.26	-
VoT Savings, Buses and Light Goods Trucks	USD 'M	-	-	-	1.67	1.75	1.85	2.80	2.80	2.80	2.80	2.80	2.80	-
VoT Savings, Heavy Goods Trucks	USD 'M	-	-	-	11.93	12.51	13.21	20.06	20.06	20.06	20.06	20.06	20.06	-
VoT Savings, Semi-trailer Trucks	USD 'M	-	-	-	47.41	49.74	52.53	79.72	79.72	79.72	79.72	79.72	79.72	-
Accident Cost Savings														
Accident Savings , Cars	USD 'M	-	-	-	2.24	2.35	2.49	3.77	3.77	3.77	3.77	3.77	3.77	-
Accident Cost Savings, Buses and Light Goods Trucks	USD 'M	-	-	-	0.53	0.56	0.59	0.90	0.90	0.90	0.90	0.90	0.90	-
Accident Cost Savings, Heavy Goods Trucks	USD 'M	-	-	-	3.88	4.07	4.30	6.53	6.53	6.53	6.53	6.53	6.53	-
Accident Cost Savings, Semi-trailer Trucks	USD 'M	-	-	-	15.20	15.95	16.85	25.57	25.57	25.57	25.57	25.57	25.57	-
Total Benefits	USD 'M	-	-	-	**179.31**	**188.13**	**198.68**	**301.52**	**301.52**	**301.52**	**301.52**	**301.52**	**301.52**	**196.09**
Costs														
Construction Costs														
Total Road Construction Costs	USD 'M	260.20	179.57	207.54	-	-	-	-	-	-	-	-	-	-
Operating & Maintenance Costs														
Total Opaerating Expenditure	USD 'M	-	-	-	8.56	8.98	9.48	14.39	14.39	14.39	14.39	14.39	14.39	-
Total Maintenance Expenditure, with Road Improven	USD 'M	-	-	-	2.58	2.58	2.58	2.58	2.58	2.58	52.21	2.58	2.58	443.60
Government Guarantee														
Government Revenue Guarantee	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Other Costs														
Changes in AP	USD 'M	-	-	-	(0.91)	(0.04)	(0.05)	(0.01)	(0.01)	(0.01)	(3.87)	3.81	(0.01)	(33.08)
Changes in CB	USD 'M	-	-	-	3.42	0.20	0.23	0.05	0.05	0.05	0.05	0.05	0.05	(5.70)
Net VAT Liability	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Tax Liabilty	USD 'M	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Costs	USD 'M	**260.20**	**179.57**	**207.54**	**13.65**	**11.72**	**12.25**	**17.01**	**17.01**	**17.01**	**62.78**	**20.83**	**17.01**	**404.81**
Net Benefits	USD 'M	**(260.20)**	**(179.57)**	**(207.54)**	**165.66**	**176.41**	**186.43**	**284.51**	**284.51**	**284.51**	**238.74**	**280.69**	**284.51**	**(208.72)**

6.5 Economic Impact

The results of the economic analysis as presented in Table 16; reveal that the R-1 road project is likely to have a positive impact on the economy of Zimbabwe if it is implemented at the moderate investment scale as both the ENPV and ERR are positive for all the given traffic scenarios. Given the case of the ultimate investment scale, the road project will only have a positive impact on the economy if the expected traffic is higher than anticipated.

The results presented in Table 16 reveals that traffic is of significant importance to the economic viability and sustainability of the road project. Given the projected traffic, it does not make economic sense to construct the R-1 toll road project at the ultimate investment scale unless road traffic is higher than the likely growth scenario. However, it should be noted that even at a high traffic growth rate, implementing the R-1 toll road project at the ultimate investment scale will be a wasteful use of public resources, which could be put to better alternative uses. Table 16 clearly shows that the country's resource are best utilized if the road project is implemented at the moderate investment scale as both the ENPV and ERR are maximized. Even at a low traffic growth rate, the ENPV of the moderate investment scale is 1.64x higher that generated in the case of the ultimate investment scale at high traffic growth.

Given the current traffic demand, an investment at the ultimate scale is not warranted and would result in an uneconomical use of resources if such as ambitious undertaking is made.

Table 16: Economic Results Matrix of the R-1 Toll Road Project

		Traffic Growth Scenarios					
		High Traffic Growth		Likely Traffic Growth Base Case		Low Traffic Growth	
	Economic Decision Metrics	**ENPV M'USD**	**ERR %**	**ENPV M'USD**	**ERR %**	**ENPV M'USD**	**ERR %**
Investment Scale Scenarios	**Ultimate Scale**	275.62	12.99%	-51.63	11.79%	-378.88	10.25%
	Moderate Scale - Base Case	994.18	16.70%	666.93	15.86%	339.68	14.30%

Chapter 7

STAKEHOLDER ANALYSIS

7.1 Introduction

The actors within the economy/society that will benefit either positively or negatively as a result of the R-1 road project need to be identified. Stakeholder analysis is used to identify which of the project's beneficiaries stand to gain or lose as a result of various impacts created by the road project. These impacts are known as externalities. The projects' externalities are derived by taking the difference between the resource flow and cash flow statements. The resource flow statement represents the overall benefits to the economy as a whole, while the cash flow statement estimates the net financial benefits to the projects' stakeholders who have a financial interest in the project.

The R-1 toll road project results in a number of externalities which were identified to affect the following stakeholders;

1. The Government of Zimbabwe
2. Road Users

The subsequent sections discuss in more detail the impacts of the project on these two stakeholders.

7.2 Project Externalities

7.2.1 Externalities to the Government of Zimbabwe (GoZ)

Project externalities accruing to the GoZ arise due to the taxes imposed on various project inputs and outputs. Additionally, externalities are created due to gains and losses in the foreign exchange premium (FEP). All these distortions translate to fiscal impacts that can be assessed from the estimated incremental tax flows to the GoZ. Table 17 summarizes the present value of externalities estimated to accrue to the GoZ as a result of the R-1 road project. It should be noted that the tax revenue inflows will be higher in the case of the ultimate investment scale as compared to the moderate investment scale due to the higher capital and operating and maintenance expenditures.

