Applying Public Private Partnership on Water Projects: Espirito Santo, Brazil

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ABSTRACT

In Brazil, the State of Espirito Santo decided to develop the water supply and sanitation in the area due to lack of clean potable water, the shortage of sufficient drainage system, and quick destruction of the environment from dumping of waste.

The aim of this thesis is to express the survey result to assess the feasibility of a present project to mitigate some shortfalls of drinking water and wastewater services in the area. There are some suggestions for better investment and operating cost strategies by use of incorporated evaluation of the fiscal, distributive, economical as well as the risk, which distributes within the project. The thesis outcomes show that the plan is projecting to generate substantial economic benefits to the society by reducing the pollution although in its present state, it is not probable to be fiscally viable. In addition, the key in improvement of the financial sustainability and perhaps the profitability of the system is directly related to enhancements in operating and management performs, which concentrate on the subjects of water discharge, billing and groups. A major challenge in the survey has been the valuation of intangible profits to the environment and their involvement in the project's evaluation of discounted net economic gains. With no assessment of these services, the general "economic value" of present project will be acutely underestimated.

Keywords: Investment Appraisal, Public Private Partnership, Water Supply, Sewerage Collection

ÖZ

Brezilya'nın Espirito Santo eyaletinde; içilebilir suyun azlığı, kanalizasyon sistemlerinin yetersizliği ve atılan çöplerin çevreyi çabuk tahrip etmesi nedeniyle, su arzı ve çevre koşullarının daha sağlıklı duruma getirilmesi için çalışmalara başlanma kararı alındı.

Bu tezin amacı, anket sonuçlarında da görülen, içme suyu ve atık su servislerinde ki eksikliklerinin giderilmesi için gerekli olan kaynağın değerlendirilmesidir. Projenin; mali, üleşimsel, ekonomik ve risk değerlendirmelerinin kullanımıyla, daha iyi yatırım ve operasyo maliyetlerine ulaşacağı üzerine bazı öneriler bulunmaktadır. Tezin sonuçları göstermektedir ki, bu proje yapıldığı eyalette kirliliği azaltarak topluma önemli economik faydalar sağlamıştır. Projenin finansal sürdürülebilirliği ve karlılığının geliştirilmesinde ki anahtar, suyun boşaltılması ve faturalandırlması gibi konular üzerinde etkinleşen operasyon ve yönetim performanslarında ki artışlardır. Bu tezde ki önemli noktalardan biri, çevrede ki maddi olmayan faydaların değerlendirilmesi ve bunların iskonto edilmiş net ekonomik kazanç değerlendirmelerine müdahil olmalarıdır. Bu servislerin göz ardı edilmesi, projenin gerçek ekonomik değerinin altında paha biçilmesine neden olur.

Anahtar Kelimeler: Yatırım değerlendirmesi, umumi özel ortaklık, su arzı, kanalizasyon

I dedicate this thesis to my family, especially…

To my father, who taught me that the best kind of knowledge to have is that which is learned for its own sake.

To my mother, who taught me that even the largest task can be accomplished if, it is done one step at a time.

To My brothers who have always supported and encouraged me from near and afar

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Chapter 1

INTRODUCTION

To construct water and wastewater treatment facilities in the region of Espirito Santo of Brazil, the Government provide multi-million dollar project. This grand scheme is a common instance of challenging for the public unit in rapidly growing municipal areas where it is necessary for public sector services, regardless of extremely limited public available sources. This plan is likely to create noteworthy gains to the inhabitants of the region by the quickly growing demand for safe potable water and simultaneously, reducing environmental pollution and avoiding water-borne diseases as well as other medical hazards. These kinds of projects in Brazil have generally need government financial supports and assurances since they have been shown to be not fiscally viable. Lots of the advantages for society are impalpable or not linked in a straight line with the operation of sewage treatment plants. Therefore, the state aid may be crucial for investment financing (Jayawardena et al, 1999).

The project assessed here contains a water preparation and provide plant and single sewage removal facility. Jointly, the two projects include an R$ 30 million initial investment. The supply system is estimated to provide new consumers by building new links and increasing the capability of supply system to the parallel enhance in demand. Present part of the plan was for 33% of the entire investment account. The sewage treatment project was designed to develop the water resources quality in the area through the installation of 36,000 new compounds, which be supposed to be

able to gather more than 11 million cubic meters of wastewater every year. Apart from preparing essential water and sanitation, the project goal is to distribute a well-organized pricing instrument, which should establish costs in an efficient manner. The water supply companies that run the projects, CESAN, wish to reach financial autarky in the long term. Assessment of these two systems is to be expected with an investigation of the fiscal and economic expenses and benefits which is created by the plan (Jayawardena et al, 1999).

This survey uses an operational technique for evaluating ecological and health advantages in financial terms. With no practical evaluation techniques, decision makers would miss essential information to make decisions. For the evaluation of non-use values, this thesis utilizes data from a contingent valuation technique to derive the willingness-to-pay studies (Jayawardena et al, 1999).

Present thesis moreover addresses the question of equitable sharing of expenses and benefits between public segment projects. For instance, one goal of the project for potable water treatment and sewage services for poor people is affordability. Just as important the project is obliged to maintain a lowest level of fiscal income to decrease the financing burden of Government (Jayawardena et al, 1999).

1.1 Current State of Environmental Pollution in Brazil

In recent decades, Brazil has benefit from quick economic development through urbanization and industrialization in company, which increased per capita income to $3000. The cost of fast economic growth and urbanization in Brazil has significant damage and pollution of the geographical area, especially land, atmosphere and water regions close to major municipal areas. Pollution of Brazil is determined by

two reasons. First, the fast speed of uninhibited industrialization make extra demand for water and wastewater treatment that is not fulfilled through existing wastewater treatment plants. Secondly, Brazil has not succeed in growing its municipal sanitation and drinking water supply infrastructure quick enough due to develop the requirements of fast industrialization and the growing people concentration in the urban regions (Jayawardena et al, 1999).

The poorest parts of the latest municipal population to settle residence in empty areas is near to water resources without hygiene infrastructure. The worsening of environmental conditions has resulted in significant reduction in life quality of metropolitan areas and concurrently raises different health problems, such as water-borne diseases and lofty rates of child death. The environmental degradation also has negative effect on tourism industry, which is significant for economy (Jayawardena et al, 1999).

The state of Brazil as a pressing environmental trouble has recognized the pollution of crucial water sources. Since the funding of the public Water and hygiene plan in 1971, the state improved investment in infrastructure and municipal water supply covering of 45% of families in 1970 to 84% in the beginning of 1990s. Nevertheless, the share of expenditure has decreased since 1991-1997. The citizens which have right of entry to water links nowadays are frequently limited to just a couple of hours of deliver every day. Investing in wastewater treatment plants and removal has developed slowly, leading to widespread accumulation of waste water and pollution of water resources (Jayawardena et al, 1999).

Brazilian water systems are increasingly burdened over the past years, because of domestic and industrial effluents in to rivers and seas with no form, taken from wastewater treatment plants to eliminate pollutants .presently; just 13% of whole sewage receives any type of treatment. Likewise, lacking of solid waste collection and removal has created large pollution in land, water and air. In current years, pollution has attained risky levels. Nevertheless, the regime has not taken tough measures to control waste removal and to offer environmentally friendly options. The increasing of industrial and municipal wastes into the environment is dangerously polluted the potable water, and existing water treatment plants abilities are not in position with the higher amount of pollution to overcome. Strong chemicals and pollutants have started to paralyze ecosystems inside the seacoast areas, killing a great deal of wildlife and endangered the welfare of the inhabitants in the region (Jayawardena et al, 1999).

