Investment Appraisal of a Mobile Phone Company: Zoom Mobile Network

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ABSTRACT

With appearance of today's technology the way of communication has also changed. In this regard, mobile telephones have become one of the most important services in recent years. Therefore, mobile network providers play an important role as a prerequisite in connection with the point previously mentioned.

This study deals with the establishment of a mobile network in Hang Dong, a remote area located in the province of Chiang Mai, Thailand. It discusses why the service is applicable to Hang Dong in terms of its necessity and costs. Financial, sensitivity and risk analysis of the proposed project has been done.

The financial analysis confirmed the project viability in aggregate as it yields a positive financial NPV but pointed out some difficulties in the ability of servicing the debt.

The risks arose from the proportion of local telephone calls, decrease in project market share, domestic inflation rate, growth in real income, decrease in local and international telephone call tariffs and pointed out some important issues and gave an enormous help in spotting the possible problems that the project may face which in turn, have an adverse impact on the financial feasibility. Various measures must be taken to reduce the exposure to these risks and to help future projects into better and more improved project design.

Keywords: Financial Analysis, Mobile Network, Risks, Thailand.

ÖZ

Günümüzde gelişen teknoloji sayesinde iletişim yolları da değişmektedir. Bu doğrultuda cep telefonları son yıllarda en önemli iletişim aracı haline geldi. Bu nedenle mobil şebeke sağlayıcıları bu konuda çok önemli rol oynamaktadırlar.

Bu çalışma Tayland'ın bir ili olan Hang Dong'ta mobil şebeke sağlayıcısının kuruluşu ele almmakta ve bu servisin gerekliliği ve maliyet analizi yapılmıstr. Önerilen projeye finansal, duyarlılık ve risk analizileri de uygulanmıştır.

Finansal analizler projenin toplamda yaşanabilirliği pozitif finansal NPV ile onaylamıştır fakat borçlarını karşılamakta bazı zorluklar görülmektedir.

Projede görülen riskler yerli telefon görüşmeleri, projenin pazar payı, enflasyon oranı, reel gelir büyümesi, yerel telefon aramalarının fiyatlarında düşüş ve projenin yaşayabilirliğini engelleyebilecek başka önemli konular ele alınmıştır. Bu riskleri azaltmak için bazı önemli tedbirler alınmalıd ve ilerdeki projelerin gelişmiş proje tasarımlarıyla daha iyi durumda olmaları sağlanmalıdır.

Anahtar Kelimeler: Finansal Analiz, Mobil Şebekeleri, Riskler, Tayland.

To My Loving Mother

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LIST OF ABBREVIATIONS

ADB ..... Asian Development Bank

ADSCR ..... Annual Debt Service Coverage Ratio

CIF ..... Cost, Insurance and Freight

EPC ..... Engineering, Procurement and Construction

IRR ..... Internal Rate of Return

LLCR ..... Loan Life Coverage Ratio

NPV ..... Net Present Value

SMS ..... Short Message Service

USO ..... Universal Service Obligation

VAT ..... Value Added Tax

VHF ..... Very High Frequency

Chapter 1

INTRODUCTION

With appearance of today's technology the way of communication has also changed. In very old days pigeons were used as means of communication. Afterwards, written messages were sent through letters by post. As the time passed, telephone was invented and now is the era of wireless communication that increases usage of mobile phones. Mobile phones are relaxing way of communication over a long distance. There is no doubt that cell phones have made human life much easier. People are in touch with their family members and friends. Moreover, mobile phones show clearly to be extremely helpful in emergencies. By looking at different aspects that prove the importance of mobile phones, we can easily understand how crucial a mobile network operator's services can be for an area where mobile phones are a critical tool to communicate. In this regard, Hang Dong a remote area in the province of Chiang Mai located in the country of Thailand is not an exception.

1.1 Aim of the Study

The aim of this thesis is to perform a feasibility study of a private network operator company (Zoom Mobile Network) that is to set up a mobile network in Hang Dong in order to respond to the huge demand for telephone communication so that villagers can make important calls and that would also prevent them to travel abroad for jobs. In this regard, the study appraises the financial, sensitivity and finally risks analysis of this investment to determine its financial viability.

1.2 Methodology of the Study

This comprehensive inquiry is done by literature review from the sources in the Eastern Mediterranean University Library, Queen's University Library and through the online worldwide web sources.

In this thesis a feasibility study of providing mobile network coverage for Hang Dong is done. In this regard, apart from financial analysis of the investment that is to see the feasibility of the Zoom Mobile Network (ZMN), a sensitivity analysis and also risk analysis is carried out.

In the financial analysis, the goal is to build the cash flow statement of the project where the spread between the receipts and the disbursements are considered. In constructing the cash flow statement, market prices are used. Besides, net present value (NPV) and internal rate of return (IRR) are calculated as the factors of the project outcome to appraise the financial viability of the project. (Jenkins, 2002, pp.25-35).

Sensitivity analysis or what if analysis is typically the first step in identification of risk variables that leads us to conduct risk analysis. This analysis tests how sensitive a project's results are to changes of the value of one parameter of the project while assuming all other variables being constant at a time.

Risk analysis is carried out by applying variables that are uncertain and are likely to influence the result of the project to the greatest extend. It analyses the overall riskiness of the project and helps the project owner to make a better solution. A risk analysis software "Crystal ball" is applied to generate Monte Carlo simulation with 10,000 runs.

1.3 Structure of the Study

After explaining the importance of mobile phone network coverage for Hang Dong and the methodology of the study in chapter 1, in chapter 2 a decision-making framework is presented, with a conceptual perspective of project appraisal which relates to investments in telecommunication. Also, some assumptions on the basis of the investment costs, operating expenses, depreciation schedules, sources of finance, taxes, sales revenue and financial values such as inflation rate, foreign exchange rate and nominal interest rates of the project are provided.

In the third chapter, project financing for telecommunication infrastructure and risk associated with it have been discussed.

In chapter 4 development of financial model and the results of basic financial analysis obtained as an outcome of analysis undertaken are examined. The interpretations on these findings also have been discussed in this chapter.

Chapter 5 discusses risk analysis.

Finally in chapter 6, conclusion has been obtained on the basis of the findings in the previous chapters and recommendations on what is necessary to make the project feasible and bankable are discussed.

Chapter 2

DECISION MAKING FRAMEWORK AND DESCRIPTION OF PROJECT

2.1 Project Appraisal

Generally, a satisfactory definition of a *project* does not exist. In their review of several decades of World Bank experience, Baum and Tolbert (1985: 8) define a project as "a discrete package of investments, policy measures, and institutional and other actions designed to achieve a specific development objective (or set of objectives) within a designated period". This definition is satisfactory for the purpose of this study. However, it is very important to clearly state here that projects usually are referred to as combination of defined tasks featured with feasibility appraisal, detailed design, and implementation and post evaluation for the benefit of specific stakeholders[1].

In developing countries, *project appraisal is* most times used interchangeably with cost-benefit analysis. A conceptual decomposition of project appraisal involves a systematic analysis of the extent to which a telecommunication project contributes to a set of developmental goals, considering the institutional relevance of the project to stakeholders as well as the scarcity of resources that would be used in the implementation of the project. Project appraisal involves a financial analysis that helps determine the financial viability and sustainability of projects; also, it entails an

[1] See more in Harberger *et al* (2010) Cost-Benefit Analysis for Investment Decisions; Chapter 2, p3.

economic analysis, which deals with the impact of the project on the entire society (Harberger, 1971). This study assumes an analysis of activities, which are yet to be implemented. For simplicity, different stages in project appraisal have been identified based on Jenkins, Harberger and Kuo (2010) decision stages design for project appraisal. The nodes include project definition, feasibility, detailed design, project implementation and post evaluation; however for the purpose of this study, post evaluation shall be omitted in appraising the case study since he project is on going.

2.2 Significance of Appraisal in Telecommunication Projects

Specific to telecommunication projects, investment appraisal entails the management of all activities of the given project right from Site Survey to Site Integration and community acceptability of installations. Consideration of these basic factors allows an operator the advantage of optimum manpower and means to executing the project successfully within desired time. For network infrastructure projects, most sites are unique in terms of the building process, peculiarity of weather, topography, possible risks, remote area problems, and availability of supporting infrastructural facilities (Russell et al, 2007: 2-3).

Project appraisal encompasses basic functions of project description, planning, scheduling, monitoring and control. Project description gives the idea and type of investment. Planning function involves listing of all tasks essential for the completion of the project, including the risk associated with sustainability of its future operations. Scheduling consists of sequencing of tasks according to their precedent time and expected times. Monitoring and control is the review and correction of difference between the projected and actual work performance of the activity.

Telecom projects usually require huge investments and high degree of uncertainty of future returns are imminent. For instance, the operation of a mobile network provider could be terribly impeded and run slowly against its desire in situation of great economic downturn that usually affects the call rate and income from tariffs. Institutional inconsistency of state agencies that serve as regulatory or supervisory body could also impede the success of implementing such project. How do we guarantee the safety of the installed infrastructures as the cell sites? How certain is it that the domestic network interchange (interconnectivity with other networks) will not be interrupted by regulators? What are the economic variables that could affect cash flows? How sensitive are financial indicators and debt service ratios to changes in the economic variables? All these questions are what investment appraisal tries to address.

2.3 Economic Significance of the Project

The launch of this project is expected to significantly reduce the mobile calling rates in the region of Thailand. Serviced by this project, by implementing the Project, tariffs would continue to drop as a result of enhanced economies of scale and increased competition. Indeed, this means that mobile telecommunication services will now be available, and at affordable cost to residents of Hang Dong. Rural and remote areas would no longer be streamed out of the global phenomenon of mobile telephony since the project expands the network coverage region where there is limited telecom service at present. The increased affordability and improved accessibility will enable inclusive economic growth by facilitating access to markets and information, such as providing remote access to bank accounts; and promote business transaction among local dwellers. The incidence of teachers suspending classes because of banking needs, especially when wage credit needs to be

confirmed, will be minimal, as such transaction would easily be done through phone conversations.

The Project could impact significantly on the community by enhancing customers' access to information pertaining to public services, education, health and security. In recent times, information such as weather forecasts, natural disasters and security alerts are critical to the general public, particularly the poor. Subsequent to completion of the Project, we expect more villages that have roads but had no mobile telephones services to enjoy an extended ambulance services common to those in the cities. Residents will be able to dial the toll free ambulance services directly. With the short messaging system-banking service provided by telecom operators and its partner banks, transportation cost and time will be saved.

Furthermore, the Project will provide direct employment, and business opportunities to staff, dealers, and contractors, thereby increasing marginal productivity of labor in that area of the country. These kinds of developments are the supposed benefits of the desired public private partnership strategy by the government of Thailand. It positions good corporate governance in the private sector to support infrastructure development through social responsibility and construction. However, the rhetoric of economic presumptions that has justified the implementation shall be analyzed as we make use of an integrated spreadsheet and crystal ball software to run a comprehensive cost-benefit analysis.

2.4 Concepts in Telecommunication

To understand the core of this study, it is good if we look at the basic concepts in Telecommunication. Reiterating the essentials of project management and investment appraisal, we define Mobile telecommunication network project as one kind of project which is spread over large areas with work sites located wide apart.

Work sites may be situated in wilderness with minimal approaches or on rooftops in urban areas with restricted working space. Therefore, investment appraisal in general and project management at large plays important role in cost-effectiveness and operation management of telecommunication projects. The main objective is to ensure that the project does not suffer in terms of quality, time and cost overruns.

For ease of comprehension, this study on the development of passive infrastructure has been designed to first present the theoretical concepts and then practically relate them to the analysis of this case study. Some technical terms used in communication networking are briefly defined below.

2.4.1 Cell Sites

A cell site is the place where network antennas and electronic communication equipment's are stationed to provide cellular service on mobile phones. Usually, cell sites are featured with tower (network mast), a back-up electrical source of power, and sheltering. Technically, in telecommunication networks, the cell site is referred to as Base Transceiver Station (BTS). The service range of a cell site - the range within which mobile devices can connect to it reliably is not a fixed figure. It will depend on a number of factors, including: the mode of signal transfer in use, the transmitter's rated power, transmitter's size; it may also be limited by local geographical or regulatory factors and weather conditions.

2.4.2 Site Sharing

Site sharing entails granting permission to other operators for usage of specified facilities under the control of a parent operator. The idea is to increase revenues from the operating process facilities through enhanced collaboration with various clients at the same facility so that maximum capacity can be utilized at the same time. This principle is synonymous to the principle of economies of scope. Site sharing permits

clients to be involved in low-end as well as high-end services. It enhances the earning capacity of different clients based on their end activity and the criticality of the infrastructure support required.

2.5 Project Background and Description

Thailand is a country located in the southeastern part of Asia, covering a land area of 513,115 square kilometers with over 64 million inhabitants. Due to technological innovation and globalization, there has been a steady growth in real GDP of 3 percent; with a future forecast of 7 percent growth by 2015. Thailand is a vibrant market for mobile telecommunications. In 2000, there are 3,056,000 mobile subscribers, mainly spread across the big cities and other major tourist zones. However, potentiality of the market is yet to be optimized; large parts of the country are technically secluded. One of the uncovered regions is Hang Dong, a remote area located in the province of Chiang Mai, Thailand. Most people from Hang Dong travel abroad for jobs. This makes telephony an important activity in the vicinity. Many villagers walk a long distance to make phone calls through the VHF service that has reiterated the high demand for an efficient mobile wireless service. In response to the huge demand for mobile telecommunication in Hang Dong, the government of Thailand through a bidding process awarded a contract to Zoom Mobile Network (ZMN) for the establishment of a mobile network covering a range of 3,000 square kilometers.

The subscriber base in the wireless market in Thailand, one of the worlds fastest growing telecom markets reached another milestone when it surpassed 4 million subscribers in second quarter of 2007. The country’s mobile services market is forecast to grow by a compound annual rate of 13percent in next five years. At present, this area does not have telephone service except as provided by the analog

system of telecommunication which is supplied on the VHF (Very High Frequency) telephones.

With the new contractual agreement to provide a state of the art technology of mobile telecommunication, it is expected that Zoom Mobile Network will establish a total of 1300 cell sites covering an area of 3000 square kilometers within a 15-year project cycle. 600 cell sites will be built in years 2000 and 2001. This number will further increase by 100 cell sites in year 2005 and 200 cell sites in years 2008, 2011 and 2014. Urban area will take 60percent of the total coverage with a coverage rate of 3.14 sq. km/cell site, while the suburban will take the remaining 40percent, with 19.5 sq. km/cell site. Each cell site is to the capacity to serve 250 subscribers at a time, with an overbooking factor of 6 (allowing the network operator to sell the amount of bandwidth 6 times). The project is expecting to make 40% of the investment outlays on the 600 cell sites in year 2000, and the remaining 60% in year 2001. The ZMN is projecting an estimated call rate of 1752 million minutes of calls per year, with 600000 connections. To reach the target the approximate capital expenditure required the project alone is expected to be approximately $235 million in next two years.

2.6 Parameters and Assumptions

2.6.1 Project Costs (Investment Costs)

The components of the investment costs and their timing are presented in [Table 1].

Table 1: Investment Costs by Components, 2000 Prices (US$)

Components	**Year 2000**	
Capital Expenditures (excluding VAT)	360,000	USD per cell site
Consultant Fee	500,000	USD – one time
Building	150,000	USD – one time
License Fee	30,000	USD – one time
Land for office premises plus lease for the initial cell sites	100,000	USD – one time

Capital Expenditures contain the cell site construction, base station equipment, antenna, integration costs, and lease of land for initial years. Capital Expenditures are subject to a 7% VAT.

2.6.2 Project Financing (ADB Loan)

In addition to the amount of equity raised by the shareholders, the mobile company arranged for a loan from the private sector department of the Asian Development Bank (ADB). The loan will be disbursed in 2 successive periods starting in year 2000. The first installment, USD 65,260,000 (in 2000 prices), will be disbursed in year 2000 and the second installment, USD 99,980,000 will be disbursed in year 2001 (in 2000 prices). ADB offered a 3-year grace period where interest will be capitalized. Starting in year 2003 the principal with the accumulated interest will be repaid in 10 annual installments. The last year of debt payment will be in year 2012. ADB will charge a real rate of interest of 7.00%. The corresponding nominal rate of interest will be variable and will change with the rate of inflation.

2.6.3 Depreciation and Residual Values

Annual depreciation expense is estimated on a straight-line basis for both economic depreciation as well as tax depreciation. The expected lives of the assets used for estimating tax and economic depreciation are presented in [Table 2].