Table 17: Present Value of Externalities to the Government of Zimbabwe

		Traffic Growth Scenarios		
		High Traffic Growth	Likely Traffic Growth Base Case	Low Traffic Growth
		PV. Externality (M'USD)		
Investment Scale Scenarios	Ultimate Scale	382.45	230.32	144.06
	Moderate Scale - Base Case	333.89	181.78	93.23

7.2.2 Government of Zimbabwe's Contingent Liability

Table 18 shows the likely impacts of the RSA on the GoZ given different traffic scenarios. If actual traffic on the toll road, once it becomes operational is lower than anticipated the GoZ will accrue a contingent liability equal to US$ 68.70 million. In the case, that traffic is higher than anticipated the GoZ will receive a share of the excess revenue to the tune of US$ 129.78 million. As the base case is deterministic it is impossible to assess how varying growth in traffic from one year to the next will impact the GoZ's net position (Revenue Shared with GoZ – Revenue Guarantee paid out by GoZ). Computation of the net position allows for the determination of the overall impact of the RSA on the GoZ; as it will show whether the government gains or loses. Monte Carlo simulations were used to assess the present value of this net position as well as the likelihood.

Table 18: Present Value of Contingent Liability/Revenue

		Traffic Growth Scenarios		
		High Traffic Growth	Likely Traffic Growth Base Case	Low Traffic Growth
		PV. Revenue Guarantee (M'USD)		
Ultimate & Moderate Investment Scale	**PV. Revenue Guarantee (M'USD)**	N/A	N/A	(68.70)
	PV. Revenue Shared with GoZ (M'USD)	129.78	N/A	N/A

7.2.3 Externalities to Road Users

Given the savings on VOCs, travel time, and accident costs generated by the road project as shown in section 6.4, the net benefits accruing to road users travelling on the R-1 toll road project are estimated to be positive for all investment scales and traffic growth scenarios as shown in Table 19. The net benefits accruing to road users were computed as follows:

$$PV.Net\ Benefits = [VOC\ Savings + TTS + ACS] - Toll\ Charges$$

Toll charges were deducted as they represent the financial cost that road users face for travelling on the R-1 road.

Table 19: Present Value of Externalities to Road Users

		Traffic Growth Scenarios											
		High Traffic Growth				Likely Traffic Growth				Low Traffic Growth			
	PV. Externality (M'USD)	Cars	Buses & LGVs	HGVs	Semi-Trucks	Cars	Buses & LGVs	HGVs	Semi-Trucks	Cars	Buses & LGVs	HGVs	Semi-Trucks
Investment Scale Scenarios	Ultimate/ Moderate Scale	144.12	37.99	139.34	579.29	115.30	30.40	111.47	463.43	86.47	22.80	83.60	347.58

Chapter 8

RISK ANALYSIS

8.1 Introduction

One of the most essential pillars of conducting an IIA of a project is assessing the project's risks and finding ways of mitigating that risk. The results of the proceeding modules of the IIA of the R-1 toll road project; that is financial, economic, and stakeholder analysis are all deterministic in nature. As a result, they are subject to change given various endogenous and exogenous factors that can cause the project's outcomes to differ from those obtained in the base case scenario.

Sensitivity analysis was utilized to identify the risk parameters of the R-1 toll road project as well as the magnitude of their impact on the project's outcomes. The main risk variables identified in sensitivity analysis were utilized to conduct a probabilistic analysis using Monte Carlo simulation to quantify the magnitude and likelihood of risk and uncertainty that these variables pose to the viability and sustainability of the project from different points of view. Unlike sensitivity which only allows for one risk variable to be scrutinized at a time, risk analysis allows for the simultaneous scrutiny of numerous variables at a time. It also permits for a range of different values and their probability distributions, as well as their relationships (correlations) to be accounted for within the analysis.

8.2 Results of the Sensitivity Analysis

Five of the project's input variables were identified to have a significant impact on the project's financial, economic, and stakeholder outcomes. The impact of these project variables are presented in Table 20.

Table 20: Risk Analysis Matrix

Project Key Variable	Base Case Project Key Variable Assumptions	Sensitivity Test Range	Sensitivity of Output Variables to Changes in Project Key Variables			
			% Change in FNPV	% Change in minimum ADSCR	% Change in ENPV	% Change in PV. Ext Road Users
GDP Growth Rate - Zimbabwe (2022 onwards)	5.00%	(+1%) - (+8%)	(-118%) - (+37%)	(-66%) - (+25%)	(-50%) - (+21%)	(-26%) - (+11%)
Base Toll Charge (USD/Km)	0.07	(0.05) - (0.08)	(-155%) - (+47%)	(-62%) - (+26%)	N/A	(+52%) - (-25%)
Investment Cost Overrun	0.00%	(-20%) - (+25%)	(+48%) - (-95%)	(+15%) - (-19%)	(+12%) - (-21%)	N/A
Domestic Inflation	0.91%	(+0.91%) - (+4%)	(0%) - (-53%)	(0%) - (-0.23%)	(0%) - (-5%)	N/A

a. **Gross Domestic Product (GDP):**

GDP was used to forecast traffic travelling along the R-1 toll road in future periods; hence a slight change in the assumption of how Zimbabwe's economy will grow in future periods has a pronounced effect on the outcomes of the project. For example, it was assumed that from 2022 onwards, the GDP of Zimbabwe would grow at a rate of 5% per annum. If GDP were to grow at a rate of 1%, then the FNPV would decline by 118%; while a GDP growth rate of 8% would result in the FNPV increasing by 37%. Given the results shown in Table 20, the GDP growth rate has a pronounced effect not only on the FNPV; but on the debt service coverage ratios, ENPV and the externalities accruing to road users.

As the revenues generated by the toll road are a function of traffic; and traffic is a function of GDP; a decrease in GDP, for example, will lead to a decrease in traffic. A drop in traffic will lead to a drop in the project's toll revenues. A reduction in toll revenues will subsequently result in a reduction in the project's ability to pay off its debt obligations; as the net cash flow available for debt service will be lower in comparison to the debt obligations (principal and interest) which are not a function of GDP. As illustrated in Table 20, if GDP decreased to 1% the minimum ADSCR would decline by 66%, while on the other hand if GDP were to increase to 8%, the minimum ADSCR would increase by 25%.

The major benefits generated by the R-1 toll road project are VOC savings, TTS and ACS accruing to road users. The magnitude of these savings is a function of the volume of traffic forecasted to travel along the R-1 toll road once it is operational. As traffic is a function of GDP, the benefits accruing to road users will increase or decrease in line with variation in GDP. The results of the sensitivity analysis presented in Table

20, reveal that if GDP declines to 1% or increases to 8%, the present value of benefits to road users (savings in VOC, travel time and accident costs) would decrease by 26% and increase by 11% respectively.

