Integrated Investment Appraisal of AzRIP Rural Road Projects

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Submitted to the
Institute of Graduate Studies and Research
in Partial fulfilment of the requirements for the Degree of

Master of Science
in
Banking and Finance

Eastern Mediterranean University
July 2015
Gazimağusa, North Cyprus

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ABSTRACT

Being one of the most intrigued topics of financial researchers, rural roads have gained a crucial role in terms of economic promotion of various developing countries lately. Azerbaijan is one of the countries giving preponderance to road infrastructure development and rehabilitation due to accelerated traffic growth rate along with boost of regional and international terrestrial economic and trade relations. To survive as a winning competitor in an economically and commercially severe rivalry, the governmental agencies of Azerbaijan give priority to high-quality projects targeting rapid development of road infrastructure.

Current thesis study aims to appraise one of those projects, implemented with the financial support of World Bank and Azerbaijani government, Azerbaijan Rural Investment Project, to find out the level of efficiency and socio-economic vitality of the project's first phase. Embracing roughly half of the total project budget, rehabilitation of rural roads covered totally 2033 km length, which is almost two-third of the total interior roads of the country. The roads also triggered improved social and commercial integration amongst diverse economic zones of the country. The fact makes the road projects of AzRIP-1attractive to be reviewed and studied in terms of their importance and feasibility.

To conduct the appraisal, this data and information were obtained from the project owners and primarily the beneficiaries of the project, efforts to review the projects from three different angles classified as Scenario 1, Scenario 2 and Scenario 3. Assuming the whole project funding realized by the government and banking

institution (35.6% and 64.4% respectively), Scenario 1 coincides with the original project, actually implemented within the project regions. Reviewed with the first scenario the project outcomes consequently revealed to have a negative financial NPV of 23.4 million USD. However, the economic analysis results and externalities were positive, with NPV comprising 155 and 180 million USD, respectively. In other words, as per Scenario 1, not predicting a toll, the road projects were financially infeasible, while economically beneficial and feasible for the country and the related economic zones.

Scenario 2 proposes governmental funds solely for covering project expenses and no loans or any other debts from financial institutions. Similarly to the previous scenario this one also excludes application of tolling system. The results of the analysis suggested negative financial NPV of 7.7 million USD; and positive economic NPV of 155 million USD. Compared with the figures of the first Scenario, decrease in negative financial NPV is three-fold, while the economic NPV remains the same. The results bear out the projects' contribution to socio-economic welfare which indicates that the project has reached its goal.

Unlike the first two scenarios the last scenario assumes a toll system on the rehabilitated roads, in line with the similar financial budget arrangements (64.4% bank investment and the remaining part is governmental funding). Scenario 3 outcomes made apparent that both NPVs are positive; 0.055 million USD and 110.7 million USD respectively. The analysis also came to conclusion that particularly direct project beneficiaries would have abundance of advantages from this project outweighing the benefits of the other stakeholders i.e. owners. With an eye on financial benefit, the last Scenario suggests introduction of Special Purpose Vehicles (SPV) would on one hand

inspire private sector involvement in the project and also possibility of implementation extended public projects' implementation without much governmental financial commitments.

Keywords: Road project, time saving, net present value, feasibility, integrated investment appraisal, financial NPV, economic NPV, risk analysis of road projects

ÖZ

Mali araştırmacıların büyük ilgisine neden olan kırsal kesimlerdeki yollar son zamanlarda gelişmekte olan çeşitli ülkelerin ekonomik kalkınmasında önemli rol üstlenmektedirler. Süratle artan trafik yoğunluğunun yanı sıra bölgesel ve uluslararası kara ekonomik ve ticari ilişkilerinin yükselmesi nedeniyle Azerbaycan da yol altyapısının iyileştirilmesine ve rehabilitasyonuna büyük önem veren ülkeler arasındadır. İktisadi ve ticari bakımdan şiddetli rekabet ortamında kazanan bir rakip olarak hayatta varoluşunu sürdürebilmek adına Azerbaycan'daki hükümet kurumları yol altyapısını hızlıca kalkındırmayı hedefleyen yüksek kaliteli projelere öncelik vermekteler.

İşbu tez çalışması o projelerden birisini - Dünya Bankası ve Azerbaycan hükümetinin mali katkısıyla gerçekleştirilmiş olan Azerbaycan Kırsal Sermaye Projesini (AzKSP-AzRIP) değerlendirmeği, projenin ilk aşamasının verimliliğini ve sosyal – ekonomik yaşama gücünü gözden geçirmeği hedeflemektedir. Toplam proje bütçesinin yaklaşık yarısını kapsayan kırsal yolların iyileştirilmesi projesi genel uzunluğu itibariyle tüm ülkede iç yolların üçte ikisini tutan 2033 kilometredir. Bu yollar aynı zamanda ülkenin çeşitli sosyal ve ticari bütünleşmesindeki gelişme sürecini tetiklemiş bulunmaktadır. Bu gerçek AzRIP-1'in yol projelerini önem ve fizibilite bakımından incelenmek için çekici kılmaktadır.

Değerlendirmeyi gerçekleştirmek amacıyla bu çalışmanın müellifi proje yetkililerinden ve projenin direk faydalanıcılarından topladığı veri ve bilgilere dayanarak, projeyi Senaryo 1, Senaryo 2 ve Senaryo 3 diye sınıflandırılan üç farklı

açıdan incelemeye gayret etmiştir. Projenin tamamen hükümet ve banka müessesesi tarafından (sırasıyla %35,6'lık ve %64,4'lük kısımlarını) finanse edildiğini farz eden Senaryo 1 proje bölgelerinden gerçekte yürütülmüş orijinal proje durumuyla örtüşmektedir. Senaryo 1 ile incelendiğinde projenin neticelerinin 23,4 milyon Amerikan dolarlına tekabül eden negatif finansal Net Bugünkü Değer'inin (NBD) olduğu görüldü. Ancak yapılan iktisadi analizlerin ve dışsallıkların sonuçları sırasıyla 155 ve 180 milyon Amerikan dolarına tekabül eden NBD değerlerini sundu. Başka deyişle, geçiş ücreti uygulamalarını öngörmeyen Senaryo 1'e göre yapılmış yol projeleri finansal fizibilite açısından uygun olmamakla birlikte, ekonomik açıdan gayet faydalı ve ülke ve ilgili ekonomik bölgelerin kalkınması için uygulanabilir olarak değerlendirilmiştir.

Senaryo 2 proje masraflarının yalnızca hükümet kaynaklarıyla karşılanması teklifinde bulunurken hiçbir mali müessesenin borç yahut kredisini öngörmemektedir. Önceki senaryoya benzer şekilde, bu senaryo da yol ücretlendirme uygulama sistemini öngörmemektedir. Analiz sonuçlarında7,7 milyon dolara tekabül eden negatif finansal NBD ve 155 milyon dolara eşdeğer pozitif ekonomik NBD rakamları ortaya çıktı. İlk senaryo ile karşılaştırıldığında negatif finansal NBD rakamlarında üç kat düşüş görülürken, ekonomik NBD aynı sonuçları göstermektedir. Analiz sonuçları projenin sosyal-ekonomik refaha katkı sağladığını ve böylelikle de projenin asıl amacına ulaştığını ortaya koymaktadır.

İlk iki senaryodan farklı olarak iyileştirilmiş yollarda geçiş ücreti sistemini ileri süren son senaryo, aynı zamanda önceki iki senaryoyla benzer finansal bütçe düzenlemelerini öngörmektedir (%64,4 banka sermayesi ve geri kalan kısmı da hükümet finansmanı). Senaryo 3 sonuçları her iki NBD rakamlarının pozitif, sırasıyla

0,055 milyon dolar ve 110.7 milyon dolar olduğunu ortaya koydu. Bu analiz özellikle proje direk faydalanıcılarının, proje paydaşlarının, sahiplerinin de bu projeden kazanabilecekleri sayısız avantajların mevcudiyetini ortaya koydu. Finansal yarar açısından baktığımızda son senaryonun teklif ettiği Özel Amaçlı Araçların kullanımı bir yandan özel sektörün projeye katılımını canlandırabilir, diğer bir yandan da daha fazla sayıda toplumsal projelerin hükümetin üzerine yükümlülük koymadan gerçekleştirebilir.

Anahtar kelimeler: yol projesi, zamandan tasarruf, net bugünkü değer, fizibilite, entegre yatırım değerlendirme, finansal NBD, ekonomik NBD, yol projelerinin risk analizi.

To my loving Mother & Father

ACKNOWLEDGEMENT

Numerous people over the years have helped me get here and elaborate my study, so there are many people I need to acknowledge and convey my sincere gratitude.

Foremost, I would like to express my deepest thanks to my supervisor, Assoc. Prof. Dr. Mustafa Besim for not only his guidance, advice and encouragement during the whole research period and writing of this thesis, but also for supporting me successfully complete my Master's Degree. It has been my great honour to study under his supervision.

I am deeply indebted to Prof. Dr. Glenn P. Jenkins for introducing me the Integrated Investment Appraisal Methodology as well as having belief in me to gain both academic and professional skills in the project appraisal.In addition, my appreciation also goes to Assist. Prof. Dr. Hasan U. Altiok and Assoc. Prof. Dr. Mustafa Besim who are teachers of EMU's programs on Investment Appraisal and Advanced Capital Budgeting who helped enrich my comprehension of the Integrated Investment Appraisal methodology.

Mr. Soubhan Asgerov and Ms. Gulbaniz Ganbarova who are Project Director and Deputy Director of AzRIP given me a great support during my research work. I express my gratitude to both of them for providing detailed and full information about the project.

Wholeheartedly, I want to thank my family members, especially my mother and father, who gave me life and their endless love for their great encouragement during the whole

my education periods. In particular, I would like to give my special thanks my father Dr. Israyil Isgandarov for his help, support, interest and valuable hints in the preparation of this thesis.

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ADSCR	Annual Debt Service Coverage Ratio
ASDAPS	Agency for Support of the Development of The Agricultural Private Sector
AZN	National Currency (Manat) of Azerbaijan
AzRIP	Azerbaijan Rural Investment Project
BCR	Benefit Cost Ratio
CBA	Cost-Benefit Analysis
CBOs	Community-Based Organizations
CEA	Cost Effectiveness Analysis
CF	Conversion Factor
CSCF	Commodity Specific Conversion Factors
CUA	Cost Utility Analysis
DR	Discount Rate
EIA	Economic Impact Analysis
EMV	Expected Monetary Value analysis
EOCK	Economic Opportunity Cost of Capital
FEP	Foreign Exchange Premium
GDP	Gross Domestic Product
IDPs	Internally Displaced People
IRR	Rate of Return
LLCR	Loan Life Coverage Ratio
MAT	Ministry of Automobile Transport
MCDA	Multiple Criteria Decision Analysis

NCF	Net Cash Flow
NGOs	Non-Governmental Organizations
NPV	Net Present Value
PBP	Payback Period
P_d	Demand price
PMU	Project Management Units
P_s	Supply Price
QALYs	Quality Adjusted Life Years
RGACs	Regional Grant Approval Committees
ROOs	Regional Operations Offices
SC	Project Steering Committee
SIA	Social Impact analysis
SPV	Special Purpose Vehicles
SROI	Social Return On Investment
TRASECA	Transport Line Europe-the Caucasus-Asia
VOC	Vehicle Operating Cost

Chapter 1

INTRODUCTION

"If you could get up the courage to begin, you have the courage to succeed"
David Viscott (American Psychologist,1938-1996)

1.1 Background

The Republic of Azerbaijan is a country located at the crossroads belonging to Eastern Europe and the western part of Asia, in 40° 30' N latitude and 47° 30' E longitude. Having a total land area of about 86,600 km2 kilometres, the country shares borders with Russia, Georgia, Armenia, Turkey and Iran which form a 2,648 km border length (390 km, 480 km, 1007km, 15km and 756 km respectively). The eastern boundary of Azerbaijan is surrounded with the Caspian Sea, extending a total length, roughly 456 km. The country measures 400 km from north to south and 500 km from east to west.

Azerbaijan is a mountainous country, with high ridges and plateaus joining to plains and lowlands. Three major mountains in Azerbaijan are Boyuk Gafgaz (The Greater Caucasus), Kichik Gafgaz (The Lesser Caucasus) and the Talysh. The highest peak is Bazardüzü which is in The Greater Caucasus range. Considerably great portion of the total mud volcanoes in the world are located in Azerbaijan, which are found out to be similar to uplands of Mars planet in the NASA geologists' relevant studies [1].

There are nearly 8,350 various widths and lengths rivers in the country, only of which 24 are big enough to be mentioned in this study. All the rivers ultimately meet the Caspian Sea.

According to official data represented by The State Statistical Committee of the Republic of Azerbaijan, the population of Azerbaijan equals roughly 9.6 million. The natural population increase number is roughly 13 per a thousand. This growth urges the transport strategy in the country, in line with the other economic, financial and social reforms. Within the frameworks of transport strategy, road rehabilitation covers the respectable portion of annual governmental budget allocations, as well as keeps its superior priority in project targets carried out by various national and international development companies operating in the country. To overview the road projects in Azerbaijan in details, one can easily notice the significance of the road rehabilitation projects implemented by AzRIP.

AzRIP is a project elaborated and financed by the Azerbaijani Government and World Bank and implemented by the State Agency on Agricultural Credits under the Ministry of Agriculture of Azerbaijan Republic within the period 2004 to 2012 years. This project was carried out in two stages. With the eye to invest in the rural development of five regions (Mughan-Salyan, Lower Shirvan, Nakhchivan, North and North West) of Azerbaijan, the significant share of project budgets was allocated to community based infrastructure investments. The total project budget was 46.65 USD.

To review the operating strategy of AzRIP, it is comprehended that, the project is ensuring monetary and technical support to target communities, endeavoring to contribute their labour, time, and funds equaling the insignificant portion of the total project budget for the sake of their communities' social well-being. The supported projects are mainly focused on rehabilitation or renovation of existing infrastructure, or constructing new infrastructure items.

1.2 About the study

1.2.1 Aim of study

This thesis aims to conduct an in-depth post-investment appraisal of AzRIP's road rehabilitation projects in terms of their financial, sensitivity impacts, cost and benefit analysis, risk assessment and applicability of the risk mitigation ways, economic efficiency and viability from the government, entrepreneurs, households and individuals' perspectives.

As a core element in this appraisal will be the examination of the incremental impact of the project; through qualitatively and quantitatively assessment of the road rehabilitation projects at large, to see the net benefit from the mentioned project. The study entails the systematic estimation of all benefits and all costs of the road projects in line with considering all the gains and losses to all members of the benefitting communities who are affected by the project.

1.2.2 Methods used in the study

A number of research and analysis methods were used in different stages (research

> "This applied research project aims to examine the issues associated with performance appraisals of AzRIP road rehabilitation projects and identify the results of the capital invested".

planning, initial data gathering, data analysis and interpreting, impact assessment, cost-benefit analysis, financial, economic, sensitivity and risk analysis, stakeholder analysis) of this study's elaboration. To increase the effectiveness of the study, we tried to appraise the investment from several various angles, to find out whether it was advantageous for the communities or not. To initially screen the view of the general investment sequences, that is, to see whether the investment met the initially set payback target or not, we used the **payback period evaluation** method, the details of

which are represented in further sections. To deepen the analysis, we preceded it with more complex calculations like **net present value** and the **internal rate of return**. To represent all the further the data more constructively, all the research studies were introduced in two: primary and secondary levels.

Data for primary level was gathered via field activities, directly from the beneficiaries of the AzRIP's road project sites. The direct communication methods like face to face interviews, discussions with project immediate stakeholders, community individuals, households, small car repairing entrepreneurs, medical points operating in communities, direct observation and when necessary, with e-mail exchange were used to get the primary data.

Secondary data was grounded on the information obtained from other companies operating the same target area, wide range of published research materials on investment analysis and impact assessment of road rehabilitation projects, World Bank reports, official statistical data on transportation and the road projects impact on economic development and other reliable sources.

The below part introduces brief description of the methods to appraise the investment made on the road rehabilitation in the AzRIP project affected communities:

a) Identification of Repair expenses
   - Choice 1: Getting experts' feedback
   - Choice 2: Calculation on the base of actual expenses
b) Monetary estimation of Time Value
c) Estimation of Vehicle Operating Cost
d) Calculation of Trucker and Farmer Benefit

e) Division of the value per beneficiary revenues and estimating their times

f) Changes in transporting tariffs

g) NPV (Net present Value) analysis

In line with all of these, the study covers the following data as well:

- the correlation of the expected return of the road projects to the cost of invested funds and to the returns expected;
- Economic and financial cost of the of the road rehabilitation investment;
- the financial and economic impact, with all the indirect effects;

Significant importance was given to appraisal of the benefits of the investment in financial terms wherever possible. Non-financial factors like

- meeting the requirements of current Azerbaijani legislation,
- improving the health conditions, family budgets,
- social and cultural integration between the affecting communities and other regions of Azerbaijan,
- developing community understanding about social development and community projects ownership,
- improving road management systems,
- Anticipating and resolving future risks and threats were the issues also considered in the study.

1.3 Data Sources

Essential source of the data used in this thesis, was obtained from the official data introduced by the AzRIP project database or provided by the project authorities, the official statistical data from the State Statistical Committee, as well as, the Ministry of

Transport of the Azerbaijan Republic, as well as, the direct beneficiaries of the project. We acknowledge that during the period of collecting the primary data from the beneficiaries, I faced with several problems to complete the necessary data needed to describe the initial view of the community roads before the implemented projects appropriate spreadsheets. To deal with these challenges, I compared the situation in the neighboring communities with no project interventions. In addition, various appraisal articles, books and internet resources were thoroughly reviewed in this stage of study.

For the specific and clear view of the project and the investment made, we used the both sources of data, qualitative and quantitative ones.

1.4 Study Approach

Investment appraisal capturing economic, financial, sensitivity and risk analyses, as well as stakeholder impact assessment were used in an integrated form to ensure the analysis of the road rehabilitation projects from the simple to sophisticated. This multi-sphere approach provides easier and clearer approach has its pros, so as, it helps to figure out the post-appraisal data of the projects, and see if the projects are efficient and whether they are sufficient enough to meet the investors' and the beneficiary communities' expectations. The outcomes of the separate parts of the integrated analyses will surely have significant differences, however the study foresees to represent the reasons for the differences and explain the detailed appraisal from the above mentioned spectra.

1.5 Investment Rationale and Justification

After the collapse of the Soviet Union, the economy of Azerbaijan has recovered considerably. Overall Gross Domestic Product (GDP) growth displayed optimistic

outcomes with its 9.3% increase, while the world was struggling with the waves of economic crisis. However, this was mostly due to oil-sector revenues. In the non-oil sector, which includes rural development as well, displayed dramatic fall from 16% to 3% in the first decade of second millennium. Covering a significant share comprising 45.8%, the rural population and the rural infrastructure are considered to be the backbone of the economy after the oil-sector. Nevertheless, the rural roads were in poor condition and urged immediate need for rehabilitation and maintenance. Majority of the villages in project target areas had earnest problems in accessibility.

This need actually was the fundamental reason for the government to elaborate its most constructive and comprehensive development reforms under 'State Program on Socio-Economic Development of Regions' since 2014 in one hand, and in the other hand urgently support regional development initiatives by local and international actors. Until the AzRIP project, 6 projects were supported by various banks, in line with the same number of projects funded by other international donors. Only two of these projects were focused on rural infrastructure development, whereas, the outcomes did not reveal sufficient road rehabilitation data. Actually that was the essential rationale of the road rehabilitation investment of AzRIP.

1.5.1 Project Objective

As per official project documents, 'AzRIP project objectives were designed to develop access to and the quality of rural economic and social infrastructure' [2].

The project mainly aimed to improve the community households' living standards and advance the utilization of infrastructure services via supporting rural communities' micro-projects implemented in the areas described in Figure 1.1. Identification and selection of

Figure 1.1: Project Location

the micro-projects investments, which would have increased the quality of and access to socio-economic infrastructure of the local communities (for instance, building and rehabilitating markets, roads, schools, clinics, etc) were forecasted to be carried out on a demand-driven base.

1.6 Investment Justification

In the time, when the AzRIP was elaborated, the country was struggling with major challenges like economic shortcomings, deterioration of state services and infrastructure, the steeply peaked level of poverty and a myriad of other daunting factors, likewise other countries with transiting CIS economies. Considering the segment that agriculture covers in the GDP pie of Azerbaijan (agriculture contributed 14 % of GDP, in line with employing the 41% share of total workforce), the dramatic decline of more than 50% in the sector output in 1991-1995 affected the state economy chronically. The sector survived only thanks to land privatization and other related reforms adopted in 1997 to meet various agriculture market chain demands.

Lack of integration between state and collective farms, together with unspecific resource actually was considered the main responsible for an accelerated decline in rural services and infrastructure. This eventually brought to the dramatic consequences like sharp decrease of four million people's way of living (a half of total population of the country). In fact, the described decrease in overall agriculture sector and its unpromising impact on the overall country economy revealed its negative shadows over the road infrastructure as well. That is the reason why the World Bank and AzRIP made an investment to the project.

1.7 Project Scope

Having studied all the related demands and imperatives of the target communities, AzRIP project was focused mainly on the following project components [3]:

- **Component A – Infrastructure**: in the initial level the component foresaw supporting about 350-450 community initiatives on designing, constructing and rehabilitating of rural infrastructure, according to the identified needs. Project samples were intended to be rehabilitation of secondary roads, water and sewerage systems, electricity transformers, so forth. The average size of the projects would vary between 35.000-50.000 US dollars. Nowadays the project budgets have been increased to one tenth of the initially forecasted investment and comprised roughly 55.000 USD per project.
- **Component B – Capacity Enhancement**: the component was designed to provide finance in order to ensure training and capacity building of the local stakeholders like communities, recipients and Regional Grant Approval Committees (hereinafter in the text RGACs)
- **Component C – Project Management**: whish was intended to provide finance for the administrative and operational project implementation and management.

The part of the project researched in this study is sub-categorized under the first component- Infrastructure. The project was implemented in two phases described below:

- Phase 1: year 2004 - 2012
- Phase 2: year 2013 - year 2020

Over 1,760,000 people benefitted within the whole project lifetime. The main scope of the project beneficiaries were rural communities residing in three economic zones: the lowlands of Shirvan, Mughan-Salyan and Nakhchivan. Approximate size of the communities changed between >1000 and <10000. For Nakhchivan the project team decided to apply a specific approach, considering the decrease of the initial >1000 to 600 people, due to less number of community residents in the mentioned areas. The target beneficiaries' capacities on identification their own demands and problems, elaborating appropriate projects to meet those demands, and after that manage to carry out and maintain the community investments. Another crucial point was developed cooperation among central, local governmental bodies, municipalities and the communities in decentralized decision-making and ensuring accountability, transparency and willingness for collaboration.

1.8 Project Finance

The total cost of AzRIP-1 project [4], launched in 2004 comprises $46.65 million USD. Initial stage budget included $15 million USD funded by the World Bank, in line with another $15 million USD of financial support in the form of loan debt. As it is obvious from Chart 2 (Figure 1.2) and Chart 3 (Figure 1.3), there is difference between appraisal estimate of the project and the actual one. The greatest increase in appraisal percentage is observed in management costs.

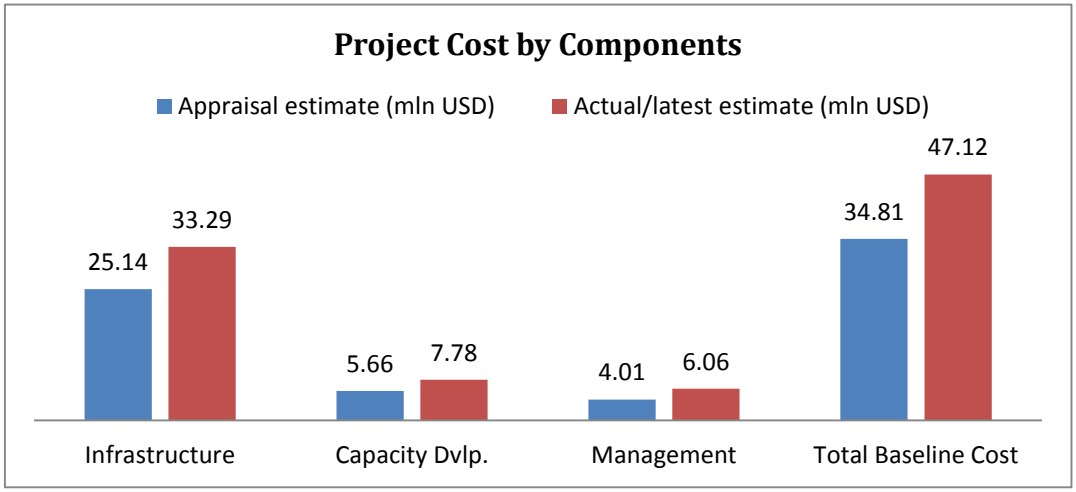

Figure 1.2: Project costs by components in million USD equivalents

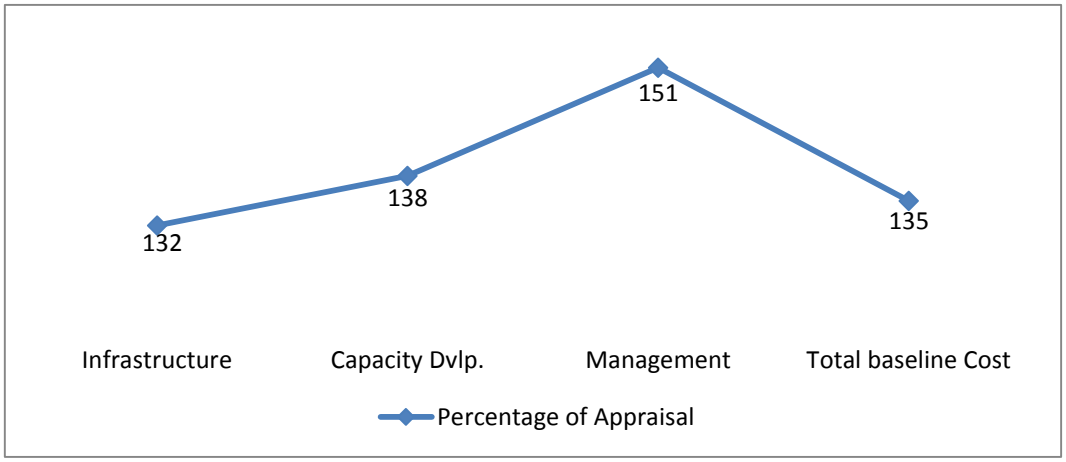

Figure 1.3: Comparison between the Appraisal and Actual Estimate (in %)

1.9 Project Management and Implementation plan

Agency for Support of the Development of The Agricultural Private Sector (ASDAPS) located in the Cabinet of Ministers of Azerbaijan was expected to be in charge for the general management of the studied AzRIP Project. The Project was managed with a three-level institutional arrangement approach [5]: a) community level, b) regional level and c) national level.

a) Community level: The community entities were planned to be the direct recipients of the micro-project grant funds, in line with the main stakeholder to carry out the

projects. Eligible entities would be CBOs (Community-Based Organizations), local NGOs, municipalities, or any other organizations approved by World Bank and the Borrower as a recipient. The entities were expected to elaborate project proposals, arranging required goods, works and other project services, disseminating project related information to beneficiary communities and project management and to be aware of all the accountabilities of community micro-projects. In line with all these, the entities were in charge of maintaining and operating the micro-project assets in post-project periods and supporting the appropriate legal entities that would be the main stakeholders of the community projects further lifecycles. Accordingly the entities had to let the Regional Operations Offices of the Project Management Units (PMU) know about the projects' progress and other details.

b) Regional Level: Regional Operations Offices (ROOs) in the target economic zones were in charge of everyday project management, basing Regional Grant Approval Committees (RGACs), as well as elaborating regional yearly investment strategies and budget allocation plans. Coordination of the relations with rayon governmental bodies, civil society actors, private sector representatives and beneficiary communities, applying the pre-developed Operational Manual, developing, registering and evaluating micro-projects, elaborating recipient -PMU grant-agreements were also among the ROOs job responsibilities. Other duties of ROOs included:

- Controlling the procurement arrangements of recipients,
- Training the entities on contracts and procurement solutions,
- Conducting monitoring and evaluation of the micro-projects, supervising and auditing the projects qualities and other arrangements.
- Submitting monthly and quarterly progress reports to PMUs.

– The working staffs of ROOs were determined by PMU.

The RCAGs were designed to review and carry out the processing of all registered micro project proposals, and eventually make appropriate funding decisions. RCAGs were represented by half with local governmental bodies, while the other half of representation belonged to the civil society members. All the members were planned to be confirmed by the project Steering Committee. One-fourth of the members were planned to be replaced for encouraging broader stakeholder participation in the project operations.

c) National level: National level institutional arrangements were implemented through PMU established within ASDAPS, as well as Project Steering Committee (SC). The established PMUs were in charge for (a) provide necessary reporting and secretarial activities for the SC on annual investment policies and strategies, external financial, management and technical audits; (b) analyze the learnt lessons and try to integrate them with the further project activities, (c) review ROO proposals, submit the proposals exceeding the initial funding limits of US$50,000 to the SC and elaborate and submit appropriate reports once in a quarter, (d) disburse funds for grantees, and a number of other relevant job duties related with management, M&E and quality auditing, as well as providing technical and supportive contributions to ROOs.