Water supply system and removal troubles of Espirito Santo are distinctive in the country. In spite of fast industrialization and urbanisation over the past two decades, just 86% of Espirito Santo has a sufficient water supply system. The majority of this right of entry is limited via blackout periods every day. Waste collection and removal troubles are much harder than the trouble of water supply treatment. In, Espirito Santo's central industrial investment area (Grande Vitoria), just around 11% of the people attached to a wastewater system, and merely around 9% of the composed sewage are replaced by some kind of treatment before discharging. The majority of the collected waste is disposed of untreated into uncontrollable landfills, rivers and the sea. Water contamination, is deteriorating noticeably due to the pollution of land, has become one of the main reasons of water-borne diseases and child death (Jayawardena et al, 1999).

The World Bank has decided to financing for the Government of Brazil, the State Secretary for the Environment (SAEMA), and the State Water Company (CESAN) to enhance the country's water system and wastewater treatment and waste removal through improvement the technical skills of current sewage treatment plants and via investing in the building and operating new wastewater treatment projects (Jayawardena et al, 1999).

Chapter 2

NOTES ON PUBLIC-PRIVATE PARTNERSHIP IN WATER SUPPLY AND SEWERAGE PROJECTS

2.1 What is the Meaning of PPP?

There is no exact explanation for Public-Private Partnership (PPP). The expression private-public partnership, generally refer to Long-term, contractual partnerships between public and private industry that relate primarily towards financing, offer design, implementation, and operation of infrastructure services that were usually offered by the public portion. In Public-Private Partnership, each partner regularly and legally binding agreements or other mechanism consents to distribute responsibilities in term of implementation and/or operation and management of a project. This cooperation or partnership established based on the proficiency of every associate, which meets obviously public requirements by proper distribution of: Resources, Risks, Rewards, and Responsibilities (united nations, 2005).

The distribution of these factors and other features of PPP projects, as discussed aspects of implementation, ending time, responsibilities, dispute decision and income arrangements are discussed between involved parties and are documented in printed contract signed by them (united nations, 2005).

The Public-Private Partnership (PPP) Project means a project on agreement or concession contract among Government or legislative unity and a private segment industry, for providing infrastructure facilities on payment of consumer charges (united nations, 2005).

2.2 Vital Conditions in PPPs Definition

2.2.1 Agreement with Private Industry:

The asset and/or service marks as part of an agreement will be offered by the Private unit to the public sector.

2.2.2 Public Goods or Services for Public Interest:

Has the aspect of conveniences/ facilities being prepared via state as a monarch to its community. To reflecting this goal more obvious, two important notions are complicated below:

2.2.2.1 Public facilities

Are facilities, which government is responsible to supply to its inhabitants (for providing the public-economic purposes). For instance, provide safety, regulation and order, electrical energy, water, etc. for the people.

2.2.2.2 Public Asset

That is the use of assets to the strong tradition of public services. For instance: municipal road, which is about public transportation, or resources that combine supreme assets to provide public services. Such as, right of way on highways, land plot of around 0.5 km near the sea, or the use of the river / water bodies, etc (Government of India, February 2010).

2.2.3 Investments, which was conducted by and/or management by the company in the private sector:

It offers for investment and non-investment Public-Private Partnerships that is also the global perform.

2.2.4 Processes or management for a certain time:

Provides a factor of time period after which the contract with private entity comes to the end. Therefore, the agreement is not eternity.

2.2.5 Considerable risk sharing with the private entity:

It is usually precise to distinguish PPPs from the simple outsourcing agreements.

2.2.6 Performance related payments:

It is important to provide essential attention to performance and not only prerequisite of facilities. A simple respite agreement may not mention as a PPP.

2.2.7 Conformity with performance standards:

There is a strong factor of service delivery feature and the notions of quality and fulfillment to pre-defined and quantifiable principles that can be précised by the sponsoring power.

2.3 International Definition on PPP

2.3.1 International Monetary Fund

As stated by IMF agreements in which the private unit provides infrastructure assets and services that usually made available by the government refer to public private partnerships (PPPs). PPPs have two other significant features besides private implementation and financing of public investment:

There is a strong emphasis on service delivery in addition to investment, by the private entity; and conveying of major risk from the public to the private entity.

Public-Private Partnerships are concerned in variety of public and economical infrastructure plans.

2.3.2 European Commission

The expression PPP is not explained at the public level, generally, the expression refers to types of collaboration among public powers and business world that intent to make sure financing, construction, administration, renovation and protection of an infrastructure that is requirement for a service.

The Commission believes that all public-private partnerships in relation to the regulations and rules for selecting the private partner and the selection and application of public procurement actions during the election of the PPP configurations is unlimited in terms of financial and legal forms to describe.

2.3.3 Public-Private Infrastructure Advisory Facility (World Bank Group)

A public-private partnership (PPP) which were traditionally made available by the government, engages the private unit in features of the prerequisite of infrastructure resources or of innovative or presented services.

2.3.4 European Investment Bank

consistent with European Investment Bank a common expression for the associations formed among the private and public sector entity frequently with the intend of setting up private sector resources and/or grate skills in the direction of providing and delivering public sector resources and services is public private partnership.

A broad range of operational arrangements from loose, unofficial and planned partnerships, to design-build-finance-and-operate (DBFO) kind of service agreements and official joint venture corporations can explained by PPP.

As stated by Draft Public-Private Partnerships Law of Brazil public private partnership contracts are considered to be agreements among government or public

sector enterprises and private sector entities, that set up an officially force commitment to set up or control, in whole or in parts, services, actions for public profit, where the private sector associate is in charge for create source to financing, investing and managing the project. According to the draft law, a public private partnership consisting of the following:

• The whole or part of condition associated with the management of municipal facility that may or may not be required by a public construction plan.

• The purpose of an action under the authority of regime or a public body, that may or may not be required by public activities.

•Implementation of public constructions project for the government or a public body.

• Implementation of public constructions project for trade, rental to the government or to a public body.

2.4 Why Do We Need to Use PPPs?

Improvement of infrastructure and prerequisite of public services have always mentioned as a pretty significant public action for the next explanations:

a. Governments accept that infrastructure have vital role in reducing poverty ratio and developing of economic growth.

b. Governments have tried to guarantee the accessibility of basic public services regardless of market circumstances, due to its public goods and essential nature.

c. participation of private sector in some main areas was slow to develop, for some of economic, social and political reasons.

The exclusive domain of the government, which always considered is Prerequisite of public services and infrastructure. On the other hand, with pressures of increasing population, urbanization along with other developmental trends, the ability of government has been severally constrained to address sufficiently the public needs

through conventional means. This has guided the Government's around the world, progressively consider the private units to complement the investment of public and make available public services through PPP.

2.5 Common Defining Elements in Definitions of PPPs

a. contract or an agreement between a government or public entity and a private entity is the most important facet of a PPP.

b. some common elements which used in identifying PPPs across countries are condition of public infrastructure or public services by companies in the private sector entity, with considerable risk transfer to provide government or social needs, and rewarding/ compensating the private sector based on outputs.

c. The arrangement whether the private unit will essentially bring in the private investment is not to identify.

d. In several countries, it is the requirement for the provision of service delivery by private entity that make the query of whether and how much of private investment is essential for the project. Consequently, the central attention is on service delivery to provide public sector or infrastructure needs rather than capital formation or investments.

e. None of the definitions laid down that wages will inevitably be through user fees to the private sector or PPP. Actually, in many countries, like Britain, the greatest part of PFIs is offered payments in majority of the case by the government agencies.