GDP has a pronounced effect on ENPV as a result of the benefits to road users which constitute the major chunk of benefits to the economy of Zimbabwe. As illustrated in Table 20, a decline in GDP to 1% would result in the ENPV decreasing by 50%, while an increase in GDP will result in ENPV increasing by 21%.

GDP growth rate poses a significant risk to the outcomes of the R-1 toll road project; however; this risk is endogenous and cannot be mitigated as it depends largely on policies as well as the economic and political climate in Zimbabwe.

b. Base Toll Charge:

The toll rate charge for road users is a critical project variable as it affects the financial outcomes of the concessionaire, the cost incurred by road users to travel along the R-1 and the tax revenue collected by the GoZ. As shown in Table 20, if the base toll charge were to decrease to US$ 5 cents per kilometre, the FNPV would decline drastically by a rate of 155%. An increase in the toll charge to US$ 8 cents per kilometre would result in the FNPV increasing by 47%.

A change in the base toll charge will also have a significant impact on the project's ability to service its debt obligations; as the net cash flow available to debt service is dependent on toll revenues collected by the project, which in turn are a function of the toll tariff. As illustrated in Table 20, decreasing the toll tariff to US$ 3 cents will result in the minimum ADSCR declining by 66%, while increasing the toll charge to US$ 8 cents would result in the minimum ADSCR increasing by 21%.

Toll tariffs will not have an impact on the economy as they are transfers and have on economic value. However, toll tariffs will have a significant impact on road users as they represent a cost for using the road. Increasing the toll tariff will raise the cost of travel for road users and will reduce the overall benefit of the road; while reducing the toll tariff will effectively reduce the cost of travel and augment the benefits of using the road. As illustrated in Table 20, decreasing the toll tariff to US$ 5 cents will result in the PV of benefits to road users increasing by 52%. On the other hand, increasing the toll tariff will reduce the PV of benefits to road users by 25%.

The results of the sensitivity analysis on toll tariffs highlight the importance of negotiating a toll charge in a PPP toll road project that meets the objectives of different stakeholders. The toll rate must ensure that the private concessionaire will earn a reasonable rate of return without burdening the road users with unnecessary travelling costs. Road toll tariffs are best set in consultation with road users, apart from negotiations between the government and the concessionaire.

c. Investment Cost Overrun:

Investment cost overruns have been identified to be caused by three main factors; delays in the implementation and construction of a project, investment scale, and accountability rather than the type of infrastructure procurement used; public or private, (Flyvbjerg et al., 2004). As an infrastructure asset, changes in the capital costs of the R-1 road project have quite a big impact on the project's outcomes; most especially the FNPV, as increased capital expenditure results in the returns accruing to the concessionaire to decline. As shown in Table 20, if the capital costs increased by 25%; the FNPV would decrease by 95%. On the other hand, a decline in the required capital expenditures would result in the FNPV increasing by 48%.

Capital costs also have an impact on the project's ability to pay its debt. As the project is financed partly by debt, an increase in capital expenditures will result in an increase in the amount of debt required to fund the project; which will not likely be compensated by increased toll revenues. Hence as capital costs rise, the project's debt-paying ability will erode. In the case of the R-1 toll road, if capital costs increased by 25%, the minimum ADSCR would decrease by 19%. However, a decrease in capital costs would result in the minimum ADSCR rising by 15%.

Capital cost overruns will impact the economy due to the resource used to construct the road. Increased capital expenditures have a negative impact on the ENPV. Increasing capital expenditures by 25% will result in the ENPV declining by 21%. Reduced capital costs have a positive effect on the ENPV. If investment costs decrease by 20%, the ENPV will increase by12%.

Capital cost overruns do not have any impact on the road users directly, however, cost recovery will be reflected in the toll charge.

As capital cost overruns have the most significant impact on the concessionaire, it would be wise for the concessionaire to arrange fixed-price supply contracts on the materials and equipment it needs s to construct the R-1 road project to contain project costs.

d. Domestic Inflation:

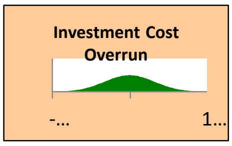
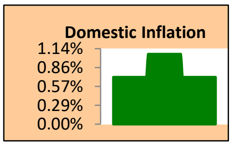
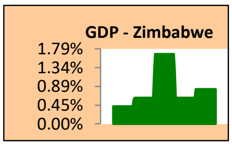
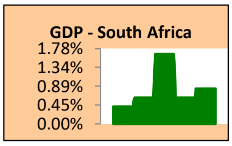
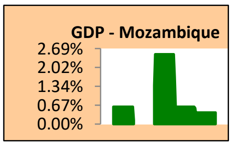
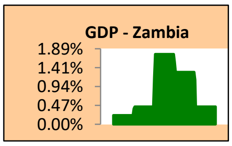
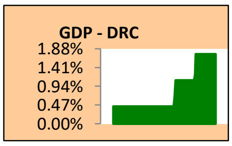
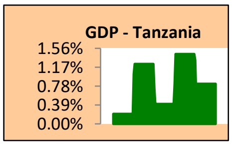
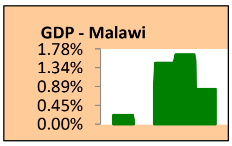
Zimbabwe's inflation over the life of the project will have both positive and negative impacts on the project's outcomes. The biggest impact was found to be on the concessionaire. As shown in Table 20, an increase in inflation of up to 4% will result in the FNPV declining by 53%. Failure to index the toll tariff to inflation will negatively affect the financial returns to the concessionaire. Additionally, it will impact the project's ability to maintain the road properly due to the reduced value of toll revenues collected.

The results of the sensitivity analysis show that there will be minimal impact of inflation on the debt paying ability as well as on the economic outcomes of the project.

8.3 Results of the Risk Analysis

A Monte-Carlo simulation consisting of 10,000 trials was conducted on the risk variables identified using sensitivity analysis. The risk variables and their respective probability distributions are presented in Table 21.