Table 2: Economic Life and Depreciation Schedule for Tax Purposes

	Economic (Years)	Tax (Years)
Capital Expenditures	**15**	**10**
Consultant Fee	**15**	**1**
Building	**15**	**10**

2.6.4 Operating Costs

2.6.4.1 Project Life

The project is expected to start operations in year 2002 and operate for 15 years, 365 days/year. All figures are stated in 2000 prices.

2.6.4.2 Operational Expenditures

Annual operational expenditures are 10% of the cumulative total capital expenditures. Operational expenditures include the costs of the cell site lease, power supply to the site, T1 lines, and cell site software.

2.6.4.3 Land Lease

The annual land lease during the project for each cell site is 20,000 Thai Baht (THBs.)/year/cell site starting from 2002. In addition the land lease is subject to VAT.

2.6.4.4 Frequency Management Fee

The annual frequency management fee is 200,000 USD/year exclusive of VAT. Frequency management fee is subject to VAT.

2.6.4.5 Numbering Fee

The regulatory body charges 12 THB/number/year as a numbering fee in normal circumstances. However, there is a fee for numbers allocated but unused within a year which is 120 THB/number/year. The unused numbers are not allowed to be

carried forward to the next year. This is because big volume of numbers are allocated to operators by government body when they request, and/or sometime operators are not using those numbers and try to keep extra numbers with them. Due to market risk, the project is buying 10% extra numbers than the total quantity demanded.

2.6.4.6 Labor Costs

0.004 persons are employed per connection. That ratio of skilled and unskilled/semi skilled will be 70% and 30% respectively. The real wage rate for the skilled labor is 80,000 THBs./month, and for the semi/unskilled labor is 20,000 THBs./month.

2.6.5 Working Capital

Account receivable is assumed to be equal to 1 month of total annual revenue from the relevant phone service. Accounts payable are also assumed to be 1 month of the sum of operational expenditures, land lease and the fees (frequency management and the numbering). The amount of cash balance to be kept for operating purposes is assumed 1 month of total operating expenses.

2.6.6 Revenues

2.6.6.1 Fees and Tariff Rates

Revenues come from the tariffs charged to the end users for the delivery of local and international calls and short message service (SMS). In 2002, ZMN will charge 4 THBs/min for local calls, and 7THBs/min for international calls, in real prices. ZMN will charge 1 THBs. for each local SMS, and 3 THBs. for each international SMS in real prices. Local and international call tariffs will decrease by 10% real for the rest of the project life starting from year 2003. There is a one-time connection fee of 500 THBs. for new customers every year. These prices are expressed in 2000 prices. The project is expecting to have 75% of the services as pre-paid, and 25% as post-paid.

2.6.7 Demand and Mobile Service Use

The mobile company has projected the composition of telephone and SMS services as follows: 80% local (domestic) services, 20% international services. The average mobile phone calls per connection is 8 minutes per day, and the average number of SMS is 1 per connection per day.

The initial total demand for telephone calls is 1,752 million minutes per year in 2002. The initial total quantity demanded for local calls, at the fixed price of 4 THBs. per minute in year 2002 price, is 1,402 million minutes per year (=1,752*80%). The growth in income is assumed to be 3% throughout the life of the project and with an income elasticity of demand is 1.5, the demand will grow by 4.5% (=1.5*3%) each year (e.g. at price of 4, the demand curve rotates to quantity 1,465 in year 2003). The maximum willingness to pay for local calls is estimated to be 10 THBs./minute. The slope of the demand curve determines the change in quantity demanded (e.g. a change in price from P_0 to P_1, causes a change in the quantity demanded by the amount $(P_1-P_0)/\text{slope}^*$).

Similarly, the total demand for international calls starts with an initial quantity of 350 minutes (=1,752*20%), and follows the same pattern as the local call demand in the following years. The maximum willingness to pay for international calls in 2002 is 15 THBs./minute where the initial price, P_0, is 7 THBs.

The project captures 100% of the total demand in the first year of operation, i.e. year 2002. Project is expecting to face the competition; as a result, the project is expecting to loose 3 percentage points of market share every year throughout the project's operation.

* Formula for Slope is $(Y_1 - Y_0)/(X_1 - X_0)$, i.e. for year 2002, (10 – 4)/(0 – 1664)

2.6.8 Payments to the State-Owned Organization

The mobile company has to pay the state-owned regulatory department 3% of its total revenue (net of VAT) for the Universal Service Obligation (USO) Fund. USO fund is used to provide the services in the remote areas of the country whenever the private operator is not able to fulfill its promises.

2.6.9 Taxation

Corporate income tax rate is 30%. The average import duty is 12.7% of CIF price. VAT is 7% of (CIF+ Import duty). The average income tax rate for skilled labor is 20% and for unskilled labor is 12%.

2.6.10 Inflation, Exchange and Discount Rates

The annual domestic inflation rate is expected to be on average 6%, and annual foreign inflation rate is expected to be on average 3% for the entire life of the project. The exchange rate is 41.00 THBs./USD in year 2000. The minimum required rate of return on equity is a real rate of 15% per annum.

Chapter 3

PROJECT FINANCING FOR TELECOMMUNICATION INFRASTRUCTURE

3.1 What is Project Financing?

There is not a single definition that all the experts agree on for project finance. For instance, Finnerty (1996) defines project finance as:

> The raising of funds to finance an economically separable capital investment project in which the providers of funds look primarily to the cash flow from project as the source of funds to service their loans and provide the return of and a return on their equity invested in the project. (p.2)

To put it another way, project financing is a loan arrangement that its repayment depends mainly on the project's cash flow and as collateral, the project's rights, interests and assets are held. These projects are usually large, with high transaction costs and high capital equipment costs.

There are three types of project finance, which are full recourse, non-recourse and limited recourse. In full recourse lenders need to make sure of debt repayment, so that they primarily look to the cash flow and assets of the project but eventually can look to a sponsor for any deficit. In non-recourse lenders need to make sure of their loans to be repaid by solely looking to the cash flow and assets of the project. In non-recourse there is not any guarantee that the lenders will be paid. In limited recourse all financing is between full and non-recourse. For debt obligations, Lenders partly look to the project cash flow and assets. In described occurrences lenders can look to

the project sponsors for debt obligations. Limited recourse is the relatively more popular due to its relative comfort provided to the financiers.

3.2 Fundamentals of Telecom Project Financing

3.2.1 Investment Requirements

Telecommunication projects are characteristically continuous investment indispensable. Networks are set up for a specific users capacity. Thus, when demand rises, more capital is required to satisfy the increased demand. As long as a cellular franchise period is, so is its investment plan. This makes one to ask what exactly is the project cost. Typically, a telecom project cost continues to require investment till the project turns out to be self-financing that is all additional investment necessities are met through the project cash generation.

3.3 Analyzing Project Risks[2]

As telecom projects require large investments, it happens quite often, that the sponsors don't have the capability to guarantee the loans disbursed to the project. Besides, many international telecommunication corporations are willing to have their corporate guarantees limited to their international projects as a matter of policy. Therefore, it is essential to view the financing of such projects on an exclusive basis, meaning that financiers contribute to risk of the project with no or limited recourse to the project sponsors except their equity invested in the project and the negotiated sponsor support. Project financing is a costlier source of finance and also specifies stricter terms and conditions like higher capitalization, share transfer restrictions, and higher debt services norms. Project financing needs a very complete analysis of the project risks by the financiers. Generally, the project risks are divided into two categories that are pre-completion and post-completion risks.

[2] See Also … Dasgupta, A (2005). FINANCING TELECOM PROJECTS IN EMERGING MARKETS. Working Paper Series (651701), University of Toronto, Faculty of Law.

1. Pre-completion risks:

Pre-completion risks involve technology risks that is the technology selected will provide the service needed successfully; then comes regulatory risks that is the risk the holder of the license has taken to obtain all the legal clearances necessary to run the service; and completion risks, which is the ability of the servicer to set up the network within a budgeted cost and time, and satisfy the technical factors specified by the regulator.

2. Post-completion risks:

Post-completion risks include technology risks in which for instance a cellular operator has a franchise for running mobile technology on the basis of a specific standard. However, there is the technology risk that a better cellular technology may come into existence in the future and this can be the reason that the current standard become uneconomical; Operational risks that is the capacity of the franchisee to operate the network and service efficiently. Having experienced operators as sponsors can reduce this risk; next is the market risk, which is the most important risk of a mobile network project, i.e. a decline in project revenues will happen. Market risk also includes subscriber increment/decrement, per subscriber use of airtime, tariff development and market competition; Regulatory risk, which involves the extension of franchise period and improvement of interconnect strategies.

3.3.1 Bankability Issues

Bankability of a telecom project is one of the main affairs that project sponsors and lenders are interested in. To assess if a project is bankable depends on some issues that can be summarized into two main parts:

3.3.1.1 Country Issues

Country specific problems are the important necessities for telecom projects, which differ with the location of the project. These concerns are probable to have a significant influence upon the feasibility and bankability of a telecom project. In most emerging countries, instead of project particular issues it will be these issues that often are the most considerable elements indicating if a project is financeable.

a. Regulatory Issues

The most important regulatory risk issues that effect project feasibility are:

- Terms and circumstances of the franchise, which involves areas such as obligation and quality of service, terms of the franchise such as franchise exclusivity, extension, fees and technology defined in the franchise and if the franchise is assignable to lenders or not.
- Terms of technical and physical interconnect: Lenders will evaluate if identical access is assigned to the new operator and if the commercial and physical interconnect rules deliver a fair and equal situation with the serving operator.
- Tariff Regulation: Lenders assess the tariff placing method and its transparency. Besides, significant care is now dedicated to the subject of tariff rebalancing that is to reduce international call rates. Tariff rebalancing is not politically popular and lenders will look at the government's past data to evaluate the extent of rebalancing likelihood to happen in any market.
- Access to radio spectrum: Lenders will evaluate the accessibility of a satisfactory amount of radio spectrum and if needed, obtaining additional spectrum.

b. Level Playing Field

Telecommunication is an infrastructure section where a new partaker experiences an inbuilt disadvantage and one-sided competition from the serving network provider. It brings up some issues of possible concern, e.g. if proper independent rules will be set to prevent one-sided competition among a privatized state telecom company and other privately possessed telecommunication companies?

c. Interconnection

It is possible to interconnect a carrier users to another's network with no technical or financial limitations in an interconnect regime. This is a requirement to develop a competitive telecommunication network. If a current service provider has attained an assured number of subscriber penetrations, the new service provider requires interconnecting with the incumbent one. If a legal agenda does not arise and provide a fair agreement, the feasibility of the new project is in question.

d. Frequency Allocation

Electromagnetic spectrum particular frequencies are what telecom depends on. This electromagnetic spectrum is categorized as a universal and limited resource and is run both at a state-run and worldwide level. A key risk in this part is delay in distributing frequency.

e. The Right of Way

Normally, the possession of an easement right to set the telecom wires or other form of cables is needed for a telecom network. Fittingly the franchisee has to obtain a grant of right of way from the land proprietors by negotiation, which is a tiresome job and has impact on the project commissioning. A uniform lawful structure relative to the grant of right of way is quite required for the feasibility of the project.

f. Viability of the Proposed Tariff

The feasibility of the projected tariffs that are normally set by the telecommunication officials is a very important concern in limited recourse telecoms financing in many emerging nations. This involves interconnection charges and upcoming rebalancing, and if the expected cash flows can be attainable.

g. Telecommunications Policy

Basically, a noticeable advantage is a well-defined telecom strategy and implementation procedure by governments. By keeping strategies in a constant fashion, they deliver a clear agenda for developers to follow up projects and can lower the seeming level of political risk. It is desired to have a clear declaration of strategy and a clear operation procedure. Additionally, it is desirable that the government approaches the execution of its telecom program in a well-organized fashion by supporting and delivering distribution of capital to enable a controllable number of projects to progress.

h. Political Risk

The financiers of a project will evaluate the political situation of the country that the project is placed in. Financiers desire an unchanging political situation as changes in government strategy could have substantial influence on the project. The concerns that may affect project feasibility, involve tax, foreign possession rules, scope of competition, legal framework and so on. Participation of multilaterals and having a strong sponsor can slightly lessen this threat. Lenders could additionally think of achieving political risk protection through private insurance market.

3.3.1.2 Project Issues

Apart from the country issues reviewed above, the project financiers will usually consider some project exclusive issues that are as follows:

a. Sponsor Related Risks

Identifying a project sponsor is a significant concern. Financiers need to make sure that the project sponsors have the skill and financial strength required to operate the project. The concerns to be well thought out are:

- The extent of sponsors' equity commitment.
- The period that they promise to keep a considerable interest in the project.
- Their pledge for delivering technical and managerial supplies to the project.

Besides, if the sponsors of the project have any interest in the project with contributing in other responsibilities like equipment provision or operators, this will obviously increase the possibility for disagreements of interest, and project financiers will need to make sure that such disagreements have been properly taken care of. Financiers need to make sure that the sponsors have sufficient financial resources and the essential management and technical expertise to implement a feasible telecommunication project. The fashion in developing markets has been followed such a way that local business companies have succeeded to protect franchises and have mostly cooperated with solid international telecommunication operatives. Lenders have to evaluate the readiness of the more substantial sponsors to undertake respectively more management and financial accountability with sufficient advantage for accepting such accountability.

b. Technological Risk

Telecom technology is likely to experience quick changes. The influence of such alteration will differ from country to country and depends on if the franchise identifies the technology to be applied. Financiers will consider the capacity of the

technology to provide the necessary excellence of service, the infrastructure price, the risk of oldness and technology applied by competitors.

c. Market Risk

Unlike other infrastructure areas like road, telecoms projects do not profit from take or pay contracts. Financiers generally run sensitivities to evaluate the strength of cash flows and the solutions accessible if actuals are not high enough. As franchises are for an identified period the evaluation is critical. The trustworthiness of the income stream has an important influence on capability to raise finance for a project. Lenders need to make sure of trustworthiness of the number of subscribers and income per subscriber that are the main income drivers. Items to be assessed contain: population coverage, the addressable population in terms of income levels, project market share, penetration rate that represents the number of active numbers, the combination of high and low usage subscribers, number of subscribers switching between operators, call profile that is to distinguish whether calls are local (short distance) or international (long distance), peak or off peak, subscriber acquisition costs that is the average cost of signing up for a new customer and level of bad debts. Generally, In order to contribute in assessment of the market risks, financiers are willing to do an independent market study.

d. Completion Risk

Financiers need to wisely evaluate the risk associated with postponements in scheduled network rollout and/or cost overruns as it can result in termination of concession, financial consequences, postponed revenues and need for further funding. Engineering, Procurement and Construction (EPC) contracts concerning the contractors and the project firm is what financiers need to get familiar with. The concerns that financiers are interested in involve the trustworthiness of the contractor

and if the contract is a turnkey, apt extent of liquidated damages and performance assurances. Financiers need to evaluate the ability of the management to make sure that network planning and incorporation concerns will not impede project completion, in the lack of turnkey contracts. The influence of suspensions in network commissioning and cost overruns need to be evaluated. Financiers will do an evaluation of the extent of contingent support that may be needed from sponsors throughout completion stage.

e. Business Expansion Risk

Unlike classic project financing in infrastructure segments like road that the project is totally completed and later commissioned, telecommunication firms could differ in rollout in terms of market growth. Telecommunication firms normally offer business plans that have high continuing capital expenditures backed from inside cash generation or extra equity in order to reach consequent network growth once. Financiers might need to do sensitivities in order to evaluate the influence of an unpredictable network commissioning on expected cash flow and on the continuing financing necessity.

f. Foreign Exchange Risk

Domestic telecommunication facilities mainly do their transactions in domestic currency. However, the receiving of net settlement payments for net incoming calls is the only US$ income. Unfavorable currency movement can extremely affect the financial wellbeing of a firm that has important unprotected foreign currency exposure where the risk is that an alteration in exchange rates will cause financial loss. As the interest rate difference will be more than compensation for the depreciation of domestic currency, several developing market operators borrow in US$ or some other foreign currency. Nevertheless, the Asian currency chaos has

underlined the misconception of such picture. When telecommunication firms borrow in foreign currencies, financiers need to insist on apt protection of foreign currency exposure.

Foreign exchange risks includes:

- Conversion risk: a government readiness to admit its currency to be changed to another foreign currency and the liquidity of the market for that currency.
- Exchange rate risk: deviations in the price of a currency comparative to another.