Chapter 2

ROAD TRANSPORTATION AND ECONOMIC DEVELOPMENT

"Roads are necessary, but the fact that we don't fully recognize that, when you build a road you're doing more than building a road –you're building the future development of your city". (By Richard Lamm)

2.1 Infrastructure and Road Transportation Sector Overview

Roads are backbones of economic development and growth of country. Their quality and sufficiency influences global and national development and have significant contribution to the overall performance of the society, in line with decreasing social isolation and reducing level of poverty worldwide. They are also considered to be the major element for promoting economic growth. This belief is obviously seen in the historical records and their comparative study in terms of road infrastructure impacts of a country's growth. Excellent examples for this are represented in accelerated economic growth samples observed in the States, Western part of Europe and Japan. The fact that richer countries possess noticeably better transportation infrastructure compared with the poorer countries is undeniable.

Being one of the most vital elements for economic growth and development, road infrastructure has a direct impact on availability of jobs, trade, social and cultural exchange among countries, as well as communities. Ensuring accessibility to development opportunities via efficient infrastructure involves increased number of production, consumption, importing and exporting activities, eventually gives a strong

push to better mobility of people and goods, simultaneously creating integrated development initiatives between two destinations. Hence countries gain access to international markets and try to minimize their development gaps.

Road transport effectiveness is determined by the state infrastructure system, able to alter rural-urban mobility in a continuous flow based on individual planning. There is an urgent need for increasing roads capacities and efficiencies: roads must be able to endure the ongoing and increasing flow of different weight vehicles and warrant an adequate level of safety at the same time. Therefore, sustainable maintenance methods are of significant importance at least as much, as rehabilitating the existing roads and constructing new roads are.

2.2 World Road Transport History

This chapter will briefly introduce road construction and development in different settlements of the world. Some countries benefitted from roads for their invasions, others gave preference to trade relations, while there were countries that developed their scientific resources and area of researching and new inventions. To briefly describe, the following tendencies were observed in various historical periods of road development [6]:

Primeval period – was the period of our initial ancestors, who initiated to follow paths made of footprints as a road. Later the techniques like using animals and birds as a road guide, using big-head animals as “transportation and shipping vehicles” were observed. Invention of Mesopotamian wheels led to marked improvements in road surfaces. First tracks of reinforced and road hardened road solutions first appeared in

3500 BC. The earliest scripts describing authentic roads are first met in Assyrian empire traces dates as long back as 1900BC.

Period of roman roads: known as "authors" of large scale road network construction, Romans could link Europe with North Africa and Asia. Their roads were first ones to include a good drainage, sufficient raw materials and proficient labour ensuring roads sustainability.

Period of the Great Silk Road: The only and the most essential roads having global importance and benefits would be considered the Great Silk Road [7], linking the farthest edges of Europe and Asia. Built in the first millennium, the road began in the capital China, Changan (Khiyan), and later had a delta division separating the road into two routes – northern and southern ones passed through Taklamakan desert in Central Asia. After the desert the routes merged again and proceed with Iranian plateau till Antiokh and Tire.

Ruling Khan Dynasty in China (206-B.C-220B.C.) period were especially prosperous for the Silk Road, and later in the history Tang Dynasty in China (613-907 A.C.) and Khanat, the Mongolian Emperor (13-14th centuries) has crucial contribution to the increased activities through the Silk Road. Mongolians protected the Great Silk Road's northern route passing through Europe and Asia during their ruling years.

Another part of the Great Silk road could be considered the sea roads, which also were developed during Dynasty times. Vessels and ships of China, Korea and Japan passed through East China and Japanese Sea, to carry their freights in 7th and 8th centuries. Chinese vessels managed to reach Iran and India, and in 15th century they had their

trade and business voyages to African countries as well. Indian and Arabian traders also used the sea routes. However the first sails from Portugal and other European States appeared first in the 16th century, when they tried to sail Eastern Asia.

A myriad of scientific and technological innovations, cultural artefacts were carried by the Silk Road from the East and from the West. The trade routes of the Great Silk Road expanded by passing China, Japan, Mongolia, Iran, Uzbekistan, Tajikistan, Azerbaijan and other countries.

French roads: cover the next period in road development particularly known with first scientific approach to road building was Pierre-Marie-Jérôme Trésaguet, a French engineer of XVIII century, who offered to use a base layer of large stone, over which a layer of small gravel layer should be spread,the approach was successful because its consideration offered a more resistant road surface, while at the same time was much cheaper than Roman roads.

British roads: Road construction techniques further developed with the British engineer John Loudon Macadam, who offered the Macadam type of road construction. Macadam's method was simpler, yet more effective at protecting roadways. Stone size had significant role in this method of road reinforcing, which eventually made this method the most economic one of its time [8].

Modern roads: Majority of modern roads are based on Macadam's method, with structural advancing additions. Rapid increase in world population and accelerated living styles urged to construct more durable, sustainable, co-effective and efficient road control, in line with transportation and demand management.

2.3 Road Transport in Azerbaijan

The road and transportation strategy of the Republic of Azerbaijan is focused on the followings: (i) determining transport system development tendencies, the major transportation means; (ii) identification of the priority system of the transport complex and figuring out the implementation priorities with respect to their specific features; (iii) to offer crucial development solutions for state transport policy development, as well as elaborate and carry out the purposeful programs in transport and economic spheres connected with transport, (iv) promotion of modern role of transport and its executive and legislative powers, property owners, transport means users and all strata of the society.

With an eye on the above mentioned objectives, Azerbaijan is giving significant place to the international projects on transport, due to the countries' geographical bearings (it is situated on the junction of the East-West and North-South transport lines). Among relevant activities discernible restoration projects on the transport lines that passes through entral Asia and the Caucasus and outlets to the Black Sea and then to Europe that is the Great Silk [9]. Road were the significant projects carried out since Azerbaijan declared its independence in 1993.

Thereupon, Azerbaijan made efforts to realize the restoration of The Great Silk Road, within which, the International Conference on Great Silk Road Restoration was arranged in Baku under the financial support of the European Union in 1998. The measures undertaken within the framework of the agreement signed at the said

conference created conditions for the gradual increase transportation activities by the Transport Line Europe-the Caucasus-Asia (TRACECA)[1].

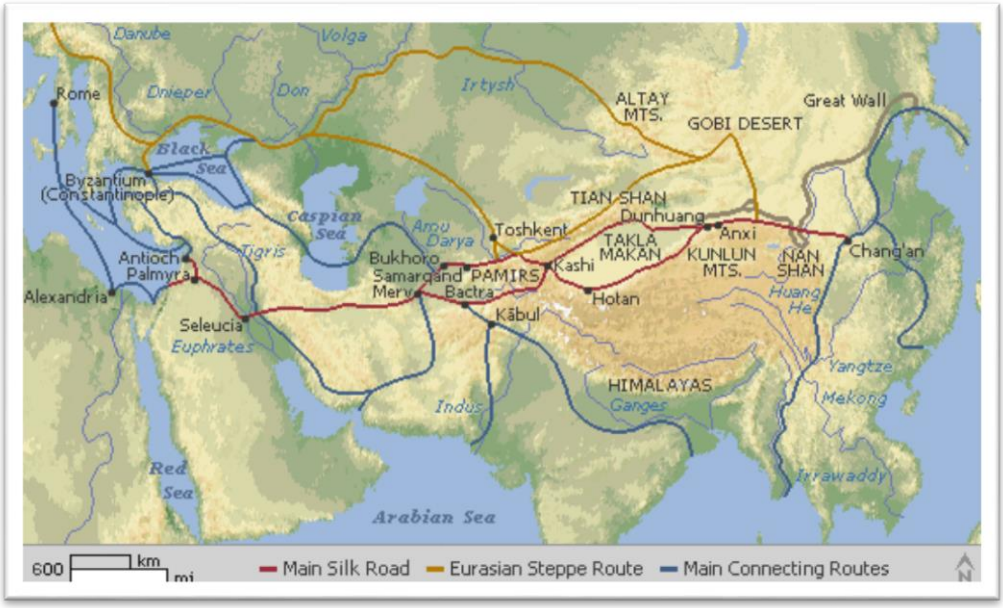

Figure 3.1: The Great Silk Road

Part of the works on the restoration and reconstruction of interregional and international lines' sections of great socioeconomic importance of the country and supported by the international fiscal structures were completed and commissioned in 2004 while another part of them are to be carried out by 2008.

Experts consider the international transport line North-South, implying the transportation of transit cargoes from the Indian Ocean and Persian gulf states via Iran, the Caspian Sea, Russia and East and North European states to be thrice as shorter as the road passing through the Suez canal. Therefore, a number of countries including Azerbaijan agreed to join the North-South line. The forecast estimate the volume of transportations to equal 10-15 million tons at the initial stage yet it may possibly

[1] More info: http://www.azerbaijans.com/content_790_en.html; http://aric.adb.org/initiative/transport-corridor-europe-caucasus-asia

increase up to 30-35 million tons. The government of Azerbaijan intends to carry out the reconstruction of 502 km railway line Yalama-Astara-Iranian border within the framework of the project.

In 2013 roughly 60.000 tons of goods were transported through the territory of Azerbaijan via the TRACECA, 46.6% of which were transported by roads. Similarly, the comparative analysis of income figures from passenger (Figure 2.3) and good transportation (Figure 2.2) in 2000, 2007 and 2013 years reveal the terrific role of roads in to the country economy. Roads only brought a total 307.3 mln AZN, covering 52.73% of total income from passenger and goods transportation [10].

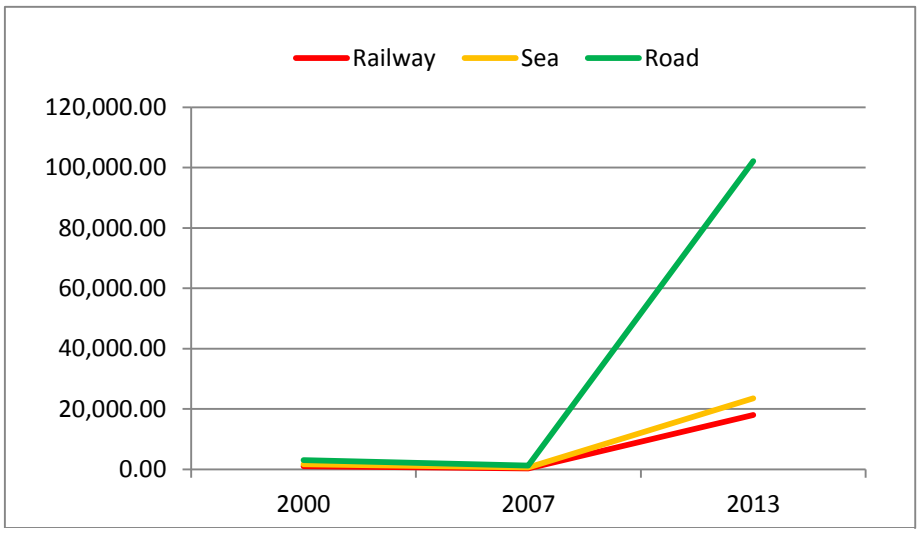

Figure 3.2: Income from good transportation, in thousand AZN

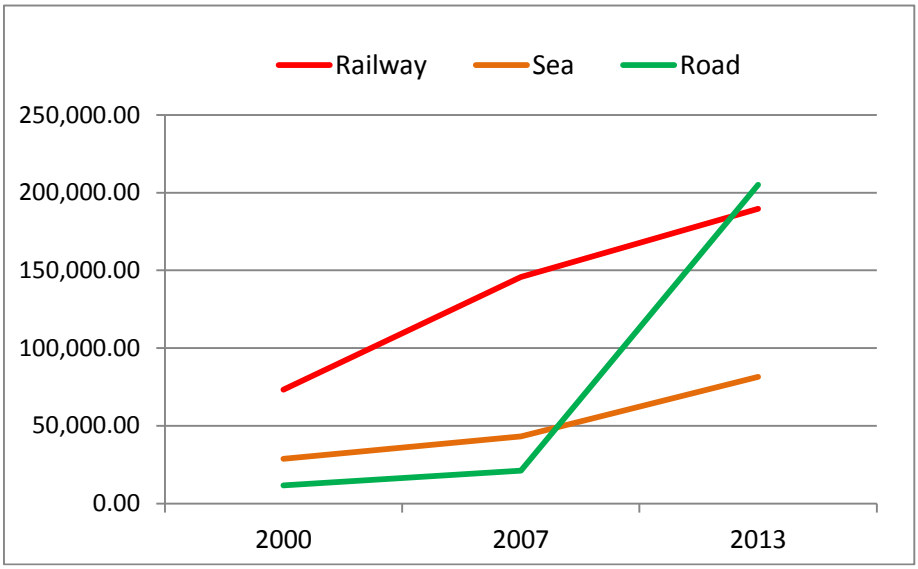

Figure 3.3: Income from passengers' transportation in thousand AZN

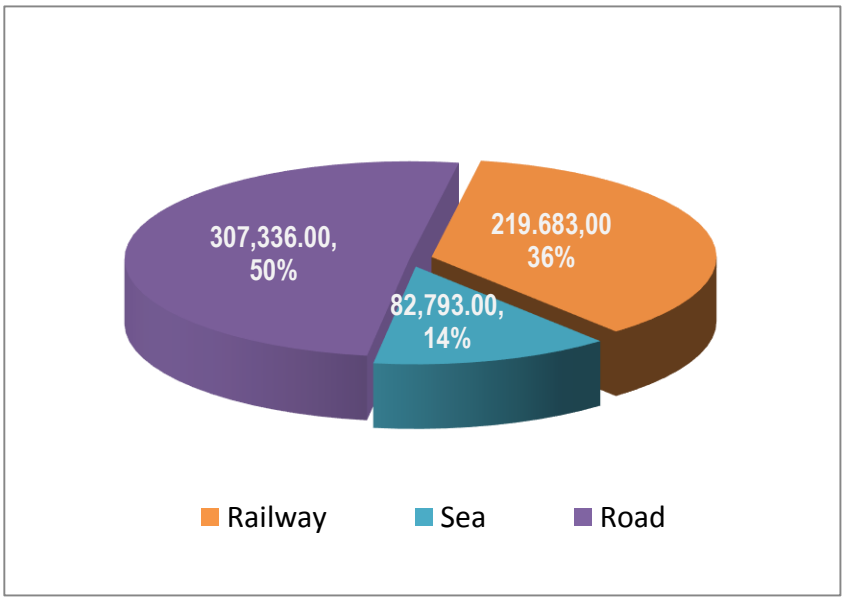

Figure 3.4: Total Income from Passenger and Good Transportation through TRASECA in 2013 (in thousand AZN)

In fact, the development policies and the local and international investment analysts clearly understand the importance of roads and their rehabilitation. That is why the respectable portion of state budget allocations is meant for road rehabilitation every year, alongside with road rehabilitation projects implemented by local and international organizations.

The official data by the Ministry of Transport of Azerbaijan represent the investment made in reconstruction of roads, which comprised $14.5 billion during the past five years [11]. On the other hand Asian Development Bank gave $ 55.4 million loan debt for rehabilitation of 39 kilometres road linking the third biggest city of Azerbaijan-Ganja with the capital and other regions up to Georgian Border.

The date when first automobiles appeared in Azerbaijan was the very beginning of XX century. By 1911th year, only 36 vehicles drove through Azerbaijani roads, the ones with solid surface of which were only 210 kilometers [12].

Appearance of a specialized vehicle parking building and system in the country was because of technological and personal purposes related with the oil industry in second and third decades of 1900s.

Number of cars rapidly increased in Azerbaijan within following fifteen years with roughly 2500%, so as, by 1,926, 896 automobiles (including 103 specialized automobiles and 518 lorries) existed in Azeri roads. “Azerneft” the national oil company of Azerbaijan owned 77,2% (400 vehicles) proportion of lorries.

Expansion of car parks urged the lengthening of highways, whose total length comprised 6500 km, 2300 km of which had substantial importance for the former Soviet Union and the Republic itself.

Increased speed of diverse sectors in the country like agriculture, industry, security and majority of other development areas triggered an accelerated formation of automobile economy. With an eye on the new and promising sector, a car

reconstruction enterprise called ‘Uniontrans’ was established in mid 1930s, where automobile groups were utilized for freight transportation and passengers [13].

In late 1930s an entity named Auto Transport People’s Commissariat (600-800 vehicles) was established, followed by Ministry of Automobile Transport (MAT) 7 years later, in 1946. In 1987-1990th years, MAT was on the top with its 140 ANM 9 industrial and 11 construction enterprises.

Established two years later, in February 1992, “Azerauto Transport” State Concern had 16000 lorries, 7600 taxis and 5800 public transport buses.

Presidential Decree issued on June 10, 2003, put an end to Azerauto Transport and AzerAutoRoad companies, and in less than 15 days, ‘AutoTransportService’ and ‘Road Transport Service’ departments were established with the Ministry of Transportation of Azerbaijan, based on the Minister’s order dated June 24, 2003 [14].

Chapter 3

METHODOLOGY

The current chapter is focused on the methodology of the research and the diverse empirical methods supporting the thesis, in line with providing necessary information on data collection and ways of conducting analyses [15]. The chapter is also conveying the details of the general thesis structure, as well as the methods of project appraisal and the methodology used to conduct the appraisal used in the thesis, whilst it also determines the strategy employed for assessing the road rehabilitation projects implemented within the frameworks of Azerbaijan Rural Investment Project (AzRIP). Definite features of the project like project identity and origin, its cost-effectiveness and impact, the sources of the data were the crucial points that were taken into consideration in pre-assessment period of the thesis elaboration. For sake of being more specific, the thesis was developed with an eye on the facts like the AzRIP program is a state originated one, its contribution and promoting impact of socio-economic development of its target regions, standing upon the actual data and the recommendations for the next period of the project.

3.1 Research Design and Methods

The project basic data was carefully checked, cost-estimates, proposed and invested financing on road rehabilitation projects, all project beneficiary targets and project outcomes, and the viability of the project was assessed in this study.

The section specifies the in depth structure, design in line with the ways and methods of the research. The trivialities of the above mentioned parts are described below:

- The section introduces the instruments for gathering data and analyses vital for problem setting and their solution;
- Methodologies used for observations, discussions and questionnaires, as well as the description of approaches and tips used in elaboration of the query forms used for data collecting.

Based on these, the qualitative and quantitative methods of data collection were used, whilst the type of the thesis could be defined as an applied research, design format is case study, whereas feasibility study was used for justification of the thesis arguments [16].

The thesis

i) Includes diverse Project Appraisal Methodologies to determine the social and economic benefits and impact that correspond to Applied Research Type philosophy. By the term of ***applied research*** we will consider necessary fact gathering project or process conducted to ensure gaining knowledge and vital data (methods and theories) addressing the road rehabilitation projects estimation.

ii) As a research object is an implemented social project (*AzRIP*) with definite social and economical outcomes and impacts, we preferred to use case study format, which we think the best choice for the current project. The ***case study*** term throughout this research will refer to the perceptible documented studies of

specific road rehabilitation regarded scenarios, analyzed and interpreted accordingly.

iii) **Quantitative** and **qualitative** methods were applied for data gathering, processing, interpreting and eventually analyzing. In depth information about the process is reflected in Data collection and data analysis sections. [17]

iv) Employing the used methods and approaches in the research urges **feasibility study**. In other words, a feasibility study method was used to introduce the project justification [18]. Though the study introduces the project outcomes, possesses a crucial importance for AzRIP. The reason of such an importance could be explained with AzRIP's intention to apply a new project approach, where they will rely on the recommendations provided according to the outcomes of the current thesis. Throughout this thesis, by the feasibility study we will mean the evaluation and analysis of AzRIP road rehabilitation projects based on in-depth investigation conducted in a systematic way to facilitate the decision-making process.

3.1.1 Data Collection

A research is successfully accomplished providing that the results gained by the researcher are constructive enough to offer comprehensive summary of the analyzed objects, which are directly affected with the methods of data gathering. The most frequently used methods are classified under two major groups, which are academically termed like **primary data collection method** and **secondary data collection method** [15]**.**

This thesis traced the same data collection methods, which in their turn were again divided into two branches, quantitative and qualitative types.

Primary data is the pile of information acquired from the first-hand sources during surveys, experimentation and/or practice throughout a research study, which has not previously processed and published anywhere. Four methods comprising observation, internet-based research through search engines and direct correspondence with survey attendants, interview and surveys through questionnaires were used to gather the primary data [19].

For the sake of detailing the exact sources and objects used for gathering primary data, the following items of investigation should be taken into consideration.

- Number of vehicles daily using the roads rehabilitated within the frameworks of the appraised AzRIP project,
- Number of passengers in each vehicle,
- VOC at exist road, Average speed at exist road, VOC at project;
- Value of time with/without project;
- Toll rate;
- Vehicle CIF and Tariff;
- General sale tax;
- Freight price and handling cost.

Information collected via questionnaires and observation was the ground for the empirical verification. There was set list of questions submitted to respondents on the pre-survey period. For the sake of ensuring more detailed and accurate data for the thesis, I had to conduct surveys with project beneficiaries in the project target regions, which are located in 6 destinations. 456 beneficiaries from 36 villages situated in the mentioned 6 regions attended the survey, based on an eight-question-asking survey sheets (Please see the Appendix 1 reflecting the surveys). During my observations and

research in project target sites I made notes on tangibility of data collected. The surveys gave me opportunity to gain the necessary data regarding VOC at existing roads, average speed of vehicles driving on the roads, estimation of time spent on the roads before the project implementation and after that as well as, the toll rate. As the result of my observations I studied the daily interval of using the rehabilitated roads by car owners in the villages, and directly witnessed the benefits the roads could offer the rural communities.

I could access the information about quantity of vans, trucks, cars and public transportation vehicles through direct and telephone appointments with regional and rural municipalities. In line with all of this information, I accessed the relative information on Vehicle CIF and Tariff, General Sale Tax, freight price and handling cost via desk research method, through in depth examination of official websites of Tariff Commission, the State Customs Committee and the State Statistics Committee of the Republic of Azerbaijan.

Definite parts of the thesis are based on the **secondary data** as well. By "secondary data", we are implying the data that have already been collected and processed by other researchers, educational institutions, related community based or not-for-profit organizations. The category itself is sub-categorized into two sources- external and internal ones. The former is attained from outside sources while the latter is collected within the areas where the project was implemented from the project stakeholders or other people residing or working in the project areas [20].

Basic information about the project – that is the internal information was acquired from the database of State Agency on Agricultural Credits under the Ministry of

Agriculture of Azerbaijan Republic, as well the project data itself directly. The data includes the followings:

- Description of AzRIP, the projects implemented and their duration,
- Summary of AzRIP's road rehabilitation projects,
- Aim and objectives of the project, the regions of target,
- The budget framework of the project,
- Financing procedures,
- Loan amount;
- Project expenses;
- Other relevant information about the project.

The required external information mainly captured the supportive data necessary for elaborating the thesis and appraising the project investment. The sources where I gathered the represented information in this study are, mainly, official web-sites of related project stakeholders and governmental authorities, books (both electronic and hardcopy books) and other documents from international institutions (The World Bank), Governmental Agencies (The Statistics Committee of Azerbaijan), annual report released by state projects of Azerbaijan, AzRIP related press-releases, news and reports, e-encyclopaedias (Britannica and Wikipedia), researches and studies that were published on the relevant topic, as well as university textbook on cost-benefit analyses and Capital Budgeting. The acquired information is mainly focused on:

- Brief summary about the road and infrastructure of Azerbaijan;
- World roads and their impact over the general development of road history,
- General data about AzRIP,
- Research , project appraisal methods;

- Economic cost of capital, tax rates, exchange rates, and foreign exchange premium in numerical data,
- Number of populace residing in the target regions, rates of annual inflation, rates of interest as reflected in statistical data;
- Number of employed people, farmers, per capita income from agriculture (farmers' indicators)
- Other relevant information.

All the primary and secondary data are sub-classified under quantitative and qualitative categories, which can be snugly described, segregated, analyzed and interpreted using the methods developed grounded on them.

3.1.2 Qualitative method (approach)

Qualitative method (approach) is a verbal means of conveying the essence, meaning and aim of the evidence gathered through interviews, observations and surveys. This study delineated the beneath mentioned information using this method:

- Description of target areas of AzRIP intervention,
- Types of roads,
- Ways of road rehabilitation and construction,
- Description of target and final beneficiaries using the roads,
- Other qualitative data used in this study.

3.1.3 Quantitative methods (approach)

Quantitative methods (approaches) in quantitative data collection process: As it is seen from the definition itself, this method or approach takes quantities, or numbers and statistics as a baseline. The method helps to conduct a systematic empirical investigation through calculable numerical data or computational ways of gauging. The outputs of quantitative method are represented in figures, charts or tables.

Furthermore, it concentrates on displaying statistical structures and classified features in quantities in order to give the explanation of the conducted observations. Its aim can be explained like “proving a point” as well, which an excellent tool for accelerating and easing decision is making process, in line with its undoubted benefits in proper planning and figurative measurement. Our thesis also used the method for responding the questions about the specific quantities regarding with:

- The rehabilitated roads length,
- Number of beneficiary communities and community members,
- Number and separate items of project expenses,
- Overall cost of the project,
- Number of vehicles using the road,
- Et cetera

Major quantitative data were employed in primary methods of data gathering, whilst qualitative data were used mostly in secondary data groups.

3.1.4 Data Analysis

To examine each component of the interpreted data, analytical and logical reasoning techniques were employed in the process of data analysis, which represents one of the steps in the research experiment process. Data mining, analysis of texts, business intelligence and data visualization are some of the diverse data analyses methods. In the study we meant the term of data analysis most like the way of data gathering, as well as, in depth elucidation and classification on the base of the research. With this focus in mind, we tried to define the number, list, backbone of the data to be used in the study, together with the moments where and when these data would be used and what results would be affected by the data [21].

3.2 Project appraisal

Project appraisal is conducted for analyzing the project in different project stages to determine possibility of its implementation, and can be reckoned in as the effort of calculating a project's viability. In most cases the assessing method can be used interchangeably with Project Valuation, however subtle differences among the two exist. Project appraisal is mostly about an ex-ante, or in other words a pre-examination of a proposal, whilst the project examination is in charge for an ex-post assessment of the accomplished project to evaluate its impact and outcomes [22].

The latter is taken as a ground in making decisions about projects from technical, economic and commercial viewpoint. The method is focused on the optimal solution, selected among a wide range of approach choices, regarding with the location of the project, the technological advancements and methods used, project activity, size and budget frameworks, its organizational and engineering structure, the size of the demanding market, socio-economic aspects of the project and myriad of other relevant issues. Project appraisal might be carried out in two approaches: a market-oriented one and grounded on material inputs such as raw materials or energy. Thus, project appraisal should be understood more like a means leading to the investment decision, rather than an endpoint in project preparation phase. The results of a project appraisal do not seek for reconciliation with the outcomes of a feasibility study. Obviously, hardly ever an investor would respond flexibly to the results of this kind of study. Project appraisal mostly plays the role of support to investment decision-making process, in the time periods when rare factors like capital, exchange and labour force are thought to be normalized in terms of alternative consumption areas that it could be

put. In investment decision appraisal time factor keeps its crucial importance on the other hand [23].

3.2.1 Feasibility study and types of appraisal

As mentioned above project appraisal incorporates majority of aspects, which are examined by the field of study called ‘a feasibility study’. This study aims analysis and evaluation of the potential of the proposed project based on in-depth examination and research facilitating the decision –making process. Feasibility is conducted mostly in five types mentioned below [22]:

- Economic Feasibility
- Market feasibility
- Technical feasibility
- Financial Feasibility
- Managerial Feasibility

For defining the feasibility techniques, the below mentioned appraisal types are employed [24]:

Technical Appraisal: it is for conducting technical and engineering analyses realized with the aim of proper examination and formulation of a development project, an important aspect of which includes required materials and input, specification of related details in line with setting up a program for supply. Most commonly fundraising or executing agencies give preference to conducting technical appraisals through their qualified technical employees.

Financial Appraisal: This type is considered for examining marketing feasibility, technical viability, financial and managerial reliability, to make decisions about investment worthiness measurement. The appraisal is mostly conducted with an eye on a private entrepreneur's viewpoint. The essence of this appraisal is to ensure viability of the cinvested business or social project's ability to respond the burden of the project activities and satisfy the return anticipations of the people invested in.

Economic Appraisal: this type of appraisal is foreseen for assessing the project impact as a whole with an eye on the projects' impact on the economic welfare of the country or the community it has been or will be implemented, through which the project profitability or efficiency analysis is assessed reckoning in the whole nation. Sometimes also defined as a 'shadow price' or a 'accounting price', both of direct and indirect costs and benefits are included in it. Once conducting an economic analysis, one should take into account all the society members, together with the measurement of the implemented project' pros and cons in terms of willingness to pay for the consumption units.

Social Appraisal (Social Impact analysis - SIA): the methodology tends to examine the social effects of infrastructure targeted projects, as well as other interventions made with the aim of development. The methodology contains analyzing, managing processes, together with the monitoring activities, carried out in intentional and unintentional ways of assessing both positive and negative social consequences of any social change processes like planned projects, plans, policies or strategies and other relevant activities. SIA mainly aims to maximize the benefits of the development program on one hand, and on the other to mzinimize its costs, giving particular

attention to the costs made by people. Project costs and benefits may and may not be measured or counted.

Market appraisal (analysis) Mostly projects managers conduct this kind of analysis to evaluate the idea of a project. Containing a six-step-analysis process, market appraisal aims to evaluate the project idea in terms of situational analysis, specification of objectives, Market analysis is carried out by the project manager in the process of evaluating a project idea. There are six steps in the market analysis: situational analysis and objectives, market survey, description of the intervention market, and market planning. Market analysis is an excellent way to figure out on the possibility of synchronization of firm's abilities with the market requirements [25].