Table 21: Risk Variables used for Monte Carlo Simulation

Risk Variable	Type of Distribution		Probability Distribution
Investment Cost Overruns	Normal Distribution		Mean 20% Std. Dev. 30%
Domestic Inflation - Zimbabwe	Custom Distribution		min max probability -2.41% -0.37% 0.29 -0.37% 1.68% 0.43 1.68% 3.72% 0.29
GDP – Zimbabwe	Custom Distribution		min max probability -17.67% -11.05% 0.10 -11.05% -4.42% 0.15 -4.42% 2.20% 0.40 2.20% 8.82% 0.15 8.82% 15.45% 0.20
GDP – South Africa	Custom Distribution		min max probability -1.54% -0.11% 0.10 -0.11% 1.32% 0.15 1.32% 2.75% 0.40 2.75% 4.18% 0.15 4.18% 5.60% 0.20
GDP - Mozambique	Custom Distribution		min max probability 1.68% 3.89% 0.15 3.89% 6.10% 0.00 6.10% 8.30% 0.60 8.30% 10.51% 0.15 10.51% 12.72% 0.10
GDP – Zambia	Custom Distribution		min max probability -0.39% 1.75% 0.05 1.75% 3.89% 0.11 3.89% 6.02% 0.42 6.02% 8.16% 0.32 8.16% 10.30% 0.11
GDP - DRC	Custom Distribution		min max probability -6.91% -3.63% 0.11 -3.63% -0.36% 0.11 -0.36% 2.92% 0.11 2.92% 6.19% 0.26 6.19% 9.47% 0.42
GDP – Tanzania	Custom Distribution		min max probability 3.71% 4.66% 0.05 4.66% 5.61% 0.30 5.61% 6.56% 0.10 6.56% 7.51% 0.35 7.51% 8.46% 0.20
GDP - Malawi	Custom Distribution		min max probability -4.97% -2.06% 0.05 -2.06 0.86% 0.00 0.86% 3.77% 0.35 3.77% 6.69% 0.40 6.69% 9.60% 0.20

8.3.1 Financial Outcomes from the Perspective of the Concessionaire

Figure 6 and 7 present the frequency distribution of the returns to the concessionaire. The base case FNPV is equal to US$ 133.43 million. However, Figure 6 reveals that, given the risk variables that were used to conduct a Monte Carlo simulation, the mean FNPV is US$ (85.65) million, with a standard deviation of US$ 260.86 million. The range was found to be a between a minimum of US$ (1,633.83) million and a maximum of US$ 540.94 million, indicating the wide range of variability in the financial returns. The results also suggest that there is 55.28% chance that the FNPV will be less than zero.

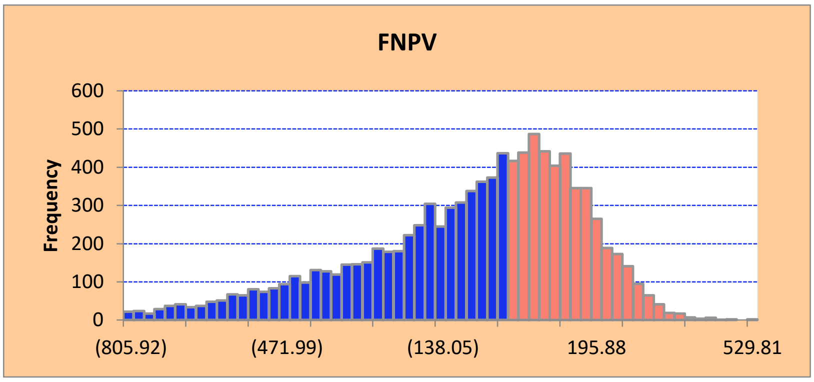


Figure 6: FNPV Frequency Distribution

In the base case, the MIRR is equivalent to 14.16%. However, Figure 7 shows that having run 10,000 simulation trials; the mean MIRR would be 10.32%, with a standard deviation of 4.58%. Just like the FNPV, there is a wide range of variability in the likely MIRR; the results show that MIRR ranges from a minimum of -2.40% to a maximum of 27.40% The MIRR is expected to be less than the RRR 55.27% of times.

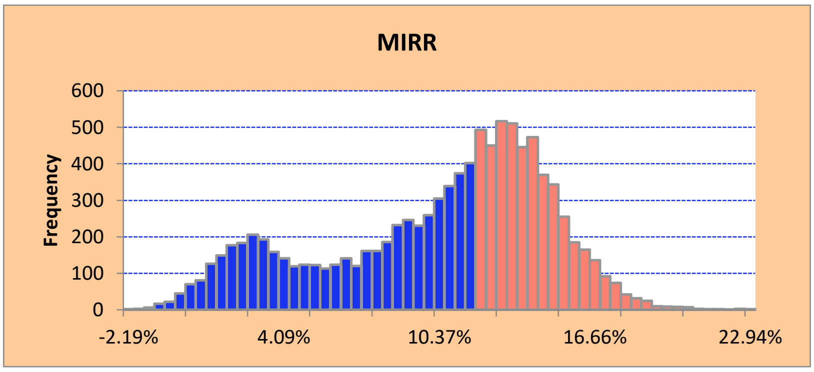


Figure 7: MIRR Frequency Distribution

8.3.2 Financial Outcomes from the Perspective of the Lender

The base case scenario showed that the project failed to meet its debt obligations only in the first year of operations as the ADSCR was equivalent to 1.22x; while in the second and third years it was equal to 1.30x and 1.52x respectively.

The results of the Monte Carlo simulation presented in Figure 8, reveal that in the first year of operations the ADSCR will on average be 1.05x, which is lower than the base case scenario, with a standard deviation of 1.37x and probability of 80.90% that it would be lower than the benchmark of 1.30x required by the lender.