3.3.2 Allocation of Risk

Financiers are worried about a fair allocation of risks between different partakers as continuing successful project expansion is normally guaranteed as long as the risk-reward intentions of different partakers are being achieved. The risk is distributed between the participants based on the followings:

- The contributor bearing the risk is able to evaluate it.
- Risk is proportionate with the partaker's economic interest in the project
- Partakers are supposed to be the best that are able to manage the risk. For instance, the sellers and equipment providers normally tolerate a general percentage of the completion risks. The lenders and project sponsors bear a major portion of the risks in post completion phase.
- The risk reward ratio is well adjusted and impartial to all participants.

3.3.3 Mitigating Risks

Generally, the risks can be mitigated in several ways that are as follows:

a. Strong Sponsors

The sponsors usually involve equipment providers and major operating firms. Such a firm can be a sponsor as one of the circumstances of the franchise issuance. Although there is yet an absence of durable institutional funding some of telecoms infrastructure finances have lately been set up. However, up to now these funds have been chosen for subordinated debt instead of delivering merely equity.

b. Sufficient Equity

Revenue assumptions in a telecom project differ from revenue assumptions in power projects. For instance, off-take contracts that are formed at the beginning of a project are intended to hedge market risks. The amount of equity in a telecom project can be minimum if the viability report proves that there will be solid cash flows. Project financiers need to have security over the capital in the franchise firm.

c. Equipment Supply and Installation Contracts

The Fundamental concerns for the franchise firm in the supply and the installation contract regarding the distribution of project risks contain the followings:

- The supply contract is required to clarify the equipment to be supplied in detail.
- The extent of the installation work should perfectly be classified.
- The exchange and inflation risks that should be tolerated by the supplier/contractor.
- The scope of the appropriateness for warranties concerning to the supply, design and installation work is required to be satisfactory to the project financiers.
- The time extension request by supplier/contractor should be regulated.

- The scope of obligation by the franchise company to force the supplier/contractor to return the money that has already been paid to it should be identified.
- The scope that the supplier/contractor accepts that its claim over the franchise firm is subordinated to the project financiers need to be identified.
- It should be arranged at the outset to whether the supplier/contractor would accept a different franchise firm being assigned, in replacement of the original franchise firm.

d. No Unproved Technology

It is ideal to not rely on any untested technology. Nevertheless, if it is vital, then satisfactory warranties should be taken from the consignor of the technology.

e. Adequate Insurance and Bonds

Insurance may be offered for force majeure incidents such as political, natural disaster, loss or damage, in addition to environmental and public liabilities. A cost-benefit analysis should be undertaken to define the best extent of insurance that is required.

f. Commitments from Sponsors

Project financiers ask for share retention contracts from the sponsors (normally for five to six years). The government also requires a high amount of equity to prove the sponsors pledge.

g. Responsibility of the State

The franchise agreement is required to ensure that the state undertakes some responsibility and in some specific situations would step in to return the related equities. The franchise firm and the project financiers will refer to the state to

recompense the economies of the plan if the equities become unstable that can be achieved thru the franchise contract or by looking to a law.

h. Substitution Right

When project fails under the finance documents or franchise contract, the project financiers need the state to accept to continue with the franchise with new sponsors (as long as the new sponsors are appropriate to it and meet the points for negotiation). One tactic is to have a new franchise company at the beginning and enter it into parallel project documents and reserve it. This provides some assurance that the replacement method works.

i. Security and Subordination Rights

The role of projects security is basically to stop third parties from claiming the project assets before the project financiers. It is clearly essential to make sure that security documents are well written and executed while fitting to local law and that all reasonable steps to satisfy the security perfectness have been taken. In this regard, due diligence analysis should be assumed to make sure that security comes first.

j. Support Agreement

Contractor, provider, operator and the state are often required provision of direct assurances to financiers of the project.

k. Subordination Agreement

To the extend that the franchise company become indebted to other third parties such as the state, the supplier and the operators will be required by the project financiers to stand after the debt obligations that the franchise company has with the project's financiers. The method by which this classification is accomplished is thru a subordination agreement that is written between the franchise companies, the

project financiers that is the senior creditor and the creditor whose obligations are to be subordinated and is called the junior creditor.

A subordinate agreement states that if the junior creditor gets paid, that according to the subordination agreement, is supposed to be received by the senior creditor, the junior creditor will keep this payment in trust for the advantage of senior creditor.

3.1.4 Security Issues

a. Role of Security

Telecom projects financing have a similar security arrangement as other methods of limited recourse project finance though in several countries, the land laws do not permit a lien over a telecoms franchise to be achieved.

The initial aim of taking security is to have the project financiers in a situation that in the default conditions of the debtor to reimburse the obligation, the financiers can get the security, typically by selling the assets and use the earnings to fulfill the outstanding debts. Nonetheless the type of telecoms assets puts some restrictions on the financiers in taking advantage of the traditional means of application.

The telecom project assets are probable to be hard to liquidate, especially if failure happens throughout the network rollout stage of the project. In such conditions the financier has the outlook of either putting more funds into the project to get through with network construction or canceling the commissioning and trying to sell the system components out in a piecemeal manner. In some circumstances it is doable to arrange the security in a way that the franchise company's shares can be pledged to be assigned to a buyer in a default occurrence. As a result, the difficulties of transferring all of the licenses and contractual relations can be defeated as the lawful character of the franchise company remains unaltered and it continues to live with its network of contractual rights and responsibilities unchanged by possession alteration.

b. Types of Security

Sponsors guarantees will generally depend on the project feasibility as well as the extent of sponsors' willingness to commit into the project. There are three classifications of security and support that are as follows:

- Sponsor support: undertakings that are basically unsecured contractual obligations are guaranteed and supported by sponsor;
- Projects physical assets' security; and
- Security over the lawful privileges and project cash flows.

c. Sponsor Support

Project sponsors offer security upon their equity investment in the project as sponsor support. The implementation of share mortgages and allocation of rights according to joint venture arrangements usually depend on governmental authorizations at the time of taking security and upon a future execution. Throughout the project rollout stage (when there is maximum financiers exposure), the sponsors will sometimes deliver responsibility to the financiers so that when the project firm, under financing is not able to pay back the interest duties because of completion postponement, sponsors will use the initial liability to pay back interest throughout the planned completion date till the tangible completion date. Besides, throughout the early project phases, sponsors might be needed to offer completion assurances, which offers financiers a comparatively high level of security.

d. Security Over the Physical Assets

Often it is quite essential to have some sort of charge or mortgage upon network equipment. Nevertheless troubles may occur because the Project Company may not

possess the land where the network station is constructed or cable is laid under this land. The financier need to make sure that any cable-laying contract does not include any alteration of control provisions, in order to successfully face likely issues concerning the enforceability of security and possession of assets. In the case of telecoms franchises, the regulators are willing to make sure that the prospect possessors are financially feasible, technically efficient and they do not cause a probable threat to the public interest.

e. Security over Rights and Cash Flows

A typical project security includes the allocation of the profits of its contractual rights according to the project documents by the project firm e.g. equipment supply contract, operation and maintenance contract etc. that in succession, should feed the financiers with security and control of the project cash flow when merged with security allocations upon the project firms' bank accounts.

A choice has to be made in order to decide which bank will hold the escrow account. Generally, the security agent acts on project financiers' behalf or an independent bank chosen for this particular purpose. Typically, it is ideal that the charge for the escrow accounts be fixed instead of being floating. It is necessary that the mortgagee have control over the assets charged to establish a fixed charge, which means that the receivables must be held in a blocked account and the borrower is not permitted to withdraw without the precise approval of the security agent.

Chapter 4

FINANCIAL ANALYSIS

4.1 Objective of Financial Analysis[3]

The financial analysis of the Zoom Mobile Network project is carried out from two evaluation perspectives; the total investment (banker's) point of view and equity (owner's) point of view.

The total investment (banker's) point of view is the first assessment step from which a project should be appraised. Theoretically, it looks at the project being without any external source of finance as if the project is being run from the equity of the owners, put another way, this approach does not take into account the financial decision about relative proportions of debt and equity, because this decision affects the issue of trade-off between financial risk and capital cost and not the overall viability of the project. The significance of looking at the project from this perspective is that it helps a banker to make sure if the project is capable of generating enough cash from its operation to repay its loans in full and in a timely manner before approving any loan to be disbursed to the project. It also concludes if these financial receipts provide a sufficient return to cover the investment and operation expenditures of the project.

Loan Life Coverage Ratio (LLCR) and Annual Debt Service Coverage Ratio (ADSCR) are calculated from the real cash flow of total investment point of view

[3] Jenkins, G, P., Integration Investment Appraisal, (Queens University 2002)

and are applied as a criterion to see if the project is capable of generating sufficient cash to service its debt. These ratios are computed only for the periods in which loan repayments are made.

Annual debt service coverage ratio (ADSCR) is described as net cash flow after tax divided by principal and interest together. See equation (1). It shows if the project is able to service its debt from its yearly cash flows. The evaluation criteria for ADSCR states that if ADSCR ratio is negative then the project has a negative cash flow in a specific year and the inflows are not even adequate to cover all the cash expenses. A positive ADSCR less than unity imply the project capability in covering its outlays, but there is not sufficient cash to pay off the debt in full to the bank. A ratio of one indicates that the project is just breaking even in terms of covering its operating costs and is able to service its debt obligations, but there is no cash available to offer a return to equity holders. Finally, a ratio well above one means that there is sufficient cash produced by the project to repay both expenses and debt obligations and also leave some profit to the equity holder(s).

$$ADSCR_t = \frac{\text{Annual Net Cash Flow in Year t}}{\text{Annual Debt Repayment in Year t}} \quad (1)$$

Loan Life Coverage Ratio (LLCR) is defined as the present value of net cash flows after tax during loan repayments period over the present value of interest and principal repayments during loan repayment period. See equation (2). It tells the banker if there is enough cash to cover bridge financing even when some years have inadequate cash flows to serve the debt. Whilst Annual Debt Service Coverage Ratio monitors the project strength on a year-to-year base, the LLCR ratio advances the mission, which is analyzing the project's ability to pay back debt duties from a broader angle and considers both remaining net cash flow and remaining debt repayment, not only for a single year. The LLCR ratio is useful when the annual

capacity of servicing the debt is in question and helps to find out the ways to attain adequate financial supplies such as sinking fund and bridge financing throughout problematic financial periods. A sinking fund is a fund established upon the requirements of the lenders to hold cash that can be used towards debt servicing, this fund restricts the payment of dividends and normally includes between 12 and 18 months of debt service. Cash can be withdrawn from the escrow fund if the project's cash flow from operations does not cover the project's debt service requirements. Bridge financing is a short-term loan to be used for the years when the project is short in cash and usually has high interest. Typically, a LLCR ratio of 1.5 to 2.0 indicates a proper handling of the debt duties by the project and ratios less than that signify a poor financial design and/or a bad business. In other words, such ratios occur to be quite subjective and vary on the individual risk preferences and industry standards on what is really an acceptable ratio. Banks usually have their own minimum of adequate ratios for different industries and project extents. In case of a low LLCR, reorganizing the terms of the loan will cause the ratios to improve and as a result of that the project will look better to the banker. This can be obtained through:

- Decreasing the interest rate on the loan,
- Decreasing the amount of borrowing and
- Increasing the duration of loan repayment

$$LLCR_{YearT}=\frac{\text{Present Value of Annual Net Cash Flows}^{Real}{}_{YearT}}{\text{Present Value of Annual Debt Repayment}^{Real}{}_{YearT}} \quad (2)$$

The next logical step of the evaluation is to perceive the project from the equity (owner's) point of view that is related to the project owner(s). This perspective is clearly different from banker's point of view by involvement of loan and parallel external sources of finance as well as grant receipts. The cash flow statement from

owner's perspective involves the loan receipts as inflow and all consequent repayment of the interest and loan as outflow. The idea is to evaluate the financial performance of the project so that the owner could decide if the business net cash flow makes him better off or not. Subsequently, the sponsor (owner) of the project receives the net cash flows following repaying all other involved parties. It is more efficient to mention that all other cash flow statement items for owner and banker's point of view follow the same fashion.

There are some evaluation criteria to assess the financial viability of a project but Net Present Value (NPV) is the most efficient criteria. From the net cash flow obtained, NPV is calculated. Jenkins et al. (2004) states that NPV is an algebraic sum of the present values of the incremental expected positive and negative net cash flows over a project's anticipated lifetime. See equation (3). (p.8)

$$NPV_{Year0}=\sum_{t=0}^{n}\frac{\text{Net Cash Flow}}{(1+r)^{t}} \quad (3)$$

Where "r" is the discount rate or the rate of return that project owners are willing to accept for investing their money in the given project that in our case is 15%. The NPV helps to decide if the project is acceptable from the owner's perspective or not, because it is the indicator of whether this project eventually adds to the value of firm or not. If the discounted value of net cash flows is greater than zero (NPV>0), then the project is commercially viable and should be accepted from the owner's point of view. If (NPV=0), then this means that the project just breaks even and neither makes profit nor lose. Otherwise in case of a negative value (NPV<0) investors will receive less than their required rate of return and as a result of that the project should not be undertaken, as the owner will be likely to lose money in this business under the given conditions.

Furthermore, in the cash flow statement from the owner point of view, Internal Rate of Return (IRR) is also considered as another criteria in deciding whether the project is viable or not. However, this measure is not a reliable project evaluation criterion as there are a number of reasons stating that IRR should not serve as a project evaluation criterion, which are as follows:

- Multiple rates of return for project,
- Projects of different sizes and also mutually exclusive,
- Projects of different lengths of life and mutually exclusive,
- The same project but started at different times.
- IRR is the result of a mathematical equation but in the determination of relevant discount rate, decision makers try to account for present and future trends in capital market and other macroeconomic indicators.

The IRR, Equation (4) is the discount rate that sets the NPV=0 (Jenkins et al.2004).

$$\text{IRR: } \sum_{t=0}^{n} \frac{\text{Net Cash Flow}}{(1+k)t} = 0 \qquad (4)$$

We should solve the equation for k, which is IRR. The project should be accepted if (k > r), and rejected if (k < r). It is significant to be mentioned that r stands for required rate of return.

In Chapter 2 of the study a detailed description of the model assumptions and parameter from which the base case financial model for the Zoom Mobile Network (ZMN) project has been developed is presented.

4.2 Results of Financial Analysis

4.2.1 Total Investment (Banker's) Point of View

The nominal cash flow statement from the investment perspective includes all the receipts that generate inflows into a project and all the expenditures that constitute

the project's outflows. The project's annual net cash flows before financing is calculated through the difference between the project's inflows and outflows that is the base for assessing the capability of the project to pay off the debt for its external financing or loan. In order to have real cash flow statement from investment perspective that is also helpful in evaluating the project capability to service its debts, the nominal cash flow statement is divided by the inflation index.

The inflows of the ZMN project includes revenues from the connection fee and monthly subscription fee from post-paid users; revenue from local call; revenue from international call; revenue from local SMS; revenue from international SMS; changes in accounts receivable from telephone; changes in accounts receivable from SMS; residual values exclusive of land and residual value of land. Table 3 and Table 5 present nominal and real cash flow statement from total investment point of view for Zoom Mobile Network (ZMN) correspondingly.

Whilst evaluating the total investment perspective, it is not needed to calculate NPV and IRR, because the key goal of this point of view is assessing the project bankability. Therefore, the outcomes of total investment point of view can be seen from the debt service ratios (ADSCR and LLCR) that assist to be the main criteria in the appraisal of the project's capability to reimburse its debt.