The purpose of **Risk analysis** is to find out the threatening factors, uncertainties and potential risks of the given project. Containing an extended range of applications, definition of project risk analysis reminds the definition used for a project. For the sake of being more precise, we will try to represent the definition, like this: **a project is any set of tasks, that are inter-related, aiming to achieve a certain goal or set of goals, to a particular quality standard within a pre-determined budget and time period, to be implemented with a limited set of resources** [26]**.**

Project Risk Analysis, on the other hand, is a process, enabling the analysis and management of project associated risks. A properly conducted risk analysis could be considered a warranty of increased likelihood of successful completion of a project in terms of its cost, time and performance objectives. The analysis is generally divided into two sub-stages, called qualitative and quantitative; the former of which is mentioned for risks identification and subjective assessment,

whilst the latter takes into account the objective assessment of risk. The table below introduces the specifications and spectra of both sub-stages:

Table 3.1: Specifications of Risk Analysis Methods

Qualitative methods of risk analysis	**Quantitative methods of risk analysis**
1. Risk probability and impact assessment	1. Data gathering & representation techniques
2. Probability and impact matrix	2. Probability distributions
3. Risk categorization	3. Sensitivity analysis
4. Risk urgency assessment	4. Expected Monetary Value analysis (EMV)
5. Expert judgment	5. Modeling & simulation
	6. Cost risk analysis
	7. Expert judgment

Managerial competence (Competence-based Strategic Management) – the proceeding factor employed in overall appraisal of a project or firm is managerial competence. It is management ability or competence that burdens the responsibility of ensuring successful implementation of project or business activities. To see the contrary side of the argument, lack of managerial competence might necessarily take a project to a failure. Independently to the successfulness of a project idea, any projects may become a successful one with good managerial ability. Therefore, we consider the managerial competence or talent of the project leaders should also be taken into account during a project appraisal.

Environmental appraisal (assessment): This type of appraisal is mainly focused on assessing possible factors having the potential to have positive and /or negative impacts coming from external forces and conditions upon the survival strategies and

growing tactics. The appraisal, which has two levels of influence- it studies short-term and long-term effects of the implemented project over its neighbourhood environment, also contains minimizing, mitigating and/or compensating the negative impacts to the environment. It can also be a baseline for environmental impact assessment. [27]

3.2.2 Techniques

The frequently used techniques of project appraisal are classified in two categories, called discounted and undiscounted (IWRM workshop, 2005 & Shyam, 2006).

- **Undiscounted Technique:**

  The beneath mentioned concepts are included into the technique:

  1. CUTOFF PERIOD:
  2. PAY BACK PERIOD
  3. SIMPLE RATE OF RETURN
  4. NET AVERAGE RATE OF RETURN (NARR):

- **Discounted technique:**

  This technique is based on the discount rate, which is considered as a rate of interest, that the consumers or beneficiaries should charge themselves for the cost of time. An adequate discount rate reflects the rate of return an alternative investment to the projects with equal risk degree.

  - Net Present Value / Worth (NPV/NPW)
  - Internal Rate of Return (IRR)
  - Benefit-Cost Ratio (BCR)

are the concepts that the technique includes.

To get more precise and reliable outcomes, an approach called **Time Value of Money** (or **Present Value Method)** is used in Project appraisal process where the discount technique is applied.

The analyses types that use NPV, BCR and IRR mostly are economic and financial ones. All of the ways are crucial for project appraisal, with their specific criteria to show projects' viability and value with their own tools and factors [22].

Taking into consideration the effectiveness and applicability of the methods for AzRIP-1 road rehabilitation projects, in this study we mostly employed two of the above mentioned Net Present Value / Worth (NPV/NPW) and Internal Rate of Return (IRR) methods for this project.

Despite of the type of the planned appraisal any project should necessarily be involved in relevant type of appraisal.

Scenario and Distribution Analysis

Scenario analysis is defined as an analysis process evaluating forecasted and non-forecasted future events by reckoning in alternative possible outcomes (also called 'alternative worlds'). The analysis represents conscious several cases regarding with the future development, rather than displaying one exact picture of the future. With its role of main projection method, the scenario analysis is often associated with the sensitivity analysis [28]. May be very subtle, but there are still some differences between the two: while the sensitivity analysis is grounded on variables by related approach, the scenario analysis accepts various factors' impacts over the cost and benefit stream to be inter-independent. To be more specific, the approach suggests that diversification of individual variables, while holding the remainder is considered to be

unrealistic. A good example here could be a tourism project, inside of which ticket sales and restaurant or gift sales should be taken as independent profit areas. After reviewing all the values within each scenario, the following step or the process could be calculation of NPV for each single scenario.

Distributional Analysis calculation of NPVs does not consider distribution of benefits and costs among benefitting community members. This factor is especially obvious as a shortcoming, when the appraisal target is a project aiming to serve specific income groups. Difference in their income levels, ethnicity, age, genders, places of residence, disability and vulnerability, as well as any distributional effects may arise in differential impact form, which urges explicating and quantification in appropriate places [29].

To measure the social and economic impact of the project the **Cost-Benefit Analysis (CBA)** is widely used.

CBA – is an economical tool used for assessing all related costs and benefits of the investments made, through indicating overall impact of the project upon the society it serves. The analysis was urged with the need to quantitative evaluation studying the level of net benefit a business or in wider scope a society gets from the implementation of the given project. The methodology itself includes systematic evaluation of all benefits and costs compared with an alternative activity [30] & [31].

Depending on the types of the projects (for instance, social, infrastructure, environmental, investment, health, etc) various impact assessment methods are used for diverse impacts of the project, the key ways of which are described below [32]:

Analysis of Cost Effectiveness (or Cost Effectiveness Analysis -CEA): As on one hand the accurate specification of final outputs and their quantification might be challenging, and on the other they are not frequently marketed, measuring the value of public investment over society is difficult in majority of times. In similar situations, it is a good idea to determine the cost of diverse alternative options in monetary terms at first.

Cost Utility Analysis (CUA) is a varying type of CEA measuring the relative effectiveness of altered interventions. Often used in health projects appraisals, it is used in two or more objectives. CUA suggests expression of costs in monetary terms, while the benefits/outcomes in utility terms, for instance, we can frequently see outcomes in such analysis to be represented in quality adjusted life years (QALYs). Duration of life and quality of life in terms of health are combined in measure of this outcome.

Multiple Criteria Decision analysis (**MCDA**) is mostly reckoned in decision-making environments with multiple criterions as a sub-discipline of operations. There are myriad of conflicting criteria urging decision-making evaluations in our daily or professional lives, the most common one of which cost or price. Another criterion conflicting with the cost is the quality measure. In purchasing a property for instance, its location, closeness to public transport means, its insulation, communal infrastructure, stability to earthquakes, the building's position to the Sun, the overall condition of the house, its age, price, mortgage rates are some of the crucial criterion that should be taken into consideration.

In line with the above mentioned Project Appraisal methods, there is another type of an appraisal having an undoubtedly crucial role for investors- that is **Investment Appraisal (Capital Budgeting)**. This appraisal is used for assessing investment projects mainly. Though both of the project and investment appraisals employ similar methods, the purpose of Investment appraisal mostly includes measuring the profitability and efficiency of investment project. Unlike project appraisal, investment appraisal doesn't deal with financial equivalents of projects' social and economic impacts; instead it mostly conducts financial analysis of a project. Investment appraisal uses the beneath mentioned methods mainly [33]:

- Accounting rate of return
- Payback period
- Net present value
- Profitability index
- Internal rate of return
- Modified internal rate of return
- Real options valuation

The conducted research revealed the fact that Investment Appraisal is not only used for financial, but also for socio-economic assessments. In line with business projects, the investment appraisal has a power of coping with the social and economic analyses of governmental projects via applying diverse combinations of social and economic analysis methods.

Some of good examples on this are provided below:

- Well-known international financial institutions such as the World Bank, Inter-American Bank, European Investment Bank, European Bank for

Reconstruction and Development, as well as Asian Development Bank have designed special project appraisal methods responding their investment policies, which are the synthesis of the above mentioned analysis methods and techniques.

- Various researchers and research institutes studying the area, suggest specific methodologies in their educational studies employing the above mentioned analysis methods. Some of the studies employing the integration of different appraisal methods are listed further: Prasanna Chandra (Author) "Projects 8th edition", Harry F. Campbell (Author), Richard P. C. Brown (Author) from University of Queensland, "Advanced Capital Budgeting: Refinements in the Economic Analysis of Investment Projects", Paperback by Harold Bierman Jr. (Author), Seymour Smidt (Author), "Capital Budgeting and Investment Analysis" Paperback- October 23, 2004 by Alan C. Shapiro (Author)
- One of the recent studies named "**Integrated Analysis of Investment Projects"** belongs to [34], Canada, which is broadly described in his book named **"Cost-Benefit Analysis for Investment Decisions".** Whilst the conventional investment appraisal approaches suggest a separate consideration of financial analysis and economic assessments, Glenn P. Jenkins advocates parallel assessment of the mentioned two factors, and their comparative analysis, as well as reckons in the effectiveness of applying the methods with social governmental projects appraisals.

With an eye on the above mentioned issues, I tried to use Glenn P. Jenkins' "The Integrated Analysis of Investment Project" as a key methodology for this study.

3.3 Integrated Investment Appraisal

Expanded and crucial infrastructure projects such as road rehabilitation projects demand a great volume of financial resources, extended time frame for building and construction activities, and precise planning. To avoid failures in project management and quality, in line with their efficiency and sustainability, finance providers prefer to have an extended project appraisal in pre-implementation period. This appraisal is a kind of guarantee of the planned project, in respect of assurance for its viability, sustainability, efficiency level of project variables on fin-economical profitability. In order to realize all the mentioned the project appraisers analyze the key project variables.

As we stated above this study is based on the Integrated Investment Appraisal Methodology, suggested by G.P Jenkins, C.Y. Kuo and A.C. Harberger (in their book on 'Cost-Benefit Analysis for Investment Decisions', published in 2011). The methodology we suggest in this study includes the financial, economic and distributive and risk analysis of AzRIP-1 road rehabilitation projects with the purpose of analyzing the long-term viability of project related economic and social benefits.

The integrated investment appraisal technique makes the decision-making simple, as it reunites the financial performance, the economic outcome and the distributive impacts of the project in one analytical framework in a regular and logical manner. Another noticeable pro of this methodology is its ability to put up a cost benefit analysis on the AzRIP road project in the same analytical framework.

3.3.1 Financial Analysis

Financial analysis, which is the first main stage of the integrated analysis, normally makes efforts to determine the financial viability of the project from the viewpoint of investors and lenders points. The baseline financial information about the project that is considered the backbone of an appraisal includes income statement, balance and cash flows. It represents the yearly financial cash flows of road projects labelled in domestic currency (in this case US dollars) for the length of project life, along with determining whether the result net cash flows discounted at the capital cost opportunity give in positive financial NPVs for the investor and affordable debt service ratios for the creditor(s). Such an analysis helps the investors, shareholders, stakeholders, contractors and corporate managers to figure out the ways and techniques of making the best choices by deciding the most suitable and profitable projects.

Project's financial analysis ensures determination of project sustainability and vitality of any investment projects [35]. Glen P. Jenkins and other co-authors of the study suggest credible arguments for employing financial analysis methods on public sector projects similar to the focus of the current study. A good example from the study could be the author's argument on importance of estimating financial profitability of some public projects. Nevertheless, in order to safeguard the projects' financial sustainability, it is crucial to analyze annual cash-flows regularly. He continues his argument with the positive correlation between public-sector projects and level of comprehension of the projects' distributional impact. In this respect, as a pre-requisite to economic, distributive and risk analysis of an appraised project it is essential to conduct a financial analysis. Another crucial thing to reckon in is ensuring availability of funds to provide the projects' financial support via its investment and operational stages.

To ensure the financial estimation of a project, the first thing to concentrate on is gathering relevant data and baseline information accurately and precisely. The variables should be classified according to their relevance to the key project topic, their vitality from the project concentration as well as, their risk factor. Following the process of putting all the collected data and information in their 'corresponding shelves', the process of project evaluation would begin. Comprehensiveness and preciseness of this information arrangement is of crucial importance for the further quality and clarity of the assessment, so as, any slight errors in this part would result in a misinterpretation of actual project situation, which will accordingly mislead the investors.

Current thesis focusing on appraising AzRIP-1 road rehabilitation projects is elaborated on the base of three scenarios, of which the first scenario is represented together with loans and no toll, while the second is given with toll and loan.

- **Scenario one**

  Scenario 1 handles the original project not including toll, as rural roads rehabilitation expenses was fully funded by the Government together with the World Bank. A 65% share of the project costs was provided by the Bank. During development of the project related data tables, the analysis begins with inflation, goes on calculation of the domestic inflation index, and subsequent adjustment of investment costs schedule. As a preceding step, operational costs of the project are considered in two viewpoints: routine and periodic classes. To go with the trace of analysis, the estimated demand schedule, displaying the amount of total vehicles using the road on a daily basis is developed. The analysis is continued with the loan and depreciation schedules, placed after demand schedule

spreadsheet. The next items are sheets on the estimated revenues and schedule of operational expenses. The next steps divided into two beneath mentioned categories are mainly representing cash flow statements:

1. Represented from nominal and real perspective, investment viewpoint in total
2. Represented from nominal and real perspective, equity viewpoint

We can get the NPV figure for a project if to subtract the initial investment value from present value or an investment's future net cash flow.

In case if the result is a positive digit, the project investment decision can be positive, and vice versa, if the result is negative, the project holders should be focused on to mitigate the effects of risky variables or the investors may want to avoid the funding decision. [34, pp. 7-8] The Four various methods that are mentioned beneath can be used with an eye on evaluating projects:

- Rate of return (IRR)
- Payback period (PBP)
- Benefit cost ratio (BCR)
- Net present value (NPV)

NPV ensures the most reliable results out of these methods, in line with representing the most trustable figures, so as, it is more significant and realistic in comparison with the remainders. The key reason lies in presence of some inaccuracies in IRR, PBP and BCR, which make them disadvantageous for our purpose [35]. Scenario one considers calculating **ADSCR** and **LLCR** ratios of investments at the end of cash-flow statement. The mentioned ratios refer to the

quantity of available cash-flow, with the purpose of meeting the project yearly debt repayment. The details of the mentioned ratios will be elaborated in further chapters (namely in Chapter 5-Financial Analysis part).

The abbreviation *ADSCR* stands for *Annual Debt Service Coverage Ratio,* whilst *LLCR* means *Loan Life Coverage Ratio.* The cash flow statements represent the profit and costs of the project, within the construction time. Project's cash inflows should cover its cash outflows to get a positive NPV result.

- **Scenario two**

This scenario is based on presumption suggesting full governmental resources, that is, the evaluated project is wholly financed by state allocated budgets, also assuming project implementers not to be obliged to get any loan and/or tolls. The key difference between the first and second scenarios is represented in fact, that scenario two does not include any loan schedules. Hence, the second scenario will have to trace a similar structure as Scenario One, except at the end of cash flow statement, the investment's ADSCR and LLCR ratios would not be calculated, because they are unnecessary in Scenario 2.

- **Scenario three**

On the contrary, Scenario 3 assumes private sector to be in charge for finding a proper loan and funding for road construction and rehabilitation. The Scenario considers allocation of investment costs like the following: governmental agencies- 35%, lending agencies – 65%. The scenario includes toll and loans.

The two main differences between the second and third scenarios are presence of loan and a proposed toll schedule in the latter one. Therefore, the third scenario would also employ the similar structure to the first scenario, with some addition.

The additions would be ADSCR and LLCR ratios calculations of the investments at the end of cash flows statements.

3.3.2 Economic Analysis

The aim of economic analysis, which is second crucial component of an Integrated Investment Appraisal, is optimization of the use of a country's limited resources. In other words it is used to understand the project effect upon economic development of the country of intervention and the project impact on citizens' welfare. Such an evaluation accentuates project profitability in regards with entire economy, along with making the best choice about the most advantageous project contributing the whole country's level of living standards promotion. The analysis reckons in determination of the project implementation benefits in regard of each single beneficiary [36].

As mentioned above there is a technique that is an essential element of the combination with which economic analysis is conducted within project appraisal process. The technique is called Cost Benefit Analysis (CBA). Serving as an important technique it enables monetary assessment of the investment made in terms of its social and economic costs and benefits over a given period of time. CBA is a systematic approach and is used to estimate the strengths and weaknesses of business alternatives responsible for transactions, project activities or functional operational requirements. On one hand CBA is a good way of determination options ensuring the best adoption and practicing approach regarding with the labour, time and cost-savings used for a business or a project. On the other hand it is known as a systematic process for computing projects' costs and benefits, and later comparing the outcomes. In this study, this analysis method (CBA) will enable us to determine project's economic benefit through diverse calculations [37]. The tools used in this economic analysis are

samples of CBA analysis methods contain the steps that are represented in the flow chart below:

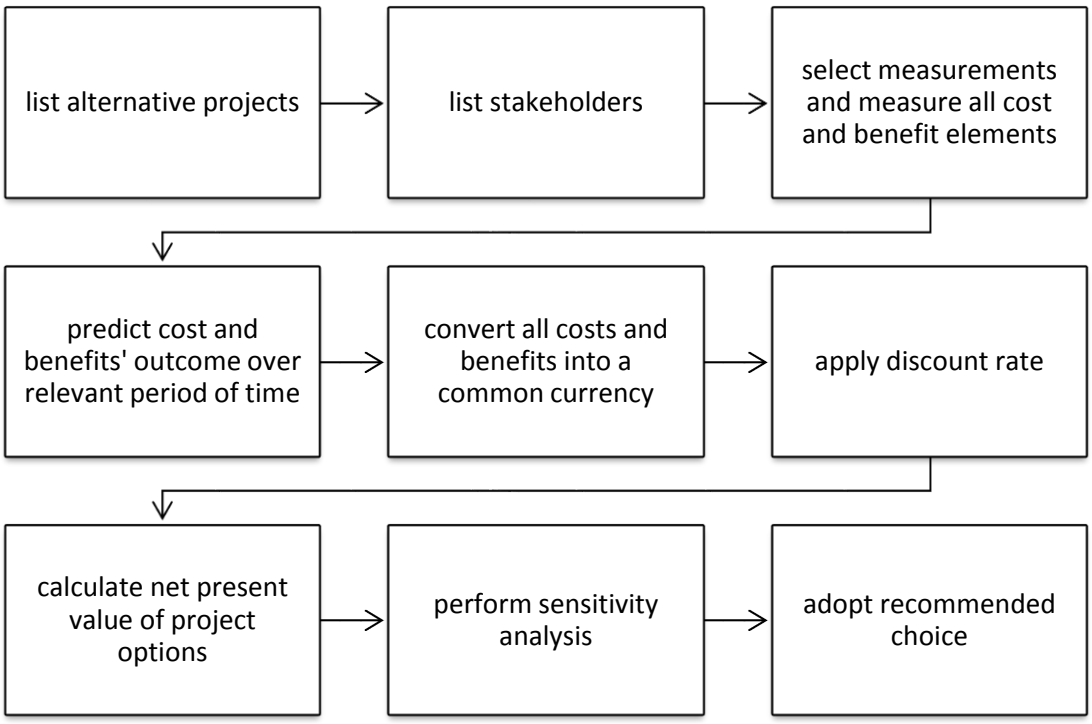

Figure 3.1: CBA Steps

Economic and financial analysis might resemble each other in terms of approaches they employ; however, they have distinct differences in their concepts. An economic appraisal mainly accentuates the real economic value of the net benefits of the implemented project to the society as a whole, and to assess whether the resources used in the project, (in the case of our study the resources used for rural road rehabilitation projects) are efficiently utilized.

To guarantee the project achievement in terms of fulfilled target objectives, it is vital to adjust a demand schedule, to meet the urged demand and required market for assuring available space for the project outputs. Theorizing that in the time of project

completion it gained success within the pre-decided budget frameworks and time limits, its economic feasibility rely upon primarily on the saleability of the project's output items. For evaluating this factor, project investors examine the supply and demand conditions for the project with an eye on project expected lifespan. The foreseen outputs of the project at a cost that will meet full manufacturing expenditure provide the project to maintain its debt and ensure a suitable rate of return to equity financiers.

In a flow chart of economic analysis scheme, the first step is setting up a parameters table. Just in the way it referred in the financial part, the table of parameters should display all the necessary data.

The subsequent step in the mentioned analysis is a schedule of well-elaborated conversion factors designed for appliances, tools, labour and vehicles used. The role of key tool in the analysis lies on the 'shoulders' of project's statement about economic costs and benefits, which is generated by converting the financial figures of the project's financial cash flow into the values expressed in terms of economic approaches via specific conversion factors used for commodity. (Hereinafter in the text **CSCF** which will stand for Commodity Specific Conversion Factors). For acquiring project's economic value, a technique containing multiplication of the financial value of ay goods and services used/produced by the project with the relevant CSCF could be used. To illustrate the differences between economic and financial values, CSCF shows either the premium that must be added or the discount that should be subtracted. Market distortions like foreign exchange premium, impact of taxes and governmental grants undertake the main responsibility for those differences.

After all the required tables for carrying out the calculation of conversion factors for construction occur, the analysis concentrates on a schedule displaying the overall description of all elements that are important for conversion and the chart representing expenses for maintenance in routine and regularly recurring intervals.

As a final step in this analysis we calculate the consumers' surplus via computing vehicles operating costs (VOC) and saved amount of time (in with and without project scenarios) and merge the results in a single table, which would also include the expected amount of traffic to use the road. Subsequently the analysis keeps on by range of tables describing gradual increase in benefits of truckers, consumers' surplus, net economic benefits statements and finally finishes with a table of externalities, which includes consolidation and distribution analysis, containing calculation of each beneficiary's share from total project benefit as well.

Statement of economic resource flow is based on project's financial cash flows, while the net resource flows are discounted at Economic Opportunity Cost of Capital (EOCK). All of these is done to develop project's economic feasibility. To achieve the economic shadow values for the project costs and benefits, the financial values of project are necessarily adjusted.

The key outcome of the NPV is to answer the question about the assessed project's net contribution to the target region's or community's welfare. To say in other words, the NPV of the net economic benefits, would represent the response to a query, about the net economic benefits of the project measured in terms of the base year is greater than zero.

3.3.3 Stakeholder Impact Assessment (Distributive Analysis)

Identification of winners and losers and determining their level of achievements and failures is vital for ensuring project sustainability over time. The distributive analysis, or in other definition Stakeholder Impact Assessment aims to examine this very issue, i.e. to be sure that the originally planned target beneficiaries were able to get their benefits, along with to be sure that no specific groups are subjected to an unaccomplished commitments as a project outcome.

The largeness of any burden could be measured with NPV of incremental net cash flows, being expected to be implemented by defined groups. The main intervention targets of public projects are commonly suppliers of those very projects, their customers, labour force used in project operations, project stakeholders, competitors and relevant governmental agencies. Projects' main impact over the governmental agencies is mostly observed in side effects, or externalities which are derived from taxes and subsidies. A good example here would a traffic lights project, which employed a distributive analysis for ensuring the two technology options. Identification of the externalities created by the project and evaluation of impact of those externalities over the main project stakeholders were in line of main analysis objectives. In depth illustration of externalities flow modelling and net present value calculation, together with reconciliation between financial and economic analysis will be given in further sections, verbally in Chapter 6.

3.3.4 Sensitivity Analysis

Another component of integrated project appraisal is sensitivity analysis, which is conducted for determination of risky variables. With an eye on assessing the vulnerability degree of the implemented project to diverse variables stemmed over the

external factors, the analysis uses different sensitivity tests grounded on financial, economic and distributive results. The mentioned tests are employed for detecting vital project variables, which might be redesigned in case of necessity for project performance improvement.

Sensitivity analysis is in charge for identification of crucial project variables and assessment of the uncertain moments related with those variables. The analysis also makes it is possible to realize the risks and their sources related with the uncertainties that influence the project's economic and financial outcomes. The analysis also is a good tool for assessing project's inputs impact on its outputs, in line with definition of possible impact of one or more variables of the project over the final project effects. Sensitivity analysis represents the NPV fluctuation sizes which significant variables are responsible for, while to ensure constant project conditions and changing only a single variable. The reason why the project conditions should be reckoned in to be constant is sensitivity analysis's inability to reflect diverse variables in meantime. The analysis helps to understand whether the implemented project resulted in loss or profitability, to make right decisions and avoid from project failures.

3.3.5 Risk Analysis

Almost in all projects there are cases in which diversification is observed between the planned project outcomes and the outcomes of economic, distributive and financial analysis of that very project. This happens because of projection uncertainties of project's parameters for future values. Consequently the mentioned uncertainties generate risky situations that threat project choices externality allocations to different stakeholders in various ways. Above mentioned sensitivity analysis is the initial step in risk analysis and is in charge for determination of critical risk variables that possibly cause variation on project outcomes.

Risk Analysis which is reckoned as an analytical tool of the Integrated Investment Approach, is conducted on pre-identified risk possibilities to determine their riskiness degree and the level of their possible influence over the project outcomes. Numbers of computer based software could be successfully used and consulted to for mitigating, reducing or eliminating the threatening risks. A good example for this purpose would be Crystal Ball's Monte Carlo Risk Simulation, which could be a good guide for making right choices about the projects in terms of their profitability. On the other hand, risk analysis could be an excellent ground for risk mitigation policies. An analyzer can easily identify the variables that have the greatest influence on the NPV. Among the tools used for risk assessment, Monte Carlo Simulation is one of the most frequently used.

Chapter 4

DATA ANALYSIS AND PARAMETERS

4.1 Road Projects Data and Description

As far as the initial needs identification in target communities under AzRIP-1 revealed the fact of urgent need for road rehabilitation in more than 50% preferences, the project authorities allocated a corresponding proportion of total budget to this need (more than 50% of the total budget). That is core reason of rehabilitation of road projects' predominance in the lists of project funded community micro-projects in AzRIP-1, while the tendency is still kept on within AzRIP-2. Statistical data regarding the projects expose the fact saying roughly a half of the community micro projects (52%, more precisely, 333 out or 642 projects) implemented during initial stage of AzRIP, tackled on rehabilitation of inter-community and intra-community roads. Lengths of the roads were 2066 km totally, and the budget allocated for all 333 projects comprised 18 million 805 thousands USD. 1.7 million People benefitted from the implemented road rehabilitation projects.

The size of projects intervention scope, their budget and number of benefitting community members urged conducting a general cost-benefit analysis of the AzRIP's road rehabilitation projects. With an eye on the mentioned purpose, AzRIP-1 road projects' impact on communities' livelihood and welfare conditions was one of the research objects within this study. The study captured all the above mentioned communities and length of project intervention roads (2066 km of rehabilitated roads

in 333 communities), which are also considered to have a crucial role of connecting internationally important roads. To be more specific, the project target roads, such as Baku-Tbilisi, Baku-Astara, and Baku-Yalama constructed or rehabilitated under the State Program on the Development of the Regions, ensure access to the regions and regional centres, within the country, make possible their access to international roads and thus, complete the road network.

4.2 Project parameters and assumptions

4.2.1 Project Duration

The AzRIP-1 road projects with six-year-life spans get their start in 2005, some of which were rehabilitated or constructed and launched to serve public needs to the end of the same year. The first period of the project (AzRIP1) finalized in 2012 as it was expected to do at the project beginning, and after 2012 the second phase of the project called AzRIP -2 was launched along with new approach (livelihood and connected road projects).

4.2.2 Project cost

The project expenses were allocated in five major budget items stated below. In depth description of the expenditures made are reflected in the proceeding sub-sections.

- Labour
- Material
- Equipment and Machinery
- General Expenses
- Gross Profit Margin

Labour

Labor with is considered to be a specific element of any project, as a rule suggests the amount and classified types of project personnel, rates of their wages, salaries, the compensation packages offered to personnel, payments for their protection and social welfare, along with awaited increase proportions and other specific data in parametrical figures. [38, pp. 3-12]

A few other parameters will also be needed to use in economic analysis aiming economic factors conversion estimation categorized for various labor types hired for project activities. [39]

The project was undertaken with 1040 employees. Within the period of project implementation, lasing 8 years, all the mentioned number of employees was involved in the project activities, 999 of whom were unskilled blue collars, and 41 workers were skilled white-collar employees. Alongside with the mentioned labour force, the project had employment contracts with six engineers, thirty-five workers. The below table displays the nuances from the payroll of employees hired for the project:

Table 4.1: Salaries and wages of AzRIP-1 road projects employees

Description	**Number of Employees**	**Monthly salary (AZN)**	**Total Monthly Salary**	**Total Annual Salary (for 8 years)**
Unskilled	999	232	232,647	2,791,204
Skilled				
Worker	35	420.2	14,700	1,411,200
Engineer	6	1002	6012	577,152
Total	**1,040**	**1,654.2**	**253,359**	**4,780,228**

Material

The essential materials used for road rehabilitation operations were: gravel, sand, silt, clay, sewer tube and water. Expenses made for supplying the project materials covered roughly 37% of general budget for projects. All the required materials were supplied within Azerbaijan, rather than importing from other countries, from neighbor towns and cities, as per the documents provided by the project contractor.

Equipment and Machinery

In depth study of project documents revealed the information about the cost equipment and machinery used for the project, which was foreseen to be 4.152.735 AZN. The list provided beneath this paragraph represents the machineries and equipment used for the road projects:

1. Dump Truck (to transport sand and gravel)
2. Water tank (to wet ground)
3. Dozer and loader (to dig, carry soil and fill trenches)
4. Grader (to excavate, embank and level the surface)
5. Road roller (to squash the soil to the desired density)
6. Water cannon machine
7. Soil mixer

General Expenses and Profit Margin

This budget item was planned for daily project operations. The expenses allocated via this item were spent to renting, utilities, insurance, employee nutrition, clothing and transportation and comprised a 4.2% segment of the general project investment pie – precisely 673 912 AZN.