2.6 Main Kinds of PPP

There are several different forms of PPP-type contracts. These range from a simple technical assistance contract to far more complex services such as the design, building, operation, maintenance and financing of infrastructure and new equipment. Examples include management contracts, concessions, Build-Operate-Transfer

(BOT) projects and related forms, especially Rehabilitate-Operate-Transfer (ROT) projects, Build-Own-Operate (BOO) projects and Build-Own-Operate-Transfer (BOOT) projects. Generally speaking, many contractual forms depend on the legal and institutional frameworks of the country in question. There is a great deal of legal engineering in this area: this requires to be examined on a "case-by-case" basis, taking into account the economic and financial equilibrium of the projects. In other words there is not really a standard contract, since a PPP set-up must be structured in line with the custom-built principle. Nevertheless, given the educational goals of this handbook, we present below the contractual forms identified worldwide as well as their main characteristics (Laurent Thorrance et. al, 2007).

2.6.1 Service Contract

This is the simplest form of PPP. The private operator makes available the human and technical resources to the public corporation in return for remuneration over a period specified by the contract; the public corporation owns and manages all the installations and assets (Laurent Thorrance et. al, 2007).

2.6.2 Management Contract

The objective is to operate the existing business more efficiently than under a simple service contract: the private operator takes on more responsibilities and risks: it is responsible for the daily operations of any company, and not a specific aspect; in return, the private operator receives a management commission (Laurent Thorrance et. al, 2007).

2.6.3 Lease Contract

The objective is to operate the existing business more efficiently than under a management contract: the lessee takes responsibility for the daily management and is responsible for the collateral for the working capital; in return, it keeps the profits

and is thus encouraged to manage operations efficiently (Laurent Thorrance et. al, 2007)

2.6.4 Concession Contract

The level of intervention and risk for the private operator is much higher in this case: this is a long-term contract through which a public corporation, the licensor, awards a private party – the concessionaire – the actual operation of a public service and/or public works, at its own expense; in return, the private operator is remunerated with revenue taken from the operation (Laurent Thorrance et. al, 2007).

2.6.5 BOT (Build-Operate-Transfer) Contract

This is a contract typically found in English-speaking countries and similar to the concession that is found for example in the legislation of Guinea and Senegal: the level of intervention and risk for the private operator is also high; the government entrusts the private operator with the building, financing, operation and maintenance of infrastructures; in return, the operator is remunerated from the fees paid by users, in order to recover its costs; note that the user can be a public corporation; the installation is conveyed to the government by contract ending (Laurent Thorrance et. al, 2007).

2.6.6 Partnership Contract, DBFO or PFI

the level of intervention and risk for the private operator is also high; the government entrusts the private operator with the building, financing, operation and maintenance of infrastructures; in contrast to a concession, the private operator does not operate a public service; in return, the operator receives its remuneration from the licensing authority in the form of a rent; the installation is conveyed to the government by contract ending (Laurent Thorrance et. al, 2007).

2.6.7 Design-Build-Operate (DBO)

The private operator designs, builds and manages an installation for a set period; once the installation is built, the operator transfers ownership of the installation to the public corporation; the risk of design and management is carried by the private operator, which is remunerated by the public corporation (Laurent Thorrance et. al, 2007).

2.7 Analysis and Sharing of the Risks

The success of a PPP project depends mainly on the partners' capacity to identify and accept the different risks found in this type of financing, especially during the building and operation phases. It is thus preferable beforehand to allocate the risks to the different parties, according to the following principle (Laurent Thorrance et. al, 2007).

Each identified risk that cannot be reduced must be accepted by the partner that is best able to bear it; in other words, the partner that can say this is part of my job.

2.7.1 Typology of the Risks

The inherent risks of PPP-type set-ups can be classified as follows:

2.7.1.1 Building Risks

The highest risks run come during this phase, and can be broken down as follows: completion risk: the building cannot be finished for geological reasons or due to force majeure, for example; cost overrun risk: the building proves to be more costly than expected; completion delay risk: the building cannot be finished in line with the foreseen calendar. An overrun of the schedule and budgets will result in a delay at the start of the operational phase and in fine of the generation of the revenue

necessary for reimbursing the debt servicing, an additional financing need, and a higher level of debt (Laurent Thorrance et. al, 2007).

2.7.1.2 Operation Risks

The main risks run during the operational phase are as follows: high rate of demands, especially for sectors without take-or-pay-type agreements (energy) or fixed-fee contracts; variable demand depending on the level of competition, the macroeconomic environment or a change in users' consumption habits (e.g. transport). This risk is particularly high during the project's early years, when the debt servicing is very high (Laurent Thorrance et. al, 2007).

2.7.1.3 Financial Risk: Interest Rate

Through indebtedness and/or through an involvement of equity capital, the financing of assets that feature in a concession agreement can be completed. Financing through indebtedness usually hold a variable interest rate. So the risk of interest rate is illustrating – for the project company and for the national authorities – by increasing the risk in reference rate and because of the total for the project's financial charges, which therefore change the project return (Laurent Thorrance et. al, 2007).

Financing through an involvement of equity capital is lead to inflation. In fact, by falling interest rate in country's economy, the price level of goods and services automatically increase, i.e. inflation. Thus, the investor runs the risk of a depreciated currency in refunds and obtaining a response rate on the investment that is less than rate of inflation (Laurent Thorrance et. al, 2007).

2.7.1.4 Exchange/Convertibility Risk

Limitation in the conversion of the project revenue into local currency: profits from the project in local currency and foreign currency debt servicing; fees for users who

do not necessarily adjusted for inflation or adjusted thoroughly following the devaluation.

2.7.1.5 Force Majeure Risk

Unpredictable and uncontrollable risk, which could in the short term or permanently avoid the project from being continued and which cannot be assigned to the project participants.

2.7.1.6 Political Risk

Discriminatory taxation and regulatory mechanisms; limitations on the concessionaire company's ability to collect fees; government biased interference in any disputes arising between the concession holder of company and the project users; confiscation or expropriation of assets of the project concessionaire (Laurent Thorrance et. al, 2007).

2.8 Risk-Sharing

2.8.1 Political Risks

The political risks may accepted by governments and/or financial institutions in international environmental.

2.8.2 Financial Risks

Mechanism can covered the financial risk which is enables in persistence of fixed rates in the currency, the one in which the project income will be received. Indexation is a further means used.

2.8.3 Building Risks

The building risks are tolerated by building constructors. The means which used in reduction of this risk are:

A. The use of construction contracts in company and fixed price, turnkey contracts;

B. Reliance on insurance;

C. companies are selected with a good status;

D. Determine that there is a need to call the balance of the supporter during the construction phase.

2.9 Framework for Setting up PPP Programs

Many international experiences have demonstrated that PPP projects are more likely to succeed if the governments shift from an ad hoc approach to the creation of dedicated Technical Units PPP-type projects. These units should contain capable personnel in guiding projects throughout their cycle (Laurent Thorrance et. al, 2007).

Even though each project is dissimilar, performed those under PPP exhibit similar properties and can therefore take the benefit of a structured systematic approach for the identification, design and production of documents for tendering, as well as the assessment, concession and award of contracts and the management the Treaty in a manner that best practice is reflected (Laurent Thorrance et. al, 2007).