Table 3: Nominal Project Financial Net Benefit Statement (Investment Points of View, in million THBs.) - Part I

	2000	2001	2002	2003	2004	2005	2006	2007	2008
INFLOWS									
Revenue									
Connection Fee			337	31	32	33	33	34	34
Monthly Subscription Fee from Post-Paid Users			404	465	531	603	679	760	847
Revenue from Local Call			6,299	6,498	6,654	6,769	6,843	6,877	6,875
Revenue from International Call			2,756	2,898	3,021	3,122	3,202	3,260	3,297
Revenue from Local SMS			197	226	259	293	330	370	412
Revenue from International SMS			148	170	194	220	248	278	309
Total Revenue			**10,141.4**	**10,288.3**	**10,690.5**	**11,039.2**	**11,334.9**	**11,578.9**	**11,773.2**
Changes in Accounts Receivable From Telephone			(189)	(7)	(6)	(4)	(3)	(2)	(1)
Changes in Accounts Receivable From SMS			(7)	(1)	(1)	(1)	(1)	(1)	(2)
Residual Values exclusive of Land									
Residual Value of Land									
TOTAL INFLOWS			**9,946**	**10,280**	**10,683**	**11,033**	**11,330**	**11,576**	**11,771**
OUTFLOWS									
Investments									
Capital Expenditure	3,790	6,027	-	-	-	-	-	-	-
Investment in Capital Expenditure	-	-	-	-	-	2,113	-	-	5,034
Consultant Fee	20.50								
Building	6.15								
License Fee	1.23								
Land for office premises	4.10								
Operating and maintenance									

Operational Expenditures			1,139.24	1,207.60	1,280.05	1,583.00	1,677.98	1,778.66	2,424.06
Land Lease during the project period of cell site			14.43	15.29	16.21	20.05	21.25	22.52	30.70
Frequency Management Fee			9.86	10.45	11.08	11.74	12.45	13.19	13.98
Numbering Fee			17.31	19.92	22.75	25.79	29.06	32.54	36.24
Labor Expenses									
Skilled Labor			1,812.14	2,085.01	2,380.95	2,699.95	3,041.86	3,406.34	3,792.87
Semi/Unskilled Labor			194.16	223.39	255.10	289.28	325.91	364.96	406.38
Income tax			1,543.16	1,219.38	1,228.05	1,191.83	1,051.73	990.59	854.22
Payment to State-Owned Operator			284.34	288.46	299.73	309.51	317.80	324.64	330.09
Change in accts. Payable			(98.40)	(6.03)	(6.40)	(25.87)	(8.35)	(8.85)	(54.84)
Change in cash balance			265.60	31.21	33.71	55.31	39.89	42.48	90.50
VAT Refunds	(248)	(394)	586	591	612	477	628	637	277
TOTAL OUTFLOWS	**3,574**	**5,632**	**5,768**	**5,686**	**6,134**	**8,751**	**7,137**	**7,604**	**13,236**
NET CASHFLOWS	**(3,574)**	**(5,632)**	**4,178**	**4,594**	**4,550**	**2,283**	**4,193**	**3,972**	**(1,465)**

Table 4: Nominal Project Financial Net Benefit Statement (Investment Points of View, in million THBs.) - Part II

	2009	2010	2011	2012	2013	2014	2015	2016	2017
INFLOWS									
Revenue									
Connection Fee	34	33	32	30	27	24	21	16	-
Monthly Subscription Fee from Post-Paid Users	938	1,033	1,133	1,237	1,344	1,454	1,566	1,679	-
Revenue from Local Call	6,837	6,766	6,665	6,536	6,381	6,204	6,006	5,790	-
Revenue from International Call	3,314	3,311	3,290	3,252	3,198	3,129	3,047	2,952	-
Revenue from Local SMS	456	503	551	602	654	707	762	817	-
Revenue from International SMS	342	377	414	451	490	531	571	613	-
Total Revenue	**11,920.4**	**12,023.3**	**12,084.7**	**12,107.6**	**12,094.9**	**12,049.1**	**11,972.5**	**11,866.6**	**-**
Changes in Accounts Receivable From Telephone	-	2	3	3	4	5	6	6	182
Changes in Accounts Receivable From SMS	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	30
Residual Values exclusive of Land									16443.97
Residual Value of Land									11.04
TOTAL INFLOWS	**11,919**	**12,023**	**12,085**	**12,109**	**12,097**	**12,052**	**11,976**	**11,871**	**16,667**
OUTFLOWS									
Investments									
Capital Expenditure	-	-	-	-	-	-	-	-	-
Investment in Capital Expenditure	-	-	5,996	-	-	7,141	-	-	-
Consultant Fee									
Building									

License Fee									
Land for office premises									
Operating and maintenance									
Operational Expenditures	2,569.50	2,723.67	3,528.67	3,740.39	3,964.81	4,966.83	5,264.84	5,580.73	-
Land Lease during the project period of cell site	32.54	34.49	44.69	47.37	50.21	62.90	66.67	70.67	-
Frequency Management Fee	14.82	15.71	16.66	17.66	18.71	19.84	21.03	22.29	-
Numbering Fee	40.13	44.22	48.49	52.93	57.51	62.22	67.01	71.86	-
Labor Expenses									
Skilled Labor	4,200.70	4,628.82	5,075.94	5,540.38	6,020.05	6,512.36	7,014.11	7,521.39	-
Semi/Unskilled Labor	450.07	495.95	543.85	593.61	645.01	697.75	751.51	805.86	-
Income tax	502.66	371.37	157.09	0.00	0.00	0.00	0.00	0.00	-
Payment to State-Owned Operator	334.22	337.10	338.82	339.47	339.11	337.83	335.68	332.71	-
Change in accts. Payable	(12.67)	(13.43)	(68.37)	(18.32)	(19.41)	(85.04)	(25.65)	(27.17)	478.80
Change in cash balance	50.30	52.93	109.62	61.17	63.66	130.47	71.94	73.97	(1,172.73)
VAT Refunds	606	602	160	540	524	(13)	429	400	0
TOTAL OUTFLOWS	**8,788**	**9,293**	**15,952**	**10,914**	**11,663**	**19,833**	**13,996**	**14,853**	**(694)**
NET CASHFLOWS	**3,131**	**2,730**	**(3,866)**	**1,195**	**434**	**(7,781)**	**(2,020)**	**(2,982)**	**17,361**

Table 5: Real Projected Financial Net Benefit Statement (Investment Points of View, in million THBs.) - Part I

	2000	2001	2002	2003	2004	2005	2006	2007	2008
INFLOWS									
Revenue									
Connection Fee			300	26	25	24	24	23	21
Monthly Subscription Fee from Post-Paid Users			360	391	421	450	479	506	531
Revenue from Local Call			5,606	5,456	5,271	5,058	4,824	4,574	4,313
Revenue from International Call			2,453	2,433	2,393	2,333	2,257	2,168	2,069
Revenue from Local SMS			175	190	205	219	233	246	259
Revenue from International SMS			131	143	154	164	175	185	194
Total Revenue			9,026	8,638	8,468	8,249	7,991	7,701	7,387
Changes in Accounts Receivable From Telephone			(168)	(6)	(5)	(3)	(2)	(1)	-
Changes in Accounts Receivable From SMS			(6)	(1)	(1)	(1)	(1)	(1)	(1)
Residual Values exclusive of Land									
Residual Value of Land									
TOTAL INFLOWS			**8,852**	**8,631**	**8,462**	**8,245**	**7,987**	**7,698**	**7,385**
OUTFLOWS									
Investments									
Capital Expenditure	3,790	5,686	-	-	-	-	-	-	-
Investment in Capital Expenditure	-	-	-	-	-	1,579	-	-	3,159
Consultant Fee	21								
Building	6								
License Fee	1								

Land for office premises	4								
Operating and maintenance									
Operational Expenditures			1,014	1,014	1,014	1,183	1,183	1,183	1,521
Land Lease during the project period of cell site			13	13	13	15	15	15	19
Frequency Management Fee			9	9	9	9	9	9	9
Numbering Fee			15	17	18	19	20	22	23
Labor Expenses									
Skilled Labor			1,613	1,751	1,886	2,018	2,144	2,265	2,380
Semi/Unskilled Labor			173	188	202	216	230	243	255
Income tax			1,373	1,024	973	891	741	659	536
Payment to State-Owned Operator			253	242	237	231	224	216	207
Change in accts. Payable			(88)	(5)	(5)	(19)	(6)	(6)	(34)
Change in cash balance			236	26	27	41	28	28	57
VAT Refunds	(248)	(372)	522	496	485	356	442	423	174
TOTAL OUTFLOWS	**3,574**	**5,314**	**5,134**	**4,774**	**4,858**	**6,539**	**5,031**	**5,057**	**8,304**
NET CASHFLOWS	**(3,574)**	**(5,314)**	**3,718**	**3,858**	**3,604**	**1,706**	**2,956**	**2,641**	**(919)**

Table 6: Real Projected Financial Net Benefit Statement (Investment Points of View, in million THBs.) - Part II

	2009	2010	2011	2012	2013	2014	2015	2016	2017
INFLOWS									
Revenue									
Connection Fee	20	18	17	15	13	11	9	6	-
Monthly Subscription Fee from Post-Paid Users	555	577	597	615	630	643	653	661	-
Revenue from Local Call	4,047	3,778	3,511	3,248	2,992	2,744	2,506	2,279	-
Revenue from International Call	1,962	1,849	1,733	1,616	1,499	1,384	1,271	1,162	-
Revenue from Local SMS	270	281	290	299	307	313	318	322	-
Revenue from International SMS	203	211	218	224	230	235	238	241	-
Total Revenue	7,056	6,714	6,366	6,017	5,671	5,329	4,996	4,671	-
Changes in Accounts Receivable From Telephone	-	1	1	2	2	2	2	3	68
Changes in Accounts Receivable From SMS	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	11
Residual Values exclusive of Land									6,107
Residual Value of Land									4
TOTAL INFLOWS	**7,055**	**6,714**	**6,366**	**6,018**	**5,672**	**5,331**	**4,997**	**4,673**	**6,189**
OUTFLOWS									
Investments									
Capital Expenditure	-	-	-	-	-	-	-		
Investment in Capital Expenditure	-	-	3,159	-	-	3,159	-		
Consultant Fee									
Building									
License Fee									

Land for office premises									
Operating and maintenance									
Operational Expenditures	1,521	1,521	1,859	1,859	1,859	2,197	2,197	2,197	-
Land Lease during the project period of cell site	19	19	24	24	24	28	28	28	-
Frequency Management Fee	9	9	9	9	9	9	9	9	-
Numbering Fee	24	25	26	26	27	28	28	28	-
Labor Expenses									
Skilled Labor	2,486	2,585	2,674	2,753	2,822	2,880	2,927	2,961	-
Semi/Unskilled Labor	266	277	286	295	302	309	314	317	-
Income tax	298	207	83	-	-	-	-	-	-
Payment to State-Owned Operator	198	188	178	169	159	149	140	131	-
Change in accts. payable	(7)	(7)	(36)	(9)	(9)	(38)	(11)	(11)	178
Change in cash balance	30	30	58	30	30	58	30	29	(436)
VAT Refunds	359	336	84	268	245	(6)	179	158	-
TOTAL OUTFLOWS	**5,202**	**5,189**	**8,403**	**5,424**	**5,468**	**8,772**	**5,840**	**5,847**	**(258)**
NET CASHFLOWS	**1,853**	**1,524**	**(2,037)**	**594**	**204**	**(3,441)**	**(843)**	**(1,174)**	**6,447**

4.2.1.1 Debt Service Ratios

As explained in section 4.1 of this chapter, two important ratios (ADSCR and LLCR) are calculated so that evaluating the capability of the project in paying off its debt. Typically, the calculations of debt service ratios are done following the real projections from the banker's point of view. From the financial analysis the outcomes given in the table below are obtained:

Table 7: ADSCR Results Obtained from Financial Analysis

Year	Net Cash Flow (Real)	Annual Repayment (Real)	ADSCR
2003	3,858	1,437	**2.69**
2004	3,604	1,324	**2.72**
2005	1,706	1,217	**1.4**
2006	2,956	1,115	**2.65**
2007	2,641	1,018	**2.59**
2008	-919	926	**-0.99**
2009	1,853	838	**2.21**
2010	1,524	755	**2.02**
2011	-2,037	676	**-3.01**
2012	594	600	**0.99**

As it can be observed from the table above and also according to what is discussed regarding ADSCR ratio's interpretation in section 4.1 of this study, the ZMN has a quite large ADSCR ratio throughout most of the years of the life of the project, which implies that there is sufficient cash produced by the project to repay both expenses and debt obligations and also leave some surplus to the equity holder(s), the exception is in years 2008 and 2011 when it decreases considerably to negative values of -0.99 and -3.01 respectively. This is due to the construction of 200 cell sites in these years and as a result of that the project has a negative cash flow and the inflows are not even enough to cover all the cash outlays. ADSCR ratio also shows a value of 0.99 in year 2012, which can be interpreted as a ratio of almost

unity that concludes the project is just breaking even in terms of covering its expenses and repaying the debt obligations, but there is no cash available to provide a return to equity.

To sum up, as an overall trend the ADSCR ratios imply that there is sufficient cash produced by the project to repay both expenses and debt obligations and also leave some profit to the equity holder(s). However, for years 2008 and 2011 in which ADSCR ratios have negative values it is necessary to determine whether to fund a debt service reserve account to cover the debt service obligations in these years.

As discussed in section 4.1 of this chapter, Loan Life Coverage Ratio (LLCR) would be the next debt service ratio. From the financial analysis the results given in the next page table are obtained:

Table 8: LLCR Results Obtained from Financial Analysis

Year	PV of Net Cash Flows (Real)	PV of Annual Repayment (Real)	LLCR
2003	13,810	7,834	**1.76**
2004	10,650	6,845	**1.56**
2005	7,539	5,908	**1.28**
2006	6,241	5,019	**1.24**
2007	3,515	4,176	**0.84**
2008	935	3,379	**0.28**
2009	1,984	2,624	**0.76**
2010	140	1,911	**0.07**
2011	-1,482	1,237	**-1.2**
2012	594	600	**0.99**

As it can be observed from the table above and also according to what is discussed regarding LLCR ratio's interpretation in section 4.1 of this study, the ZMN has a quite low LLCR ratios (LLCR was calculated by a discount rate of 7%, which is the real interest rate) starting from year 2005 till last year of debt repayment, which is 2012.This means that project is unlikely to have adequate cash flows to repay any bridge financing undertaken to cover the possible shortages throughout

these years. This is a good reason for the banks to not deliver bridge financing for the project throughout these years. Consequently the project may be asked to make up a sinking fund for these 8 years to cover the shortages. It should be mentioned that the project will not face any problem in years 2003 and 2004 for its debt repayment, as LLCR ratios for these years are 1.76 and 1.56 respectively, which appear to be acceptable as they are both greater than 1.5.

4.2.2 Total Owner's Perspective

According to what is reviewed over in section 4.1 regarding equity (owner's) perspective, NPV, IRR and their interpretation and also according to the results of the financial cash flow statement from owner's point of view shown in Table 9, the Net Present Value (NPV) shows a positive amount of 4,505 million THBs that implies the ZMN will cover all its costs and in addition, the owner has earned more than a 15% real return on his equity. Besides, since one of the pitfalls of IRR as a project evaluation criterion is having multiple values for a single cash flow profile with several negative flows throughout the project life cycle and having an inappropriate IRR with respect to cash flow performance of the project, MIRR (Modified Internal Rate of Return) seems to be a proper solution for this problem. Using a discount rate equal to required rate of return on equity of 15% for positive flows and real interest rate of 7% for discounting negative parts of cash flow profile the resulting MIRR calculated is 16.75% instead of 91.37%, which is extremely high with respect to cash flow performance of the project. Therefore, IRR is 16.75%, which is greater than 15% that is the required rate of return.

To conclude, these ratios both indicate that the project is financially viable and should be accepted (undertaken) from the owner's point of view.