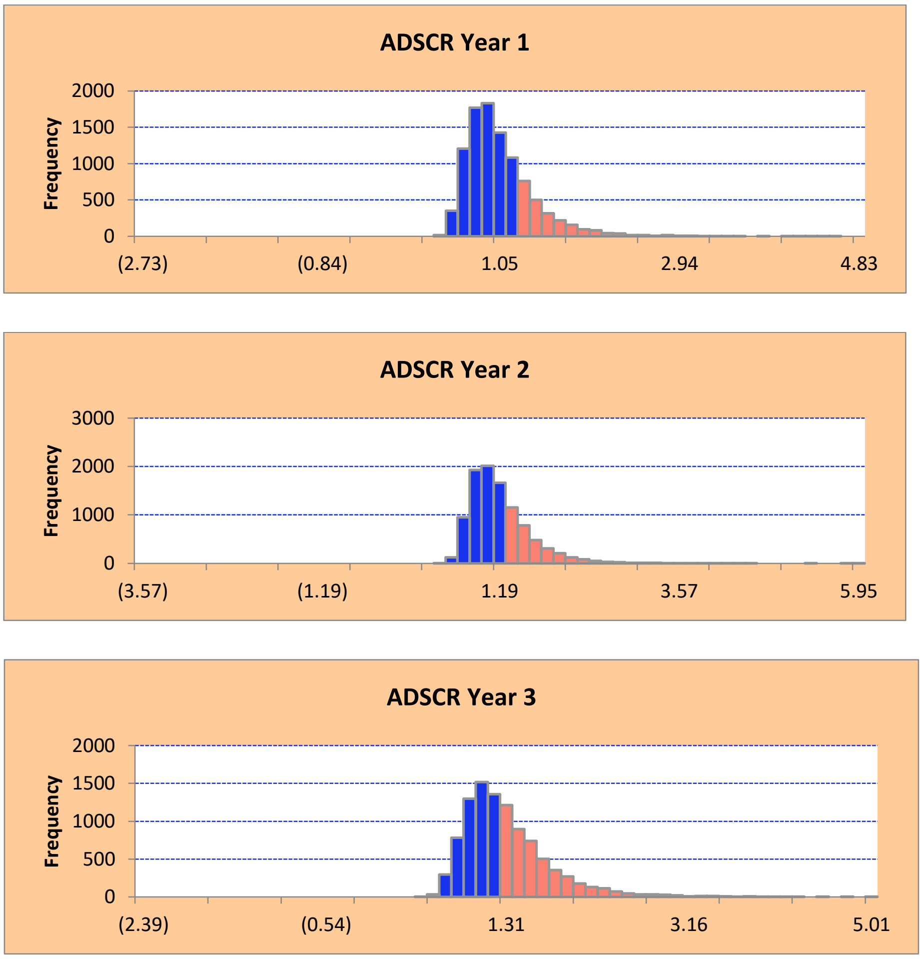


Figure 8: Frequency Distribution of the ADSCRs

In the case of the second year of operations, the mean ADSCR was found to be 1.11x, which is again lower than the base case and the required benchmark. The standard deviation is equal to 1.73x and the probability of an ADSCR lower than the benchmark is 69.78%.

As for the third year of operations, the mean ADSCR is lower than the base case but a little higher than the benchmark and stands at 1.31x, with a standard deviation of 1.34x. The probability that the ADSCR in this year is lower than the benchmark is equivalent to 58.08%.

Despite the simulation results of the ADSCRs showing that the project will most likely face difficulties paying off its debt in the first few years of operations, the results of the LLCRs give some hope with regards to the project's ability to pay off its debt over the life of the loan as illustrated in Figure 9. Looking at the first year of operations, the mean LLCR is 2.10x which is higher than the required benchmark of 1.30x. Though the standard deviation is equal to 2.07x, the probability that the LLCR is less than the benchmark is very low and stands at 0.44%.

Similarly, in the second and third year of operations the mean LLCRs which stand at 2.24x 2.40x respectively are higher than the benchmark, and though the standard deviation is 2.16x and 2.21x respectively, there is a 0.06% and a 14.39% chance that the LLCR will be lower than the required benchmark. For some unknown reason, it seems that the project may run into some kind of cash flow kink in the third year of operations.

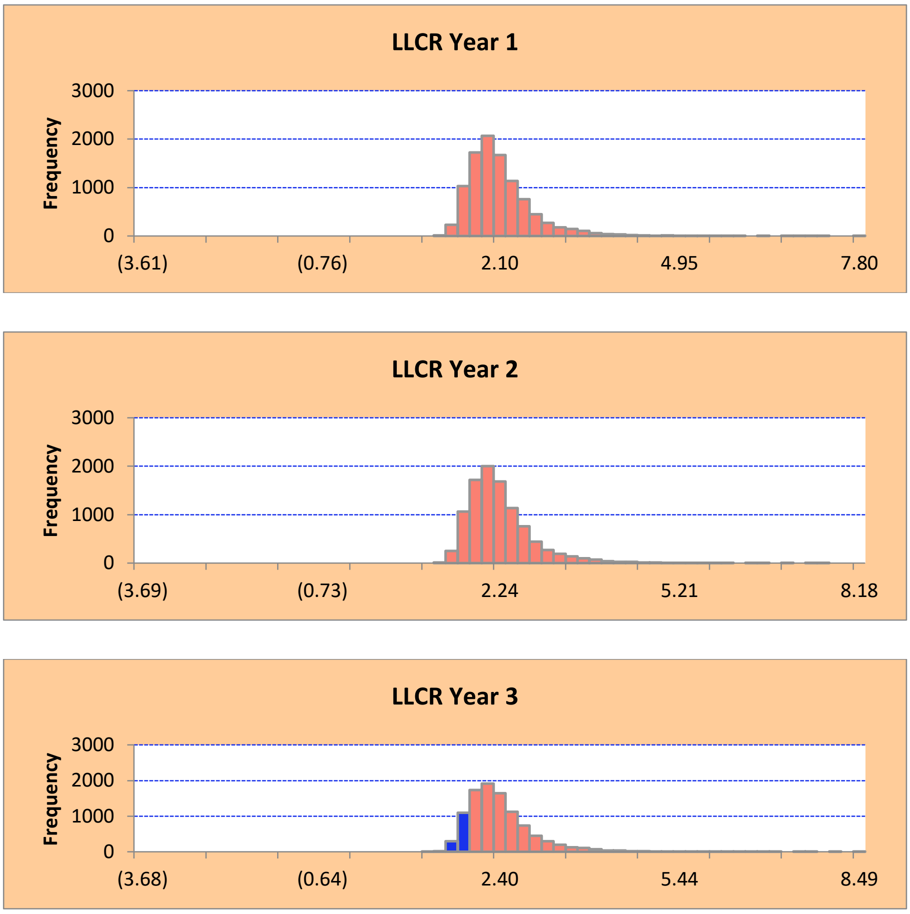


Figure 9: Frequency Distribution of the LLCRs

8.3.3 Economic Outcomes

Figure 10 presents the frequency distribution of the ENPV of the R-1 toll road project. The base case scenario predicted an ENPV of US$ 666.93 million, however, the risk analysis predicts that the mean ENPV is likely to be equivalent to US$ 187.36 million; which is significantly lower than the initial point estimate of the base case scenario. The standard deviation of the ENPV is US$ 200.37 million, with a range that lies between a minimum and maximum of US$ (678.01) and US$ 925 million respectively. Though there is wide variability in the distribution of the ENPV, the probability that the ENPV will be less than zero is 17.43%.