PPP entities have existed around the world for many years and have proven successful in building and improving the regulation of the projects. Though many of these entities were effective in increasing awareness of PPP programs and projects, the creation in itself does not guarantee the approach success (Laurent Thorrance et. al, 2007).

Developing of PPP projects and PPP programs needs considerable skill. And skills for PPP projects have different skills which are required for promotion and to complete a PPP program and carry out certain general activities of the PPP approach in various projects and industries. Crucial skills to manage PPP programs concern the following options: To consult stakeholders; complete awareness raising programs to

ensure that the promotion of PPP programs at international, national and local levels, create and explore opportunities to improve credit conditions. To develop and popularize a PPP program, the below steps, based on top international practice, are suggested:

2.9.1 Evaluation of the Legislation in Force on PPPs

According to the Public-Private Infrastructure Advisory Facility, the difficulties caused by coordinating PPPs in some countries experienced particularly on the fact that the goal of these entities were not clear from the beginning, and that they are not needed on the political influence and / or does not offer tax benefits that are necessary for the promotion of sectoral ministries and regulatory authorities in order for the reforms to increase awareness of the PPP program and projects to implement.

It is important to current and future legislation, to assess the ability to accept PPPs. This assessment must examine whether existing laws and proposals (on PPPs and the treatment of various forms of public procurement), is in line with the PPPs program of the government or whether they potentially set incompatible. This first phase is important and is a key part of the processing legislation related to public-private partnerships (Laurent Thorrance et. al, 2007).

2.9.2 Drafting of the Legislation and Regulation on PPPs

This phase concerns the development of a new law on public-private partnerships, from the directives of a general policy statement on PPPs. It is good general law that allows, in general, and specifically, ministries and other relevant public units to include specified public-private partnerships for the provision of services and sectors in the general policy statement and act on national, regional and local level. It allows the government to perform, identify, design, evaluation, procurement and regulation

of PPP projects within a stable and transparent frame (Laurent Thorrance et. al, 2007)

2.9.3 Drafting of the Related Financial and Technical Directives (Rules and Regulations on the Implementation) for the Extension and Definition of the General Scope of the Legislation in Economic and Financial Terms

A series of guidelines on the financial institution accompanied by PPP (and is an integral part of) legislation which is related to public-private partnerships. The aim of these guidelines is to define more precisely the tax obligations, commitments, and financial guarantees from the government in relation to PPP projects (Laurent Thorrance et. al, 2007).

In line with the objectives of the government, can be pulled out guidelines for each specific sub-sectors (e.g. telecommunications, transportation ,electricity, water supply and sanitation, education, health, agriculture and other services, such as IT and management prisons).other hand, policies can be set in a general manner, as to cover all sectors. Either way, these guidelines obviously show what the legislation does and what does not allow doing it (Laurent Thorrance et. al, 2007).

2.9.4 Development of a Manual for Public Bodies, on How to Use the Legislation and Financial Directives

This phase relates to the preparation of a practical guide on PPPs, especially on the part of officials and bodies that have or intend to participate in public-private partnerships. The goal is to provide a practical use and technical insight into the law and guidelines on the implementation of PPP.

2.9.5 Drafting of PPP Model Contracts

This relates to the preparation of model PPP agreements. Clear written contracts in key sectors (telecommunications, transportation, water supply and sanitation,

electricity, education, health and other services) are modeling in most excellent international practices, but customized to local environments. Concession contracts, including treaties on the operating entity, the shareholders, construction and concession. If available, make this model contracts and considerably accelerate the negotiation process and PPP projects popularization (Laurent Thorrance et. al, 2007).

2.9.6 Drafting of Models of Documents for Calls for Bids and Requests for Proposals for PPPs

This concerns the creation of model documents for tender and calls for bids. Following the example of the model contracts above these model documents for permitting projects faster and all the associated delays are developed to avoid – taking account of the requirement for explanations, if the tender documents are poorly prepared to give. Sample documents for tendering and the call for proposals must be included the legal and technical manual (Laurent Thorrance et. al, 2007).

2.9.7 Options Proposal for the Setting up of a Body to Regulate/ Monitor/ Manage Contracts

This procedure should spread across several months or years. The entity for regulating and managing of contracts is responsible for monitoring and controlling the terms of the contract after it has been assigned to ensure that the provisions of the agreements are respected. In addition, it helps local governments and the company's procedures and requirements in terms of regulation, but works closely with the technical department to ensure that laws and regulations in the procedures for entering the competition and the conclusion and the signing of contracts are respected. It also sets the standard rates of the framework services, in collaboration with the ministry or the local authority, and also set the process of revision and

adopting the height of the tariff for the various sectors in corporation with the appropriate regulatory agencies or institutions (Laurent Thorrance et. al, 2007).

2.9.8 Development of and Decision on an Expertise and Capacity

Powerful plan for the entity and the major actors at the national and local level, the above- described unit is a real institution support for centralized and decentralized governments and their institutions. The institution is the driving force behind the centralization of funding and best practices expertise, public agencies, which often do not train on the way to be in these new practices in public procurement. The unit's personnel policy should be considered a long-term investment. His best skills can then be mobilized to establish a PPP competence center that serves the country.

2.10 Public-Private Partnership in Water supply and Sewerage Projects

The method of managing potable water is modifying globally. The recent system, conquered through public provision, is progressively comprehended as ineffective due to lack of innovative power. This system is also corrupt in several countries. Both emerging and industrial countries need vast investment to provide the fundamental requirements of their people, and the private sector considered as a method to transport money and effectiveness toward the water segment. But, private investment seems restricted in contrast with other infrastructure segments. A number of the obstacles to efficiency are intrinsic to the water sector. Public-private partnerships are not able to eliminate a lot of these obstacles by itself. Consequently, in water sector performance area enforcement and regulatory design are considered as critical components. Privatization is not an easy move back of the government, but also a differently define of public sector function as a controller in a “market

oriented" country. The subject of public-private partnership is intricate all the time, and more complicated in the case of urban water supply.

During the 1990s, involvement of private sector is globally increased in water services. However the share of private sector to serves in water sector is just around 5 percent of the entire world inhabitants. In the last part of the 1990s, MNCs (multinational corporations) started to go out from a number of concessions and contracts in emerging countries and now reducing the amount of projects which are not cost-effective or too risky. On the other hand, in industrial countries there are still some Appealing markets, and the policy makers of global corporations use decentralization and privatization as a main policy.

2.10.1 Functions, Obligations and Challenges for Governments

Determine the scope of business is the crucial function of government in all types of PPPs. In order to reach successful PPPs, government indicates precedence and outputs, and set the instruments (via concessions, regulatory agency, regulations, market devices, etc.). Experiences demonstrate that lack of institutional and lawful frameworks lead to decline in reliability and quality of water provision, and finally resulted in fail of public private partnerships. Moreover, in the water segment investments cost are dramatically high and irreversible, so private firms are concerned about the security of investment and need to be assured of rate of profit. Additionally, there is no 'one style fit in all instances' method and the selection of a specific type of partnership be supposed to rely on the regional background and on its possibility. Formerly PPPs are accomplished, they require to be controlled to provide motivation for the private sector and to support clients against monopoly misuse.

Implementation of PPPs is expensive, complicated, and time consuming. There is no experiential proof of the comparative effectiveness of the private division. Practical consequences are combined and do not resulted in any strong consequence in support of a particular ownership formation.