Table 9: Real Projected Financial Net Benefit Statement (Equity Points of View, in million THBs.) - Part I

	2000	2001	2002	2003	2004	2005	2006	2007	2008
INFLOWS									
Revenue									
Connection Fee			300	26	25	24	24	23	21
Monthly Subscription Fee from Post-Paid Users			360	391	421	450	479	506	531
Revenue from Local Call			5,606	5,456	5,271	5,058	4,824	4,574	4,313
Revenue from International Call			2,453	2,433	2,393	2,333	2,257	2,168	2,069
Revenue from Local SMS			175	190	205	219	233	246	259
Revenue from International SMS			131	143	154	164	175	185	194
Total Revenue			**9,026**	**8,638**	**8,468**	**8,249**	**7,991**	**7,701**	**7,387**
Changes in Accounts Receivable From Telephone			(168)	(6)	(5)	(3)	(2)	(1)	-
Changes in Accounts Receivable From SMS			(6)	(1)	(1)	(1)	(1)	(1)	(1)
Residual Values exclusive of Land									
Residual Value of Land									
TOTAL INFLOWS			**8,852**	**8,631**	**8,462**	**8,245**	**7,987**	**7,698**	**7,385**
OUTFLOWS									
Investments									
Capital Expenditure	3,790	5,686	-	-	-	-	-	-	-
Investment in Capital Expenditure	-	-	-	-	-	1,579	-	-	3,159
Consultant Fee	21								
Building	6								
License Fee	1								
Land for office premises	4								

Operating and maintenance									
Operational Expenditures			1,014	1,014	1,014	1,183	1,183	1,183	1,521
Land Lease during the project period of cell site			13	13	13	15	15	15	19
Frequency Management Fee			9	9	9	9	9	9	9
Numbering Fee			15	17	18	19	20	22	23
Labor Expenses									
Skilled Labor			1,613	1,751	1,886	2,018	2,144	2,265	2,380
Semi/Unskilled Labor			173	188	202	216	230	243	255
Income tax			1,373	1,024	973	891	741	659	536
Payment to State-Owned Operator			253	242	237	231	224	216	207
Change in accts. Payable			(88)	(5)	(5)	(19)	(6)	(6)	(34)
Change in cash balance			236	26	27	41	28	28	57
VAT Refunds	(248)	(372)	522	496	485	356	442	423	174
TOTAL OUTFLOWS	**3,574**	**5,314**	**5,134**	**4,774**	**4,858**	**6,539**	**5,031**	**5,057**	**8,304**
NET BENEFIT FLOWS	**(3,574)**	**(5,314)**	**3,718**	**3,858**	**3,604**	**1,706**	**2,956**	**2,641**	**(919)**
Project Financing									
Loan Disbursement	2,676	3,980							
Loan Repayment				1,437	1,324	1,217	1,115	1,018	926
Net Cash flow after Financing	**(899)**	**(1,334)**	**3,718**	**2,421**	**2,280**	**488**	**1,840**	**1,623**	**(1,845)**
NPV @ 15%	**4,505**								
IRR	**16.75%**								

Table 10: Real Projected Financial Net Benefit Statement (Equity Points of View, in million THBs.) - Part I

	2009	2010	2011	2012	2013	2014	2015	2016	2017
INFLOWS									
Revenue									
Connection Fee	20	18	17	15	13	11	9	6	
Monthly Subscription Fee from Post-Paid Users	555	577	597	615	630	643	653	661	
Revenue from Local Call	4,047	3,778	3,511	3,248	2,992	2,744	2,506	2,279	
Revenue from International Call	1,962	1,849	1,733	1,616	1,499	1,384	1,271	1,162	
Revenue from Local SMS	270	281	290	299	307	313	318	322	
Revenue from International SMS	203	211	218	224	230	235	238	241	
Total Revenue	**7,056**	**6,714**	**6,366**	**6,017**	**5,671**	**5,329**	**4,996**	**4,671**	
Changes in Accounts Receivable From Telephone	-	1	1	2	2	2	2	3	68
Changes in Accounts Receivable From SMS	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	11
Residual Values exclusive of Land									6,107
Residual Value of Land									4
TOTAL INFLOWS	**7,055**	**6,714**	**6,366**	**6,018**	**5,672**	**5,331**	**4,997**	**4,673**	**6,189**
OUTFLOWS									
Investments									
Capital Expenditure	-	-	-	-	-	-	-	-	-
Investment in Capital Expenditure	-	-	3,159	-	-	3,159	-	-	-

Consultant Fee									
Building									
License Fee									
Land for office premises									
Operating and maintenance									
Operational Expenditures	1,521	1,521	1,859	1,859	1,859	2,197	2,197	2,197	-
Land Lease during the project period of cell site	19	19	24	24	24	28	28	28	-
Frequency Management Fee	9	9	9	9	9	9	9	9	-
Numbering Fee	24	25	26	26	27	28	28	28	-
Labor Expenses									
Skilled Labor	2,486	2,585	2,674	2,753	2,822	2,880	2,927	2,961	-
Semi/Unskilled Labor	266	277	286	295	302	309	314	317	-
Income tax	298	207	83	-	-	-	-	-	-
Payment to State-Owned Operator	198	188	178	169	159	149	140	131	-
Change in accts. Payable	(7)	(7)	(36)	(9)	(9)	(38)	(11)	(11)	178
Change in cash balance	30	30	58	30	30	58	30	29	(436)
VAT Refunds	359	336	84	268	245	(6)	179	158	-
TOTAL OUTFLOWS	**5,202**	**5,189**	**8,403**	**5,424**	**5,468**	**8,772**	**5,840**	**5,847**	**(258)**
NET BENEFIT FLOWS	**1,853**	**1,524**	**(2,037)**	**594**	**204**	**(3,441)**	**(843)**	**(1,174)**	**6,447**
Project Financing									
Loan Disbursement									
Loan Repayment	838	755	676	600					
Net Cash flow after Financing	**1,015**	**769**	**(2,712)**	**(7)**	**204**	**(3,441)**	**(843)**	**(1,174)**	**6,447**
NPV @ 15%	**4,505**								
IRR	**16.75%**								

4.2.3 Sensitivity Analysis, Objective and Results

Following the financial analysis of the project, the so called sensitivity or "what if" analysis performs a sensitivity examination on the main outcomes of project as a mean to evaluate reaction of the project's outcomes to changes in the value of only one parameter of the model at a time. The idea is to choose a particular parameter and test the model over a range of the probable values of the selected parameter, so that the model recalculates its final outcomes with each value of the parameter. Sensitivity analysis is an appropriate method to spot the critical project's variables and then realize how to re-configure the arrangement of the project as a mean to make it less vulnerable to potential dangers. In financial sensitivity analysis, the model's results from the owner's perspective and also from banker's viewpoint should be considered. Hence, for all sensitivity experiments made in this project, NPV for owner's point of view, ADSCR ratios for the last four years of loan repayment (2009, 2010, 2011 and 2012), and LLCR for two years of loan repayment (2006 and 2007) are considered. In this regard the parameters tested for the purpose of financial sensitivity analysis are: domestic inflation rate, income growth rate, decrease in market share, decrease in real call rate, local call rate, international call rate, number of labor required per connection, proportion of local telephone call, proportion of pre-paid services and finally investment cost overrun. The corresponding tables including the results of sensitivity analysis and their interpretation are as follows:

- Domestic Inflation Rate

Table 11: Sensitivity Test Results of Domestic Inflation Rate

Domestic Inflation Rate	Financial NPV	ADSCR 2009	ADSCR 2010	ADSCR 2011	ADSCR 2012	LLCR 2006	LLCR 2007
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
1.0%	4804	2.34	2.18	(2.87)	1.02	1.34	0.95
2.0%	4741	2.31	2.14	(2.87)	1.01	1.32	0.93
3.0%	4678	2.28	2.11	(2.91)	1.01	1.30	0.91
4.0%	4617	2.26	2.08	(2.95)	1.00	1.28	0.88
5.0%	4559	2.23	2.05	(2.98)	0.99	1.26	0.86
6.0%	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
7.0%	4453	2.19	1.99	(3.04)	0.98	1.23	0.82
8.0%	4403	2.17	1.97	(3.07)	0.98	1.21	0.81
9.0%	4356	2.15	1.95	(3.10)	0.97	1.20	0.79
10.0%	4311	2.13	1.93	(3.12)	0.96	1.18	0.77
11.0%	4267	2.12	1.91	(3.14)	0.95	1.17	0.76
12.0%	4226	2.10	1.89	(3.16)	0.94	1.15	0.74

The Thailand inflation rate in the base case is 4.6%. However, it is very likely that the actual inflation rate will fluctuate over time. As it can be seen from table above, a sensitivity analysis has been done for this parameter in order to observe the reaction of the project results to dissimilar inflation rates varying from 1% to 12%. The analysis outcomes show that although NPV, ADSCR and LLCR deteriorate as inflation increases the project does not respond significantly to domestic inflation rate. Therefore, domestic inflation rate is not a sensitive parameter as NVP and Debt Service Ratios reaction to inflation changes are minor. Besides it can be concluded that the projects' success does not depend on domestic inflation rate.

- Income Growth Rate

The next parameter to be tested by sensitivity analysis is income growth rate with a value of 3% in the base case. It is possible that the income growth rate deviate from this forecast. This sensitivity test shows the project response to different income growth rates ranging from 1% to 10% in increment of 1%. As the tabulated results of this test show, income growth rate is a highly sensitive parameter due to the

considerable reaction of NPV and Debt Service Ratios to income growth rate deviations. NPV improves by 8,779 million THBs as income growth rate increases from 1% to 10%. LLCR ratios also improve significantly parallel with the increase of income growth rate. Therefore income growth rate is highly sensitive and it can be a candidate for risk analysis.

Table 12: Sensitivity Test Results of Income Growth Rate

	Financial	**ADSCR**				**LLCR**	
Income Growth Rate	**NPV**	**2009**	**2010**	**2011**	**2012**	**2006**	**2007**
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
1.0%	2970	1.66	1.41	(3.84)	(0.01)	0.71	0.25
2.0%	3714	1.92	1.70	(3.39)	0.46	0.97	0.54
3.0%	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
4.0%	5340	2.52	2.37	(2.62)	1.43	1.52	1.15
5.0%	6224	2.86	2.76	(2.19)	1.91	1.83	1.49
6.0%	7173	3.23	3.19	(1.70)	2.45	2.16	1.86
7.0%	8196	3.64	3.67	(1.16)	3.06	2.52	2.26
8.0%	9297	4.07	4.19	(0.55)	3.75	2.90	2.70
9.0%	10476	4.55	4.76	0.13	4.53	3.33	3.18
10.0%	11749	5.06	5.39	0.88	5.41	3.78	3.71

- Decrease in Market Share

Decrease in market share is another parameter affecting the profitability of the ZMN project. It is assumed in the base case that the decrease in market share is 3%. This variable has been tested over the given range of 1% to 10%, in an incremental of 1%. The tabulated results above indicate that the project is highly sensitive to decrease in market share deviations as it alters NPV and also LLCR ratios significantly. As market share decreases NPV deteriorates in a way that it gets even negative as soon as market share decreases to 9%. LLCR ratios follow the same trend. Therefore, the project is highly sensitive to decrease in market share and it is indeed a candidate for risk analysis.

Table 13: Sensitivity Test Results of Decrease in Market Share

Decrease in Market Share	Financial	ADSCR				LLCR	
	NPV	2009	2010	2011	2012	2006	2007
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
1.0%	5909	2.74	2.64	(2.31)	1.80	1.72	1.37
2.0%	5216	2.47	2.33	(2.66)	1.41	1.48	1.11
3.0%	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
4.0%	3772	1.95	1.71	(3.40)	0.42	0.99	0.56
5.0%	3021	1.68	1.40	(3.91)	(0.14)	0.73	0.25
6.0%	2245	1.42	0.96	(4.41)	(0.71)	0.45	(0.07)
7.0%	1442	1.04	0.51	(4.92)	(1.27)	0.15	(0.41)
8.0%	638	0.66	0.07	(5.43)	(1.84)	(0.15)	(0.75)
9.0%	(169)	0.28	(0.38)	(5.93)	(2.40)	(0.44)	(1.09)
10.0%	(1003)	(0.10)	(0.82)	(6.44)	(2.97)	(0.76)	(1.46)

- Decrease in Real Call Rate

Table 14: Sensitivity Test Results of Decrease in Real Call Rate

Decrease in Real Call Rate	Financial	ADSCR				LLCR	
	NPV	2009	2010	2011	2012	2006	2007
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
5.0%	8220	3.56	3.73	(0.88)	3.64	2.48	2.27
6.0%	7515	3.30	3.40	(1.31)	3.11	2.24	1.99
7.0%	6791	3.03	3.05	(1.74)	2.57	1.99	1.71
8.0%	6039	2.76	2.71	(2.17)	2.04	1.74	1.42
9.0%	5279	2.48	2.36	(2.60)	1.52	1.49	1.13
10.0%	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
11.0%	3716	1.94	1.68	(3.47)	0.30	0.98	0.53
12.0%	2930	1.67	1.34	(4.03)	(0.36)	0.70	0.21
13.0%	2146	1.40	0.89	(4.57)	(0.98)	0.42	(0.11)
14.0%	1365	1.04	0.45	(5.08)	(1.57)	0.13	(0.45)
15.0%	611.93	0.68	0.03	(5.56)	(2.11)	(0.15)	(0.77)

The next variable, which a sensitivity test has been done for would be decrease in real call rate. The base case value for decrease in real call rate is assumed to be 10% and it has been tested over the given range of 5% to 15%, which is totally a 10% deviation. Tabulated results below show that when real call rate decreases from 5% to 10%, NPV and also LLCR ratios react noticeably with the same trend. NPV

deteriorates by 612 million THBs, which shows 7608 units of decline. The same trend happens for LLCR ratios and they become weaker as real call rates fall. Hence, decrease in real call rates is another sensitive parameter

- Local Call Rate

Table 15: Sensitivity Test Results of Local Call Rate

	Financial	**ADSCR**				**LLCR**	
Local Call Rate	**NPV**	**2009**	**2010**	**2011**	**2012**	**2006**	**2007**
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
0.00	(11740)	(1.32)	(1.63)	(6.85)	(3.00)	(2.13)	(2.64)
0.50	(9647)	(0.97)	(1.29)	(6.52)	(2.68)	(1.78)	(2.28)
1.00	(7575)	(0.58)	(0.91)	(6.14)	(2.31)	(1.39)	(1.90)
1.50	(5500)	(0.16)	(0.49)	(5.72)	(1.89)	(0.96)	(1.47)
2.00	(3553)	0.30	(0.02)	(5.26)	(1.43)	(0.52)	(1.02)
2.50	(1624)	0.80	0.48	(4.75)	(0.91)	(0.10)	(0.57)
3.00	371	1.35	1.04	(4.19)	(0.34)	0.35	(0.10)
3.50	2410	1.77	1.56	(3.57)	0.29	0.79	0.37
4.00	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
4.50	6658	2.69	2.52	(2.50)	1.55	1.71	1.32
5.00	8890	3.20	3.05	(1.93)	2.14	2.20	1.83
5.50	11203	3.75	3.64	(1.32)	2.78	2.72	2.38
6.00	13621	4.34	4.26	(0.66)	3.48	3.28	2.97
6.50	16128	4.97	4.94	0.06	4.24	3.88	3.60
8.00	24295	7.14	7.29	2.59	6.95	5.92	5.76
9.00	30362	8.83	9.15	4.62	9.14	7.51	7.46
10.00	36981	10.74	11.27	6.96	11.70	9.28	9.37

The local call rate can be also tested on its impact on the ZMN project. As it can be seen from Table 15, local call rate deviations have a significant effect on the ZMN project's NPV and LLCR ratios. In fact, when local call rates rise comparing to its base case value that is 4, NPV and LLCR ratios improve and vice versa. It can be concluded that the parameter deviation affect on the project is quite considerable. Therefore the project is sensitive to local call rates.

- International Call Rate

Table 16: Sensitivity Test Results of International Call Rate

International Call Rate	Financial	ADSCR				LLCR	
	NPV	2009	2010	2011	2012	2006	2007
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
1.00	(1636)	0.80	0.47	(4.77)	(0.95)	(0.10)	(0.58)
3.50	666	1.39	1.07	(4.17)	(0.34)	0.38	(0.07)
4.00	1167	1.49	1.21	(4.02)	(0.19)	0.49	0.05
4.50	1686	1.59	1.37	(3.86)	(0.03)	0.61	0.17
5.00	2216	1.70	1.48	(3.69)	0.15	0.72	0.29
5.50	2763	1.82	1.61	(3.51)	0.34	0.85	0.42
6.00	3329	1.94	1.74	(3.32)	0.54	0.98	0.56
6.50	3907	2.07	1.87	(3.17)	0.76	1.11	0.70
7.00	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
7.50	5117	2.35	2.17	(2.85)	1.19	1.38	0.99
8.00	5748	2.51	2.34	(2.68)	1.37	1.53	1.14
9.00	7063	2.84	2.69	(2.30)	1.78	1.84	1.47
10.00	8461	3.20	3.08	(1.87)	2.23	2.18	1.83
11.00	9944	3.60	3.52	(1.40)	2.75	2.56	2.23
12.00	11527	4.04	4.01	(0.87)	3.33	2.96	2.67
13.00	13199	4.52	4.54	(0.28)	3.97	3.41	3.15
14.00	14972	5.04	5.13	0.38	4.70	3.90	3.68

The international call rate is tested in Table 16, and its base case value is 7THBs. This parameter is assessed in terms of a sensitivity analysis to observe the response of NPV and LLCR ratios by assuming a range of values from 0 to 10 for international call rate. As international call rate increases, NPV of the project rises and the same fashion is followed by LLCR ratios in reflection to the international call rate increment. As this responds are quite significant, we can conclude that the project is also sensitive to the international call rate deviations.