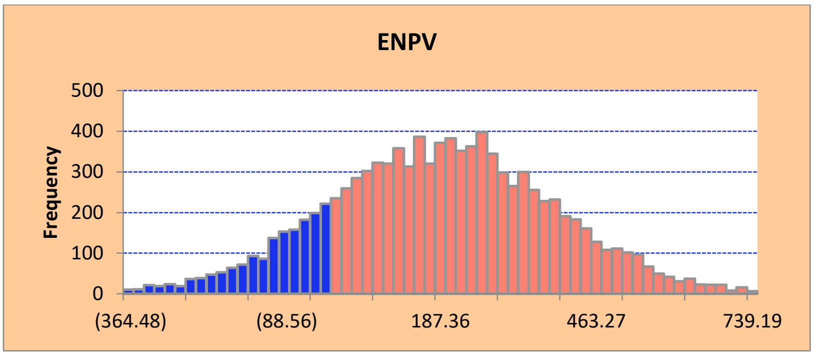


Figure 10: Frequency Distribution of the ENPV

Figure 11 presents the frequency distribution of the ERR. The mean ERR is anticipated to be 13.32%, which is lower than the predicted base case point estimate of 15.86%. The distribution of the ERR ranges from a minimum of 8.79% to a maximum of 28.70% and has a standard deviation of 1.47%. The probability that the ERR will be lower than the EOCK of capital is 17.43%.

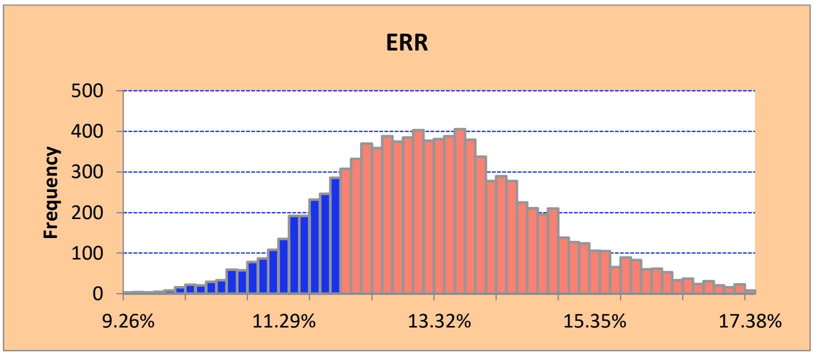


Figure 11: Frequency Distribution of ERR

8.3.4 Outcomes of the Revenue Sharing Agreement

Figure 12 shows the frequency distribution of the PV of the overall impact of the RSA on the GoZ. The PV gain/loss is computed by subtracting the PV of the Revenue Guarantee that the GoZ pays to the concessionaire from the PV of Revenue it receives from the concessionaire over the life of the project. The difference shows the overall impact of RSA on the GoZ. A negative result implies that the funds paid out by the GoZ to meet its revenue guarantee obligation are higher than the revenue they receive from any excess revenue generated by the project. In other words, a negative result translates to a contingent liability. In the case of a positive result the GoZ will reap a financial benefit from the RSA.

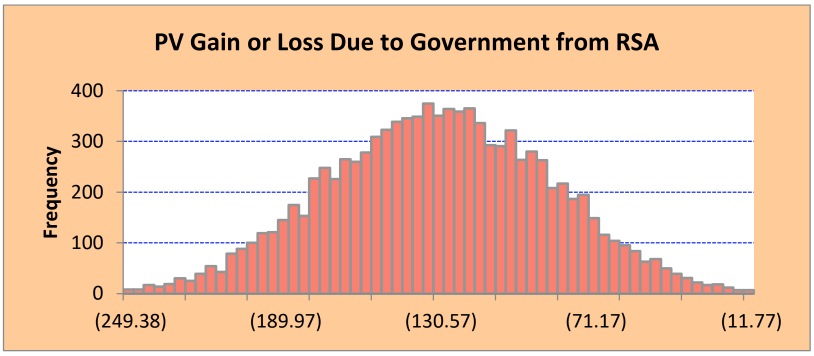


Figure 12: Frequency Distribution of PV of Impact of the RSA

Given the simulation of different traffic growth rates in the risk analysis, the results reveal that over the course of the project's life the GoZ will is likely to incur a contingent liability. The mean PV of this contingent liability is excepted to be US$ (130.57) million, with a standard deviation of US$ 43.14 million. The range of the PV of the contingent liability/benefit lies between US$ (301.29) million (contingent liability) and US$ 42.07 (contingent benefit). The likelihood that the GoZ will reap a benefit from this RSA is equal to 0.09%.

Chapter 9

CONCLUSIONS

9.1 Observations

Based on the results obtained from the IIA of the proposed R-1 toll road project the following observations were made given the deterministic analysis in the base case;

1. The financial analysis showed that the project is a potentially feasible and viable business opportunity for the private sector to undertake. The concessionaire should reap a reasonable positive rate of return if the project is undertaken at the moderate investment scale. However, if traffic growth is low, the returns may not be attractive to the concessionaire. Nevertheless, the risk of low traffic is unlikely to impact the concessionaire as the GoZ will take on the risk through a minimum traffic revenue guarantee built into the revenue-sharing agreement.
2. With respect to project financing, the concessionaire is expected to fund part of the capital cost using debt financing. The financial analysis shows that the project will generate sufficient cash flow to service its debt over the life of the loan; however, the project will likely run into short-term difficulty in servicing its debt in the first few years of operations.
3. The first observation from the economic analysis is that the R-1 toll road project would benefit the economy of Zimbabwe if it is implemented at the moderate investment scale, as it is at this scale that resources are efficiently employed. Constructing the road at the ultimate scale seems to be an

uneconomical use of resources as traffic demand does not warrant such an ambitious undertaking. Secondly, the road user benefits in terms of savings in VOCs, travel time and accident costs are quite significant compared to the toll traffic levied on road users. Hence, the benefits to road users outstrip the imposed user charges.

The results obtained from the IIA of the base case would lead one to draw the conclusion that the project is a worthwhile undertaking. Having conducted a thorough risk analysis of the base case financial, economic and stakeholder outcomes; a more accurate picture of the project's feasibility and viability was observed;

1. The odds of the concessionaire reaping a positive return are less than 50%, in fact; the mean return to the concessionaire was found to be negative, despite the revenue guarantee being in effect.
2. The project is highly likely to run into difficulties paying its debt in the first few years of operations due to the high probability that the ADSCRs will be significantly lower than the benchmark.
3. From an economic point of view, the project promises to be a worthwhile investment as it will result in a positive return to the economy, with very low likelihood that things could go sour, it is implemented at the moderate investment scale.
4. Though the RSA is a guarantee mechanism aimed at striking a balance between attracting private sector investment and minimizing the possibility of the private sector earning an abnormal return, it will most definitely have a negative impact on the GoZ due to the potential contingent liability it presents.