Competition appears to be a better resource of good organization than the kind of possession. Nevertheless, vice versa the electricity and gas segments, competition is restricted in the water division. In UK, endeavors to increment competition have been successful partially.

Auction of contracts in the water segment is the predominant type of competition, but this method is weak in general. Competitive offers are expensive and time consuming for governments and for bidders and therefore rarely happen in perform. Owing to the shortage of competition the information by competitive methods may have not exposed, which the lack of information makes more constraining on water segment than in other service industries. Access to information generally limited with private sector. Therefore keep a high degree of accountability and transparency would be difficult.

Engagement of customers in the decision making procedure from the beginning is so important. In fact, the accomplishment of PPPs be contingent on the support of customers, as they directly (via fees) or indirectly (via taxes) contributes to finance public private partnerships. In order to guarantee a high degree of transparency and accountability the role of tools such as legislation, monitoring systems and guaranteeing access to information is so significant. Lastly, the diverse preferences of investors, customers and government generally lead to resistances and disagreements over the term of partnership.

The main goal of private sector is to maximize profit, but governments have wider goals (environmental and social). Regular talks and negotiations on the distribution of risk and the pricing will be an element of the relationship. Additionally, systems with low rate of returns and spread regions too risky to invest for private enterprise, if they are not guarantee. Governments confront a trade-off among investment decisions and attract private companies to increase their ability to take a risk.

2.10.2 How Widespread is the Water Privatization all Over the World?

There are two important forms are in the water segment: the British model of complete privatization, which are ownership and administration sectors control privately, as well as the French form of entrusted management (concession and lease agreements), wherever the property is control by public sector and the administration is a combination of private and public facilities.

The British model is used primarily in UK and Wales, while the French model, which strongly boosted through the World Bank, has been offered in different types in industrial countries and emerging countries. Globally, the private division runs only a tiny quantity of water service. "Of the total world population of 6 billion, only about 5 percent are served by private companies. From [this] 290 million people, 126 million in Europe, 72 million in Asia and Oceania, 48 million in North America, 21 million in South America and 22 million in other countries" (Stephenson, 2005).

As can be seen in figure 6, Private water substructure projects in emerging countries in 1990s increased at a peak power during 1997 and reduced since 1999. Despite the declining participation of the private sector in current years in several emerging countries, the development from early of 1990s is important.

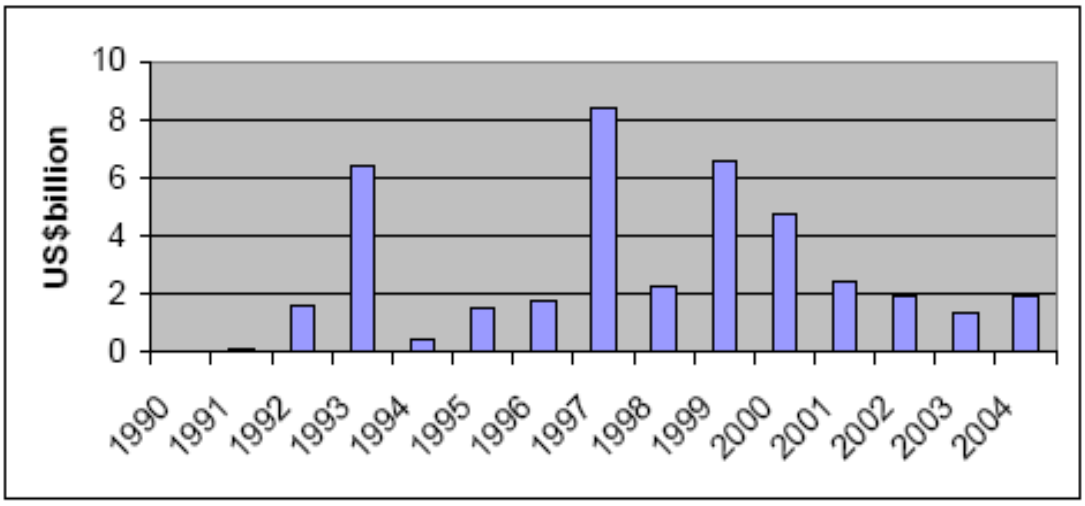


Figure 1: Investment Obligations in Water and Sewerage Projects with Private Involvement in Emerging Countries, 1990-2004

However, the involvement of the private division in water system is tiny in comparison with the public sector. Just 3% of the inhabitants are in poor or developing countries, delivered by entirely or partially private directors. Moreover, in comparison with various infrastructure projects by involvement of private sector, water projects only attracted 5 percent of the total investment commitment in emerging countries, which is also have tiny correlation with the sector to achieve, the Millennium Development Goals in water sectors and hygiene sectors.

The movements at emerging countries demonstrate that projects in water sector were small in 2001-2004 compared to the years 1995-2000 and managerial contracts participating more than lease or concession contracts. In fact, average annual investment flows in water supply decreased by U.S. $ 3600000000 in 1995-2000 to U.S. $ 1100000000, while the yearly amount of projects have changed little, from 28 in 1995-2000 to 27 in 2001-2004. The quantity of leasing contracts declined from 19 in 1995-2000 to 9 in 2001-04, even as management agreements rose from 10 to 17.

In the same way, concessions reduced in terms of size and number. In Latin America, privatization was setup mainly due to the serious political monitoring of public services in many countries and the corruption of the government. Decentralization and privatization have been at the middle of structural development in the last two decades. New legislation in Chile, adopted to renew the water segment in 1988.

Approximately all Latin American countries at the end of the 1990s had some kind of private sector contribution and consider restructuring to facilitate it. Nevertheless, the deepness of reform fluctuates considerably between countries and is relatively weak in comparison with, what is attained in the telecommunications and electricity divisions. Until the late 1990s, in Latin America 14.8 percent of municipal water consumers have been served through some kind of PPP (Foster, 2005).

2.11 Final Point

PPPs are complicated, time consuming and expensive to accomplish. Since the water sector is require vast amount of capital the majority of the investments are impossible to reverse and there is no substitution option to use, considering this circumstances institutional and organizational adjustment are required to prepare reliable support for sponsors so that they can assured about their investments. In addition it is significant to ensure that there are organizations to prepare well-structured motivations for the private sector and protect customers from monopoly maltreatment.

Many goals were to be taken into consideration in the water division: accountability, the support of public health and the location, involvement, justice, lucidity, availability for the poor, effectiveness and efficiency.

What is the most excellent method to balance all these goals in line when the benefits of the stakeholders do not meet all the time? In fact, privatization appears to be not an answer to the slums and agricultural areas, as water corporations will find out such areas are not gainful or excessively risky. Governments face a trade-off in offering assurances to private operators to create appealing investments because they are thus raising their own risk. The successful implementation of public private partnerships in water supply remains a complicated subject for governments.

It is important for each government to comprehend the stimulus that attracts the private sector to come into PPPs and to expand the wisdom and abilities required to deal with unidentified and unexpected conditions during the entire duration of the partnership. In addition, owing to lacking regular appraisal of direct observation, there is no proof that the profits of presenting the private sector compensate the costs. There is no obvious evidence to who are the winners and who are the losers of public private partnerships; consequences of experiences internationally are combined and rely on the conditions and contrive of the agreement. Additional alternatives supposed to be considered, because PPPs are obviously not fitted to all conditions.