- Number of Labor Required per Connection

The base case value assumed for number of labor required per connection is 0.0040 and the test is done with a range of values ranging from 0.0020 to 0.0100. Sensitivity analysis test results for the parameter show that the parameter has a

reverse relationship with NPV and LLCR ratios and parameter indicates to be highly sensitive as when it increases, NPV and LLCR ratios get weaker and vice versa. The project turns to change from a quite feasible one to a loss case, as NPV turns negative when number of required labors increase by 0.0005 from 0.0055 to 0.0060 that indicates the project is highly sensitive to this parameter. In this regard, maximum possible automation could be considered as a solution.

Table 17: Sensitivity Test Results of Number of Labor Required per Connection

	Financial	**ADSCR**				**LLCR**	
Number of Labor Required per Connection	**NPV**	**2009**	**2010**	**2011**	**2012**	**2006**	**2007**
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
0.0020	9019	3.37	3.36	(1.46)	2.81	2.35	2.04
0.0025	7904	3.08	3.02	(1.85)	2.36	2.07	1.74
0.0030	6789	2.79	2.69	(2.24)	1.91	1.80	1.44
0.0035	5657	2.50	2.35	(2.63)	1.46	1.52	1.14
0.0040	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
0.0045	3326	1.92	1.68	(3.44)	0.35	0.95	0.52
0.0050	2128	1.63	1.34	(3.99)	(0.29)	0.64	0.18
0.0055	902	1.32	0.86	(4.55)	(0.93)	0.32	(0.19)
0.0060	(350)	0.91	0.38	(5.10)	(1.57)	(0.02)	(0.57)
0.0065	(1602)	0.50	(0.09)	(5.65)	(2.21)	(0.36)	(0.95)
0.0070	(2873)	0.08	(0.57)	(6.20)	(2.85)	(0.71)	(1.35)
0.0075	(4157)	(0.33)	(1.05)	(6.75)	(3.48)	(1.07)	(1.75)
0.0080	(5477)	(0.74)	(1.53)	(7.30)	(4.12)	(1.44)	(2.18)
0.0085	(6823)	(1.16)	(2.00)	(7.86)	(4.76)	(1.82)	(2.60)
0.0090	(8181)	(1.57)	(2.48)	(8.41)	(5.40)	(2.22)	(3.03)
0.0095	(9554)	(1.99)	(2.96)	(8.96)	(6.04)	(2.61)	(3.46)
0.0100	(10954)	(2.40)	(3.44)	(9.51)	(6.68)	(3.00)	(3.88)

- Proportion of Local Telephone Call

As tabulated results (Table 18) indicate the project is not sensitive to proportion of local telephone calls. The assumed base case value for this parameter in test is 80% and the test has been done for a range of values from 5% to 95% with an increment of 5%. As it can be perceived for a total range of 90% deviation considered for the proportion of local telephone calls, NPV reacts in such a way that project remains feasible. Debt service ratios follow the same fashion in this regard, i.e. when the

parameter deviates significantly, these ratios do not respond accordingly, which means the project is not sensitive to the parameter.

Table 14: Sensitivity Test Results for Proportion of Telephone Call (Local)

Table 18: Sensitivity Test Results of Proportion of Local Telephone Call

Proportion of Telephone Call (Local)	Financial	ADSCR				LLCR	
	NPV	2009	2010	2011	2012	2006	2007
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
5%	17668	5.19	5.19	0.36	4.61	4.12	3.84
10%	16797	4.99	4.98	0.13	4.37	3.93	3.64
15%	15927	4.79	4.77	(0.09)	4.13	3.74	3.44
20%	15057	4.59	4.55	(0.32)	3.88	3.54	3.24
25%	14185	4.39	4.34	(0.55)	3.64	3.35	3.04
30%	13311	4.19	4.13	(0.77)	3.40	3.16	2.84
35%	12435	3.99	3.91	(1.00)	3.16	2.96	2.64
40%	11557	3.79	3.70	(1.23)	2.92	2.77	2.44
45%	10679	3.60	3.49	(1.45)	2.68	2.58	2.24
50%	9803	3.40	3.28	(1.67)	2.44	2.39	2.04
55%	8927	3.20	3.07	(1.90)	2.20	2.20	1.84
60%	8048	3.00	2.86	(2.12)	1.96	2.01	1.64
65%	7166	2.80	2.65	(2.35)	1.73	1.82	1.44
70%	6285	2.60	2.44	(2.57)	1.49	1.63	1.24
75%	5396	2.41	2.23	(2.79)	1.25	1.44	1.04
80%	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
85%	3605	2.01	1.81	(3.24)	0.65	1.05	0.63
95%	1785	1.62	1.39	(3.84)	(0.02)	0.64	0.20

- Proportion of Pre-paid Services

Proportion of pre-paid services is also one of the parameters to be tested in sensitivity analysis. As it can be perceived, the project is not sensitive to the parameter deviations either. It is assumed that the base case is 75% and a range of values from 10% to 95% with an increment of 5% are assigned to the parameter, which in total is 85% of deviation. Although the test involves a huge range of deviation NPV does not respond accordingly and remains positive, indicating a feasible project throughout the project. The same trend is observed for LLCR ratios except year 2012 for ADSCR and also 2006 and 2007 for LLCR, which state that as

proportion of pre-paid services fall, these ratios in specified years improve. To conclude, the project is not sensitive to the parameter changes although Debt Service Ratios react significantly in some specified years.

Table 19: Sensitivity Test Results of Proportion of Pre-Paid Services

Proportion of Services (Pre-Paid)	Financial	ADSCR				LLCR	
	NPV	2009	2010	2011	2012	2006	2007
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
10%	8357	3.30	3.28	(1.56)	2.71	2.28	1.97
15%	8065	3.22	3.18	(1.67)	2.58	2.20	1.88
20%	7773	3.13	3.09	(1.78)	2.45	2.12	1.80
25%	7481	3.05	2.99	(1.89)	2.32	2.04	1.71
30%	7189	2.96	2.89	(2.00)	2.19	1.96	1.62
35%	6896	2.88	2.79	(2.12)	2.06	1.88	1.54
40%	6604	2.80	2.70	(2.23)	1.93	1.80	1.45
45%	6308	2.71	2.60	(2.34)	1.80	1.72	1.36
50%	6010	2.63	2.50	(2.45)	1.67	1.64	1.28
55%	5713	2.55	2.41	(2.57)	1.54	1.56	1.19
60%	5416	2.46	2.31	(2.68)	1.41	1.48	1.10
65%	5113	2.38	2.21	(2.79)	1.28	1.40	1.02
70%	4810	2.29	2.12	(2.90)	1.15	1.32	0.93
75%	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
80%	4196	2.13	1.92	(3.13)	0.80	1.16	0.75
85%	3887	2.04	1.83	(3.24)	0.62	1.08	0.66
90%	3575	1.96	1.73	(3.37)	0.43	0.99	0.56
95%	3259	1.87	1.63	(3.53)	0.25	0.90	0.46

- Investment Cost Overrun

If there are any cost overruns, the likely consequence by this parameter is to jeopardize the project's performance. For the purpose of the sensitivity analysis a base case of 0% and a range of values from -40% to 45% is assumed for the parameter. It is possible that the project's performance get damaged in case of any increase in cost overrun. However, as the test results indicate, even if there is 40% of cost overrun the project still remains feasible and also as cost overrun falls to -40% NPV improves. LLCR ratios do not get affected in a significant manner as cost overrun increases. To sum up, the project is not sensitive to the deviations in cost overrun.

Table 20: Sensitivity Test Results of Investment Cost Overrun

Investment Cost Overrun	Financial	ADSCR				LLCR	
	NPV	2009	2010	2011	2012	2006	2007
	4505	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
-40%	8843	2.45	2.29	(2.70)	1.46	1.49	1.10
-35%	8303	2.42	2.26	(2.74)	1.41	1.46	1.07
-30%	7761	2.39	2.22	(2.78)	1.35	1.43	1.04
-25%	7218	2.36	2.19	(2.82)	1.29	1.40	1.01
-20%	6676	2.33	2.16	(2.86)	1.24	1.37	0.97
-15%	6134	2.30	2.12	(2.90)	1.18	1.34	0.94
-10%	5592	2.27	2.09	(2.94)	1.13	1.31	0.91
-5%	5050	2.24	2.05	(2.98)	1.07	1.28	0.88
0%	**4505**	**2.21**	**2.02**	**(3.01)**	**0.99**	**1.24**	**0.84**
5%	3960	2.18	1.98	(3.05)	0.91	1.21	0.81
10%	3415	2.15	1.95	(3.09)	0.83	1.18	0.77
15%	2870	2.12	1.92	(3.13)	0.75	1.15	0.74
20%	2324	2.09	1.88	(3.18)	0.67	1.12	0.70
25%	1775	2.06	1.85	(3.25)	0.59	1.08	0.66
30%	1225	2.03	1.81	(3.32)	0.51	1.05	0.62
35%	676	2.00	1.78	(3.39)	0.43	1.01	0.59
40%	126	1.97	1.74	(3.46)	0.35	0.98	0.55
45%	(423)	1.94	1.71	(3.53)	0.27	0.94	0.51

Chapter 5

RISK ANALYSIS

Up to this point, an integrated financial model of the mobile network project has been developed according to the different factor assumptions, and the outcomes are nothing but an exclusive mixture of the suggested factors. The concern here is if the factors applied in the deterministic case, surely stay constant throughout the project's existence. A clear answer to such question is negative as factors will be either more or less than the used values, but not precisely identical as what is really used in the model.

The approach of the sensitivity analysis has some drawbacks such as allocating a probability to the values of the parameters under test in addition to the disability of considering the correlations between the parameters. Sensitivity analysis is not able to test the project in terms of such issues but risk analysis is able to handle these short falls.

Risk analysis of a project is a key section of the integrated project analysis. The risk analysis offers the specialist to perceive what will be the probable impact of the interaction between different parameters influencing the results of the project. A Monte-Carlo risk simulation through the help of specialized software called Crystal Ball is done, so that assessing the sources and nature of the changeability of the resulting selected financial variables. There are some preconditions before running a simulation: some risky variables have to be outlined and allocated a sensible probability distribution for each. Next comes the relationships between the risk

variables that should be identified and finally the targeted output variables (forecasts) have to be chosen. As soon as forecasts are defined the simulation is ready to be run.

5.1 Selection of Risk Variables

Typically, the first stage in preparation of risk analysis is to select the risky parameters of the project, which are chosen from those tested in the sensitivity analysis. However, it should be taken into consideration that all the variables tested in the sensitivity analysis are not worth being involved into the risk analysis. Typically, candidate parameters that can be qualified as a mean of risk analysis have two qualities: the project is sensitive to these parameters and there is large extends of uncertainty over the accurate value of these variables in doubt.

Following studying the deterministic analysis, involving the sensitivity tables, the following 5 parameters have been qualified to be selected as critical risk parameters in the risk analysis:

- Proportion of Telephone Call (Local)
- Decrease in Project Market Share
- Domestic Inflation Rate
- Growth in Real Income
- Decrease in Local and International Telephone Call Rates (Tariffs)

5.2 Probability Distribution Selection

Savvides (1994) sates that "The preparation of a probability distribution for a selected risk variable involves setting up a range of values and allocating probability weights to it". The suitable probability distribution and the likely range of values can be allocated while considering the historical values of the chosen parameter or by taking into account the experts' opinion about it. The type of probability distributions selected for our chosen risk variables are as follows:

- Proportion of Telephone Call (Local):

Proportion of local telephone call is one of the parameters selected to be tested under risk analysis. It is assumed that proportion of local telephone call has a triangular distribution with the minimum of 60% and maximum of 100%.

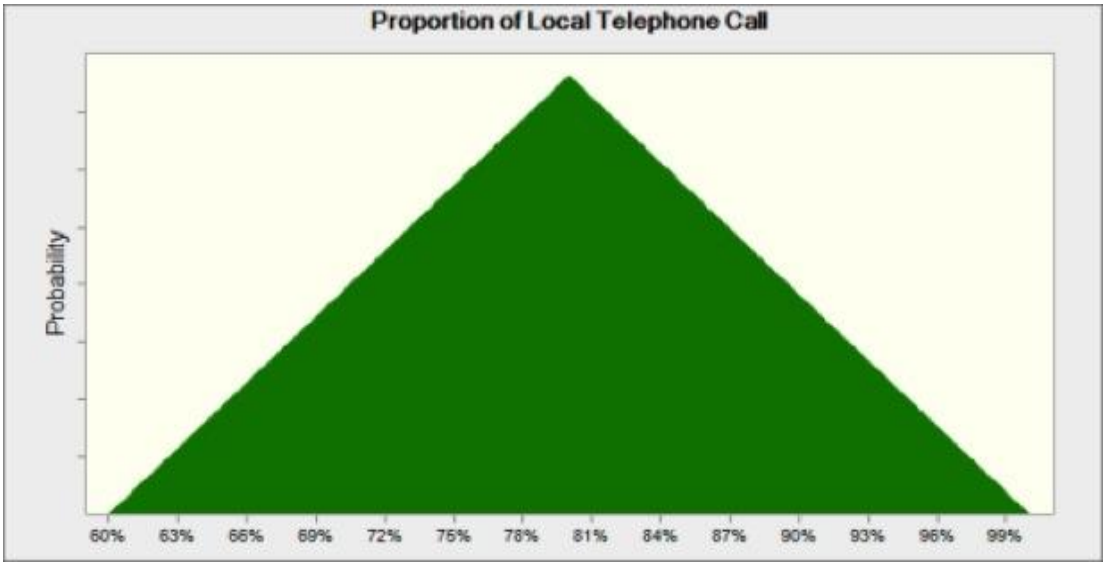

Figure 1: Triangular Distribution for Proportion of Local Telephone Call

- Decrease in Project Market Share:

As it can be observed in sensitivity analysis discussed in chapter 4 of this dissertation, project is highly sensitive to decrease in market share. Therefore, we selected this parameter to be tested under risk analysis. It is assumed that the decrease in market share for local and international services has a normal distribution with a standard deviation of 3%.

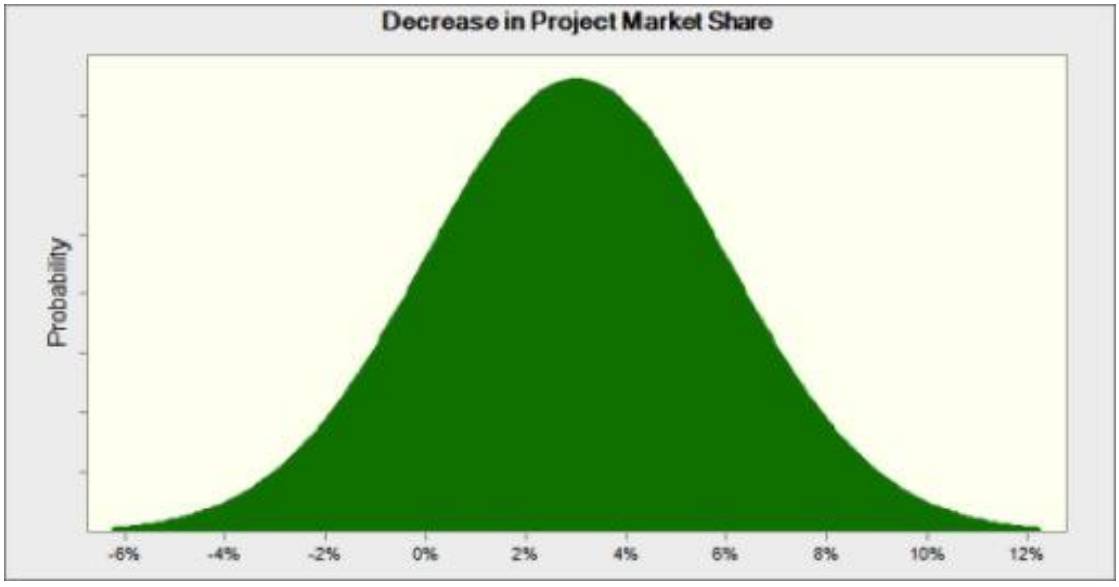

Figure 2: Normal Distribution for Decrease in Project Market Share

- Domestic Inflation Rate:

Forecasting the inflation is a complicated and hard task. It is practically impossible to predict precisely the inflation fluctuation. The annual domestic inflation rate is one of the macro economic variables that are very difficult to forecast due to the complexity of economic, financial and political forces influencing its determination. In this study a custom (step) distribution was assigned to this parameter. This distribution will be based on the inflation of Thailand from 1965 to 2005. Using the parameterization technique, we estimated the custom distribution.