Being a profit indicator, contractor's profit refers to a measure of contractor's revenue in construction period. To calculate this data in this project, we sought the revenues like a proportion of investment cost. The proportion of available earnings for the contractor is represented as an income from the project. In our thesis for this figure we indicated the profit of contractors with whom AzRIP their partnership agreements, covering roughly one-eighth (13%) of general investment (2 085 919 AZN).

4.3 Project financing

> Project financing may be defined as the raising of funds on a limited-resource or non-resource basis to finance an economically separable capital investment project in which the providers of the funds look primarily to the cash flow from the project as a source of funds to service their loans and provide the return of and the return on their equity invested in project. The terms of the debt and equity securities are tailored to the cash flow characteristics of the project. For their security, the project debt securities depend mainly on the profitability of the project and on collateral value of project's assets. Examples for the assets that can be financed on a project basis include pipelines, refineries, electric generating facilities, hydroelectric projects, dock facilities, mines, toll roads and mineral processing facilities. [69]

In other words, **project finance** is a prolonged funding for infrastructural and industrial projects grounded on project-projected cash-flows preferably than the sponsors' balance sheets. Typically a number of equity investors, who also are called 'sponsors', along with banks or other lending entities providing operational loans are involved in a project.

With an eye on examining and appraising AzRIP-1 road project on scenarios the thesis tries to find out the way of inspiring private sector entities to get involved in implementation of civil construction and infrastructure projects' implementation. Hence, the study represents evaluation of the project's viability with three scenarios. The developed scenarios that are developed for the project are:

- **Scenario 1:** analyzes the project with the assumption of using loan (Original one);
- **Scenario 2:** does not consider any loan and toll for road rehabilitation (the party that undertakes all project expenses by the government);
- **Scenario 3:** estimates the project with the assumption of tolls and loans provided;

In the original form (**Scenario 1**), project is implemented with a received loan. . Fundamentally this project scenario does not involve a toll system and the share of investment cost is as follows: government- 35.6% and bank- 64.4%.

Scenario 2 will get engaged in determining road projects' feasibility without loans, completely financed by governmental authorities. Alongside with this, the scenario will maintain the assumption of impossibility of toll system for this project.

Scenario 3 suggests project implementation with loan and toll. Similar to the Scenario 1, project expenses will be provided by government and banking institution.

Loan

The stakeholders of the project established a combined or composite loan opportunity with World Bank within the frameworks of two scenarios mentioned above, with terms of drawing annual loan facilities down over the eight-year-period of project implementation. The loan covered more than two-third of all investment costs, while the remaining one-third part of total project investments was provided by the government.

Figurative data of the composite loan facilities provided was 12, 223, 486 AZN and loan facilities comprised a 50%-proportion of composite loan in 2005, and the other half of the loan was provided in 2008th year for both scenarios. Beginning in 2005, the principal amount of loan together with its accumulated interest was repaid in seven annual instalments. The interest rate accumulated for the loan comprised 1.68% in 2005, while it fell to 0.50% for 2008. The debt was due to be paid by 2012.

Toll

As mentioned above the third scenario assumes the project to put a toll on the rehabilitated roads, in order to cover some proportion of project construction expenses. This toll also is in positive correlation with inflation rate. The vehicles using the roads could be categorised under the following classes:

1. Automobiles
2. Buses
3. Trucks (2 or 3 axles)
4. Trucks (4 or more axles)

Possible toll structure, obtained from other tolled roads in the country is reflected in the table below. The Table 4.2 indicates the offered toll structure applied in other available project patterns using a toll method:

Table 4.2: Toll Structures in AZN

Vehicles	Cars	Buses	Trucks
Total	0.2	0.3	0.6

4.4 Road Projects Data and Description

4.4.1 Financial Parameters

The main information to be used for financial analysis will be described in this part. The data about the project and its financial resource is needed for this which is detailed in the relevant Appendix 2.

Project Operational Life and investment cost

Construction operations within the first phase of AzRIP were initially planned to be finalized in 8 years. As per the rehabilitated roads' life expectancy, they were planned to be 6 year per each in the initial project documents. However, in actual implementation of the project, after all the roads are rehabilitated, the project is expected to proceed till 2018; i.e. the lifespan of each project would be extended to 13 years. Project investment comprised 18.5 million AZN (roughly 23.7 million USD).

Table 4.3: Investment Costs of the project (Nominal)

Investment Costs Chart (in million AZN)								
Year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Equipment and Materials								
Domestic	889,068	966,417	1,129,741	1,363,598	1,377,234	1,455,460	1,573,353	1,689,781
Imported	519,092	539,856	551,193	574,894	589,841	605,177	614,860	632,691
Labour Force								
Skilled	248,562	270,187	315,849	381,230	385,042	406,912	439,872	472,423
Unskilled	348,969	379,330	443,436	535,228	540,580	571,285	617,559	663,258
General Expenses	84,239	91,568	107,043	129,201	130,493	137,905	149,075	160,106
Contractor's Profit Margin	260,740	283,424	331,323	399,907	403,906	426,848	461,422	495,568
Total	**2,350,670**	**2,530,781**	**2,878,585**	**3,384,056**	**3,427,095**	**3,603,587**	**3,856,141**	**4,113,827**

Operating Cost

As per initial project documents, operational expenses were predicted to capture a five-percentage-share of the total investment.

Depreciation

Project depreciation was to be calculated via applying a straight-line method towards the project progress completion.

Taxation

Analysis of initial project budgets revealed the flowing taxation information: the expected general sales tax was planned to be 18%, whilst personal income tax to be 4% less, 14%.[2]

Discount rate (Required Rate of Return)

Annual inflation in the project comprises 2%, whereas the figures for the required rate of return suggest 10% that could be identical for similar investments in Azerbaijan. However the model was developed on the ground of actual figures, which urged using inflation rate to determine the investment costs in nominal terms. As per a rationale for discount rates, it should be reckoned with that no examples of discount rate is observed in Azerbaijan, the author of the thesis had to benefit from the World bank analysis, and Dr. Glenn P. Jenkin's study. As a result, a ten-percent discount rate was used in this study, which corresponds to the return on investment investor could earn from similar investments.

[2] Please, see Appendix 2: Table of Project and Financial Parameters

4.4.3 Economic Parameters

Economic Opportunity Cost of Capital

When economic NPV estimation for an investment is taken on, the most relevant discount rate to be used should be an Economic Opportunity Cost of Capital (EOCK). Or, as stated Jenkins et al [40]:

> "The economic cost of capital is calculated as a weighted average of the rate of time preference to savers, the gross-of-tax returns on displaced investment, and the marginal cost of foreign capital inflow "

In line with the above mentioned definition, EOCK represents the least or minimum expected rate of return on investment. The minimum economic rate of return vital for AzRIP-1 project to earn is 10%, relevant to the purpose this analysis. In these terms only the project can contribute to economical growth of Azerbaijan.

Foreign Exchange Premium (FEP)

Being one of the key elements in an economic analysis of a project, this element contains foreign currency and exchange rate, which is in the same time in the economic price of foreign exchange. Any economy is influenced with foreign exchange premium via its effects over supply and demand for foreign currency, so is import and exports sectors. In line with affecting the items mentioned above, tax and tariff may directly influence FEP. FEP is very appropriate way for handling any loss, which is stemmed from foreign currency fluctuation on international projects and investments.

The formula for foreign exchange premium in simple is like [41]:

> If the elasticity of foreign exchange supply is equal to the elasticity of foreign exchange demand:
>
> (1)
>
> **FEP= TR+ES–ET / VOI+VOE**
>
> Where **(TR)** stands for Tariff Revenue, **(ES)** means Export Subsidies and **(ET),** represents Export Taxes. **(VOI)** and **(VOE)** are understated as Value of Imports and Value of Export respectively.

FEP can also be effectively used to calculate the conversion factors for price of traded and non-traded goods to the project. This project's FEP indicator was calculated on the base of above mentioned formula, which comprised to 2%. The essence of this data could be understood in simple way like the following: government gets foreign exchange rate's economic cost 2% more than its market price.

Demand

Demand has to do with traffic using the roads. The demand for this study is classified in two broad groups:

1. Without project: This category tackles the road and vehicles before the project implementation.

2. With project: This is category considers the number traffic of rehabilitated and newly constructed roads, plus the diverted traffic which is about the people changing their preferences among the old and new roads due to the better quality and reduction in length and time spent. The below given table illustrate daily demand for traffic forecasted (with and without project).

Table 4.4: Forecasted traffic demand under three scenarios

Type of Vehicle (Daily)	**With Project**				**Without Project**
			Scenario 1&2	Scenario 3	
	Generated Traffic	Diverted Traffic	Total	Total (35% reduction)	Total
Cars	6,706	1,004	52,660	34,229	44,950
Buses	76	10	592	385	506
Trucks (2 or 3 axles)	913	100	5,813	3,778	4,800
Trucks (4 or more axles)	21	10	182	119	151
Total	**7,716**	**1,124**	**59,248**	**38,511**	**50,408**

Economic Conversion Factors

During project analysis conversion factor helps to recognize viability of the project being implemented from economic standpoint. Conversion factors provide conversion of project cash flows' financial value to economical one, to get economic price of project input and output. Alongside with this, the process helps to understand the project's actual costs and benefits [42].

It should be considered that using conversion factors or economic prices during an analysis does not differentiate the analysis' conclusions. However, in major cases conversion factors are more preferred than economic prices, because of their convenient usage. The first pro of using a conversion factor is the fact that it can be applied directly to the financial data. And the second advantage is inflation does not affect conversion factors, as long as the percentage of tax underlying and subsidy distortion relating to the price of goods does not change. Ultimately, in case if underlying distortion figures remain unchanged, one project's calculated conversion

factors can easily be applied to a number of similar projects implemented in the same country.

To calculate economic conversion the following process should be tracked: after estimating the economic value, with the reason of finding the economic conversion, we should divide it by financial price. In this respect, supply price *(Ps)*, among the project outputs, is the pertinent financial price put to use to find the conversion factor the project takes. Provided that the item represents input of project the demand price (P_d) becomes the relevant estimate, which has to be paid by the project. Along with these, multiplication of the financial cash flow statement's entire line by those particular goods' or services' conversion factors would give the stream of economic costs and benefits for that good or service [35].

To set economic pries in most accurate way, one should adjust every item in project financial cash flow with their conversion factors. In the current study project conversion factors cover:

- Vehicle's operational costs
- Routine maintenance
- Periodic maintenance
- And construction costs

Vehicle Operating Cost (VOC) and Time Saved

Generally, the expenses under VOC contain of the flowing: expenses for fuel, oil, gas, tire wear, insurance, maintenance and depreciation. Table 4.5 displays operation cost estimates classified for each vehicle type benefitting from the project:

Table 4.5: Existing Daily VOC (AZN/km)

Category	Cars	Buses	Trucks
Without project	0.2548	0.3753	0.5082
With project	0.1863	0.2959	0.41
Gain	**0.069**	**0.079**	**0.098**

Source: Obtained by self-study.

This project's economic benefit has to do with the saved time due to using the rehabilitated project roads and savings from vehicles' operational costs. Both resources are crucial for achieving economical purpose within this project. Table 4.6 represents the time spent on roads before and after the project in comparative data, the outcomes of which is also added to the economic benefits of the road project to the country's economy:

Table 4.6: Comparison of value of time spent on roads before and after AzRIP-1 project (AZN/km)

Category	**Cars**	**Buses**	**Trucks**
Without project	0.093	0.108	0.122
With project	0.054	0.067	0.077
Gain	**0.039**	**0.041**	**0.045**

Operational costs of vehicles directly depends on the traffic, even any slight changes in project traffic would demonstrate positive correlation with it.

Estimating Benefit to Farmer, Trucker and Middlemen

Rural roads rehabilitation can be considered a grant for farmers, due to the projects' easing their access to markets and emergency services. Moreover sufficiently implemented road projects ensure reduction of nutrition insecurity and malnutrition possibilities which can be a threat for vulnerable people residing in the area (IDPs, refugees, etc) via expanding their income opportunities.

Another group benefiting the advantages of the constructed roads are truckers and middlemen or intermediaries. The project is a good opportunity for them to expand their trade and marketing relations and increase the volume and number of their travels and goods sold, alongside with decreasing their operational costs. Closer and easier connection among large cities and distant countryside would also expand employment opportunities, in line with promoting the regional industries and productions.

Estimation of Economic Conversion Factors

This section will be about the data that were economically converted. Among conversion factors (CF), CIF (Cost, Insurance and Freight) price, handling and freight prices are the keys for proper calculation. The initial economic data used for CF calculations is represented in the Appendix 3 about Parameters for Economic Analysis. In concordance with facts and information taken from the project, no imported materials were put to use in the course of the project implementation. The factor indicating *vehicles' operating cost* are represented in Table 4.7, where all the given figures are for tradable goods except diesel and labour force, which is explained separately.

Table 4.7: Summary of Conversion factors of Vehicle Operating Costs

Component	Light Vehicles	Buses	Trucks	Weight	Light Vehicles	Buses	Trucks
Vehicles	0.6286	0.6286	0.5372	55.00%	0.3457	0.3457	0.2954
Tires	0.8057	0.8057	0.8057	10.00%	0.0806	0.0806	0.0806
Gasoline	0.7913			20.00%	0.1583		
Diesel		0.8283	0.8283	20.00%		0.1657	0.1657
Lubricants	0.8057	0.8057	0.8057	5.00%	0.0403	0.0403	0.0403
Tools	0.8057	0.8057	0.8057	3.00%	0.0242	0.0242	0.0242
Vehicle Parts	0.7641	0.7641	0.7641	5.00%	0.0382	0.0382	0.0382
Labour	0.9611	0.9611	0.9611	2.00%	0.0192	0.0192	0.0192
Weighted Conversion Factor				**100.00 %**	**0.7064**	**0.7138**	**0.6636**

For estimating economic conversion factors for **construction costs** the following will be taken into account. Construction cost: categorizes only equipment classified under tradable goods. Conversion factors of construction cost are illustrated in table below:

Table 4.8 Conversion factors for Construction Costs

Component	CF	Weight	Weighted CF
Sewer Tube	**0.8283**	3.00%	0.0248
Geotextiles	**0.0000**	0.00%	0.0000
Equipment	**0.8283**	38.50%	0.3189
Materials and other	**0.8283**	42.00%	0.3479
Labour			
Skilled	**0.7592**	11.30%	0.0858
Unskilled	**0.7823**	5.20%	0.0407
Weighted Conversion Factor		100.00%	**0.8181**

Under maintenance costs, we meant all the materials for maintaining the roads rehabilitated within AzRIP-1 project. The outcomes related to conversion factors for routine and periodic maintenance are detailed in Tables 4.9 and 4.10.

Table 4.9 Calculation of Conversion Factors for Routine Maintenance

Component	**CF**	**Weight**	**Weighted CF**
Equipment	**0.8283**	30.00%	0.2485
Materials and Other	**0.8283**	56.00%	0.4639
Labour			
Skilled	**0.7592**	4.00%	0.0304
Unskilled	**0.7823**	10.00%	0.0782
Weighted Conversion Factor		**100.00%**	**0.8210**

Table 4.10: Calculation of Conversion Factors for Periodic Maintenance

Component	**CF**	**Weight**	**Weighted CF**
Equipment	**0.8283**	38.00%	0.3148
Materials and Other	**0.8283**	48.00%	0.3976
Labour			
Skilled	**0.7592**	4.00%	0.0304
Unskilled	**0.7823**	10.00%	0.0782
Weighted Conversion Factor		**100.00%**	**0.8210**

Labour: Majority of blue-collar employees involved to the project were hired from the rural regions of project's sites and their wages were identical with the wages rate of those regions.

Chapter 5

FINANCIAL ANALYSIS

5.2 Objective of Financial Analysis

According to the Integrated Investment Appraisal methodology, financial analysis allows assessment of the project on two alternative viewpoints, that is, total investment or banker's point of view and equity (owner's) point of view.

The investment in total perspective does not include any finance coming from external sources into project cash flow. It tries to ensure assessment of financial receipts generated in terms of their ability to cover project investment and expenses for operation in line with providing sufficient return. The fact that it enables bank officers to figure out on sufficiency in covering project's interest rates and loan obligations, makes the financial analysis to be known as a banker's standpoint. The total investment (banker's) point is the initial step of the assessment, grounded on which a project is appraised. In theory, it reckons on projects not considering any external financial sources, as if the project was run with its owners' own equity. In other words, in as much as the decisions made as the outcome of this decision influences tradeoff issue between financial risk and capital risk and cost, this approach does not account in the financial decisions about relative debt and equity proportions. A banker can reliably use this method if he/she wants to be sure about project capability of gaining assets as the result of appropriate activities to pay the bank's loans off based on in-time reimbursement schedule prior to loan provision. The analysis is also a good way to

understand if those financial receipts would provide a sufficient return to get back the investment and project expenses for operations.

In order to see project capability in terms of generating sufficient cash to service its debt, actual flow of cash related to overall point of investment are taken as a base for computing Loan Life Coverage Ratio **(LLCR)** and Annual Debt Service Coverage Ratio **(ADSCR)**. The mentioned ratios are calculated for loan repayment periods (Jenkins et al, 2011 Ch.4, pp. 22-24).

Following the computing operation (2) considering dividing net cash flow after tax by principal and interest jointly, we get the rate of payoff capability that represents annual debt service coverage ratio (ADSCR).

(2)

$$ADSCR_t = \frac{\text{Annual Net Cash Flow in Year}_t}{\text{Annual Debt Repayment in Year}_t}$$

As per criteria set for evaluating ADSCR, providing that proportion of ADSCR represented in negative value, project estimated will be positively proportional with ADSCR, that means will have a cash flow that is negative in a particular timeframe; also, the influxes are inadequate to comprise all of the refunds. If the ADSCR is positive, and is less than unity, it means that the assessed project is capable to cover its spending; however, it does not have sufficient cash to repay the bank debt fully. If the ratio equals one, it means that the project is breaking even to meet its operating expenses, but still can afford to service its debt undertakings, although the project does not own any cash to offer a return to equity holders.

Terminally, a ration above one conveys the message that the project produces sufficient cash to repay both expenses and loan obligations, in line with leaving some extra profits to the investors.

Mostly, the term Loan Life Coverage Ratio (LLCR) is perceived as net cash flows present value after taxation process throughout the course of loan repayments submitted upon the existing time's interest value, in line with principal reimbursement until the expected loan reimbursing time.

Loan Life Coverage Ratio (LLCR) can be explained in the following way: it is the existing time value of flows that are in net cash form, succeeding tax at one point within a period of reimbursing loans with today's interest value and the main part of reimbursements within the overall pay off term. The relevant equation (3) is given below:

(3)

$$LLCR_t = \frac{\text{Present Value of } ANCF_{t \text{ to end year of}}}{\text{PV of Annual Debt Repayment}_{t \text{ to end year of year}}}$$

The outcome of this equation enables the analyzing banker to understand whether there is enough cash to cover the project financing after the flows of cash that are not adequate to the loan commitment service. While Annual debt Service Coverage Ratio tracks the advantages of the project on annual ground, LLCR ratio can go further and analyze the project capability to pay their debt commitments back and reckons on the remaining net cash flow, as well as the remaining loan repayment, not just for a single year.

In the time, when it is necessary to analyze the yearly debt servicing capacity, the LLCR ratio is very handy, and it facilitates to bring solutions to financial supply questions like decreasing budgets and allocating finance for bridges during challenging fiscal periods. **Decreasing budgets (or sinking funds)** are the fund resources, which are grounded on lender requirements to keep cash, to provide their usage when it is crucial in terms of servicing their debts. The mentioned funds limit undertaking the necessary financial commitments, and contain 12 and 18 months of debt allocation. In case, when cash flow from project activities cannot afford to undertake the project's debt requirements, cash can be taken from the escrow (or bono) fund. **In terms of bridge financing**, it is a loan considered for a short time period, which can be used in case if the project suffers from lack of cash and usually is a matter of high levels in rate of interest.

LLCR ration equalling 1.5 to 2.0 typically implies that the invested project is accomplishing its debt duties quite properly, while lower ratios are the cautionary elements of a poor financial design or failing business. To put it in another way, such kinds of ratios appear to be more subjective and might diverse according to individual preferences related with risks and industry standards about the level and essence of acceptable ratio. Banking institutions generally apply the adequate ratios set by them own for various industries and project extents. If the LLCR figure is low, amendment or reorganization the loan terms would be a stem for ratios improvement and eventually make the project seem advantageous to bank owners. The elements increasing its possibility are:

1. Reduction of loan's rate of interest ,
2. Reduction of loan extent,

3. Extending the period of the loan payoff.

The proceeding evaluation step is to pick up the project from owner's viewpoint, which eventually will show whether or not the equity or owners are making profit. This result is crucial in decision making. Having a great difference from a banker's viewpoint, via loan, other external financial sources and grant receipts' involvement, the cash flow statement involves the loan receipts as inflow and all interest repayments as an outflow. Here the essence of the method is evaluation of project financial performance to enable the owner to make decision whether the business net cash flow is beneficial in regards of project implementer. Thereafter, the owner gets the net cash flows following whole reimbursement to entire shareholders. All of other cash flow statements developed for the investor's and banker's consideration follow the same way.

Amongst numbers of evaluation criteria for assessing the project's financial viability, NPV is the most efficient one. That is the reason of our preference in choosing the NPV technique as the key criterion to evaluate and measuring its benefits.

NPV is calculated on the base of obtained net cash flow. Jenkins et al. (2011) suggests NPV to be a mathematical general amount of the existing time values of the accumulative awaited net flows of cash that are positive and negative with an eye on forecasted project life conjecture (Jenkins et al, 2011, Ch.4 p.3). See equation (4).

$$NPV^0 = \sum_{t=0}^{n} \frac{\text{Net Cash Flow}}{(1+r)^t} \quad (4)$$

In the above equalling “r” stands for the rate of discount or the rate of return, that project owners are consentaneous to adopt for investing their money in the presented project that in our case equals to 10%.

Grounded on the fact of being an indicator of project ability to add value to the implementing firm, NPV enables the owners to decide is they can accept its implementation or not. Below we will review three values of NPV and its explanation in a simple way:

Table 5.1: Interpretation of different NPV values from investors' viewpoint

Figurative description	**Verbal description**	**Interpretation from investors’ viewpoint**
NPV>0	Discounted value of net cash flows is greater than zero	A commercially feasible project, adaptation from the owner's stance should be considered
NPV=0	Discounted value of net cash flows equals to zero	The project is in neutral position; it is neither a profiting one, nor a losing.
NPV<0	Discounted value of net cash flows is smaller than zero, is in negative value	The people investing in this project will receive less than their required rate of return and money loss is a great probability for owners.

Internal Rate of Return (IRR) is another crucial criterion for a project owner to decide whether the project is worthy for an investment or not. Nonetheless, this is not a trustworthy gauge for judging the project because of several justifications asserting that using IRR as an assessment tool for projects is not advisable. Some of the justifications are suggested below:

- Multiple rates of return for project,

- The same project launched in different times,
- The evaluated objects are not identical as per their volumes and sizes and also they are in most cases are reciprocally circumscribed,
- The evaluated objects are not identical in terms of their duration and are reciprocally circumscribed
- IRR is obtained as the outcome of algebraic equalization; nevertheless, the bodies making decisions makers make efforts to clarify for existing time and forthcoming inclinations in financial markets and other macroeconomic indexes to determine corresponding rate of discount.

To review the IRR equalization, (5) stands for the discount rate making the net present value equal to 0 (Jenkins, et al.2011

(5)

$$\text{IRR:} \sum_{t=0}^{n} \frac{\text{Net Cash Flow}}{(1+r)^t} = 0$$

To work out the equaling per k, that relates to IRR, the evaluated program is to be consented providing that (k > r), and turned away on the condition (k < r). Herein r indicates the required repayment rate.

5.2 Results of Financial Analysis

5.2.1 Total Investment (Banker's) Point of View

To view the case from the investor's perspective it becomes apparent that the nominal cash flow statement contains entire receipts generating influxes into the project, along with entire disbursement expenses. The cash inflow amount enables the decision makers to understand whether it will be able to meet project debt and other financial commitments or not. Besides this point, it proposes the available level of paying all the funds received, including interest and loans. The annual net cash flows of the

project that entitle the pre-financing period is computed via comparing the project inflows and outflows that might be a basement for project potential to refund the loans or debts undertaken.

To get real cash flow statement from investment standpoint the nominal cash flow statement should be divided by the inflation index. The acquired result can also be effectively used in evaluation of project capacity to service its debts.

Table 5.1 and Table 5.2 reflect nominal and real cash flow statement from total investment point of view for AzRIP-1 correspondingly. The total inflow and outflow rates are not represented in these tables, whereas the in-depth information about them will be illustrated in Total Owner's Point View.

Table 5.1: Cash Flow Statement from the Total Investment Point of View (Scenario 1)

Year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Net Cash Flow Without Financing	-837	-932	-1,013	-7,398	-1,201	-1,300	-2,634	-1,493
Minus Tax Shield	0	0	0	0	0	0	0	0
Minus Debt Flow	-850	-771	-651	3,997	-1,714	-1,613	-1,466	-1,340
Net Cash Flow With Financing	**-1,687**	**-1,703**	**-1,664**	**-3,402**	**-2,914**	**-2,913**	**-4,100**	**-2,833**

Table 5.2: Cash Flow Statement from the Total Investment Point of View (Scenario 3)

Year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Net Cash Flow Without Financing	-450	-144	192	-78	884	1,249	396	2,036
Minus Tax Shield	0	0	0	0	0	0	0	0
Minus Debt Flow	-850	-771	-651	-1,687	-1,714	-1,613	-1,466	-1,340
Net Cash Flow With Financing	**-1,300**	**-915**	**-459**	**-1,765**	**-830**	**-364**	**-1,070**	**696**

Calculation NPV and IRR does not need to be necessarily computed during evaluation of total investment perspective. The reason lies in the goal of the total investment point of view, i.e. it is assessing project profitableness. Therefore, the results of total investment viewpoint can be estimated from the loan commitment service proportions (ADSCR and LLCR) that would provide facilitation for essential touchstones in the project capability assessment to pay off its debt.

Debt Service Ratios (ADSCR&LLCR)

For evaluating project capability in reimbursing its debts, two crucial ratios (ADSCR and LLCR) should be computed as suggested in section 5.1 of this chapter. For the sake of restating the key measurement criteria regarding the ADSCR ratio, the followings should be taken into consideration:

The value for this ratio should be greater than 1, in case if it is very well-thought for a year. However, a sound project would have a ratio bigger than 1.50. Similar to NPV values, this ratio also has a positive correlation with project capability to reimburse its debts. Accordingly, in case the ADSCR ratio of the project is less than 1, that would convey the message that the evaluated project's net flows of cash are insufficient in regard with meeting the financial commitment of the taken year, it denotes the project is not able to make enough amount of money to fulfil expected financial undertakings. If the ratio of the project is in negative value that should be interpreted like the following: the inflow of the evaluated project is not sufficient to pay the project debt service, thus it cannot afford to do.

According to the above-mentioned statements, ADSCR schedule has been developed in the following tables considering for two scenarios, where for the second scenario is not needed because of the project is full granted by government.

Table 5.3: ADSCR Indicators on Project Financial Analysis (Scenario 1)

Year	Annual net cash flow (Real)	Annual debt repayment (Real)	ADSCR
2005	-836,839	850,168	**-0.98**
2006	-934,895	838,511	**-1.11**
2007	-1,012,940	826,855	**-1.25**
2008	-7,675,272	2,291,330	**-3.35**
2009	-1,255,189	2,345,167	**-0.52**
2010	-1,321,839	2,333,017	**-0.57**
2011	-2,656,180	2,291,707	**-1.16**
2012	-1,514,974	2,550,397	**-0.67**

Table 5.4: ADSCR Indicators on Project Financial Analysis (Scenario 3)

Year	Annual net cash flow (Real)	Annual debt repayment (Real)	ADSCR
2005	-449,860	850,168	**-0.53**
2006	-143,533	838,511	**-0.17**
2007	174,159	826,855	**0.21**
2008	-111,823	2,291 ,331	**-0.05**
2009	859,001	2,654,405	**0.37**
2010	1,226,692	2,333,653	**0.53**
2011	373,841	2,291,707	**0.16**
2012	2,036,064	2,550,397	**0.90**

As it is obvious from Table 5.4, in all years of scenario one (original project) the project's ADSCR ratio appeared to be wholly negative. This is because the project's annual net cash flow is negative, that reveals the fact that the appraised project is not capable to pay off its debt obligations. To examine the figures in the table closer, we can see the ADSCR indicators for 2007th and 2008th years were at their lowest negative values, -1.25 and -3.35 respectively, while the ratio in 2009 was – 0.52. Still this ratio cannot be considered to be more sufficient than other figures, as it still remains very insignificant in terms of repayment capability of the project. This trend gives us a ground to come to conclusion that, on one hand the project is ultimately challenged to reimburse its debts and expenditures in all years, however on the other hand, that can be a good motivation for project owners and contractors to search some ways to improve and promote the ADSCR of the project.