2.12 Suggestions

2.12.1 Good Governance

Good quality of water governance is significant for both private and public suppliers and is important for successful PPPs. Governance worries not only the associations but also the communications among different layers of government and the communication among all the stakeholders engaged and the government. Rule of high-quality governance (accountability, consumer orientation, environmental and health security…) are key to capable water supply and should be center of each

development, including PPPs. It is required to find instruments to superior implement high-quality governance principles.

2.12.2 Public Inspection

The center of a successful partnership is trust. Engagement of community in the procedure from the starting point is supposed to increment public trust. Agreements suppose to be made public before they are signed.

2.12.3 Systematic Project Appraisal

Numerous improvement projects in water sector, containing PPPs, have taken place around the world in the water sector. Nevertheless, there is no organized assessment of performance, of the distributional effects or of ecological influences. While PPPs have failed it would be valuable to know why. Consequently, systematic appraisal of restructuring projects should be done by urban and local governments.

2.12.4 Distribution of Information

Information lacking is a significant limitation in the water division, in particular for prospective private sector applicants, but also for the public sector as a controller, and for customers.

2.12.5 Independent Regulator and Oversight of PPPs

Public-Private Partnerships are currently regulated by treaties. It would be useful to appraise the possible advantages and expenses of having an independent controller, most likely at the regional rank.

2.12.6 Additional Options have to be Considered

PPPs are obviously not suitable for all conditions. It is therefore required to achieve the advantages and disadvantages of several ways to think about before choosing one. Justly, the selection is supposed to contain all related stakeholders. It is require to better understanding under what conditions PPPs are an appropriate solution.

Chapter 3

METHODOLOGY OF THE STUDY

The common approach in this survey is to evaluate the likely effects of the planned project that contain a water supply system and treatment together with wastewater treatment project in the Guarapari catchment region from three perspective: economical, financial, and distributive. Because every approach concentrates on different expenses and profits of the project, it is significant to differentiate among the individual and count them discretely. The four major groups of actors in the project - the World Bank, the Espirito Santo state, Brazil, and CESAN - have diverse benefits and also risk in project. All stakeholders put various degrees of concentration on several variables. The banker's perspective and owner's perspective indicate the standpoints of the World Bank as the financial association and of CESAN as the operating firm, correspondingly. Even though banks and shareholders normally concentrate on the fiscal possibility of a project, CESAN as communal organizations and the World Bank moreover are supposed to focus on net benefit of economy (Jayawardena et al, 1999).

The financial evaluation is derived from an analysis of discounted cash flow. The project's Net Present Value is evaluated from the equity perspective of CESAN. In addition the overall investment perspective evaluates by assessing the project via unleveraged point of view. This analysis facilitates financial organizations, similar to

the World Bank, to assessing the financial stability of the project and capability of project to meet all debt (Jayawardena et al, 1999).

After the financial appraisal, I approximate the economic costs for inputs and also outputs to obtain the list of economic achievements. Despite the fact that the financial analysis concentrate on the net financial profits for the subdivision of public directly impressed via project, the economic appraisal count all advantages and expenses for the whole economy. In addition, I estimate the economic factors for Brazil that contain the economic expense of foreign exchange and the economic capital cost. The conversion factors are evaluated for the main inputs and outputs of the project. By means of these variables, the financial cash flow statement is transformed to show an economic resource flows from the project (Jayawardena et al, 1999).

We extend the investigation to realize the various clusters within the public, which is predicted to pick the fruits and recognize the expenses incurred in the planned project. Because the project's objective is not only to be adequate to itself, but also to supply basic water and hygiene services to the residents of the area to create the distributive evaluation as a vital means for measuring the project success. Because the public sector will carry a large part of the financial obligations and project risk to improve living standards of people, it is significant to illuminate how the benefits are awarded between the residents of the area (Jayawardena et al, 1999).

Risk analysis enhanced the utility of the monetary, distributive and economic analyses. It assists in making decision via judging the probability of definite vital variables and their predictable impacts on the outcomes of this Project. The factors of

Project, like input prices, real exchange rates, and the inflation rate are essential in identifying future income from the project. To calculate the expansion of different risks, a Monte Carlo analysis utilized to pattern a possible distribution for every variable. The risk management analysis evaluates the effect of varying in main micro and macroeconomic circumstances on the project result (Jayawardena et al, 1999).

Chapter 4

FINANCIAL ANALYSIS

4.1 Investment and Operating Parameters

1. The project operation is estimated 30 years.

2. The water supply and treatment facility has a power of supply, 4.8 million cubic meters of pure water in each year. The sewer structure will add more than 35,000 compounds in the plan; collect more than 11 million cubic meters of wastewater for removal and treatment (Jayawardena et al, 1999).

3. Financing of project: The interest rate of World Bank is estimated according to the actual cost of funds, a risk premium for the state which is borrowing money, as well as the inflation rate for the country which is pay the loan. The real interest rate is projected at 7 percent (Jayawardena et al, 1999).

4. The actual service price is estimated to stay constant, although all information is adapted to indicate the impacts of inflation. In wastewater collection plan, CESAN decide to increase the actual tariff on service during the lifetime of the plan.

5. The work is divided into different skillfulness types. The wages level are measured to be dominants wage rates of government, that are considerably more than the market wage rates for work of equal value (Jayawardena et al, 1999).

6. Third party of employment is assumed as a proportion of the entire labor cost.

7. It considered that in every year of the project, real wages will increase 2%.

8. The total amount of investment in both sewage disposal and water supply projects is R$34 million. More than two-thirds of this amount is ascribed to the water supply part. Unlike the land, any additional investments are considered totally depreciated and free from all residual value. Land's residual value is considered to have equal actual value like its original value. The investment table for both projects is as below:

Table 1: Investment Tables (in R$)

	1997	**1998**	**1999**
Labor	1,034,000	1,364,880	822,558
Raw Water Intake, Transmission & Pumping	1,687,190	2,136,611	1,275,479
Treatment	898,141	1,148,211	657,948
Treated Water Transmission and Pumping	1,337,692	1,694,383	980,287
Reservoirs & Distribution	1,575,233	1,994,807	1,153,840
Connections	111,765	141,557	43,935
Cost of Land	110,000	-	-
Total Investment Costs	**6,754,021**	**8,480,448**	**4,934,046**

Table 2: Sewage Collection and Disposal Project

	1997	1998	1999
Labor	449,900	867,570	907,742
Connections	131,820	244,650	245,538
Collectors & Interceptors	630,158	1,169,360	1,173,422
Pumping Stations & Raw Sewage Pressure Pipes	300,667	557,838	559,675
Treatment and Outfall Pipes	594,804	1,103,846	1,107,777
Cost of Land	165,000	-	-
Total Investment Costs	**2,272,350**	**3,943,265**	**3,994,154**

Table 3: Combined Project Investment

	1997	1998	1999
TOTAL INVESTMENT	**9,026,371**	**12,423,713**	**8,928,200**

The equity capital of project will be supplied via CESAN. The World Bank is likely to make available monetary support through a loan, which compensate half of the investment expenditures. The loan will be paid back by 10 same payments after extra time of five years. Furthermore, CESAN will repay the accumulated interest per all year at the interest rate of World Bank (Jayawardena et al, 1999).

4.2 Analytical Point of View

The fiscal feasibility of the plan is evaluated from the whole investment perspective and the equity standpoint. The perspective of investment, (also identified as the banker's point of view,) eliminates the cost of funding, and is utilized to evaluate the financial capability of project with no loan. By sorting out the impacts of debt financing, banks can more precisely evaluate the project's capability to cover its liability. The equity ratio perspective, on the other hand referred to as the owner's

point of view, includes the expenditure of debt financing, and is utilized to evaluate the projects net fiscal benefits after the loan is received and installments of the loan are assessed. The first loan will be treated as cash for investment, although reimbursement of principal and interest are considered as outflows of funds (Jayawardena et al, 1999).