9.2 Conclusions

The R-1 toll road project is a potentially feasible and viable project, both from a financial and economic standpoint if it is implemented at the correct investment scale. However, the project is riddled with risks that must be addressed if it is to succeed. The mitigation of these risks will require that the project stakeholders find ways to manage and mitigate the identified risks. Only a private concessionaire with high-risk appetite is likely to undertake this project, given that the current economic and political environment in the country is quite volatile. Furthermore, the success of R-1 toll road is dependent on the rehabilitation and improvement of the R-2 highway which forms the other half of the north-south corridor which links Zimbabwe to Zambia and other countries to the north of Zimbabwe.

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APPENDIX

A.1. Labor Conversion Factor

CONVERSION FACTOR AND ECONOMIC VALUE OF LABOR																
Local labor	Wp	Wa	Ws	Tax	Hd	Ws(1-T)	HdWaT	EOCL	CF	Weight	Weighted CF	Labor benefits (Wp*(1-T) - Ws*(1-T))	Govt. benefits (Wp*T - HdWaT)	Total benefits	Ext.% to labor	Ext.% to Gvt.
	USD	USD	USD	%	%	(a)	(b)	=(a) + (b)	CF	%	%				%	%
Skilled labor	500	380	400	20%	90%	320	68	388	0.777	30%	0.23	80	32	112	71.7%	28.3%
Semi-skilled labor	350	250	250	20%	75%	200	38	238	0.679	20%	0.14	80	33	113	71.1%	28.9%
Unskilled labor	150	125	125	0%	50%	125	0	125	0.833	50%	0.42	25	0	25	100.0%	0.0%
TOTAL							Labor Conversion Factor				0.79	185	64	249	74.27%	25.73%

A.2.1. Transportation

	Ax	Pi	Pi m	n	e	Wd	Ws	T	t	di	I	j
Tradable Inputs												
Fuel	1.0	4,443	3,091					25%	15.00%	43.75%	1,352	
Lubricants	1.0	107	85					10%	15.00%	26.50%	22	
Maintenance	1.0	1,333	1,008					15%	15.00%	32.25%	325	
Tires	6.0	156	120					13%	15.00%	29.95%	216	
Depreciation	1.0	2,359	1,784					15%	15.00%	32.25%	575	
Return to Capital	1.0	1,180	1,026						15.00%	15.00%	154	
Non-Tradable Inputs		Pj										
Adminstrative Overhead	1.0	613	533	(0.5)	1.0	0.33	0.67		15.00%	15.00%		75
Operational Overhead	1.0	398	346	(2.0)	1.0	0.67	0.33		15.00%	15.00%		45
License	1.0	184	160	(0.2)	1.0	0.17	0.83		15.00%	15.00%		23
Insurance	1.0	1,320	1,148	(0.2)	1.0	0.17	0.83		15.00%	15.00%		166
Labour cost - Staff(semi skilled)	2.0	1,226	1,066						15.00%	15.00%		0
Total Costs											2,645	309
			Pd=FV	15,325	Demand Elasticity [n]		(1.0)		Ws Ps + Wd Pd	13,826		
FV	15,325		Ps=Pm	13,326	Supply elasticity [e]		3.0		Wd Pm d*	400		
EV	11,929		%T	68%		Wd	0.25		Ws (i + j)	2,215		
			%NT	32%		Ws	0.75		Value of FEP	676		
Transportation Conversion Factor	0.78	CF	d*	12.00%					Value of NTP	43		

A.2.2. Utilities

	Ax	Pi	Pi m	n	e	Wd	Ws	T	t	di	I	j
Tradable Inputs												
Primary energy	1.0	39,332	32,573					5.00%	15.00%	20.75%	6,759	
Materials	1.0	23,368	19,352					5.00%	15.00%	20.75%	4,016	
Depreciation and ammortization	1.0	15,356	12,717					5.00%	15.00%	20.75%	2,639	
Return to Capital	1.0	16,706	14,527						15.00%	15.00%	2,179	
Non-Tradable Inputs		PJ										
Financial contracts	1.0	10,801	9,392	(0.5)	1.0	33%	67%		15.00%	15.00%		1,221
Transport costs	1.0	2,151	1,870	(2.0)	1.0	67%	33%		15.00%	15.00%		262
Admistrative and general expenses	1.0	3,813	3,316	(0.5)	1.0	33%	67%		15.00%	15.00%		431
Other operating expenses	1.0	6,231	5,418	(0.5)	1.0	33%	67%		15.00%	15.00%		704
Labor (semi-skilled)	1.0	30,608	26,616						15.00%	15.00%		0
Total Costs											15,592	2,618
			Pd=FV	148,366		Demand Elasticity [n]	(1.0)		Ws Ps + Wd Pd	135,465		
FV	148,366		Ps=Pm	129,014		Supply elasticity [e]	2.0		Wd Pm d*	5,161		
EV	124,810		%T	0.64		Wd	33%		Ws (i + j)	12,140		
			%NT	0.36		Ws	67%		Value of FEP	6,180		
Utilities Conversion Factor	0.84	CF	d*	12.00%					Value of NTP	466		