In the proceeding Scenario 3 (Table 5.5), where we applied the toll method, we planned to see the changes in net cash flow and NPV, that was expected consequently influence the diversifications in overall project ADSCR and LLCR values positively. Nevertheless, in the third scenario, the ratio decreases considerably in 2005, 2006 and 2008 years to negative values, -0.53, - 0.17 and -0.05 respectively. This is due to the increase construction cost and load repayment in given time period. The reason would be related with the outcomes of evaluated project that have unfavorable flow of cash and the influxes (toll) that are of insufficient amount to meet entire financial expectations. During remaining years we can follow the ADSCR ration again fall under 1, which can be interpreted as the project is failing to cover its expenditures and refunding the debt, nevertheless no available cash exists to provide a return to equity.

To wrap up, as an entire inclination the ratios of ADSCR of both scenarios make it apparent the project is not producing enough cash amount to reimburse project expenses, and or debt obligations, not to speak about additional revenues for equity holder(s). However still, for years 2005 to 2012 when ADSCR ratios had the lowest negative values, it is necessary to determine whether funding a debt service reserve account to cover the debt service obligations in these years.

As discussed in above section of this chapter, the next debt service ratio would be Loan Life Coverage Ratio (LLCR). Typically this analysis is applied when the ADSCR results do not reveal sufficient outcomes, to get the most precise grounds (ratios) the right choices.

Review of financial analysis, made the beneath mentioned information regarding LLCR:

Table 5.5: LLCR Results Obtained from Financial Analysis (Scenario 1)

Year	PV of Net Cash Flows (Real)	PV of Annual Repayment (Real)	LLCR
2005	-12,238,798	9,516,133	**-1.29**
2006	-12,542,155	9,532,561	**-1.32**
2007	-12,767,986	9,563,455	**-1.34**
2008	-12,911,886	9,610,260	**-1.34**
2009	-5,760,275	8,050,822	**-0.72**
2010	- 4,988,595	6,276,220	**-0.79**
2011	-4,033,430	4,337,523	**-0.93**
2012	-1,514,974	2,250,397	**-0.67**

Table 5.6: LLCR Results Obtained from Financial Analysis (Scenario 3)

Year	PV of Net Cash Flows (Real)	PV of Annual Repayment (Real)	LLCR
2005	2,070,408	9,516,133	**0.22**
2006	2,772,295	9,532,561	**0.29**
2007	3,210,711	9,563,455	**0.34**
2008	3,339,548	9,610,260	**0.35**
2009	3,796,508	8,050,822	**0.47**
2010	3,231,257	6,276,220	**0.51**
2011	2,205,027	4,337,523	**0.51**
2012	2,014,305	2,250,397	**0.90**

If to examine these tables with an eye on the LLCR ratio calculation rules detailed in section 5.1, the following interpretation may be made on the represented data: a greater LLCR number than 1 brings out the outcome of project is making as much cash flow as required to meet its debts, anyhow the pending proportion is expected be more than 1.70 to indicate a satisfying inclination for LLCR and being less risky. A LLCR less than 1 should be a reason for warning, because it should be interrupted as the project is failing to generate a positive flow of cash.

Closer examination of Table 5.6 reveals that AzRIP-1 road projects (Scenario 1) own fairly negative LLCR ratios (in calculation of LLCR, the discount rate comprised 10%, which corresponds to actual interest rate) starting from early 2005 until the end of debt repayment year, 2012. This could be interpreted like this: the project is not able to afford adequate cash flows to reimburse any of its financial obligations meant to meet even its own demands throughout these years. This is associated with the negative net cash flow (NCF) of the project, in other words, as the project does not make any

income from the roads, its maintenance expenses cannot paid, which eventually gets responsible for negative NCF.

According to the methodology applied, to rely upon the theory, the banking institution should not invest in such a project during its lifespan. As a result the project might be requested to establish a sinking fund for the mentioned lifespan period (8 years) to get rid of these shortages.

The Table describing Scenario 3 (Table 5.7) suggests the start point of the project LLCR to be 0.22, which means that the project has no enough NCF to cover its debt obligations, nevertheless, the figure is still great risky, as is does not have sufficient financing. To put it more concretely, there is no cash available to provide a return to equity. The insufficient LLCR value keeps on until last year of loan payment (2012), when the ratios continue to be risky for repaying. In general, the table displays no positive trend for LLCR which has a positive correlation with debt repayment capability. Beginning with 2009, the LLCR values comprise 0.47 or above (1.00), where the increasing tendency reaches its highest level in 2012, 0.91 as in ADSCR. The interpretation of these data makes obvious the following: these ratios make sure of bankers (or investors) that the project will face a big challenge to reimburse its debt and loan obligations. Hence, it should not be a reason to turn a blind eye to the fact that these are not real indicators, so as, scenario 3 employs a number of variables in terms of methods and concepts (like toll) for project analysis, the outcomes are calculated on those figures.

5.3.2 Total Owner's Point of View

Relying upon the information in section 5.1 about equity (owner's) perspective, a project's owner could be defined like the party investing to a project or supporting it

financially. It worth to remind, an owner can be either a private investor, or an entity like a governmental agency and/or semi-governmental institution shouldering project financials. Project's owner has to tussle with all the cash flows, expenses and costs of the project in order to find the project's capability in profit generation. Tables 5.8 and 5.9 indicate the results of financial cash flow statement from owner's point of view, displaying the Scenario 1 and Scenario 3 respectively.

Table 5.7: Cash Flow Statement from the Equity Owner's Point of View (Thousand AZN) – Scenario 1

Year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Receipts														
Toll revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in Accounts Receivable	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loan portion	1,514	1,504	1,490	1,482	1,469	1,457	1,443	1,433	-	-	-	-	-	-
Total Inflows	1,514	1,504	1,490	1,482	1,469	1,457	1,443	1,433	-	-	-	-	-	-
Expenditures														
Construction Costs	2,351	2,336	2,313	2,301	2,282	2,263	2,241	2,226	-	-	-	-	-	-
Routine Maintenance	-	103	206	310	413	516	619	723	826	826	826	826	826	826
Periodic Maintenance	-	-	-	619	-	-	1,239	-	-	1,545	-	-	1,653	-
Operating Expenses	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Loan Repayment	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Interest	93	76	61	67	104	88	55	26	-	-	-	-	-	-
Principal	757	707	661	1,803	1,685	1,575	1,472	1,376	-	-	-	-	-	-
Value Added Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corporate Income Tax	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in Accounts Payable	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Change in Cash Balance	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Outflows	3,201	3,223	3,242	5,100	4,484	4,443	5,627	4,350	826	2,371	826	826	2,479	826
Net Cash Flow	-1,687	-1,719	-1,752	-3,619	-3,014	-2,985	-4,183	-2,916	-826	-2,371	-826	-826	-2,479	-826

NPV(AZN) **- 18.2 mln**

Table 5.8: Cash Flow Statement from the Equity Owner's Point of View (Thousand AZN) - Scenario 3

Year	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Receipts														
Toll revenues	407	830	1,268	1,723	2,194	2,683	3,189	3,715	3,789	3,862	3,937	4,014	4,093	4,173
Change in Accounts Receivable	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Loan portion	1,514	1,504	1,490	1,482	1,469	1,457	1,443	1,433	0	0	0	0	0	0
Total Inflows	1,921	2,334	2,758	3,204	3,663	4,140	4,633	5,148	3,789	3,862	3,937	4,014	4,093	4,173
Expenditures														
Construction Costs	2,351	2,336	2,313	2,301	2,282	2,263	2,241	2,226	0	0	0	0	0	0
Routine Maintenance	0	103	206	310	413	516	619	723	826	826	826	826	826	826
Periodic Maintenance	0	0	0	619	0	0	1,239	0	0	1,545	0	0	1,653	0
Operating Expenses	20	41	63	86	110	134	159	186	189	193	197	201	205	209
Loan Repayment	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Interest	93	76	61	67	104	88	55	26	0	0	0	0	0	0
Principal	757	707	661	1,803	1,685	1,575	1,472	1,376	0	0	0	0	0	0
Value Added Tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corporate Income Tax	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Accounts Payable	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Cash Balance	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Outflows	3,221	3,265	3,305	5,187	4,593	4,577	5,786	4,535	1,015	2,564	1,023	1,027	2,684	1,035
Net Cash Flow	-1,300	-930	-547	-1,982	-930	-437	-1,153	613	2,774	1,298	2,914	2,987	1,409	3,138

NPV(AZN) **0.54 mln.**

From the owner's standpoint, the sufficient evaluation criteria succeeding cash flow are NPV and IRR, enabling investors and owners to figure out whether the undertaken project will have increased or decreased values over the years.

The outcomes of NPV and IRR give an investor a reliable and firm ground to make right investment decisions, which in the same time are the main indicators of project attractiveness for investors, the details of which were broadly handled in above sections.

Before moving to the outcomes of the analysis it worth to remind, that this thesis was planned to handle three scenarios, the third of which assumed a private sector approach of using a toll system on the rehabilitated roads. In this respect, scenario 3 could generate revenues to compensate its investment costs. Contrarily we will not handle Scenario 2, as this scenario was based on the hypothesis of government's meeting all the project's expenses, which lead to the identical conclusions with Scenario 1.

The financial indicators of Scenario1 for NPV revealed to be negative 18.2 million AZN (approximately 23.3 mln USD). As the project was financed by government and bank, there were no charges required (in toll system or other ways), and which consequently led to negative value of NPV. Still it is no doubt that the road caused users' savings in terms of time, vehicle maintenance costs, decreased number of accidents, and a number of similar benefits. In section about economic analysis there is a detailed description of the NPV and its interpretation.

Similar to scenario 1, scenario 2 suggests negative values, i.e. negative 6 mln AZN (equaling 7.7 mln USD), the outcomes of which are not referred to in this study, so long as it gives very close conclusions as the first scenario.

The NPV in Scenario 3 comprises 42,496 AZN, equaling roughly 54, 482 USD, which leads to optimistic outcomes about accepting the investment. Hence, it should not be forgotten that the scenario employs assumption on using toll system, even is large-size public project. In this case the project financers can make a positive decision about investments no matter what the project size is. Of course, this decision would decrease the government's responsibility in providing infrastructure, along with creating a rivalry environment amongst different investors, which subsequently would lead to more effective use of economical resources and promote level of service provided to citizens. (See Table about cash flow statement for equity owners).

Internal Rate of Return, which is another criterion for cash flow statement appraisal, can be understood as a rate making project NPV a zero. Still, one should not ignore the stumbling block of IRR, that is, the fact that the method incorporates multiple values for a single cash flow profile with several negative flows throughout the project lifespan.

In Scenario 1 and 2 the project IRR is not obtained, possibly due to existence of negative cash flows. Project IRR in scenario 3 comprise 10%. The proportion is same as the discount rate (DR) (10%), and can be interpreted as the project is not strogly feasible or acceptable to be invested. Moreover, the IRR analysis results coincide with NPV analysis results, indicator that NPV>0 leads to and IRR>DR.

As per theory suggested by Integrated Investment Appraisal, the financial outcomes of conducted analysis (negative cash flow, ADCRL, LLCR and negative financial NPV and IRR) give ground for rejection the project investment, and define the project infeasible in terms of financial evaluations. However, grounded upon the fact that

government implements the project, the initial investment made by the bank is reimbursed from relevant state program budget. The analysis was conducted because of the procedure of the methodology required that, nevertheless, the project benefit and viability will be identified as per the results of economic analysis.

5.3 Sensitivity Analysis

In the flow chart of financial analysis, the next step is a 'what-if' or sensitivity analysis, conducting a sensitivity examination of main project outcomes. The aim of this analysis is evaluating reaction of project outcomes over the changes on the base of single parameter of the model at a time. To express in a very simple way, projects are future investments in which components are estimated. To put it in other way, there always will be risks in terms of estimated numbers' occurrence. Specifically in large-scale projects like road project, this analysis is required for ensuring identification all the risks and be ready for preventive measures.

Sensitivity analysis is the initial thing in conducting analysis of risks is to find out variables that may be risky for the project. The technique is used in studying impacts of key project variables' changes over NPV and IRR of the project. This analysis ensures identification of variables, having extended impact on project outcomes in line with defining their size of effectiveness on the project's net benefits. Additionally sensitivity analysis develops a way to reduce these variables' negative effects on project outcomes [43].

To conduct this analysis a particular parameter should be chosen the model should be tested over a range of the probable values of the chosen parameter, in such a way that the model could calculate its final figures with parameters of value. Being one of the

effective ways to distinguish the main variables of project, this analysis helps the analysts to realize the ways of re-configuring projects' arrangements to make them more reinforced to survive among the potential dangers. The results of the model taken should be considered from the owner and banker's perspective. All the sensitivity experiments employed for this project should use this method.

The two scenarios meant for this analysis contain the following parameters:

Scenario 1:

- Domestic inflation, equity discount rate and cost overrun.

Scenario 3 (with toll and loan):

- Domestic inflation and toll (car, bus, trucks), reduction in demand, routine maintenance, cost overrun, equity discount rate.

Scenario 2 was not examined within this sensitivity analysis, because on one hand the project was funded by the government, and on the other the results are similar to the results of Scenario 1.

After identifying the critical parameters per each scenario, the analysis was conducted, the details of which are described in below sections.

Sensitivity Analysis of Scenario 1:

- **Cost Overrun**

Table 5.10 represents an unfavorable NPV for the project entirely, while Cost Overrun is in negative correlation with the project NPV. That is, as more the project cost increases as less the NPV is.

Table 5.9: Outcome Indicators of Sensitivity Analysis (Cost Overrun vs NPV)

Cost Overrun	
	-18,214,877.59
0%	**-18,214,877.59**
5%	-18,824,952.63
10%	-19,435,027.68
15%	-20,045,102.72
20%	-20,655,177.76
25%	-21,265,252.80
30%	-21,875,327.85

- **Equity discount rate**

The sensitivity analysis for equity DR in Scenario 1 gave ground to come to conclusion that the changes in DR do not influence NPV, because majority of the costs appear over construction process of the project, so the changes in this indicator lead to important changes as the duration is not long.

Nevertheless in the third scenario these happen in a different aspect, where sustained funds inflow coming from toll of the throughout project life, change in the equity discount rate is expected to result in consequential modification in NPV.

Table 5.10: Outcome Indicators on Sensitivity Analysis of Equity Discount Rate

Equity Discount Rate	
	(18,214,877.59)
8%	(19,896,123.22)
10%	**(18,214,877.59)**
12%	(16,760,032.30)
14%	(15,493,835.60)
16%	(14,385,819.23)
18%	(13,411,233.02)
20%	(12,549,845.51)

- **Domestic Inflation**

Succeeding parameter in a sensitivity analysis is domestic inflation rate. As the inflation is in single digit In Azerbaijan, 7% make the indicator an important parameter for sensitivity analysis. Its unpredictable nature is in charge for its direct effects on NPV as it can increase all the benefits and costs, which subsequently increases NPV figures. Eroding the value of future money, inflation is a strong parameter affecting project expenses and efficiency. A project affected by inflation, would have similarly affected inflows and outflows. As AzRIP-1 does not produce any outcomes that bring any financial revenues, and the construction expenses contain the main part of financial costs, it is directly affected with domestic inflation changes.

Table 5.11: Outcome Indicators of Sensitivity Analysis (Domestic Inflation vs. NPV)

Domestic Inflation	
	(18,214,877.59)
6%	(18,421,535.21)
7%	**(18,214,877.59)**
8%	(18,017,839.80)
9%	(17,829,835.40)
10%	(17,650,320.79)
11%	(17,478,791.64)
12%	(17,314,779.61)
13%	(17,157,849.40)
14%	(17,007,596.09)

Result of Sensitivity Analysis in Scenario 3:

- **Demand**

Roads with tolls are greatly dependent of demand. In case if the roads with tolls are not demanded by the project beneficiaries, the project would definitely be challenged to generate enough funds the project expenses and maintenance costs, thus project

demand has to do with toll demand flexibility. In AzRIP-1 road projects pattern the flexibility is anticipated to be in low values, inflexible due to absence of much alternative roads to be preferred instead of AzRIP-1's intercommunity roads. Nevertheless applying a tolling system on the roads would cause some users' displeasure and force them to seek alternative choices. Taking into consideration this fact it is expected that there would be more than one-third fold decrease (35%) in roads with tolls. Changes in demand for the roads affect the project NPV and as the below table reflects, there is a reverse correlation between the NPV and demand. The NPV of the project will as lower as the demand decrease rate is higher.

Table 5.12: Reduction and Growth in Demand of project

Decrease or Increase in Demand	
	42,496
0%	9,873,368
5%	8,468,958
10%	7,064,547
15%	5,660,137
20%	4,255,727
25%	2,851,317
30%	1,446,907
35%	**42,496**
40%	-1,361,914
45%	-2,766,324
50%	-4,170,734
55%	-5,575,145

- **Cost Overrun**

For the evidence of direct affect on NPV, cost overrun is seen as another important variable of the project. The table below makes it evident that any cost overrun changes would be responsible for large changes in NPV amounts. In our case, this variable has a negative correlation with NPV, so that, the more the cost overrun is, the less the NPV

is, and vice versa. That is the reason why a cost surplus is considered one of the most deceptive risky elements.

Table 5.13: Outcome Indicators of Sensitivity Analysis (Cost Overrun vs. NPV)

Cost Overrun	
	42,496.36
0	**42,496.36**
5%	(567,578.68)
10%	(1,177,653.72)
15%	(1,787,728.76)
20%	(2,397,803.81)
25%	(3,007,878.85)
30%	(3,617,953.89)

Outcomes of sensitivity analysis regarding the cost overrun and its impact on ADSCR of the project is displayed in related table. As the table also convey, the cost overrun has a negative correlation with the ADSCR and NPV. The rise on cost overrun triggers the increase in expected cost of the project, and while the project cost gets bigger, its ability to reimburse its debt get lower because of insufficient net cash flows. The outcomes make it evident to see that as the cost overrun increases, the indicators close to positive move towards negative value. That is very well seen in ADSCR indicator for 2012, when it was closer to 1, and while the indicator gets farther than 1, the result worsens. Mainly the increases in maintenance costs are responsible for these outcomes, so as, the situation improves as the maintenance costs change positively. Thus, any change in the costs overrun has a negative correlation with the ADSCR, and this change is casted back in the project capability in paying off its debt and taking on other financial commitments.

Table 5.14: Outcome Indicators of Sensitivity Analysis (Cost Overrun vs ADSCR)

Cost Overrun	ADSCR 2005	ADSCR 2006	ADSCR 2007	ADSCR 2008	ADSCR 2009	ADSCR 2010	ADSCR 2011	ADSCR 2012
	(0.53)	(0.17)	0.21	(0.05)	0.37	0.53	0.16	0.90
0%	**(0.53)**	**(0.17)**	**0.21**	**(0.05)**	**0.37**	**0.53**	**0.16**	**0.90**
5%	(0.55)	(0.21)	0.15	(0.06)	0.33	0.48	0.14	0.84
10%	(0.57)	(0.25)	0.10	(0.08)	0.30	0.45	0.12	0.78
15%	(0.59)	(0.28)	0.05	(0.09)	0.27	0.41	0.10	0.73
20%	(0.61)	(0.31)	0.01	(0.10)	0.25	0.38	0.08	0.69
25%	(0.62)	(0.34)	(0.03)	(0.11)	0.22	0.35	0.06	0.65
30%	(0.63)	(0.36)	(0.07)	(0.12)	0.20	0.32	0.05	0.61

- **Equity Discount rate**

This is a rate used for cash flow discounting, which enables the analyzer to determine the pending future income of the project, that is to say, how much it worth in analyzed country's currency. Moreover, the large percentage of required rate of return is a good inspiration for investors to make their financing preferences amongst several projects.

As seen from the table below, a two-percent change in DR, NPV indicators dramatically changes. This finding puts the equity DR among the risky project variables [44].

Table 5.15: Outcome Indicators of Sensitivity Analysis for Equity Discount Rate

Equity discount rate	**NPV (AZN)**
	42,496.36
8%	937,878.17
10%	**42,496.36**
12%	(657,758.16)

14%	(1,205,067.15)
16%	(1,632,072.52)
18%	(1,964,151.38)
20%	(2,221,119.60)

The table below will explain the changes in LLCR that is caused by changes in discount rate. Obviously, ADSCR does not have any relations with discount rate and does not directly affect it. However, it is used in some kinds to determine the LLCR. Any changes in DR are proportional with LLCR rates per years. When discount rate rises, LLCR rate also appear to rise and when it begins to fall the same happens to the LLCR appropriately.

Table 5.16: Outcome Indicators of Sensitivity Analysis (Cost Overrun vs LLCR)

Equity discount rate	LLCR 2005	LLCR 2006	LLCR 2007	LLCR 2008	LLCR 2009	LLCR 2010	LLCR 2011	LLCR 2012
	0.22	0.29	0.34	0.35	0.47	0.51	0.51	0.90
8%	0.23	0.30	0.34	0.35	0.47	0.52	0.51	0.90
10%	0.22	0.29	0.34	0.35	0.47	0.51	0.51	0.90
12%	0.21	0.28	0.33	0.34	0.47	0.51	0.51	0.90
14%	0.19	0.27	0.32	0.34	0.47	0.51	0.50	0.90
16%	0.18	0.27	0.32	0.33	0.46	0.51	0.50	0.90
18%	0.17	0.26	0.31	0.32	0.46	0.51	0.50	0.90
20%	0.16	0.25	0.31	0.32	0.46	0.51	0.49	0.90

- **Domestic Inflation**

As explained in above sections, domestic inflation is one of the crucial components of sensitivity analysis. As detailed in Table 5-18, as the proportion of domestic inflation increases, the same happens to toll revenues and project revenues. But still, due to

spending the great majority of operational costs in the initial years of the project, the project costs would be so much affected.

Table 5.17: Outcome Indicators of Sensitivity Analysis (Domestic Inflation vs. NPV)

Domestic Inflation	**NPV (AZN)**
	42,496.36
6%	(164,161.25)
7%	**42,496.36**
8%	239,534.15
9%	427,538.55
10%	607,053.16
11%	778,582.31
12%	942,594.34
13%	1,099,524.55
14%	1,249,777.87

Appropriate to tendency suggested in Table 5-19, each increase element in domestic inflation will make the project ADSCR fall correspondingly. Every single decrease in project's ADSCR values complicates the reimbursement ability of the project and lessens the rate of net cash flow. On this account efforts should be made to find out some ways for mitigation of risky variables' and increasing the ADSCR value of the project.

Table 5.18: Outcome Indicators of Sensitivity Analysis (Domestic Inflation vs. ADSCR)

Domestic Inflation	ADSCR 2005	ADSCR 2006	ADSCR 2007	ADSCR 2008	ADSCR 2009	ADSCR 2010	ADSCR 2011	ADSCR 2012
	(0.53)	(0.17)	0.21	(0.05)	0.37	0.53	0.16	0.90
6%	(0.53)	(0.18)	0.21	(0.05)	0.37	0.53	0.16	0.90
7%	**(0.53)**	**(0.17)**	**0.21**	**(0.05)**	**0.37**	**0.53**	**0.16**	**0.90**
8%	(0.53)	(0.17)	0.22	(0.05)	0.36	0.52	0.16	0.89
9%	(0.53)	(0.17)	0.22	(0.04)	0.36	0.52	0.16	0.88

10%	(0.53)	(0.17)	0.22	(0.04)	0.36	0.51	0.17	0.87
11%	(0.53)	(0.17)	0.23	(0.04)	0.35	0.51	0.17	0.86
12%	(0.53)	(0.17)	0.23	(0.04)	0.35	0.50	0.17	0.85
13%	(0.53)	(0.16)	0.23	(0.03)	0.35	0.50	0.17	0.84
14%	(0.53)	(0.16)	0.24	(0.03)	0.34	0.49	0.17	0.83

- **Car Toll**

Being a fundamental source of project income, tolls have crucial roles in a road project's life. Accordingly toll rates can be considered among the risky variables of the project, as any changes in tolls would directly have impact over the project cash flow. Even insignificant changes in car toll causes significant change tendencies in NPV. As an example, we can examine the correlation in changes between the two in the below table, even a slight increase of 0.05 AZN in car toll (roughly 0.06 USD), increases the NPV nearly 3.664.645 AZN.

Table 5.19: Outcome Indicators of Sensitivity Analysis (car Toll vs.NPV)

Car Toll	**NPV**
	42,496.36
0.05	(10,823,952.05)
0.10	(7,201,802.58)
0.15	(3,579,653.11)
0.20	**42,496.36**
0.25	3,664,645.83
0.30	7,286,795.30
0.35	10,908,944.77
0.40	14,531,094.25
0.45	18,153,243.72

The ADSCR is directly influenced by car toll, which evident from figures introduced in Table 5-21 also. Rises in ADSCR of tolls could be interpreted as improvement of

the cash flows of the project, indicating an increasing trend and expansion of project revenue stocks.

Table 5.20: Outcome Indicators of Sensitivity Analysis (Car Toll vs. ADSCR)

Car Toll	ADSCR 2005	ADSCR 2006	ADSCR 2007	ADSCR 2008	ADSCR 2009	ADSCR 2010	ADSCR 2011	ADSCR 2012
	(0.53)	(0.17)	0.21	(0.05)	0.37	0.53	0.16	0.90
0.05	(0.79)	(0.72)	(0.63)	(0.47)	(0.16)	(0.12)	(0.62)	(0.04)
0.10	(0.70)	(0.54)	(0.35)	(0.33)	0.02	0.10	(0.36)	0.27
0.15	(0.62)	(0.36)	(0.07)	(0.19)	0.19	0.31	(0.10)	0.58
0.20	(0.53)	(0.17)	0.21	(0.05)	0.37	0.53	0.16	0.90
0.25	(0.44)	0.01	0.49	0.09	0.54	0.74	0.42	1.21
0.30	(0.35)	0.19	0.78	0.23	0.71	0.96	0.69	1.52
0.35	(0.27)	0.37	1.06	0.37	0.89	1.17	0.95	1.83
0.40	(0.18)	0.55	1.34	0.51	1.06	1.38	1.21	2.14
0.45	(0.09)	0.73	1.62	0.65	1.24	1.60	1.47	2.45

- **Truck (2 or 3 axles) and Bus Toll**

Actually the situation with truck and bus tolls is the same with the car toll outcomes, so that they influence NPV and ADSCR in the same manner. However, while we had in depth calculations the outcomes of truck and bus tolls did not cause as big changes in ADSCR values, as car toll did. To put it more precisely, no changes were observed when examined per years. The tables below reflect the Truck and Bus tolls' impact over NPV, and the changes between them.

Table 5.21: Truck and Bus Tolls vs. NPV

Truck Toll	**NPV**	**Bus Toll**	**NPV**
	42,496.36		42,496.36
0.35	(973,682.71)	0.15	(73,861.63)
0.40	(634,956.35)	0.20	(35,075.63)

0.45	(296,229.99)	0.25	3,710.36
0.50	**42,496.36**	**0.30**	**42,496.36**
0.55	381,222.72	0.35	81,282.36
0.60	719,949.08	0.40	120,068.36
0.65	1,058,675.43	0.45	158,854.36
0.70	1,397,401.79	0.50	197,640.35
0.75	1,736,128.15	0.55	236,426.35

Closer examination of the analysis details and their results from all the calculated data, it is understood that the main scenario (Scenario 1) remains insufficient in terms of generating profits, that is to undertake its financial obligations. Whereas, the positive NPV calculated in the third scenario with toll and loan, makes it evident that is government manages to motivate private sector to invest in infrastructure projects, the resources could be used in economic and efficient way, which would subsequently lead to mutual benefit and close cooperation and partnering relations between government and private sector.

5.4 Summary of Financial Analysis

The outcomes of the financial examination of the project revealed that the actual project situation is very close to scenario one, where there is no toll and the project is financed by the government and an international funding institution, which is the key reason of the negative NPV. In myriad of experiences the roads projects are supported and implemented with an eye on regional development rather than making financial revenues. The evidence about this project's economic benefits will studied in the succeeding chapter.

To make right decisions about the viability of similar infrastructure projects, Scenario 3, considering toll is introduced. As per Scenario 3, road projects can be viable from financial point of view, if to apply a toll system. The approach requires a proper

elaboration of special purpose vehicles (SPV). We acknowledge that in initial years there could be some financing problems, because of the high investment costs, but with proper financial techniques the challenges could be mitigated. In brief, SPV is able to produce a positive financial NPV comprising 54.482 USD that makes the project possible to be invested by specific investors.

The forthcoming section is planning to conduct the project's economic appraisal with an eye on appreciating the project economic pros and cons for the country.

Chapter 6

ECONOMIC AND DISTRIBUTIVE ANALYSIS

This chapter will mainly focus on examining the economic viability of AzRIP-1 road projects. With an eye on this, the chapter will start the study with two basic cases, one of which will consider the project together with the rehabilitated roads; another case will study the project without them. The approach will enable us to identify whether the project was economically beneficial or not.

6.2 Objective of Economic Analysis

Economic analysis helps to measure the general level of project attractiveness with an eye on country's development opportunities and prospering. The standpoint of economic analysis is country's national economy, grounded on which it observes the project's level of impact of the country's and the citizens' welfare, not only from project owner's, but also entire country's economic viewpoint.

Economic analysis resembles financial analysis as per its nature. The difference is economic analysis measures all the project costs and benefits with the country's point of view, and does not take market prices as a baseline to measure project costs and benefits. Economic analysis calculates the costs and benefits considering the value of the economic benefits generated from the project outputs, and measures economic costs by the project inputs. Financial analysis, on the contrary, has to do with the benefits and costs through the project's actual transactions. It is economic analysis

that enables to measure project benefits to the society and the economy of regions (G.P. Jenkins 2011, Ch.1, p 11).