Table 4: Project Financing

Year	**1997**	**1998**	**1999**
Total Investment	**R$ 9.00 MM**	**R$ 12420 MM**	**R$ 8.90 MM**
Loan Financing (WORLD BANK)	R$ 4.50 MM	R$ 6.20 MM	R$ 4.45 MM
Equity Financing (CESAN)	R$ 4.50 MM	R$ 6.20 MM	R$ 4.45 MM

4.3 Methodology

The analyses performed from two perspectives are changed from nominal value to real value, by utilizing the present price deflator due to calculating the effect of inflation. Inflation has two real effects, direct effect and indirect effect. Indirect effects, also identified as tax effects, do not have any impacts on present project, since CESAN has not projected to disburse the income tax of company. The direct actual effects of inflation on projects net income are indicated in changing of accounts payable and receivable, altering in actual cash balances as well as actual interest cost The total investment perspective investigates the debt service ratios of the net cash flows due to find out CESAN's capability to cover loan compensation needs. From the CESAN perspective, the projects financial value is evaluated by adding the present values of the expected annual cash flows. Cash flows are discounted yearly by the suitable discount rate to reach the NPV of the projects.

To use this consequence from actual cash flows, I apply 10% as a discount rate to show the end real yield of return on equity.

Table 5: Financial Cash Flow Statement for Water Supply Project

Year	1996	1997	1998	1999	2000	...2005	...2010	...2015	...2020	...2025	...2027
CASH INFLOWS											
Revenue Collected from Water	-	147,840	323,390	512,431	2,816,410	2,926,424	2,978,219	2,978,219	2,978,219	2,978,219	-
change in A/R	-	(20,688)	(26,459)	(30,582)	(329,079)	(40,456)	(41,230)	(37,905)	(37,905)	(37,905)	379,046
Salvage Value of Land	-	-	-	-	-	-	-	-	-	-	100,000
Loan Received from World Bank	-	3,070,009	3,504,318	1,853,511	-	-	-	-	-	-	-
Total Inflows	-	3,197,152	3,801,249	2,335,360	2,487,331	2,885,968	2,936,990	2,940,315	2,940,315	2,940,315	479,046
CASH OUTFLOWS											
Investment Costs											
Labor											
Non-Semi-skilled Labor	-	552,000	662,000	363,000	-	-	-	-	-	-	-
Semi-skilled Labor	-	388,000	466,000	255,000	-	-	-	-	-	-	-
Raw Water Intake, Transmission & Pumping					-	-	-	-	-	-	-
Materials	-	1,281,100	1,479,263	809,876	-	-	-	-	-	-	-
Equipment	-	252,709	286,531	148,410	-	-	-	-	-	-	-
Treatment											
Materials	-	681,849	787,362	415,251	-	-	-	-	-	-	-
Equipment	-	134,644	161,572	79,074	-	-	-	-	-	-	-
Treated Water Transmission and Pumping											
Materials	-	1,013,916	1,171,092	617,776	-	-	-	-	-	-	-
Equipment	-	202,168	229,225	118,728	-	-	-	-	-	-	-
Reservoirs & Distribution											
Materials	-	1,195,696	1,380,642	728,109	-	-	-	-	-	-	-
Equipment	-	236,334	267,959	138,788	-	-	-	-	-	-	-
Connections											
Materials	-	84,791	97,925	23,134	-	-	-	-	-	-	-
Equipment	-	16,814	19,064	9,875	-	-	-	-	-	-	-
Cost of Land	-	100,000	-	-	-	-	-	-	-	-	-
Loan Repayment to World Bank	-	-	-	-	-	1,752,777	1,061,820	-	-	-	-
Operational Costs											
Total Cost of Labor Required by Project	-	50,051	81,126	113,423	146,980	367,289	617,811	916,502	1,221,110	1,608,258	-
Total Cost of Tertiary Labor Required by Project	-	25,526	38,129	52,175	63,201	139,570	234,768	348,271	464,022	611,138	-
Total Cost of Chemicals	-	7,207	14,494	21,808	113,906	114,377	114,377	114,377	114,377	114,377	-
Total Energy Costs	-	28,185	58,148	86,790	446,958	448,800	448,800	448,800	448,800	448,800	-
Total Other Service Costs	-	27,742	47,972	68,549	192,761	267,509	353,939	456,988	562,077	695,643	-
Total Maintenance Costs	-	68,800	68,800	69,800	69,800	71,020	69,800	67,580	64,140	60,700	-
Total Replacement Investments	-	-	-	-	-	-	-	-	-	-	-
change in A/P	-	(13,871)	(11,376)	(12,469)	(65,222)	(18,600)	(23,081)	(33,730)	(36,452)	(43,420)	326,430
change in CB	-	11,097	9,101	9,975	52,178	14,880	18,465	26,984	29,161	34,736	(261,144)
Total Outflows	-	6,344,756	7,315,019	4,117,074	1,020,562	3,157,623	2,896,699	2,345,772	2,867,237	3,530,233	65,286
Net Cash Flow	-	(3,147,605)	(3,513,770)	(1,781,714)	1,466,768	(271,655)	40,291	594,543	73,078	(589,918)	413,760
Net Present Value (NPV) @ 10.0%	(5,570,846)										

Table 6: Financial Cash flow Statement for Sewage Collection Project

Year	1996	1997	1998	1999	2000	..2005	..2010	..2015	..2020	..2025	..2027
CASH INFLOWS											
Revenue Collected from Sewage Collection	-	29,493	64,645	113,902	1,938,303	2,584,741	2,689,281	2,736,183	2,773,671	2,803,718	-
change in A/R	-	(4,129)	(5,297)	(7,719)	(256,866)	(37,444)	(38,581)	(35,913)	(36,173)	(36,383)	357,506
Salvage Value of Land	-	-	-	-	-	-	-	-	-	-	150,000
Loan Received from World Bank	-	1,032,886	1,629,448	1,500,433	-	-	-	-	-	-	-
Total Inflows	-	1,058,251	1,688,797	1,606,617	1,681,437	2,547,297	2,650,700	2,700,271	2,737,498	2,767,335	507,506
CASH OUTFLOWS											
Investment Costs											
Labor											
Non-Qualified Labor	-	325,000	570,000	542,000	-	-	-	-	-	-	-
Qualified Labor	-	84,000	147,000	140,000	-	-	-	-	-	-	-
Connections											
Materials	-	105,770	178,783	163,438	-	-	-	-	-	-	-
Equipment	-	14,067	23,407	21,038	-	-	-	-	-	-	-
Collectors & Interceptors											
Materials	-	504,089	851,990	778,795	-	-	-	-	-	-	-
Equipment	-	68,783	114,423	102,814	-	-	-	-	-	-	-
Pumping Stations & Raw Sewage Pressure Pipes											
Materials	-	240,817	406,928	371,885	-	-	-	-	-	-	-
Equipment	-	32,517	54,095	48,607	-	-	-	-	-	-	-
Treatment and Outfall Pipes											
Materials	-	477,558	807,149	737,806	-	-	-	-	-	-	-
Equipment	-	63,173	105,121	94,483	-	-	-	-	-	-	-
Cost of Land	-	150,000	-	-	-	-	-	-	-	-	-
Loan Repayment to World Bank	-	-	-	-	-	850,918	515,480	-	-	-	-
Operational Costs											
Total Cost of Labor Required by Project	-	35,309	36,016	36,736	95,934	110,460	136,013	155,706	195,158	234,387	-
Total Cost of Tertiary Labor Required by Project	-	18,008	16,927	16,899	41,252	41,975	51,685	59,168	74,160	89,067	-
Total Cost of Chemicals	-	-	-	-	-	-	-	-	-	-	-
Total Energy Costs	-	4,038	8,133	13,483	565,442	659,052	750,811	840,608	926,506	1,007,020	-
Total Other Service Costs	-	13,192	14,047	15,437	161,604	186,642	215,857	242,761	275,040	306,009	-
Total Maintenance Costs	-	11,800	10,800	10,821	10,842	10,955	11,079	11,217	11,368	11,536	-
Total Replacement Investments	-	-	-	-	-	-	-	-	-	-	-
change in A/P	-	(7,055)	(1,099)	(1,426)	(78,918)	(11,519)	(12,947)	(14,252)	(16,765)	(17,333)	151,210
change in CB	-	5,644	879	1,141	63,135	9,215	10,358	11,402	13,412	13,866	(120,968)
Total Outflows	-	2,146,709	3,344,600	3,093,958	859,290	1,857,699	1,678,337	1,306,609	1,478,879	1,644,553	30,242
Net Cash Flow	-	(1,088,459)	(1,655,804)	(1,487,341)	822,147	689,598	972,363	1,393,662	1,258,619	1,122,782	477,264
Net Present Value (NPV) **@** **10.0%**	**3,127,013**										