Table 21: Frequencies and Probabilities of Custom Distribution of Domestic Inflation

Range	**Frequency**	**Probability**
-5% - -0.77%	1	3%
-0.77% - 3.54%	11	27%
3.45% - 7.67%	18	45%
7.67% - 11.89%	6	14%
11.89% - 16.11%	2	4%
16.11% - 20.33%	3	7%
Total	**41**	**100%**

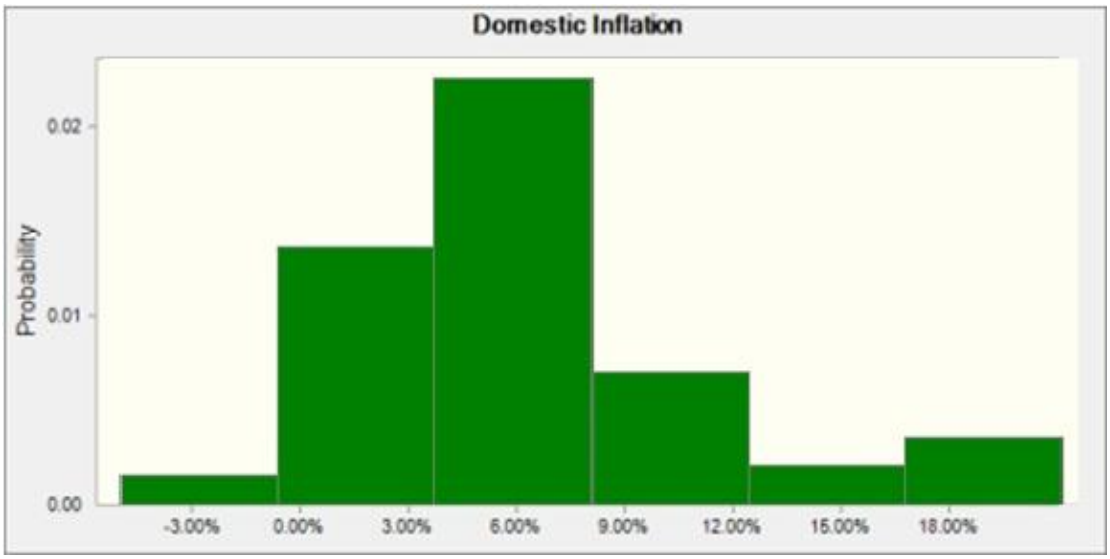

Figure 3: Custom (Step) Distribution for Domestic Inflation

- Growth in Real Income:

As it can be observed in sensitivity analysis of this dissertation, growth in real income is one parameter, which project is highly sensitive to and subsequently it is a candidate for risk analysis. A custom distribution was assigned to this parameter. This distribution will be applied to the annual growth in real income rate during the entire project lifetime, which is from 1965 to 2005. Parameterization technique is the approach through which the custom distribution was estimated.

Table 22: Frequencies and Probabilities of Custom Distribution for Real Income Growth Rate

Range	**Frequency**	**Probability**
-10.51% - -6.54%	10	25%
-6.54% - -2.58%	0	0%
-2.58% - 1.39%	0	0%
1.39% - 5.36%	10	24%
5.36% - 9.32%	14	35%
9.32% - 13.29%	7	16%
Total	**41**	**100%**

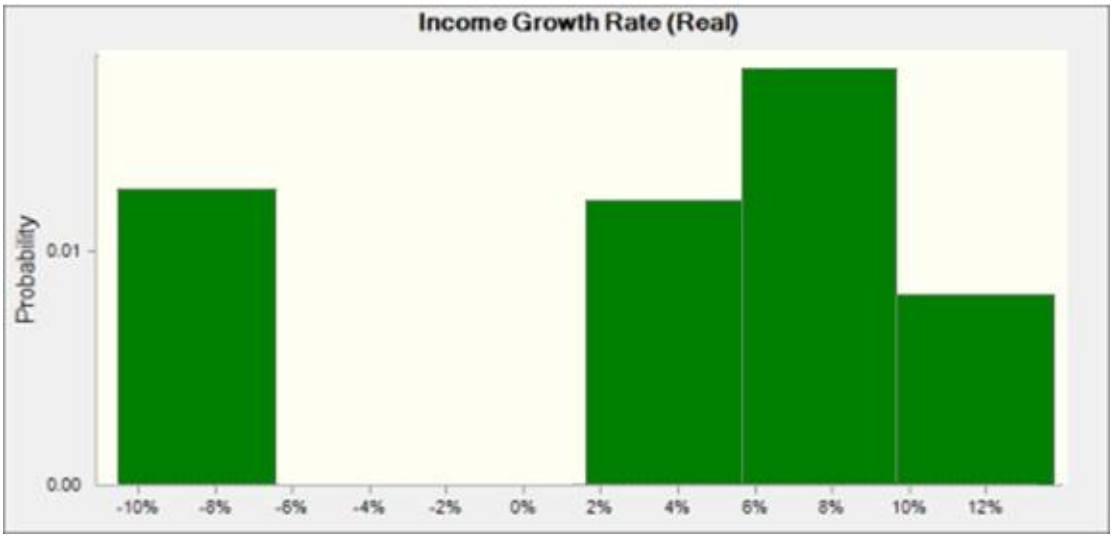

Figure 4: Custom (Step) Distribution for Real Income Growth Rate

- Decrease in Local and International Telephone Call Rates (Tariffs):

Decrease in real call rates is another parameter that the project is sensitive to its deviations and that's why it was selected as one of the risk analysis candidates. It is assumed that telephone tariffs will fall an average by 10% real per year. Using the parameterization, we estimate a custom distribution for decrease in local and international telephone call tariffs.

Table 23: Frequencies and Probabilities of Custom Distribution for Decrease in Local and International Telephone Call Rates

Range	**Frequency**	**Probability**
-24.23% - -19.32%	7	3%
-19.32% - -14.40%	3	27%
-14.40% - -9.49%	3	45%
-9.49% - -4.57%	14	14%
-4.57% - 0.34%	7	4%
0.34 %- 5.26%	1	7%
Total	**35**	**100%**

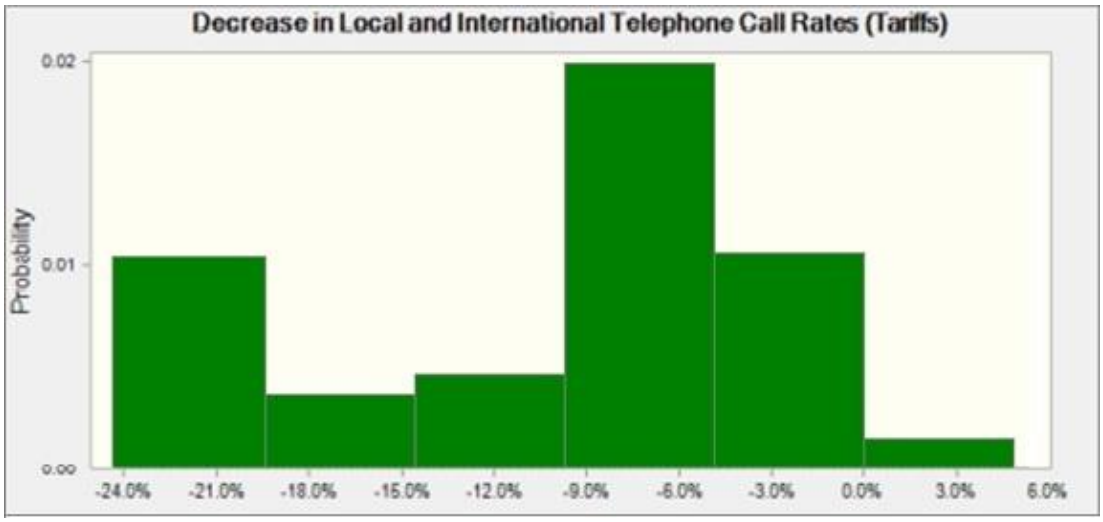

Figure 5: Custom (Step) distribution for Decrease in Local and International Telephone Call Rates (Tariffs)

5.3 Results of Risk Analysis

Once we distinguished and defined the assumptions, which is allocating the probability distributions for each of the uncertain parameters, its time to define the forecast. Defining forecast means choosing a parameter to be tested as a mean to observe its result while considering the assumptions made. In this dissertation the following indicators are risk forecasts monitoring the financial performance of the project during a risk simulation: the project's financial NPV; the ADSCR ratios for years 2009, 2010, 2011 and 2012 and the LLCR ratios for years 2006 and 2007.

A Monte-Carlo simulation was performed using the Crystal Ball^{TM} software with 10,000 runs, each generated a group of the input variables from their allocated probability distributions, and outcomes of the forecasts were recorded. The results of the risk analysis may be explained using some of the simple statistics, which include mean, standard deviation, minimum and maximum values.

The mean of a set of results is the expected value of the parameter, which the risk analysis is done on. If the mean of the computer-generated results is too biased from

the original static value of the parameter, then it implies about a tendency that in fact, the value of the parameter will be lesser or higher than the original value. The standard deviation of a group of outcomes explains the dispersion of the results around the mean (expected value). A high standard deviation indicates that it is more likely for a value of the parameter to be more away from the mean, i.e. result of the project is unclear. The minimum and maximum values state the two very sides, up to where a result of a parameter may touch.

Following defining the forecasts we start the simulation run with 10,000 trials of Monte-Carlo simulation technique using the Crystal Ball™ software and we got the outcome for each defined forecast. The outcomes of the simulation are as follows:

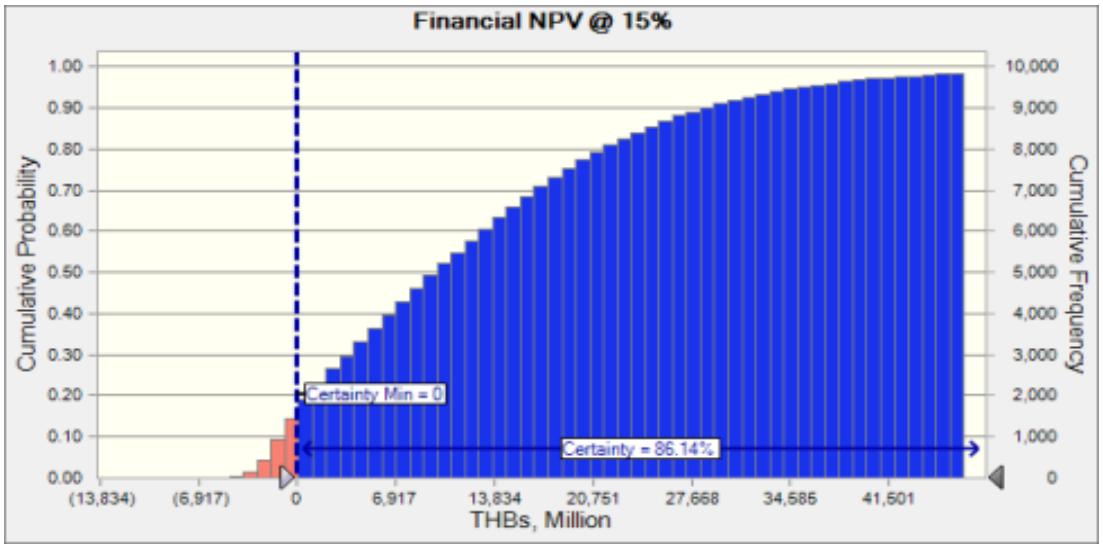

Figure 6: Financial NPV Forecast

After 10,000 trials were performed the results obtained indicate an expected value (mean) of NPV equal to 12,496 million THBs and a standard deviation of 12,225 million THBs. The certainty that the NPV will be between 0 to infinity is 86.14%, which indicates an acceptable investment decision for the owner, as there is roughly 14% chance of project failure, which is quite insignificant. Therefore, this project is beneficial and that the project is safe to be undertaken.

The forthcomings are the ADSCR ratios forecast graphs following approximately alike fashion for the years observed.

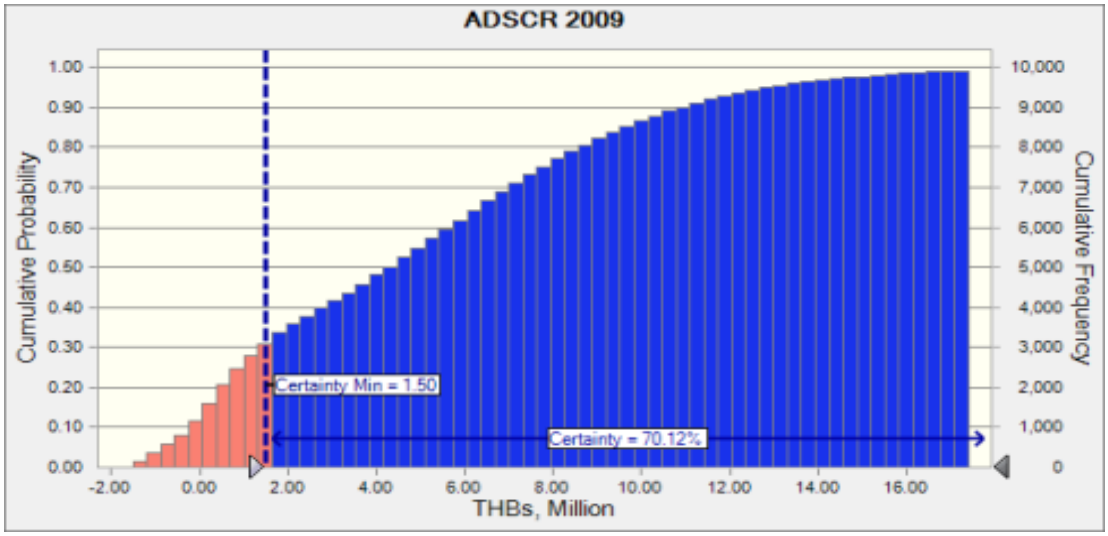

Figure 7: ADSCR Forecast in Year 2009

Table 24: ADSCR Forecast Statistic for Year 2009

Certainty level is	70.12%
Certainty range is	From 1.5 to Infinity
Entire range is	From -1.83 to 26.22
Base case is	2.21
After 10,000 trials, the std. error of the mean is	0.04
Trials	10,000
Mean	4.96
Standard Deviation	4.44

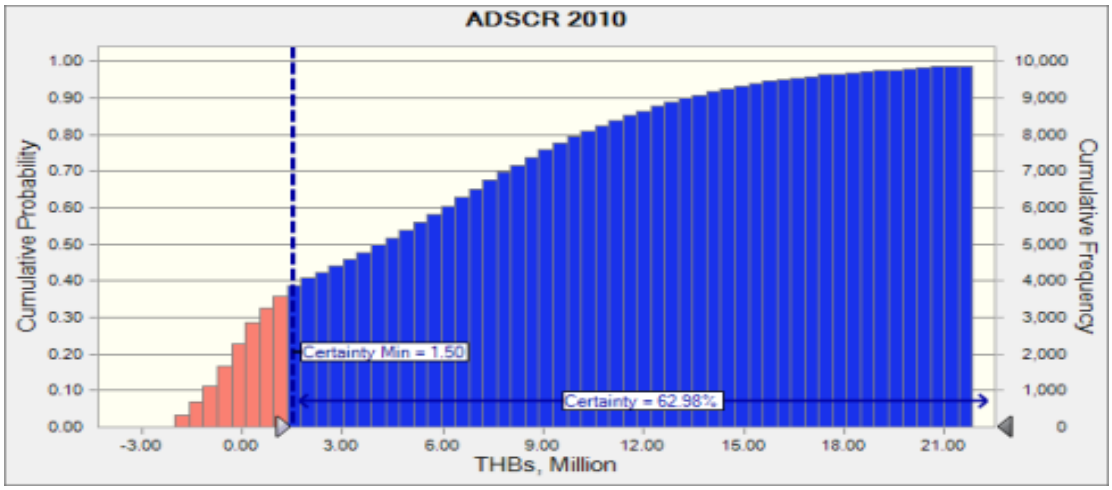

Figure 8: ADSCR Forecast in Year 2010

Table 25: ADSCR Forecast Statistic for Year 2010

Certainty level is	62.98%
Certainty range is	From 1.5 to Infinity
Entire range is	From -3.68 to 35.90
Base case is	2.02
After 10,000 trials, the std. error of the mean is	0.06
Trials	10,000
Mean	5.36
Standard Deviation	5.88