In line with examination of all the impacts of the project, either negative or positive, the analysis helps to define the consumption units that would increase the project's economic impacts. A desired result in economic assessment could be achieved via proper evaluation of all the stages from the beginning to the end.

The first stage of this analysis is gathering proper data, making economic assumptions and definition of economic parameters. The assumptions include taxes, import duty, national parameters, economic data and parameters and estimation of economic conversion factors. The succeeding stage in the analysis is calculation of economic benefit (inflow). For this baseline data about number of vehicles using the roads and quantity of beneficiaries should be taken into account. The calculations are held to measure the VOC, value of time, profit of truckers and farmers, the method and other detailed information about which is described extendedly in above chapter about Economic parameters.

The crucial tool in economic analysis is the project's statement of economic costs and benefits, also defined as real economic resource flow statement. The statement is generated via financial values of the project's real cash flow from the investment viewpoint based on economic conversion tools. In other words, the statement makes conversion of all financial parameters possible to economical values and prices.

The financial revenues and income become economically beneficial only when financial expenditures or outflows re economically adjusted to various externalities.

The diversification between the economic costs and benefits gives the project's net economic benefits.

One of crucial points in economic analysis is the fact that, obtained net economic benefits are afterwards discounted by the economic opportunity cost of capital (EOCK), which is an efficient tool to appraise the project's NPV to the economy of the country. In depth description of this statement is described in data Analysis section in Chapter 4.

Mentioned in the methodology part, a cost-benefit analysis (CBA), which can also be understood as a technique employed in conduction of integrated investment appraisal quantifying the project associated pros and cons also enables to analyze AzRIP-1 policies' impact to the economy of Azerbaijan.

CBA analysis, which was also our preference to find out the economic income and benefit include: saving in VOC, value of saved time and truckers' and farmers' benefit.

Similar to financial analysis, economical appraisal also calculated project NPV and IRR on the base of net economic benefits. The economic NPV and IRR can also be considered as an economic feasibility indicator of a project. The varieties between the NPV indicator of two types of analysis (financial and economic) suggest the externalities of the project measuring its economic impact. The cash flow statement is economically analyzed; the outcomes of this analysis introduce project efficiency level. Interpretation of the outcomes should be understood as following: economic NPV correlates positively with the society welfare and promotion of a country's economy. To put in other way, when the NPV is positive, country's economy and

people's welfare is also in positive tendency, and its means that, project is capable to allocate its resources efficiently, subsequently which contributes to country's economic development.

6.3 Description of Calculating Economic Benefit

VOC (Vehicle Operating Cost)

Surveys were conducted in pre and post-project periods about vehicles' operating costs in the project target regions, of 70% of which and old and used vehicles, as the outcomes of which expenses for average annual maintenance and usage, as well as costs per each km were calculated. The costs also include fuel, maintenance and lubricant costs for the vehicles. Subsequently vehicles' savings from VOC expenses due to this project was identified as the survey outcomes. As an example we can review a case study with one of the vehicles using the project road before and after the implementation. Before the project the vehicle's annual cost comprised 95 AZN per a km, while after the road rehabilitation the same vehicle spent only 68 AZN annually per a km that is the vehicle managed to benefit in the volume of 27AZN yearly, which means 29% budget saving in a year.

Value of Time

The conducted surveys enabled us to determine the saved time of local residents because of the rehabilitated roads. To calculate this data, the ratio of the average salary of an Azerbaijani citizen per hour (2.80AZN) to local residents' movement through the roads in their vehicles per a minute was calculated. And relevantly value of time that each person spends per a km on a time division was defined. Eventually the saved time was identified and converted to monetary value. In time saving calculations two passengers were considered per a vehicle, therefore, the results are multiplied by two.

Farmer and Tracker profit

After acquiring the data about the number and annual income of the farmers operating in the target regions where the project was implemented, from the Statistical Committee of Azerbaijan, increase in farmer's annual incomes after the project implementation was acquired as the result of the survey. Relevantly, annual benefit of the project for the local farmers was identified to be 5%.

Another target group benefitting from the project were truckers. To get this information we used observation of the number of truckers using the roads, and the survey results reveal the same. That means, the number of truckers steeply increased after the roads were rehabilitated, and correspondingly their incomes also increased for 60% to 76% in each following year.

6.4 Results

The outcomes of the NPV calculations in the first scenario which suggests a funding structure identical with the original project (Scenario1) comprises 120.9 mln AZN (155 mln USD) and the scenario with toll (Scenario 3) revealed 86.3 mln AZN, (110.7 mln USD) of NPV. (Please see the tables and summary of preformed cash flow for economic NPV for both scenarios on the next pages)

Table 6.1: Economic Cash Flow Statement (Thousand AZN) Scenario 1

Year	CF	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Benefits															
Toll revenues	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Change in Accounts Receivable	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumer Surplus (Generated and Diverted Traffic)	1.00	543	1,118	1,728	2,373	3,056	3,778	4,541	5,347	5,514	5,681	5,852	6,029	6,211	6,398
VOC Savings Normal Traffic															
Light Vehicles	0.71	615	1,249	1,904	2,580	3,275	3,994	4,734	5,497	5,585	5,675	5,765	5,858	5,951	6,047
Buses	0.71	8	15	26	35	43	53	63	73	74	75	76	77	78	80
Trucks	0.66	76	153	233	315	400	488	578	671	682	693	704	715	727	739
Value of Time Savings Normal Traffic	1.00	1,159	2,356	3,589	4,863	6,176	7,530	8,926	10,363	10,530	10,698	10,870	11,043	11,220	11,400
Benefits to Farmers	1.00	248	519	818	1,145	1,503	1,894	2,320	2,784	2,925	3,072	3,225	3,386	3,556	3,734
Benefits to Truckers and Middleman	1.00	170	351	544	749	967	1,200	1,445	1,706	1,763	1,820	1,879	1,941	2,004	2,068
Total Benefits		2,817	5,763	8,842	12,060	15,423	18,936	22,607	26,442	27,073	27,713	28,371	29,049	29,746	30,464
Costs															
Construction Costs	0.82	1,923	1,911	1,892	1,882	1,867	1,851	1,834	1,821	0	0	0	0	0	0
Routine Maintenance	0.82	0	85	170	254	339	424	509	593	678	678	678	678	678	678
Periodic Maintenances	0.82	0	0	0	509	0	0	1,017	0	0	1,268	0	0	1,357	0
Operating Expenses	1.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Costs		1,923	1,996	2,062	2,645	2,206	2,275	3,359	2,414	678	1,947	678	678	2,035	678
Net Economic Benefits		895	3,767	6,780	9,415	13,217	16,661	19,247	24,028	26,395	25,766	27,693	28,370	27,711	29,785

NPV(AZN) **155 mln.**

Table 6.2: Economic Cash Flow Statement (Thousand AZN) Scenario 3

Year	CF	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Benefits															
Toll revenues	1.00	407	830	1,268	1,723	2,194	2,683	3,190	3,715	3,789	3,862	3,937	4,014	4,093	4,173
Change in Accounts Receivable	0.00	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Consumer Surplus (Generated and Diverted Traffic)	1.00	254	522	807	1,109	1,428	1,766	2,122	2,499	2,577	2,655	2,734	2,818	2,902	2,990
VOC Savings Normal Traffic															
Light Vehicles	0.71	400	812	1,238	1,677	2,129	2,596	3,077	3,573	3,630	3,688	3,747	3,807	3,868	3,93
Buses	0.71	5	11	16	22	28	34	40	47	48	49	49	50	51	52
Trucks	0.66	49	99	151	204	259	317	376	436	443	450	458	464	472	480
Value of Time Savings Normal Traffic	1.00	754	1,531	2,334	3,161	4,015	4,895	5,802	6,737	6,844	6,954	7,065	7,17	7,297	7,410
Benefits to Farmers	1.00	161	338	532	744	977	1,231	1,508	1,810	1,901	1,997	2,096	2,207	2,311	2,428
Benefits to Truckers and Middleman	1.00	113	234	363	500	645	800	964	1,137	1,175	1,213	1,253	1,294	1,336	1,378
Total Benefits		2,142	4,377	6,709	9,141	11,677	14,321	17,079	19,954	20,408	20,868	21,341	21,827	22,327	22,841
Costs															
Construction Costs	0.82	1,923	1,911	1,892	1,882	1,867	1,851	1,834	1,821	0	0	0	0	0	0
Routine Maintenance	0.82	0	85	170	254	339	424	509	593	678	678	678	678	678	678
Periodic Maintenenace	0.82	0	0	0	509	0	0	1,017	0	0	1,268	0	0	1,357	0
Operating Expenses	1.00	20	41	63	86	110	134	159	186	189	193	197	201	205	209
Total Costs		1,943	2,037	2,125	2,731	2,315	2,409	3,519	2,600	867	2,140	875	879	2,240	887
Net Economic Benefits		199	2,340	4,584	6,409	9,361	11,912	13,560	17,354	19,541	18,729	20,466	20,948	20,087	21,954

NPV(AZN) **86.3 mln.**

Scenario 2 has the identical economic indicators as scenario 1, as the scenario assumes government funding for entire project.

Close examination of both scenarios makes it evident that, NPVs have viable outcomes from economical standpoint. Dissimilar to outcomes of NPV from economical and financial standpoints in scenario one (financial NPV had a negative figure, which made the project financially unviable), scenario 3 revealed positive outcomes in both of financial and economic analyses. As per scenario 3, alongside with its benefits for the economy, citizens and all the users, AzRIP-1's road projects could become very attractive investment motivation for private sector and project owners. The crucial element for a road project to be economic and especially financial attractiveness for execution is its high and positive NPV indicator. Positive outcomes of economic NPV calculations purport a positive development trend for the economy of entire country of intervention and promotions in society welfare, which will be closer examined in distributive analysis. Anyway, in this point, there is a good ground to claim that VOC and time savings mostly contribute to economy.

As per investment appraisal methodology and rules, AzRIP-1 road projects appear to be economically viable, while in financial terms, Scenario1 the project could not pass the grade. However as the most crucial indicator in our case is the project's economical value for the regional and country's development, the project is accepted as a needed and viable one.

6.4 Sensitivity Analysis for Economic Variables

As per sensitivity analysis, it mainly focuses on determining risky economic variables. The economic analysis parameters tested in two scenarios include:

Table 6.3: Parameters of economical sensitivity analysis per two scenarios

Scenario 1	Scenario 3
1. Traffic growth rate of normal, generated and diverted traffic	1. Demand
2. With and without: Vehicles operating cost for light vehicles, buses, trucks	2. Max. WTP for light vehicles.
3. With and without: Time cost for light vehicles, buses, trucks	3. With and without: Traffic growth rate for normal, generated and diverted traffic
	4. With and without: Vehicles operating cost for light vehicles, buses, trucks
	5. With and without: Time cost for light vehicles, buses, trucks

At the conclusion of sensitivity analysis, the results disclose that the following variables are sensitive in two scenarios: EOCK and Normal traffic growth rate in the first scenario and in the third scenario, maximum WTP, EOCK and normal traffic growth rate. The analyses make it evident that the NPV is greatly influenced by even slight changes in variables.

Results of Sensitivity Analysis in Two Scenarios

Scenario 1: Sensitivity analysis in both scenarios revealed the outcome that, changes is risky variables correlate with NPV outcomes positively. Therefore, during project appraisal, appropriate ways should be sought in order to minimize the influence of the threatening variables to a higher NPV. The scenario 1 variables are displayed in following data sections:

Table 6.4: Sensitivity Analysis for Normal Traffic Growth Rate

Normal Traffic Growth Rate	**NPV (million AZN)**
0.60%	116,864,544
1.10%	118,834,531
1.60%	**120,881,447**
2.10%	123,008,356
2.60%	125,218,439
3.10%	127,515,001
3.60%	129,901,473
4.10%	132,381,418
4.60%	134,958,537

Howbeit, the outcome of sensitivity analysis of EOCK divulged that any small changes in its rate will be in charge for huge changes in NPV. EOCK correlates with the project NPV negatively, so as, when EOCK increase by 2 percent, NPV decreases in half of its value. Therefore EOCK is recognized as a risky project variable.

Table 6.5: Sensitivity Analysis of EOCK

EOCK	**NPV (million AZN)**
	120,881,447
0.04	187,340,467
0.06	160,810,966
0.08	138,972,972
0.10	**120,881,447**
0.12	105,800,662
0.14	93,154,204
0.16	82,487,705
0.18	73,440,867
0.20	65,726,343

The other sensitivity analysis elements in scenario 1 are VOC and Time Cost Saving of all vehicle kinds are represented in Appendix 4: sensitivity analysis of VOC and Time of Value of Vehicles sections. As the difference between the operating costs of without project and with project scenarios increases positive and negative trends over economic benefits are observed, in other words, NPV increases rapidly, and the outcomes of sensitivity analysis per both factors decrease in case of contradicting assumption. As an illustration, in VOC sensitivity analysis, if the with-project expenses are less than without-project expenses, this is evidence of NPV increase, and vice versa. This tendency is obvious in time saving outcomes, i.e. the difference between time costs of with-project and a without-project scenario correlates with NPV outcomes positively.

Scenario 3: the risky variables affecting the third scenario are illustrated below. The rate of the mentioned risky variables' impact is evidently seen in the table, which also gives us a ground to understand demand's crucial role in a project. Direct effect of demand upon NPV is also noticeably reflected in the data below:

Table 6.6: Reduction in Demand of Project

Decrease in Demand	NPV (million AZN)
0%	86,329,883
5%	96,160,755
10%	94,756,345
15%	93,351,935
20%	91,947,524
25%	89,138,704
30%	87,734,294
35%	**86,329,883**
40%	84,925,473
45%	83,521,063
50%	82,116,653
55%	80,712,243

Traffic growth rate analysis outcomes disclosed the fact that NPV would not be changed much, as it would be in maximum willingness assumption, which has a marked impact on economic NPV. However traffic growth rate still saves its important position in terms of economic analysis and its impacts over the NPV, though insignificant.

Table 6.7: Sensitivity Analysis of Normal Traffic Growth Rate

Normal Traffic Growth Rate	**NPV (million AZN)**
	86,329,883
0.60%	83,428,801
0.85%	84,133,372
1.10%	84,851,562
1.35%	85,583,642
1.60%	**86,329,883**
1.85%	87,090,567
2.10%	87,865,977
2.35%	88,656,403
2.60%	89,462,140
2.85%	90,283,490

Table 6.8: Sensitivity Analysis of Max.WTP

Max. WTP (Light Vehicles)	**NPV (million AZN)**
	86,329,883
0.00	75,381,524
0.20	75,381,524
0.40	**86,329,883**
0.60	97,278,243
0.80	108,226,603
1.00	119,174,962
1.20	130,123,322

In line with all the analysis, sensitivity analysis of EOCK makes it apparent that, even inappreciable changes in its rate are responsible for extensive amount of changes in NPV. EOCK is inversely proportional with the project NPV, which causes NPV to decrease nearly two-fold each time when EOCK value increases for only 2%. This peculiarity of EOCK makes it one of the strongest risky variables for a project.

Table 6.9: Sensitivity analysis of EOCK

EOCK	**NPV (million AZN)**
4%	134,682,172
6%	115,367,664
8%	99,480,784
10%	**86,329,883**
12%	75,376,646
14%	66,199,448
16%	58,466,042
18%	51,913,055
20%	46,330,511

VOC and Time Cost Saving of all vehicle kinds are among other types of sensitivity analyses as per scenario 3, the details of which are represented in Appendix 5. The outcomes of the analysis made it apparent that the more the difference between operational costs in with-project and without-project is, the less economic benefit observed and vice versa.

6.5 Distributive Analysis and Externalities

Externalities created by the project are identified with the help of distributive analysis of stakeholder impact, which is also a powerful tool to evaluate the influence of these externalities on its main collaborators. When a difference is observed between financial and economic cash flows, these externalities become apparent. All of the

defined externalities, independently of their degree of positive and negative inclinations are afterwards distributed among diverse stakeholders of analyzed project. Typically a distributive analysis aims to identify the project vanquishers and losers along with the gains and losses arose for them from project implementation. Distribution of externalities is followed with reconciliation between financial and economical resource flow statement with distributive impacts. To process enables the analyzers to conduct the project appraisal in coherently (Jenkins et al, Ch.13, p 11).

Project externalities have to do with any losses and gains of stakeholders, or their any activities related to project. In the road project example, the externalities are categorized either as positive and or negative ones. Some of important items are introduced below [45]:

Positive externalities:

- Growth in emergency services provision capabilities
- Raised real-estate prices
- Consistency of benefits
- Accessibility (easiness of getting from place to place)
- Value of saved time
- Reduced VOC and lowered number of road accidents

Negative externalities:

- increase in local air pollution
- increase in local light pollution
- Increase in noise pollution
- Increase is demographic changes

Distributive analysis identifies different stakeholders among project collaborators and involved target group to understand the beneficiaries of the projects, and the negatively affected groups, along with their degree and reason of losses. This helps the project owners to be aware of the project losers, who are prone to be further threats for their

projects and to design preventive measures, or to make strategic decision about the ways of converting them into project positive stakeholders.

To calculate the externalities value,

1. Economical and financial cash flow statement should be developed via using economic discount rates.
2. Financial NPV must be subtracted from economic NPV.

Thereby, the consequence of this extraction provides value of project externalities [46].

Identifying and Allocation of Externalities

Four parties were determined for allocation to the project's externalities' list in this stage, the first of which is consumers, who are likely to benefit from VOC reductions, time costs, etc. The second externality is the government of project implementation country, third one is the farmer is second bigger beneficiary and the final group is truckers' and intermediaries', having the most benefit from the project.

The rehabilitated roads within frameworks of AzRIP-1 improved the connection between Azerbaijani districts and regions, which is an ample contribution the cost saving for its beneficiaries. Construction of rural roads enabled the regions and villages which are considered to be in the most abundant and fertile bearings of Azerbaijan, to develop their industries and agricultural sectors due to improved connection with out border regions. Tables 6.10 and 6.11 below represent the results of project distributive analysis per both scenarios.

Table 6.10: Distribution Analysis of Scenario 1

	Consumers	Government	Farmers	Truckers and Middleman	Total
Real Soles					
Toll revenues		0			0
Change in Accounts Receivable		0			0
Consumer Surplus (Generated and Diverted Traffic)	27,693,184				27,693,184
VOC Savings Normal Traffic					0
Light Vehicles	28,408,791				28,408,791
Buses	374,844				374,844
Trucks	3,468,244				3,468,244
Value of Time Savings Normal Traffic	53,559,883				53,559,883
Benefits to Farmers			14,509,520		14,509,520
Benefits to Truckers and Middleman				8,836,323	8,836,323
Construction Costs		2,452,761			2,452,761
Routine Maintenance		656,565			656,565
Periodic Maintenenace		420,122			420,122
Operating Expenses		0			0
Value Added Tax		0			0
Corporate Income Tax		0			0
Change in Accounts Payable		0			0
Change in Cash Balance		0			0
Total (AZN)	113,504,946	3,529,447	14,509,520	8,836,323	140,380,236
U.S $	145,519,162	4,524,932	18,601,949	11,328,619	179,974,662

Table 6.11: Distribution Analysis of Scenario 3

	Consumers	Government	Farmers	Truckers and Middleman	Total
Real Soles					
Toll revenues		0			0
Change in Accounts Receivable		0			0
Consumer Surplus (Generated and Diverted Traffic)	12,942,137				12,942,137
VOC Savings Normal Traffic					0
Light Vehicles	18,465,714				18,465,714
Buses	243,649				243,649
Trucks	2,254,358				2,254,358
Value of Time Savings Normal Traffic	34,813,923				34,813,923
Benefits to Farmers			9,431,188		9,431,188
Benefits to Truckers and Middleman				5,890,882	5,890,882
Construction Costs		2,452,761			2,452,761
Routine Maintenance		656,565			656,565
Periodic Maintenenace		420,122			420,122
Operating Expenses		0			0
Value Added Tax		0			0
Corporate Income Tax		0			0
Change in Accounts Payable		0			0
Change in Cash Balance		0			0
Total (AZN)	68,719,782	3,529,447	9,431,188	5,890,882	87,571,299
U.S $	88,102,285	4,524,932	12,091,267	7,552,412	112,270,896

Reconciliation of the Economic and Financial statement

According to Jenkins, reconciliation enables the analyzer to verify whether all the externalities were taken into consideration and whether the outcomes of economic and financial statements (as they are the only externalities identified in this analysis) are precise or not.

(6)

The general formula for reconciliation is:

$$\text{Economic NPV} = \text{Financial NPV} + \sum (\text{PV Externalities})$$

The outcomes of analyses displayed in tables, make it apparent that the key beneficiaries of project externalities are the community members who are expected to use the road mainly for their all kinds of transportation needs. Both scenarios imply their benefitting from saving in cost of time and VOC, as well as consumer surpluses.

Scenario one revealed a consumer surplus comprising 27.7 million AZN (35.5 million USD), while the third scenario introduced almost two-fold less surplus (16.6 million USD). This difference is mainly stemmed from the consumer components in both scenarios. In scenario one the consumers are supposed to use a road without a toll. The two extremely significant components worth to be mentioned here are VOC, and value of time savings. The components bearing crucial importance over their shoulders, reflected the following figures: in **Scenario 1:** 41.6 and 68.5 million USD, in **Scenario 3:** there was a decrease to 21 and 44.6 million USD. The toll rate applied in Scenario 3 is thought to be responsible for that, as after applying a toll on roads, there was a decrease in demand, (35%), which led to appropriate decrease in number of road users. Tables illustrating the first scenario's externalities reveal that the main source of users' benefits is expected to come from consumers (Value of time and VOC saving on

Normal Traffic) along with farmer and truckers, who are considered to be the next level of project beneficiaries.

To sum up, examination of scenario 1 makes us to comprehend that though the project cannot afford to generate a sufficient financial NPV, its economic NPV makes restitution of all the financial shortages via offering a noticeable level of externalities.

On the whole, the distributive analysis conducted within the framework of AzRIP-1 road project suggests the project to be beneficial and efficient for all parties of the project.

Chapter 7

RISK ANALYSIS

What is risk? Risk means the potential digressions from the projected results. In order to realize the project's risk analysis, first of all, one should to find out the key variables, by using sensitivity analysis. For this purpose major risky variables existing in the project should be identified and their influence on the project's results should be evaluated. Identification of variables is very necessary for involving large share in project's cash flows (Jenkins et al, 2011, CH 6 p.2)

After identification of the risky variables, one should select a relevant probability distribution and risky extent of values for every risk, taking into account historical orders of risk values and thoughts of various experts related with this risk. (Jenkins et al, 2011, CH 6 p.6).

After this step, Monte Carlo simulation can be used to get the project results' probability distribution. The simulation is grounded on the process, which represents uncertainties explicitly through identifying inputs as probability distributions. In case the represented system inputs' uncertaintanties, the case will be the same for the future performance predictions, i.e., the predictions will certainly be uncertain. In other words, a probability of distribution is the same thing as the analysis' results based on represented inputs by probability distributions [47].

7.1 Selections of Variables and Probabilities

Variables that risky are better to be decided on the base of sensitivity analysis of the project at pre-risk analysis period. The ways of conducting this analysis are described in Chapters 5 and 6. In order to find the project's most riskiness variables, the risky variables, with serious impact over the project NPV should be estimated through risk analysis as well. Risky variables are selected from the project's sensitivity analysis.

From the first Scenario:

1. Capital Cost's opportunity from economic viewpoint
2. Rate of traffic growth in normal conditions
3. Discount rate of equity
4. Overrun of Costs

From the second Scenario:

1. Capital Cost's opportunity from economic viewpoint
2. Rate of traffic growth in normal conditions
3. Willingness to pay in maximum
4. Inflation Rate in the Country
5. Discount rate of equity
6. Tolls for Trucks (2X3 axles)
7. Overrun of Costs
8. Toll for cars
9. Rate of Demand

7.1.1 Determining Probability Distributions

With an eye on getting the necessary probability distribution of chosen risky variables, it is important to figure out numbers of variables and their probabilities. Historical

values of variables are used to prepare the distribution of needed probabilities. If the required data and information is not possible to access to and there is no opportunities to get them, relevant range of values and probability is selected on the base of appropriate expert's opinion (N.J. Smith, 2013).

NPV of the project is influenced by the risky variables mentioned above. It is the risk analysis part, where distribution of probability is allocated per each variable. A number of variables possess relatively great impact on NPV, able to cause big changes in values, with their small figurative differences. Allocated distributions of probability per the mentioned variables that are risky for projects are reflected in paragraphs beneath:

- **Economic opportunity cost of capital (EOCK)**

Myriad of factors are able to modify EOCK. Prognostication of economic discount rate's variance is of crucial importance in defining the size of its effect on the NPV. Project's evaluator cannot achieve a good prognosis because of a lot of confusing factors. Thus, the World Bank and analogous projects are included in this project due to lack of historical information needed for finding the appropriate probability distribution for the appraised AzRIP road rehabilitation program.

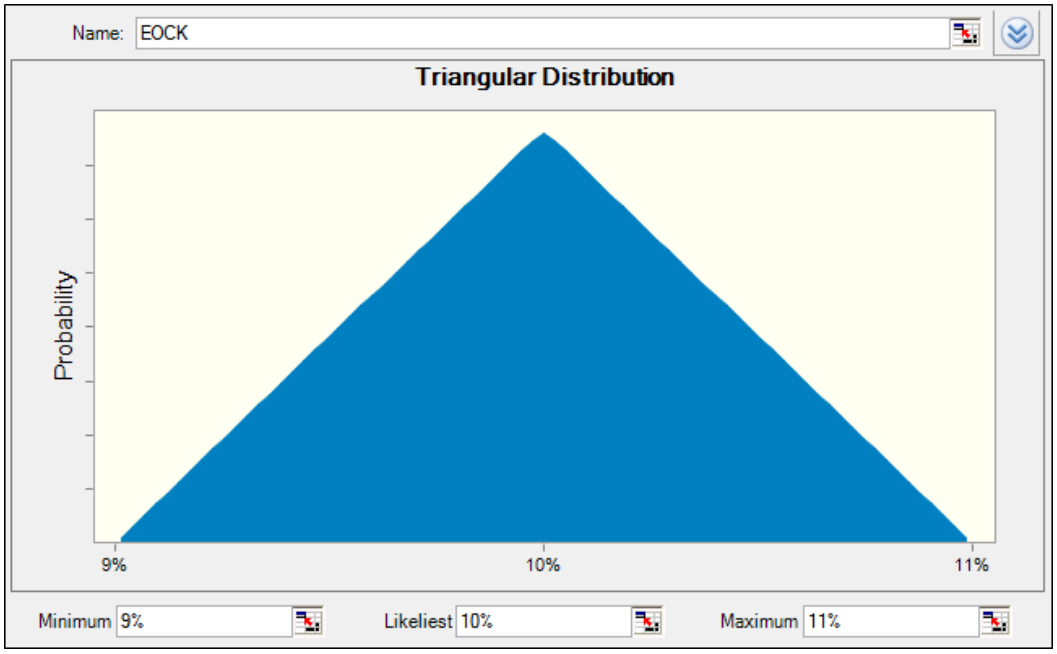

Figure 7.1: Triangular Distribution of EOCK

Table 7.1: Probability for EOCK

Parameters of Triangular distribution:	
Minimum	9%
Likeliest	10%
Maximum	11%

- **Equity Discount Rate**

Time value and total sum of financial revenues that the investors await to get is reflected in equity discount rate. The question here is, the variables possess a connatural risk, which relevantly hardens prognostication of changes' tendency and ratio. This in its turn urges all analysis to be held on estimations. The distribution of probability of this variable is triangular in this project.

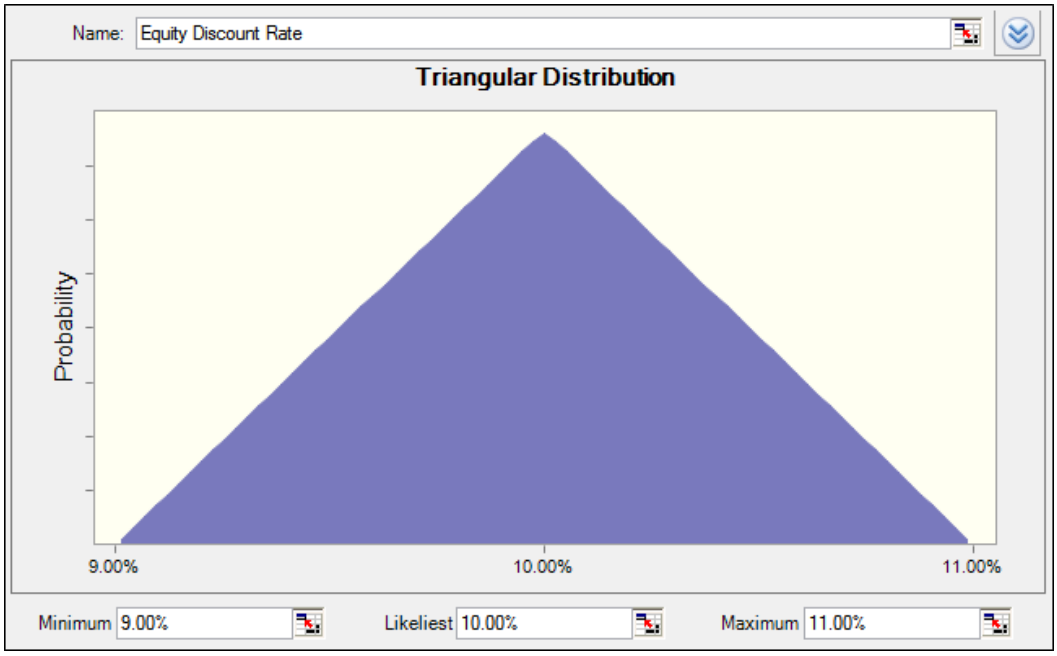

Figure 7.2: EDR Triangular Distribution

Table 7.2: EDR Distribution

Triangular distribution with parameters:	
Minimum	9%
Likeliest	10%
Maximum	11%

- **Car Toll**

Estimation of changing probability of car toll factor is possible, because it is controlled by a private sector or government. Identification of rate of car toll is the responsibility of that sector, which is going to realize works related to tolled road.