A.2.3. Aggregate

	Ax	Pi	Pi m	n	e	Wd	Ws	T	t	di	I	j
Tradable Inputs												
Mining products	7.0	6.10	5.05					5.00%	15.00%	20.75%	7.34	
Wood products	2.0	2.80	2.21					10.00%	15.00%	26.50%	1.17	
Petroleum products	4.0	12.25	9.68					10.00%	15.00%	26.50%	10.26	
Plastic products	2.0	7.90	6.11					12.50%	15.00%	29.38%	3.59	
Ceramic products and ceramic ware	5.0	6.10	4.28					24.00%	15.00%	42.60%	9.11	
Iron and steel products	25.0	1.36	0.98					21.00%	15.00%	39.15%	9.59	
Structural metal products	30.0	2.13	1.61					15.00%	15.00%	32.25%	15.61	
Treated and other fabricated metal products	4.0	3.68	2.78					15.00%	15.00%	32.25%	3.58	
Electrical equipment products	30.0	2.33	1.76					15.00%	15.00%	32.25%	17.02	
Non-Tradable Inputs		Pj										
Cement and other non-metallic products	40.0	2.42	2.10	(1.0)	3.0	0.25	0.75		15.00%	15.00%		10.72
Business and othe services	1.0	140.10	121.83	(1.0)	3.0	0.25	0.75		15.00%	15.00%		15.53
Other non-traded services	4.0	3.40	2.96	(1.0)	3.0	0.25	0.75		15.00%	15.00%		1.51
Return to capital	1.0	107.60	93.57						15.00%	15.00%		0.00
Labour (semi-skilled)	8.0	30.41	26.45						15.00%	15.00%		0.00
Total Costs											88.70	27.76
			Pd=FV	1,000		Demand Elasticity [n]	(1.0)		Ws Ps + Wd Pd	902		
FV	1,000		Ps=Pm	870		Supply elasticity [e]	3.0		Wd Pm d*	26		
EV	820		%T	40%		Wd	0.25		Ws (I + j)	87		
			%NT	60%		Ws	0.75		Value of FEP	26		
Aggregate Conversion Factor	0.82	CF	d*	12.00%					Value of NTP	5		

A.3.1. Bitumen

Bitumen Conversion Factor		0.82	CF		

	Bitumen		Financial Value	CF for NT Services	Value of FEP	Economic Value
	CIF Price (USD)		1.00		7.50%	1.08
[+]	Tariff	15.00%	0.15			
[+]	Exisice duty					
[+]	Value added tax (VAT)	15.00%	0.15			
[+]	Port charges	5.00%	0.05	0.75		0.04
[+]	Freight & Transport, port to project	5.00%	0.05	0.78		0.04
	Project-site price		1.40			1.15

A.3.2. Traffic Signals

Traffic Signals Conversion Factor		0.77	CF		

	Traffic signals		Financial Value	CF for NT Services	Value of FEP	Economic Value
	CIF Price (USD)		1.00		7.50%	1.08
[+]	Tariff	25.00%	0.25			
[+]	Exisice duty					
[+]	Value added tax (VAT)	15.00%	0.15			
[+]	Port charges	5.00%	0.05	0.75		0.04
[+]	Freight & Transport, port to project	5.00%	0.05	0.78		0.04
	Project-site price		1.50			1.15

A.3.3. Portland Cement

Portland Cement Conversion Factor		1.13	CF		

	Portland cement		Financial Value	CF for NT Services	Value of FEP	Economic Value
	FOB Price		1.00		7.50%	1.08
[-]	Port charges	5.00%	0.05	0.75		0.04
[-]	Freight & Transport, port to market	5.00%	0.05			
	Market Price		0.90			1.04
[+]	Freight & Transport, market to project	5.00%	0.05	0.78		0.04
	Project Price		0.95			1.07

A.3.4. Steel

	Steel Conversion Factor		1.13	CF		
	Steel		**Financial Value**	**CF for NT Services**	**Value of FEP**	**Economic Value**
	FOB Price		1.00		7.50%	1.08
[-]	Port charges	5.00%	0.05	0.75		0.04
[-]	Freight & Transport, port to market	5.00%	0.05			
	Market Price		0.90			1.04
[+]	Freight & Transport, market to project	5.00%	0.05	0.78		0.04
	Project Price		0.95			1.07

A.4. Construction Conversion Factors

Construction Conversion Factor	0.90	CF	
	% WEIGHT	**CF**	**WEIGHTED CF**
ICW Break down of costs (% of construction costs)			
Skilled labour, (% share in construction costs)	5%	0.777	0.04
Semi-skilled, (% share in construction costs)	5%	0.679	0.03
Unskilled labour, (% share in construction costs	10%	0.833	0.08
Machinery	15%	0.92	0.14
Cement, (% share in construction costs)	13.65%	1.13	0.15
Bitumen,(% share in construction costs)	12.53%	0.82	0.10
Aggregate, (% share in construction costs)	7.08%	0.82	0.06
Steel, (% share in construction costs)	10.29%	1.13	0.12
Fuel, (% share in construction costs)	9.94%	0.77	0.08
Wood, (% share in construction costs)	2.50%	1.13	0.03
Tires, (% share in construction costs)	1.20%	0.83	0.01
Fencing, (% share in construction costs)	2.42%	0.79	0.02
Wire, (% share in construction costs)	0.11%	0.74	0.00
PVC materials, (% share in construction costs)	0.10%	0.82	0.00
Other materials, (% share in construction costs)	1.89%	0.79	0.01
Traffic signals, (% share in construction costs)	2.42%	0.77	0.02
Lighting, (% share in construction costs)	0.81%	0.77	0.01
Total	100%		0.90

A.5. Operations Conversion Factor

Operations Conversion Factor	0.80	CF	
CONVERSION FOR OPERATIONS			
	% WEIGHT	**CF**	**WEIGHTED CF**
Operations Break down of costs (% share of operations costs)			
Operations			
Utilities, (% share in operations costs)	30%	0.84	0.25
Transportation, (% share in operations costs)	20%	0.78	0.16
Labour, (% share in operations costs)	50%	0.79	0.39
Total	100%		0.80

A.6. Maintenance Conversion Factor

Maintenance Conversion Factor	0.85	CF	

CONVERSION FOR MAINTENANCE			
	% WEIGHT	CF	WEIGHTED CF
Labour			
Skilled labour, (% share in maintenance costs)	8.8%	0.777	0.07
Semi-skilled, (% share in maintenance costs)	7.6%	0.679	0.05
Unskilled labour, (% share in maintenance cost	14.8%	0.833	0.12
Machinery, (% share in maintenance costs)	15.6%	0.92	0.14
Materials			
Fuel	24.6%	0.77	0.19
Bitumen	1.9%	0.82	0.02
Tires	5.9%	0.83	0.05
Cement	4.8%	1.13	0.05
Steel	7.7%	1.13	0.09
Wood	1.8%	1.13	0.02
Miscellaneous	6.5%	0.79	0.05
Total	100%		0.85

A.7. VOC Conversion Factor

Vehicle Operating Cost Conversion Factor	0.80	CF	

CONVERSION FOR VEHICLE OPERATING COST			
	% WEIGHT	CF	WEIGHTED CF
Fuel	70.0%	0.77	0.54
Tires	10.0%	0.83	0.08
Repair	20.0%	0.92	0.18
Total	100%		0.80