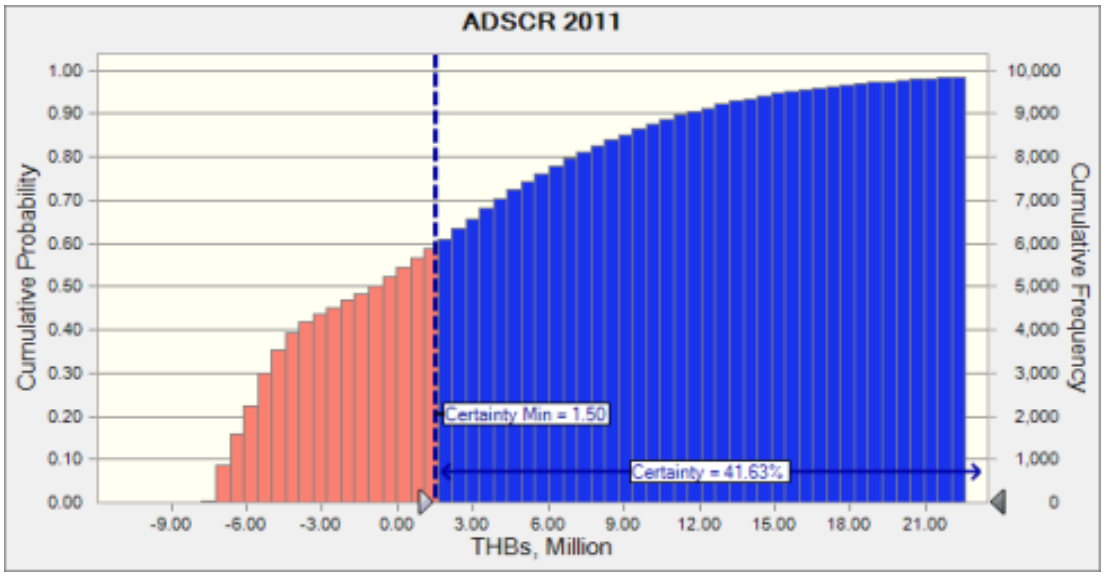

Figure 9: ADSCR Forecast in Year 2011

Table 26: ADSCR Forecast Statistic for Year 2011

Certainty level is	41.63%
Certainty range is	From 1.5 to Infinity
Entire range is	From -11.10 to 44.33
Base case is	-3.01
After 10,000 trials, the std. error of the mean is	0.08
Trials	10,000
Mean	1.08
Standard Deviation	7.67

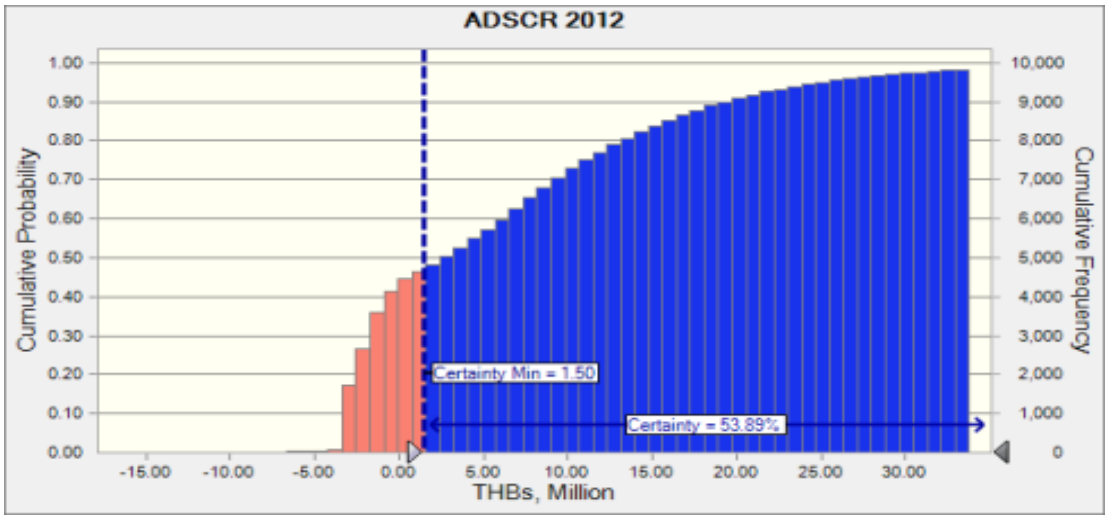

Figure 10: ADSCR Forecast in Year 2012

Table 27: ADSCR Forecast Statistic for Year 2012

Certainty level is	53.89%
Certainty range is	From 1.5 to Infinity
Entire range is	From -16.60 to 66.83
Base case is	0.99
After 10,000 trials, the std. error of the mean is	0.1
Trials	10,000
Mean	6.12
Standard Deviation	9.86

The next graphs are LLCR forecast, which are as follows:

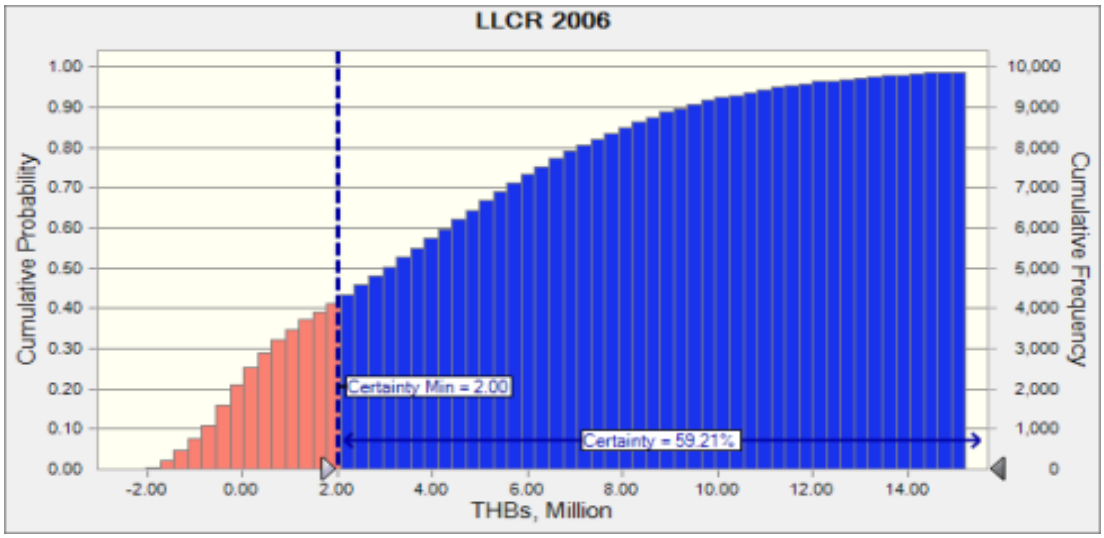

Figure 11: LLCR Forecast in Year 2006

Table 28: LLCR Forecast Statistic for Year 2006

Certainty level is	59.21%
Certainty range is	From 2 to Infinity
Entire range is	From -2.60 to 24.77
Base case is	1.24
After 10,000 trials, the std. error of the mean is	0.04
Trials	10,000
Mean	3.83
Standard Deviation	4.06

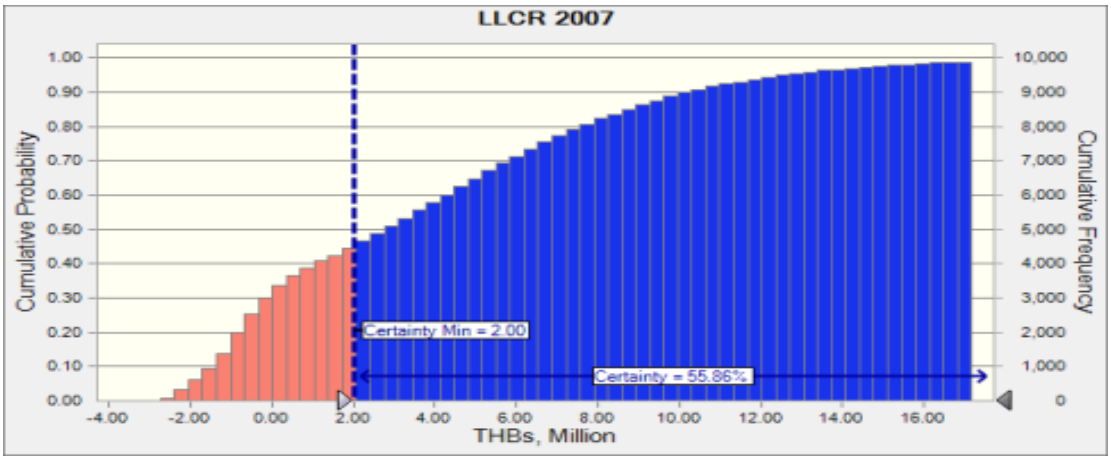

Figure 12: LLCR Forecast in Year 2007

Table 29: LLCR Forecast Statistic for Year 2007

Certainty level is	55.86%
Certainty range is	From 2 to Infinity
Entire range is	From -3.77 to 28.92
Base case is	0.84
After 10,000 trials, the std. error of the mean is	0.05
Trials	10,000
Mean	3.77
Standard Deviation	4.78

Table 30: Selected Parameters' Forecast Statistic

	NPV	$ADSCR_{2009}$	$ADSCR_{2010}$	$ADSCR_{2011}$	$ADSCR_{2012}$	$LLCR_{2006}$	$LLCR_{2007}$
Base Case	4,505	2.21	2.02	-3.01	0.99	1.24	0.84
Mean	12,496	4.96	5.36	1.08	6.12	3.83	3.77
S. Deviation	12,225	4.44	5.88	7.67	9.86	4.06	4.78
Minimum	-12,561	-1.83	-3.68	-11.1	-16.6	-2.66	-3.77
Maximum	84,396	26.22	35.9	44.33	66.83	24.77	28.92
C. Range	0 to ∞	1.5 to ∞	1.5 to ∞	1.5 to ∞	1.5 to ∞	2 to ∞	2 to ∞
Certainty	86.14%	70.12%	62.98%	41.63%	53.89%	59.21%	55.86%

The debt service ratios chosen here signify the behavior of the annual debt service coverage of the project to fulfill its loan obligations in addition to the cumulative strength of the project cash flows relative to the amount of debt. As it can be perceived from forecast figures and also corresponding statistic tables above, all the debt ratios have expected values (mean) higher than their deterministic values calculated in the base case. For instance, the base case value of the $ADSCR_{2009}$ is 2.21 while its mean (expected value) from risk simulation appears to be 4.96. If only the annual debt service coverage ratios are thought out then it is obvious how the project's cash flows remain promising over time, i.e. although the cumulative probability of being bigger than 1.5, which is supposed to be a satisfactory threshold, declines from 70.12% in 2009 to 53.89% in 2012 as an overall trend remains almost promising.

Although LLCR seems to not have a big chance for having a ratio higher than 2 (LLCR in 2006 and 2007 has a cumulative certainty of 59% and 56% correspondingly), which is assumed to be an acceptable threshold both of the LLCR ratios in 2006 and 2007, have expected values (mean) higher than their deterministic values calculated in the base case. Expected values are 3.83 and 3.77 comparing to 1.24 and 0.84 as base case (static) values respectively.

To sum up, the general financial performance of the Zoom Mobile Network project from the banker's viewpoint is satisfactory, and the banker will be willing to offer funding to this project.

Chapter 6

CONCLUSION

This study has done an integrated financial, sensitivity and risk analysis of the proposed Zoom Mobile Network company in Hang Dong, a remote area located in the province of Chiang Mai, Thailand, in order to assess the feasibility and long term sustainability of the project. The proposed mobile network project has an important objective: it aims to respond to the huge demand for telephone communication so that villagers can make important calls and that would also prevent them from traveling abroad for jobs and etc. Sections, representing the underlying organization of the study, can summarize the conclusions of the analysis.

6.1 Financial Analysis

From the banker's point of view, the mobile network project would be a tolerable project to finance through the offered finance arrangement. This is due to an overall trend, from which the ADSCR ratios imply that there is enough cash generated by the project to reimburse both expenses and debt obligations apart from leaving some profit to the equity holder(s). However, for years 2008 and 2011 in which ADSCR ratios have negative values it is necessary to determine whether to fund a debt service reserve account to cover the debt service obligations in these years. The bank can further reduce its risk by negotiating collateral in the form of the fixed assets of the company. In short this is a satisfactory project from the banker's point of view due to an overall trend that ADSCR ratios look high enough to service the project debt obligations.

The ZMN has quite low LLCR ratios starting from year 2005 till last year of debt repayment, which is 2012.This means that project is unlikely to have sufficient cash flows to repay any bridge financing assumed to cover the likely shortages during these years. This is a good motive for the banks to not offer bridge financing throughout these years. Thus, the project could be requested to set up a sinking fund for these 8 years to cover the shortages.

From the owner's viewpoint, the financial NPV of the ZMN is 4,505 million THBs, which indicate the ZMN will cover all its costs and in addition, the owner has earned more than a 15% real return on his equity. Besides, IRR is 16.75% that is greater than 15%, which is the required rate of return. Therefore, these ratios both indicate that the project is financially viable and is worth to be accepted (undertaken) from the owner's perspective.

6.2 Sensitivity Analysis

The model is sensitive to the following parameters: income growth rare, decrease in market share, decrease in real call rate, local call rates, international call rates and number of labor required per connection. Furthermore, the model has a little reaction to changes in the following parameters: investment cost overrun, proportion of pre-paid services, proportion of local telephone call and domestic inflation rate.

6.3 Risk Analysis

A Monte-Carlo simulation technique was performed on the model using Crystal Ball^{TM} software with 10,000 trials. The parameters tested are:

- NPV
- ADSCR year 2009
- ADSCR year 2010
- ADSCR year 2011

- ADSCR year 2012
- LLCR year 2006
- LLCR year 2007

The results of the analysis show that there is 86% probability that the NPV of the project will be greater than 0 (positive). Therefore, the project is not risky to be undertaken and there is a great possibility that the result of the project will be positive.

The results attained for the ADSCR ratio for years 2009 and 2010 show that the probability that the project will be capable of generating enough cash and repay the debt obligation is high. The result obtained for these years are 70% and 63% respectively.

The results obtained for the ADSCR ratio for years 2011 and 2012 indicate that the probability of having a ratio greater than 1.5 for these years is relatively low. Results show that the probability that the ADSCR ratio will be above 1.5 for these years is 42% and 54% correspondingly, which signify there is probability that the project will not be capable of meeting its debt obligation from the cash generated by ZMN project. Therefore, corrective arrangements should be taken. The investors have the option to seek for bridge financing that is a loan taken from alternative credit institute to repay the primary loan.

The results found signify that the probability that LLCR will be satisfactorily high in 2006 and 2007 is 59% and 56% respectively.

In order to improve the weak ratios in last 2 years of the loan repayment, different actions can be taken into consideration: The project possessors could negotiate for a change in the terms of the loan repayment in order to repay more of their debt obligations in the early years of the loan repayment, when the cash flows from sales

will be higher and enough to meet the debt. They can also negotiate for a lower interest rate on the loan so that the ratios look better and more attractive to the banks. Another option could be adding up more to equity so that decreasing the amount of loan required. Therefore, the yearly reimbursement of that loan becomes lesser and the capability of the project to meet the debt becomes more confident.

To sum up, the project should be able to repay its debt notwithstanding experiencing some shortages in the cash flow to service the debt in the last two years of debt repayment.

6.4 Project Financing (Risks and Solutions)

According to the project findings, it can be concluded that project may face some problems regarding its project financing. First of all there is foreign exchange risk as the project's receipts are in THBs. while its loans are in USD. Changes in the exchange rate can have detrimental impacts on the project's ability to service its debt. This risk can be reduced or partially hedged by taking out a loan in THBs. in which the project will receive its receipts. Alternatively, the sponsors can use forward or future markers, or arrange currency swaps. There is also market risk in which project may not be able to sell the entire bandwidth or sell the bandwidth at profit provisions. In first situation the risk can be hedged thru long-term contract with creditworthy buyers such as: take or pay; take if delivered and take and pay and in case of price the project sponsors can set up a minimum volume/floor price and also can go for price escalation provisions. Besides, certain events of force majeure regarding the network operator's cell sites such as fires or earthquakes can be insured against. It should be mentioned here that in the case of the events covered by insurance, lenders would require the project sponsors to pledge the right to receive insurance payments as part of the security for project loans.

6.5 Recommendation

For supplementary studies it is strongly recommended to carry out an economic analysis to conclude what the overall impact of the project on the economy as a whole and among various stakeholders is. The economic analysis was not done due to lack of essential data related to the country.

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