Table 7.3: Distribution of Car Toll

Uniform distribution with parameters:	
Minimum	0.18
Maximum	0.22

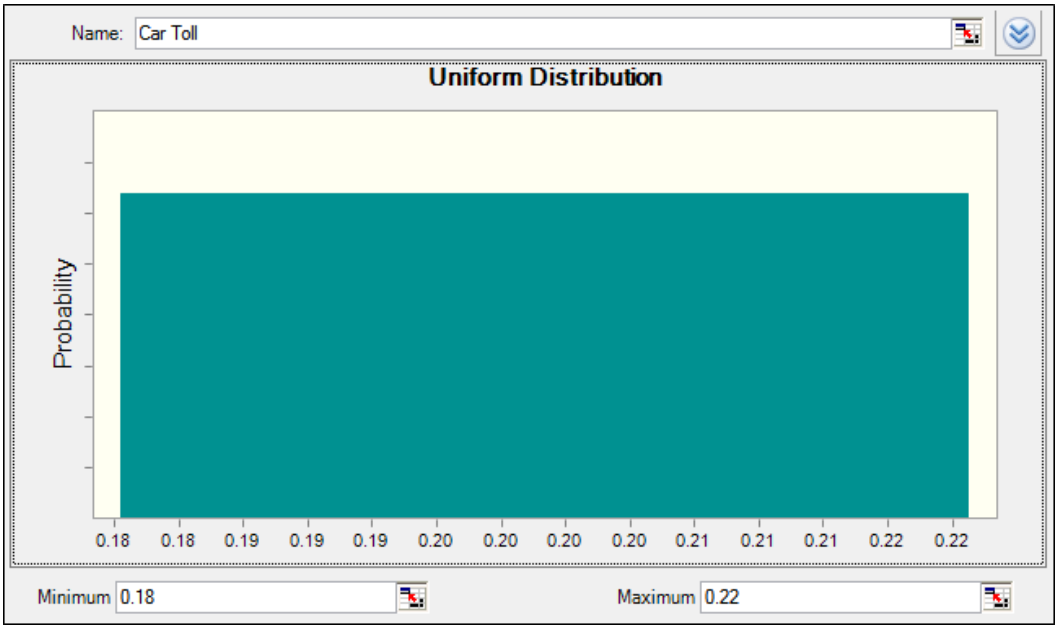

Figure 7.3: Car Toll Uniform Distribution

- **Cost Overrun**

Overrun of Cost is another variable of this project with the potential to influence project figures. It has more impact over the NPV rather than other variables. So, in case the project's cost is underestimated, then the project will face with cost overrun problem, that will cause raises in the project's investment cost. The distribution of probability regarding this parameter is step distribution.

Table 7.4: Distribution of Cost Overrun

Custom distribution with parameters:		
Minimum	Maximum	Probability
0.00	0.05	0.30
0.05	0.10	0.25
0.10	0.15	0.20
0.25	0.20	0.10
0.20	0.25	0.10
0.25	0.30	0.05

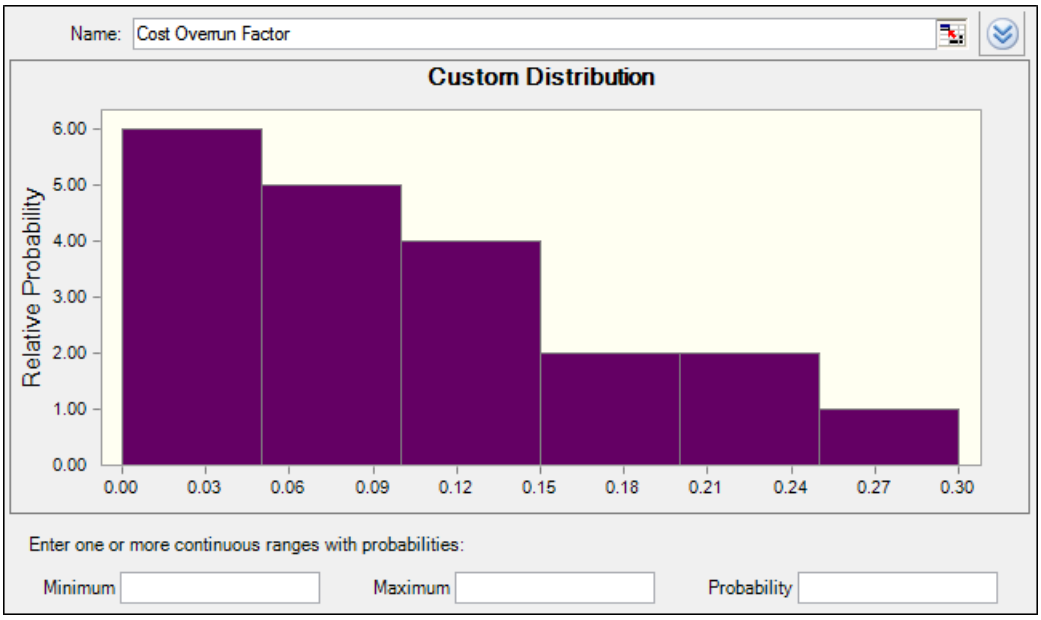

Figure 7.4: Cost Overrun Custom Distribution

- **Traffic Growth in Normal Conditions**

Normal traffic growth rate is another major variable which influences the project's NPV. Many reasons can lead to an increase in traffic growth rate and thus can make this variable unpredictable. As per the project's risk analysis, traffic growth rate has an huge amount impact over the NPV. This variable's distribution of probability is normal distribution.

Table 7.5: Traffic Growth Rate's Mean and Standard Deviation

Parameters of Normal distribution:	
Mean	1.16 %
Std. Deviation (SD)	0.16 %

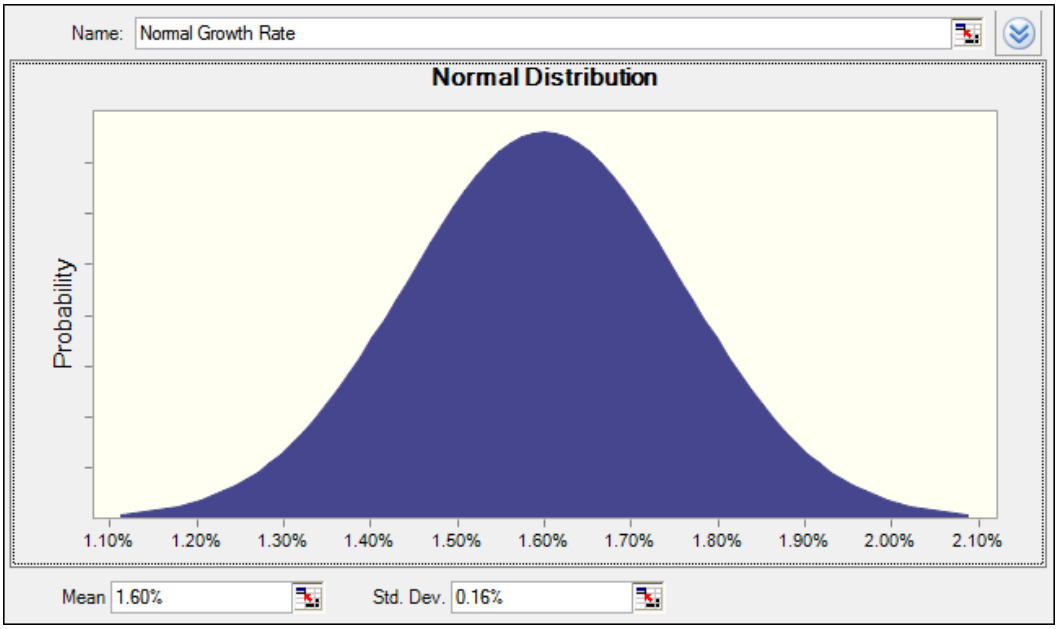

Figure 7.5: Traffic Growth Rate's Normal Distribution

- **Decrease in demand**

Demand is the last variable, and is defined as a risky variable in process of risk analysis. Demand has normal distribution. And it will increase with the increase of the toll rate.

Table 7.6: Deviation of Demand's mean and standard

Parameters of Normal distribution:	
Mean	35 %
Std. Deviation (SD)	4 %

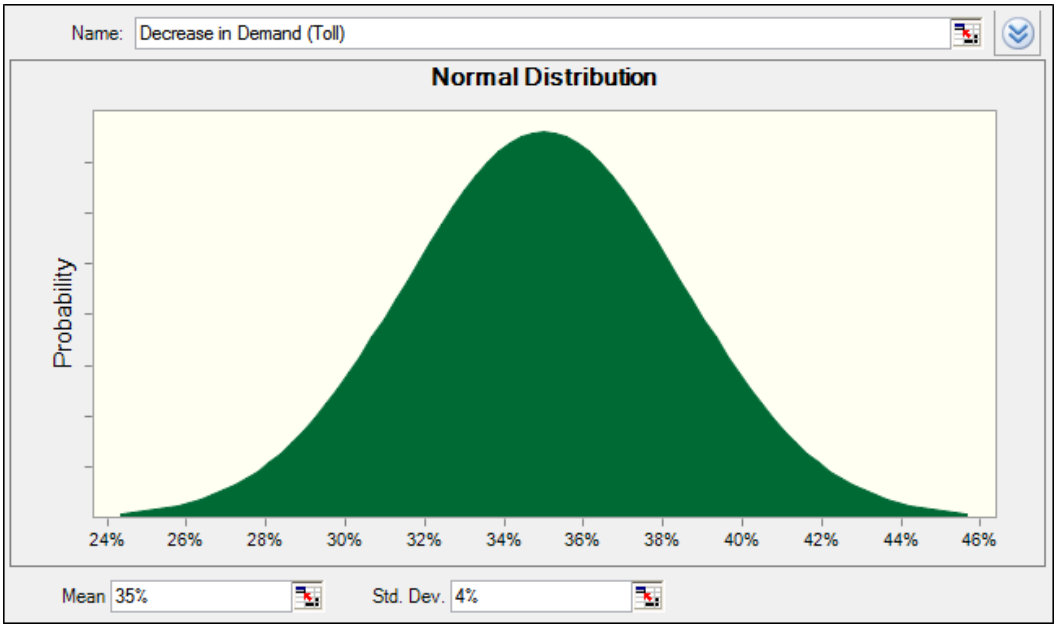

Figure 7.6: Decrease in Demand's Normal Distribution

7.2 Results of Risk Analysis

All the uncertain variables are identified with their probability distribution during the first step of the risk analysis of this project. In order to obtain the output results, some variables are needed to be forecasted for testing purposes at the second step. The forecasted variables for the both scenarios are as followings:

The first scenario:

1. NPV from Financial Standpoint
2. NPV of Economic Standpoint
3. NPV from Externalities Standpoint

The third scenario:

1. NPV from Financial Standpoint
2. NPV of Economic Standpoint
3. NPV from the standpoint of externalities
4. ADSCR, for years between 2005 and 2012
5. LLCR, for years between 2005 and 2012

Simulation of the third step can be launched following prognostication of selected variables. Implementation of 10 000 samples of simulation called Monte Carlo was carried out in order to get precise results via using Cristal Ball software, which would serve conducting the risk analysis of current project. The results are represented in below sections:

7.2.1 Scenario one

Financial NPV: this term stands for the initial project variable. As claimed in the results, its mean comprises (19.4) million AZN and the standard deviation is equal to (0.978) million AZN. Its amount is minimum (22.7) million AZN and maximum (17.5) million AZN. As per the Figure 7.7, the NPV probability equaling >0 to 0 comprises to 0 percent. The negative NPV figure that is <0 equals to 100 percent and can be interpreted as the analyzed project's unbeneficial to be invested.

In analysis of a road project, the most crucial one to influence the implementation decisions should be considered to be the economic NPV results.

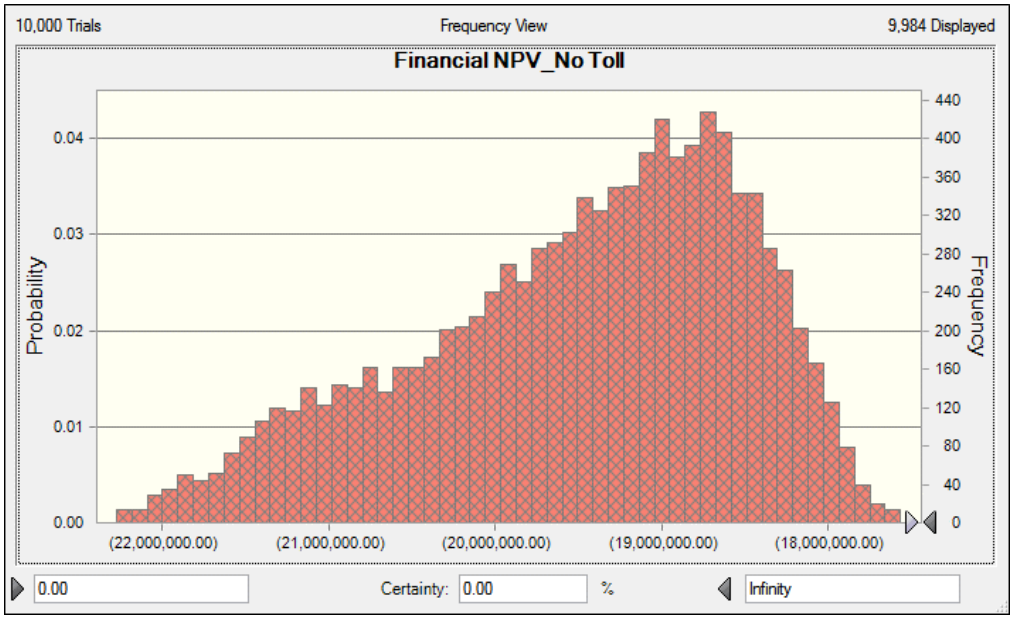

Figure 7.7: Prognostication of Financial NPV

Economical NPV: the variable following financial NPV in this scenario is economic. NPV. As per the analysis outcomes reveal, the project's mean of the NPV comprises 119.7 million AZN (about 291.9 USD), with 3.54 million AZN standard deviation. The second kind of NPV for this project (economic NPV) changes between minimum positive 110 and maximum 130 million AZN. The probability of the NPV is between zero and positive range is 100 percent. It shows that our NPV is positive with 100 percent probability. Figure 7.8 suggests a positive economic NPV's probability. The outcomes of the NPV analysis under the initial scenario made apparent that the undertaken AzRIP road project which has unfavorable financial and favorable economic net present value parameters can be considered appropriate for carrying out by the governmental agencies. The reason lies on significance of economic NPV in infrastructure projects, particularly in road rehabilitation project.

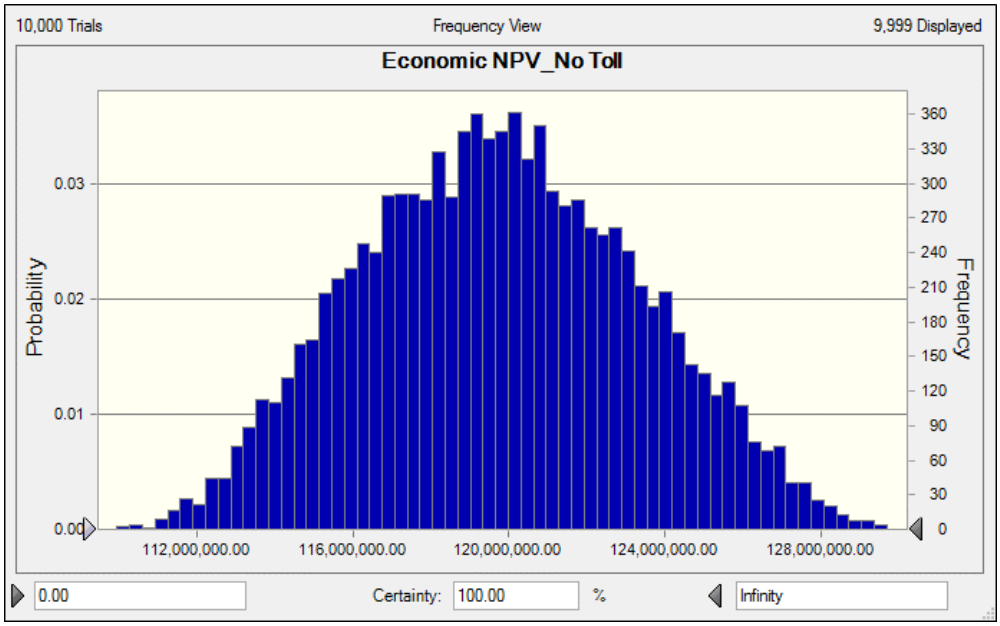

Figure 7.8: Prognostication of Economical NPV

Externalities NPV: the Externalities NPV is the variable coming after the Economic NPV. The results of this prognostication mean comprises to 140.7 million AZN, and

standard deviation comprises 3.77 million AZN. The outcomes of the analysis makes it apparent that, the net present value of externalities changes between 130.8 million AZN in the deepest point and peaks 15.6 million AZN in its highest indicator. Figure 7.9 reveals that probability for externalities for positive indicators > 0 is 100 percent. To put it other way, this road rehabilitation project had a positive value in its Externalities NPV. The fact can be interpreted like, as per the outcomes of the current NPV, the whole share of the benefit got from the road project was allocated to the road utilizers.

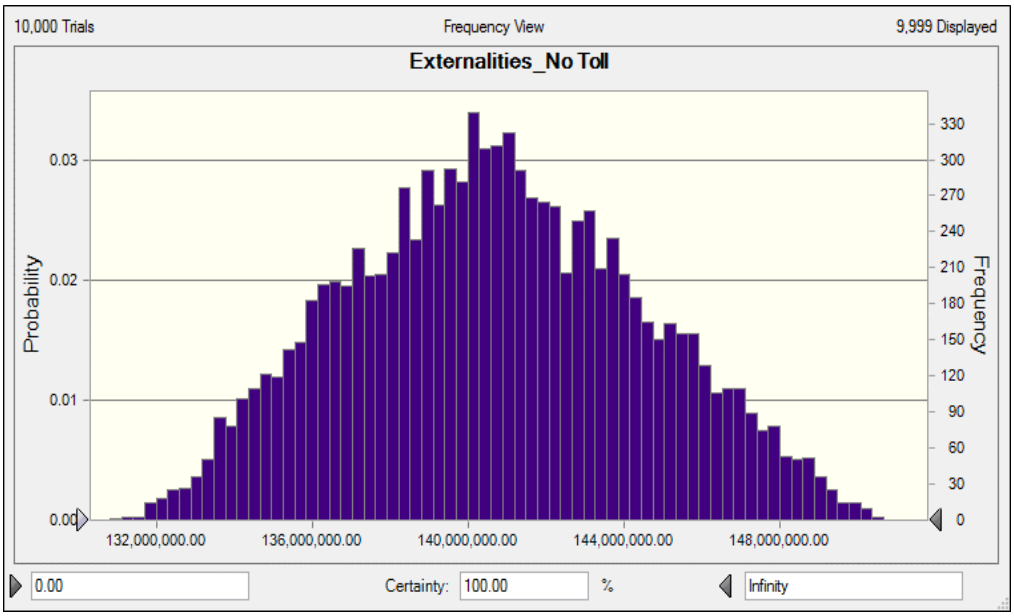

Figure 7.9: Prognostication of Externalities NPV

7.2.2 Scenario Three

Financial NPV: In this scenario, according to the results after realizing 10,000 trials, a mean figure comprises to negative 1.24, while standard deviation equals to 1.60 million AZN. Alongside with this, the deepest and the highest NPV indicators change between negative and positive values (7.16 and 4.24 million AZN respectively). As per the data indicated in Figure 7.10, when the NPV is > 0, it is positive with a

probability of 22.72 percent. This is an indicator of a positive NPV; however, a high probability of it into negative NPV still exists. This positive NPV refers to the fact that the analyzed project is advisable to be carried out and invested in.

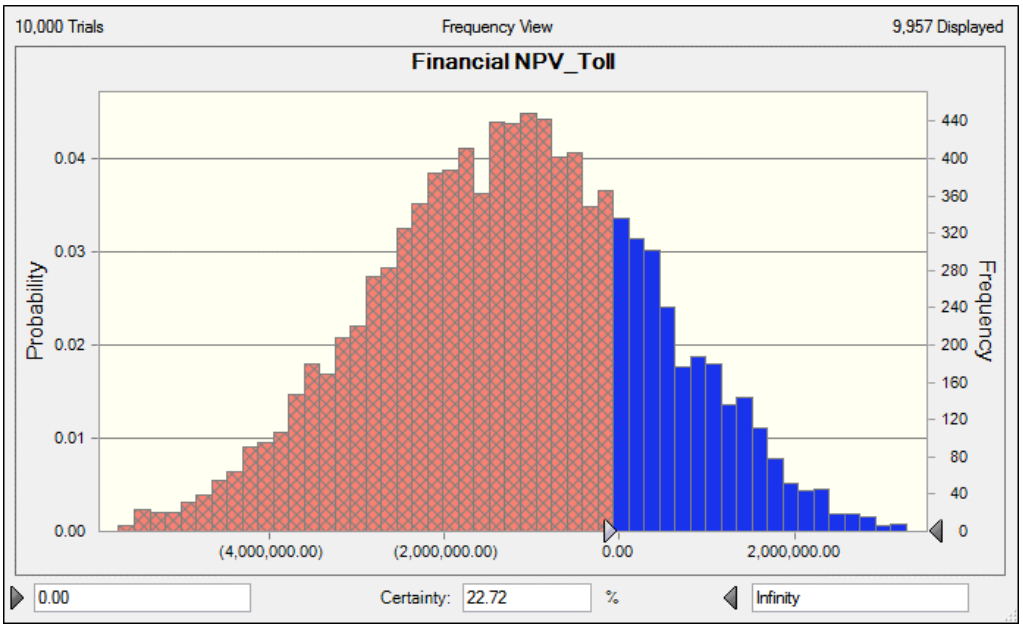

Figure 7.10: Prediction of Financial NPV (Toll)

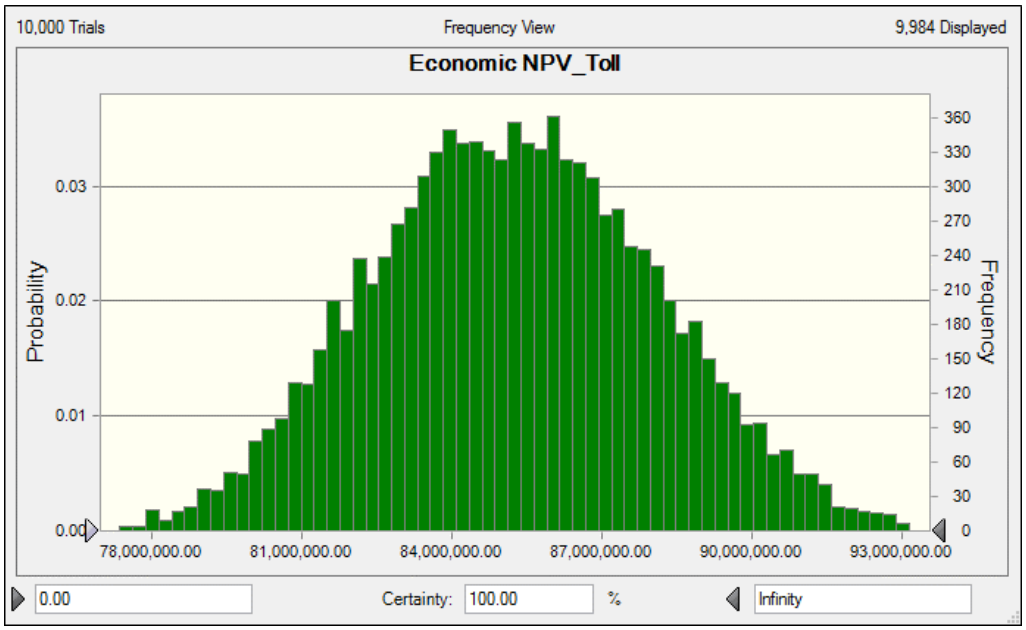

Figure 7.11: Prediction of Economical NPV (Toll)

Economic NPV: The outcomes of the Scenario 3 revealed a positive economic NPV. Examination of the risk analysis results made apparent that the NPV mean and standard deviation equal 85.2 and 2.8 million AZN respectively. Figure 7-11 shows that this NPV ranges more than zero and is in positive range by a probability of 100 percent and minimum positive 76.6 and maximum 94.2 million AZN. To put it other way, this project can be considered a profitable and good one to be implemented with an eye on its economic benefits.

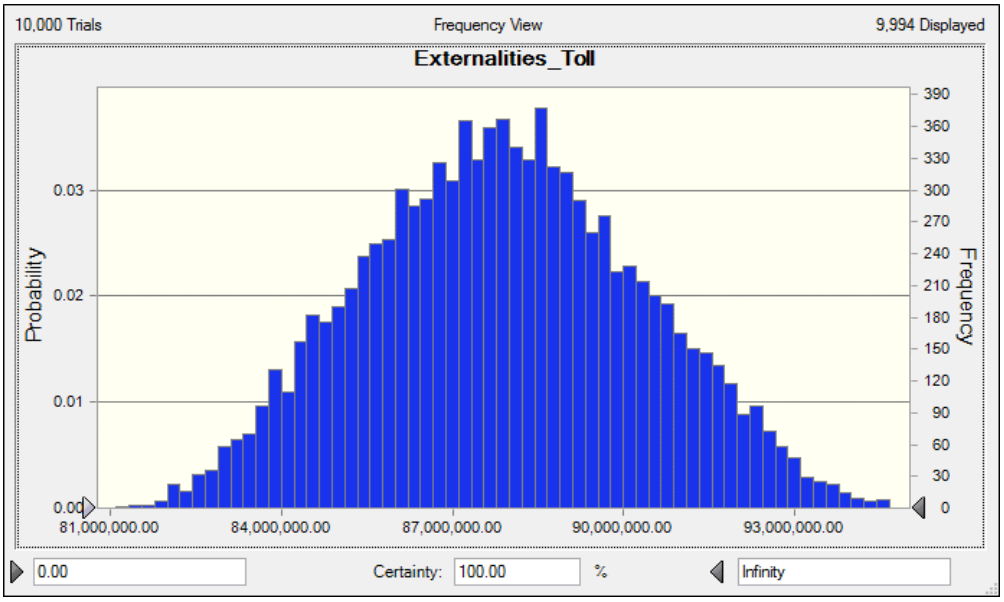

Figure 7.12: Prognostication of Externality NPV (Toll)

Externalities NPV: According to the results of risk analysis for this variable, a mean equals to 87.9 and a standard deviation equals to 2.4 million AZN. NPV is between minimum of 81 and maximum 95 million AZN. Figure 7-12 shows that the NPV was in the positive range with the probability of 100 percent. This positive result shows that this project is a good one to be invested on.

Indicators of ADSCR and LLCR are represented with brief interpretation in this part. The risk analysis results suggest that ADSCR extends from 2009 to 2012 while the

indicator of LLCR changes between 2007 and 2011 in prognosticated amounts. The figures reveal the ADSCR per 4 years has certainty equaling of 0 percents, and the LLCR in 5 years has certainty of 0 percent.

As far as it is understood from the given data, that in the mentioned years (5 and 4 years per each), the project ADSCR and LLCR, with the probability of being above 1.50 and 1.70 correspondingly, equals to zero percent. The project implementers were seriously challenged to conduct repayment of its debt throughout initial project years.

Some sections of prognosticated ADSCR and LLCR charts with probability between 0 to 1.50, as well as 0 to 1.70 are reflected in the following section. The interpretation of the information given in the graphs is like the following: to ensure project success in debt repayment and financial responsibilities, the analyzed project should consider raising its net cash flows during the mentioned years.

Table 7.7: Statistic data for ADSCR Year 2012

Statistic	**Forecast Value**
Trials	10,000
Base Case	0.9
Mean	0.78
Median	0.78
Mode	---
Standard Deviation	0.13
Minimum	0.39
Maximum	1.25

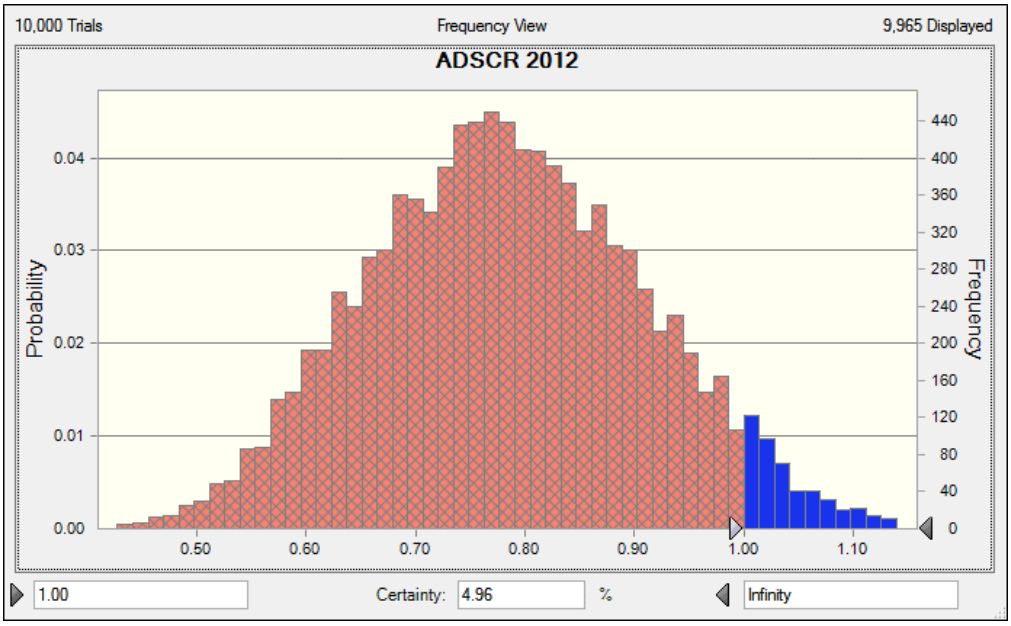

Figure 7.13: ADSCR Prognostication for 2012th Year

Though the ADSCR indicators for this project on the scenario three could not exceed 1.00 during these years, we had forecast analysis for the 2012 year. Figure 7.13 reflects 4.96% probability for the 2012th year. This ratio means that ADSCR of this year was above 1.00 with the probability of 4.96%. As per the statistic table below, ADSCR of this year is a minimum 0.50 and maximum of 1.25. As it is observed, this indicator cannot exceed 1.50, and the new project is not good and profitable to repay the bank debt. One of the LLCR with the probability of between 0 and 1.70 is reflected in the next Table and Figure.

Table 7.8: Statistic data for LLCR Year 2012

Statistic	Forecast Value
Trials	10,000
Base Case	0.90
Mean	0.78
Median	0.78
Mode	---
Standard Deviation	0.13
Minimum	0.39
Maximum	1.29

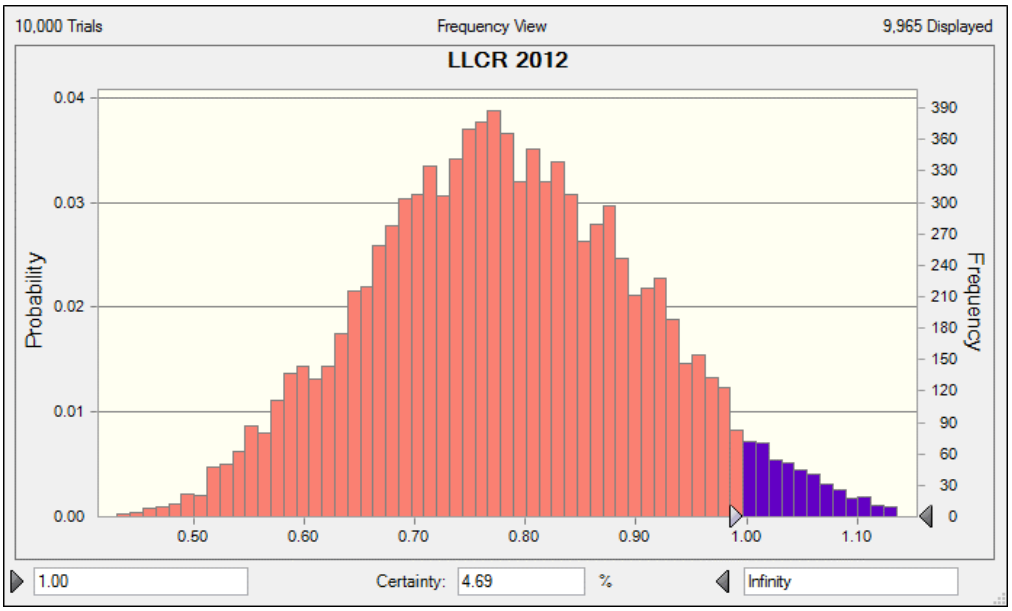

Figure 7.14: LLCR Prognostication for 2012th Year

As ADSCR, the LLCR indicators are not positive in the last years. LLCR was below 1.00 from 2012. It means that this project doesn't has probability for repayment of the debt on Scenario 3. As per the Figure 7.14 shown above, represented risk analysis outcomes of prognostication for 2012 suggests the current year's LLCR to have probability comprising equal to 0.00%. The peak and the dip values for the year comprise to 0.39 and 1.27 respectively, and thus, the LLCR of the previous years are characterized with a negative probability trending up the allocated range.

Due to very low results of LLCR over all years from the project's financing point of view, it means that the project couldn't service all its debt and liabilities. These analyzing is suggesting the project to have trend that is negative from analyzers point of view. The some observed increase in ratio can ultimately cause challenge the project, however, the project keeps strongly its riskiness and demands careful consideration for mitigating its financing problems. A range of policy strategies is represented in the conclusion section with an eye on solving the mentioned problems.

Chapter 8

CONCLUSION AND RECOMMENDATION

8.1 Conclusion

The role of transportation has become increasingly important especially within the last century due to its crucial effects on regional and national development of various countries. Governments make efforts to be committed to improve the network of roads linking rural areas with town and cities, and these commitments are also reflected in annual budget allocations for rehabilitation of transportation infrastructure. Being a pre-requisite for economical growth of various regions, rural roads positively influence country prosperity via time savings from travelling and VOC, as well as, triggering the level of employment.

The implementation aim of AzRIP-1 project, which was thoroughly overviewed in this study, also coincides with developing countries' preference mentioned in the above paragraph. In fact, the project was vitally important it approved its vitality with its powerful influence on accelerated economic development of five most important agricultural provinces of Azerbaijan. In line with contributing the transportation and economical infrastructure the project roads also caused reinforced and effective business and marketing relations between the rural and urban industries.

Analysis of AzRIP-1 was stemmed over three scenarios, of which the first two did not presume toll systems over the roads, but the third one. As per budget arrangements,

the first scenario was identical to the original project, with joint funding by the government and the banking institution; the second scenario assumed only government's funding and the third one analyzed the project with the presumption of similar budget decision as the first one, but with toll.

Scenario 2 in most cases was excluded from the all-inclusive analysis, due to its identical results with Scenario 1 in terms stakeholder and risk analyses. The only place where Scenario 2 was reviewed in this study was financial analysis part.

- **Scenario one**

Grounded on identical budgeting assumptions with the original project, Scenario 1 required baseline data about the project employees and contractors. The outcomes of relevant analysis within this scenario revealed financial NPV to be negative with 23.4 million USD, alongside with positive economic NPV comprising 243.2 million USD, while the externalities NPV it suggested was 155 million USD. To be sure about the financial NPV outcomes we reviewed the second and third scenarios in terms of appraising project's financial feasibility and the tactics government could use for private sector's motivation in undertaking a road project and subsequently increase their cooperation with the government.

- **Scenario two**

Scenario two presumes a sole government funding for AzRIP project. The scenario prefers excluding usage of loans or any debt options and tolling system. The results of the Scenario were as following: (a) financial NPV was negative - 7.7 million USD; (b) economic NPV was positive - 155 million USD.

Compared with Scenario 1, negative rate of financial NPV of this scenario has decreased three-fold. So, funding of the project only by the government impacts on the decrease of negative value of financial NPV, but does not affect economic NPV. It bears a witness that this project noticeably improved the target regions' socio-economic opportunities, that is, the project achieved its goal.

- **Scenario three**

The scenario was based on the assumption that the project used a toll and a loan debt from banking institution comprising 64.4% of total project budget. With this scenario, the outcomes of both (financial and economical) NPVs and externalities NPV appeared to be positive (respectively 0.055 million USD, 110.7 million USD, 112.3 million USD). These figures could be interpreted like this: **implementation of road rehabilitation projects are valuable and profitable, and they worth to undertake.** The project can afford to pay its investment back, plus it is able to bring additional revenues to its investors.

However, some risks also exist; so as, although project is profitable, analyses of ADSCR and LLCR on both scenarios (one & three) have pointed that project is challenged to provide its finance and fulfil its loan commitments within the payoff duration. The next section introduces range of possible solutions and recommendations are outlined to dissolve or minimize these problems.

8.2 Recommendations

Financial sensitivity and risk analyses of AzRIP-1 project revealed that some variables that highly influence the NPV are more risky than other variables. However, risk potential of the project lays particularly the project's financial results. Not only financial NPV could be affected by risk, but also factors like ADSCR and LLCR in

involvement of banks and investors could be under the influence. Analysis revealed those factors to be negative in original AzRIP project.

To eliminate these risks the following solutions would be effective:

I. **Government's commitment to undertake a part of expenses and loan debts for the project**: this would also serve government's responsibility to contribute socio-economic development of related regions and policy improvements in population's welfare.

II. **Giving priority to construction of construction and rehabilitation of following road types:**

   a. Intercommunity roads- that would trigger close commercial and social integration amongst target rural areas and other destinations.

   b. Roads with the potential to promote access to markets especially for rural households – these roads would also push poverty reduction and expansion of rural family budgets.

   c. Roads ensuring access to regional centers and highways.

III. **Implementation of integrated projects:** by integrated projects we mean projects with dual purposes: rehabilitation of roads plus any integrative activities to expand local communities' economic revenues. A good example for an integrated project is establishment a "Transport and Road Maintenance Center" that would be in charge for routine repair of vehicles using the rehabilitated roads and carry out all further maintenance needs of those roads.

IV. **Setting pre-program arrangement criteria for road location and type:** grounded on the rural development purpose, it is important to give accentuated consideration not only the places and the geographical areas

where the roads are needed to be constructed or rehabilitated, but also, it is important to figure out the types of the needed roads in the needs identification phase. Among those criteria the followings could be especially highlighted alongside with the conventional needs assessment criteria: (i) level and potential of engagement in agricultural activities, (ii) poverty weight and (iii) density of heavy vehicular traffic.

The above-mentioned activities would trigger increases in traffic, access to markets, decreased travel time and travel costs, as well as increased access to services for project communities using these roads.

It is estimated that these projects will bring overall higher benefits to communities than roads benefiting single households. Investment appraisal methodology underlies these recommendations. Thus, tolling intra-village roads is not convincing, however it is possible to toll above-recommended roads.

As the result of scenario three, the best solution to the problem of decreasing the impacts of unfavorable NPV is applying a car toll method which considers car toll as the most significant variable, as per the Integrated Investment appraisal methodology, applied toll has to be applied in association with the inflation rate. To reduce the effect of these variables and to increase the financial NPV of the project, it is necessary to use new terms over the project implementation. Improvement of ADSCR and LLCR values are crucial for persuading investors and financial institutions to invest in the project.

The nuances described below would increase project's attractiveness and contribute the project in undertaking its debt obligations:

- To be to afford debt obligations on time and make the cash flow statement reliable, the project's owners could ask for subsidized interest rate on the received bank loans. This would help the ratios to get an attractive view for bankers and investors and would inspire them for cooperation.
- A request with decreased amount of borrowed loan and debt and later increased equity investment would also contribute to the project investors in terms of servicing the project debts.
- Request about extension of loan repayment duration or paying its debt in the year with a better financing structure might be another solution to the issue.

The study has a strong belief that the project would have a more powerful and stronger financial structure ensuring an improved ADSCR and LLCR values if it can manage to undertake the rules represented herein.

To summarize, as it was also obvious from the study, economically feasible projects certainly contribute and promote regional and national development. The projects that are conventionally accepted to be public projects could also be carried out by private sectors. These initiatives would enable governments to delegate some of their commitments to private sector, which would also be responsible for increased fiscal sources for the governments.

The mentioned recommendations and justifications were discussed with the authorities from World Bank and AzRIP-2 and were welcomed to be implemented in the next stage of project implementation.

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APPENDICES

Appendix A: Thesis Questionnaire

AzRIP-1 Rural Road Projects

Thesis Survey Form

Israfil Isgandarov

Question 1

1. What was the benefit of this project for you?

Question 2

2. How much were the Vehicle Operating Costs before and after the project (km)?

Question 3

3. How long did it take you to get to the certain point before & after the project, (road length for each project is 6.2km)?

Question 4

4. How much Trucker's revenue has increased after the road upgrade?

Question 5

5. How much increase has been in the incomes of farmers?

Question 6

6. At least how many people (with a driver) are there in the vehicle passing this road?

   - ○ Only Driver
   - ○ Two Person (with driver)
   - ○ Three person (with driver)
   - ○ Or More

Question 7

7. How many times do you use the rehabilitated road per a day?

Question 8

8. If a toll (with AZN) were assessed for the road passage per a day, how much would you like it to be?

Car Toll	Bus Toll	Truck Toll	Big Truck Toll
○ 0.10	○ 0.20	○ 0.30	○ 0.50
○ 0.20	○ 0.30	○ 0.40	○ 0.60
○ 0.30	○ 0.40	○ 0.50	○ 0.70
○ 0.40	○ 0.50	○ 0.60	○ 0.80
○ 0.50	○ 0.60	○ 0.70	○ 0.90

Appendix B: Project and Financial Parameters

Table of Parameters		
Highway Maintenance		
Routine Maintenance (every)	400.00	AZN per km (years)
Periodic Maintenance (every)	800.00	AZN per km (5 years)
Length	2,066.00	km
Labor Force		
Skilled	0.04	
Unskilled	0.96	
General Expenses	4.2%	of Investment
Contractor's Profit Margin	13.00%	of Investment
Inflation and Exchange Rate		
Inflation Rate (US$)	2.00%	
Domestic Inflation Rate	7.00%	
Exchange Rate	0.78	
Sales Tax (IGV)	18.00%	
Inflation Grouth Rate		-
Toll Used	Yes	-
Car Toll Level	No	
Net Working Capital		
Accts. Receivables	-	of Toll Receipts
Accts. Payable	-	of Total Maintenance
Cash Balance	-	of Total Maintenance
Proposed toll rate 2005	Total	$
Cars	0.20	0.16
Buses	0.30	0.23
Trucks (2 or 3 axles)	0.50	0.39
Trucks (4 or more axles)	0.70	0.55

Useful Life		
Usage per year		365.00
Bank Loan		64.4%
Government Contribution		35.6%
Interest Rate on Loan	2004	1.54%
	2008	0.3300%
Grace Years		1
Duration of Loan		9
Amortization		8
Equity Discount Rate		10.00%

Investment Costs (AZN 2005)	
Equipment and Materials	
Domestic	7,112,542.38
Imported	4,152,735.55
Labor Force	
Skilled	1,988,499.32
Unskilled	2,791,754.42
General Expenses	673,912.33
Contractor's Profit Margin	2,085,919.12
Total	18,805,363.11
Bank Distribution	
Year 0	50.00%
Year 4	50.00%
Construction Distribution	
Years of 8	12.50%
Cost Overrun Factor	0.00

Appendix C: CIF calculation parameters from Economic Analysis

Table 1: Table of Parameters		
Economic Cost of Capital		10%
Foreign Exchange Premium		2%
Tariff :		**4% of CIF Price**
Light Vehicles		35% of CIF Price
Buses		38% of CIF Price
Trucks		62% of CIF Price
Vehicle Parts		10% of CIF Price
Selective Consumption Tax		3% of CIF Price
General Sales Tax		18% of Landed Price
Freight		2.0% of CIF Price
Handling		1.0% of CIF Price
Payroll Tax		3.0% of CIF Price
Freight by Volume		3.5% of CIF Price
Gasoline Excise Tax		5% per gallon (AZN)
Personal Income Tax		14%

Appendix D: Sensitivity analysis of VOC and Time of Value of Vehicles (Scenario 1)

Light Vehicles –Vehicle Operating Cost (Without and With Project)

With	Without						
	0.155	**0.205**	**0.255**	**0.305**	**0.355**	**0.405**	**0.455**
0.036	141,622,705	162,361,123	183,099,541	203,837,958	224,576,376	245,314,794	266,053,211
0.086	120,881,288	141,622,705	162,361,123	183,099,541	203,837,958	224,576,376	245,314,794
0.136	100,145,870	120,881,288	141,622,705	162,361,123	183,099,541	203,837,958	224,576,376
0.186	79,407,452	100,145,870	120,881,288	141,622,705	162,361,123	183,099,541	203,837,958
0.236	58,669,035	79,407,452	100,145,870	120,881,288	141,622,705	162,361,123	183,099,541
0.286	37,930,617	58,669,035	79,407,452	100,145,870	120,881,288	141,622,705	162,361,123
0.336	17,192,199	37,930,617	58,669,035	79,407,452	100,145,870	120,881,288	141,622,705
0.386	(3,546,218)	17,192,199	37,930,617	58,669,035	79,407,452	100,145,870	120,881,288
0.436	(24,284,636)	(3,546,218)	17,192,199	37,930,617	58,669,035	79,407,452	100,145,870

Bus –Vehicle Operating Cost (Without and With Project)

With	Without						
	0.234	**0.281**	**0.328**	**0.375**	**0.422**	**0.469**	**0.516**
0.108	121,100,582	121,321,850	121,543,118	121,764,386	121,985,654	122,206,921	122,428,189
0.155	120,879,314	121,100,582	121,321,850	121,543,118	121,764,386	121,985,654	122,206,921
0.202	120,658,046	120,879,314	121,100,582	121,321,850	121,543,118	121,764,386	121,985,654
0.249	120,436,778	120,658,046	120,879,314	121,100,582	121,321,850	121,543,118	121,764,386
0.296	120,215,511	120,436,778	120,658,046	120,879,314	121,100,582	121,321,850	121,543,118
0.343	119,994,243	120,215,511	120,436,778	120,658,046	120,879,314	121,100,582	121,321,850
0.390	119,772,975	119,994,243	120,215,511	120,436,778	120,658,046	120,879,314	121,100,582
0.437	119,551,707	119,772,975	119,994,243	120,215,511	120,436,778	120,658,046	120,879,314
0.484	119,330,439	119,551,707	119,772,975	119,994,243	120,215,511	120,436,778	120,658,046

Truck - Vehicle Operating Cost (Without and With Project)

With	Without						
	0.261	**0.342**	**0.423**	**0.504**	**0.585**	**0.666**	**0.747**
0.099	124,364,974	127,840,860	131,316,745	134,792,631	138,268,517	141,744,402	145,220,288
0.180	120,889,089	124,364,974	127,840,860	131,316,745	134,792,631	138,268,517	141,744,402
0.261	117,413,203	120,889,089	124,364,974	127,840,860	131,316,745	134,792,631	138,268,517
0.342	113,937,318	117,413,203	120,889,089	124,364,974	127,840,860	131,316,745	134,792,631
0.423	110,461,432	113,937,318	117,413,203	120,889,089	124,364,974	127,840,860	131,316,745
0.504	106,985,547	110,461,432	113,937,318	117,413,203	120,889,089	124,364,974	127,840,860
0.585	103,509,661	106,985,547	110,461,432	113,937,318	117,413,203	120,889,089	124,364,974
0.666	100,033,775	103,509,661	106,985,547	110,461,432	113,937,318	117,413,203	120,889,089
0.747	96,557,890	100,033,775	103,509,661	106,985,547	110,461,432	113,937,318	117,413,203

Light Vehicle – Value of Time (Without and With Project)

With	Without						
	0.027	**0.030**	**0.033**	**0.036**	**0.039**	**0.042**	**0.045**
0.010	130,407,832	140,271,434	150,135,036	159,998,638	169,862,240	179,725,842	189,589,444
0.013	120,544,230	130,407,832	140,271,434	150,135,036	159,998,638	169,862,240	179,725,842
0.016	110,680,628	120,544,230	130,407,832	140,271,434	150,135,036	159,998,638	169,862,240
0.019	100,817,025	110,680,628	120,544,230	130,407,832	140,271,434	150,135,036	159,998,638
0.022	90,953,423	100,817,025	110,680,628	120,544,230	130,407,832	140,271,434	150,135,036
0.025	81,089,821	90,953,423	100,817,025	110,680,628	120,544,230	130,407,832	140,271,434
0.028	71,226,219	81,089,821	90,953,423	100,817,025	110,680,628	120,544,230	130,407,832
0.031	61,362,617	71,226,219	81,089,821	90,953,423	100,817,025	110,680,628	120,544,230
0.034	51,499,015	61,362,617	71,226,219	81,089,821	90,953,423	100,817,025	110,680,628

Bus – Value of Time (Without and With Project)

With	Without						
	0.026	**0.030**	**0.034**	**0.038**	**0.042**	**0.046**	**0.050**
0.008	121,191,228	121,561,338	121,931,449	122,301,559	122,671,669	123,041,780	123,411,890
0.012	120,881,118	121,191,228	121,561,338	121,931,449	122,301,559	122,671,669	123,041,780
0.016	120,451,007	120,881,118	121,191,228	121,561,338	121,931,449	122,301,559	122,671,669
0.020	120,080,897	120,451,007	120,881,118	121,191,228	121,561,338	121,931,449	122,301,559
0.024	119,710,786	120,080,897	120,451,007	120,881,118	121,191,228	121,561,338	121,931,449
0.028	119,340,676	119,710,786	120,080,897	120,451,007	120,881,118	121,191,228	121,561,338
0.032	118,970,566	119,340,676	119,710,786	120,080,897	120,451,007	120,881,118	121,191,228
0.036	118,600,455	118,970,566	119,340,676	119,710,786	120,080,897	120,451,007	120,881,118
0.040	118,230,345	118,600,455	118,970,566	119,340,676	119,710,786	120,080,897	120,451,007

Truck – Value of Time (Without and With Project)

With	Without						
	0.036	**0.039**	**0.042**	**0.045**	**0.048**	**0.051**	**0.054**
0.014	123,011,990	124,098,446	125,184,903	126,271,360	127,357,817	128,444,274	129,530,730
0.017	121,925,533	123,011,990	124,098,446	125,184,903	126,271,360	127,357,817	128,444,274
0.020	120,879,076	121,925,533	123,011,990	124,098,446	125,184,903	126,271,360	127,357,817
0.023	119,752,619	120,879,076	121,925,533	123,011,990	124,098,446	125,184,903	126,271,360
0.026	118,666,163	119,752,619	120,879,076	121,925,533	123,011,990	124,098,446	125,184,903
0.029	117,579,706	118,666,163	119,752,619	120,879,076	121,925,533	123,011,990	124,098,446
0.032	116,493,249	117,579,706	118,666,163	119,752,619	120,879,076	121,925,533	123,011,990
0.035	115,406,792	116,493,249	117,579,706	118,666,163	119,752,619	120,879,076	121,925,533
0.038	114,320,335	115,406,792	116,493,249	117,579,706	118,666,163	119,752,619	120,879,076

Appendix E: Sensitivity analysis of VOC and Time of Value of Vehicles (Scenario 3)

Light Vehicles –Vehicle Operating Cost (Without and With Project)

With	Without						
	0.155	**0.205**	**0.255**	**0.305**	**0.355**	**0.405**	**0.455**
0.036	99,811,702	113,291,673	126,771,644	140,251,616	153,731,587	167,211,559	180,691,530
0.086	86,329,730	99,811,702	113,291,673	126,771,644	140,251,616	153,731,587	167,211,559
0.136	72,851,759	86,329,730	99,811,702	113,291,673	126,771,644	140,251,616	153,731,587
0.186	59,371,787	72,851,759	86,329,730	99,811,702	113,291,673	126,771,644	140,251,616
0.236	45,891,816	59,371,787	72,851,759	86,329,730	99,811,702	113,291,673	126,771,644
0.286	32,411,844	45,891,816	59,371,787	72,851,759	86,329,730	99,811,702	113,291,673
0.336	18,931,873	32,411,844	45,891,816	59,371,787	72,851,759	86,329,730	99,811,702
0.386	5,451,901	18,931,873	32,411,844	45,891,816	59,371,787	72,851,759	86,329,730
0.436	(8,028,070)	5,451,901	18,931,873	32,411,844	45,891,816	59,371,787	72,851,759

Light Vehicles –Vehicle Operating Cost (Without and With Project)

With	Without						
	0.234	**0.281**	**0.328**	**0.375**	**0.422**	**0.469**	**0.516**
0.108	86,472,321	86,616,145	86,759,970	86,903,794	87,047,618	87,191,442	87,335,266
0.155	86,328,497	86,472,321	86,616,145	86,759,970	86,903,794	87,047,618	87,191,442
0.202	86,184,673	86,328,497	86,472,321	86,616,145	86,759,970	86,903,794	87,047,618
0.249	86,040,849	86,184,673	86,328,497	86,472,321	86,616,145	86,759,970	86,903,794
0.296	85,897,025	86,040,849	86,184,673	86,328,497	86,472,321	86,616,145	86,759,970
0.343	85,753,201	85,897,025	86,040,849	86,184,673	86,328,497	86,472,321	86,616,145
0.390	85,609,377	85,753,201	85,897,025	86,040,849	86,184,673	86,328,497	86,472,321
0.437	85,465,552	85,609,377	85,753,201	85,897,025	86,040,849	86,184,673	86,328,497
0.484	85,321,728	85,465,552	85,609,377	85,753,201	85,897,025	86,040,849	86,184,673

Truck –Vehicle Operating Cost (Without and With Project)

With	Without						
	0.399	**0.434**	**0.469**	**0.504**	**0.539**	**0.574**	**0.609**
0.287	87,191,163	88,167,415	89,143,667	90,119,918	91,096,170	92,072,422	93,048,674
0.322	86,327,911	87,191,163	88,167,415	89,143,667	90,119,918	91,096,170	92,072,422
0.357	85,238,659	86,327,911	87,191,163	88,167,415	89,143,667	90,119,918	91,096,170
0.392	84,262,408	85,238,659	86,327,911	87,191,163	88,167,415	89,143,667	90,119,918
0.427	83,286,156	84,262,408	85,238,659	86,327,911	87,191,163	88,167,415	89,143,667
0.462	82,309,904	83,286,156	84,262,408	85,238,659	86,327,911	87,191,163	88,167,415
0.497	81,333,652	82,309,904	83,286,156	84,262,408	85,238,659	86,327,911	87,191,163
0.532	80,357,400	81,333,652	82,309,904	83,286,156	84,262,408	85,238,659	86,327,911
0.567	79,381,148	80,357,400	81,333,652	82,309,904	83,286,156	84,262,408	85,238,659

Light Vehicle – Value of Time (Without and With Project)

With	Without						
	0.024	**0.027**	**0.030**	**0.033**	**0.036**	**0.039**	**0.042**
0.010	86,328,692	92,522,034	98,933,375	105,344,716	111,756,058	118,167,399	124,578,741
0.013	79,699,351	86,328,692	92,522,034	98,933,375	105,344,716	111,756,058	118,167,399
0.016	73,288,010	79,699,351	86,328,692	92,522,034	98,933,375	105,344,716	111,756,058
0.019	66,876,668	73,288,010	79,699,351	86,328,692	92,522,034	98,933,375	105,344,716
0.022	60,465,327	66,876,668	73,288,010	79,699,351	86,328,692	92,522,034	98,933,375
0.025	54,053,985	60,465,327	66,876,668	73,288,010	79,699,351	86,328,692	92,522,034
0.028	47,642,644	54,053,985	60,465,327	66,876,668	73,288,010	79,699,351	86,328,692
0.031	41,231,303	47,642,644	54,053,985	60,465,327	66,876,668	73,288,010	79,699,351
0.034	34,819,961	41,231,303	47,642,644	54,053,985	60,465,327	66,876,668	73,288,010

Bus – Value of Time (Without and With Project)

With	Without						
	0.026	**0.030**	**0.034**	**0.038**	**0.042**	**0.046**	**0.050**
0.008	86,531,241	86,771,813	87,012,385	87,252,956	87,493,528	87,734,100	87,974,672
0.012	86,320,669	86,531,241	86,771,813	87,012,385	87,252,956	87,493,528	87,734,100
0.016	86,050,098	86,320,669	86,531,241	86,771,813	87,012,385	87,252,956	87,493,528
0.020	85,809,526	86,050,098	86,320,669	86,531,241	86,771,813	87,012,385	87,252,956
0.024	85,568,954	85,809,526	86,050,098	86,320,669	86,531,241	86,771,813	87,012,385
0.028	85,328,382	85,568,954	85,809,526	86,050,098	86,320,669	86,531,241	86,771,813
0.032	85,087,811	85,328,382	85,568,954	85,809,526	86,050,098	86,320,669	86,531,241
0.036	84,847,239	85,087,811	85,328,382	85,568,954	85,809,526	86,050,098	86,320,669
0.040	84,606,667	84,847,239	85,087,811	85,328,382	85,568,954	85,809,526	86,050,098

Truck – Value of Time (Without and With Project)

With	Without						
	0.035	0.038	0.041	0.044	0.047	0.05	0.053
0.015	87,243,938	87,950,135	88,656,332	89,362,529	90,068,726	90,774,923	91,481,120
0.018	86,329,741	87,243,938	87,950,135	88,656,332	89,362,529	90,068,726	90,774,923
0.021	85,831,545	86,329,741	87,243,938	87,950,135	88,656,332	89,362,529	90,068,726
0.024	85,125,348	85,831,545	86,329,741	87,243,938	87,950,135	88,656,332	89,362,529
0.027	84,419,151	85,125,348	85,831,545	86,329,741	87,243,938	87,950,135	88,656,332
0.030	83,712,954	84,419,151	85,125,348	85,831,545	86,329,741	87,243,938	87,950,135
0.033	83,006,757	83,712,954	84,419,151	85,125,348	85,831,545	86,329,741	87,243,938
0.036	82,300,560	83,006,757	83,712,954	84,419,151	85,125,348	85,831,545	86,329,741
0.039	81,594,363	82,300,560	83,006,757	83,712,954	84,419,151	85,125,348	85,831,545