4.4 Results

Table 7: Breakdown of Results from Financial Analysis

	Water Supply Project	**Sewage Collection Project**
NPV of project* (PV of benefits - PV of costs)	**R$ -5.6 MM**	**R$ 3.1 MM**
PV of benefits*	**R$ 27.6 MM**	**R$ 20.9 MM**
PV of costs*	**R$ 33.2 MM**	**R$ 17.8 MM**

Table 7 reviews the outcomes of financial analysis of discounted cash flow evaluation. The financial NPV of water supply plant is negative, but for the wastewater disposal, it is positive. The lofty expenses which make the NPV of the water supply project negative are mainly because of high amount of investment at begging of the project and high employment costs connected with the water supply procedure.

The wastewater collection project needs just 50% of the capital cost, and significantly a smaller amount of worker than the water supply plan. In addition, the wastewater collection project can accumulate a service charge (used water) on CESAN's total water supply; since the benefits from the project to all inhabitants who are linked to the sewer system will be, grow. Briefly, the first high "fixed cost" for construction of broad water treatment plants and infrastructure is the major cause for the lackluster "financial performance" of the present water plan. On the contrary, the slighter investment and operating costs make the wastewater project more feasibility in financial terms.

The main investments cost is the buy the construction materials like bricks, steel and cement, that accounts for more than 65% of the entire investment in both projects. The extra costs are composed of machinery and labor force for the construction of the two facilities.

4.5 Sensitivity of NPV to Cost Overruns

The fiscal impacts of decreasing or increasing the likely costs are investigated in the below chart. A 10% increasing in investment expenses would decrease the project NPV over 20%, because investment expenses include a substantial financial expense in infrastructure projects. On the contrary, it is probable to recover the financial situation of project by managing the project investment outlay. These investment expenses, conversely, show technical specifications and market values that do not permit for important decline. Local experience from same infrastructure projects, suggesting that expenses really might be estimated to exceed forecasts. Material expenses are as well sensitive to fluctuations of foreign exchange, because more than 50% of materials and machinery will be imported directly. Consequently, a real deprecation of the Real (R$) through the investment stage of project could negatively affected by an increase in the expense of funding the two systems.

Table 8: Sensitivity of NPV to Cost Overruns

	Water	Sewerage
	Financial NPV	**Financial NPV**
-6%	(4,763,947)	3,516,980
-4%	(5,032,913)	3,386,991
-2%	(5,301,879)	3,257,002
0%	(5,570,846)	3,127,013
2%	(5,839,812)	2,997,024
4%	(6,108,778)	2,867,035
6%	(6,377,745)	2,737,046
8%	(6,646,711)	2,607,057
10%	(6,915,677)	2,477,068

Percentage of Cost overruns

4.6 Sensitivity of NPV to Changes in Real Growth in Wages

The financial sustainability of the water project will be influenced by the raises in the wage level, appears as labor accounts for more than 50% of operation costs. In addition, the government of Espirito Santo and CESAN give their labors 25% to 40% more than market prices for comparable work. The authentic wage is predicted to increase 2% per year, after the current trend in Brazil. Though, a single percentage change in the rate of actual wages growth could alter financial NPV of project over 20%. It is difficult to imagine a reduction in the existing wage structure, connected to specific political factors with state utility. The NPV of sewer project should be less influenced by labor productivity, because it uses fewer workers for project operations.

Table 9: Sensitivity of NPV to Changes in Real Growth in Wages

	Water	Sewerage
	Financial NPV	**Financial NPV**
1.00%	(4,626,989)	3,317,240
1.20%	(4,802,435)	3,281,544
1.40%	(4,984,281)	3,244,717
1.60%	(5,172,783)	3,206,715
1.80%	(5,368,206)	3,167,496
2.00%	(5,570,828)	3,127,013
2.20%	(5,780,939)	3,085,221
2.40%	(5,998,840)	3,042,069
2.60%	(6,224,843)	2,997,507
2.80%	(6,459,277)	2,951,481
3.00%	(6,702,482)	2,903,937
3.20%	(6,954,812)	2,854,817

Percentage Change in Growth of Real Wage Rate

4.7 Sensitivity of NPV to Changes in Invoicing and Collection Efficiency

Both projects' income should be notably influenced by CESAN's problems in administration of billing and collection process of incomes, which is allocated to the utility. These impacts are essential for water project, because it compromise the project fiscal feasibility. In addition poor management is destructive to the wastewater project, regardless of its monetary buoyancy, due to deprived invoicing and collecting of income.

CESAN is not charged to many water users, as they do not use an effective system for reading meters in water consumption. The objectives for improving are not considered sufficient due to making the project fiscally viable. In addition, if the improvements were sufficient, it could infinitely improve the project financial state. For instance, increasing 10% in invoicing can improve 37% in NPV of project, or more than R$2 million.

Table 10: Sensitivity of NPV to Changes in Invoicing or Collection Efficiency

	Water	**Sewerage**
	Financial NPV	**Financial NPV**
-15%	(8,652,783)	506,191
-10%	(7,625,470)	1,379,799
-5%	(6,598,158)	2,253,406
0%	(5,570,846)	3,127,013
5%	(4,543,533)	4,000,620
10%	(3,516,221)	4,874,228
15%	(2,488,909)	5,747,835

Change in the level of currently expected Collection or Invoicing Efficiency (0%=base case)

CESAN also faces a daunting task in term of gathering incomes for water service. Enhancing the existing level of collection should direct to a remarkable inflow of further revenue, which would improve the project fiscal. Though, the existing institutional developing of CESAN is expressed with concentrating on effectiveness of invoicing instead of billing to the collections, as shown in the figure below. However, it is obvious that invoicing improvements alone could not refresh the water project financially. In reality, CESAN should consider to using a dual strategy, focusing both on improving the invoicing and the expansion of charging of fees for their services.

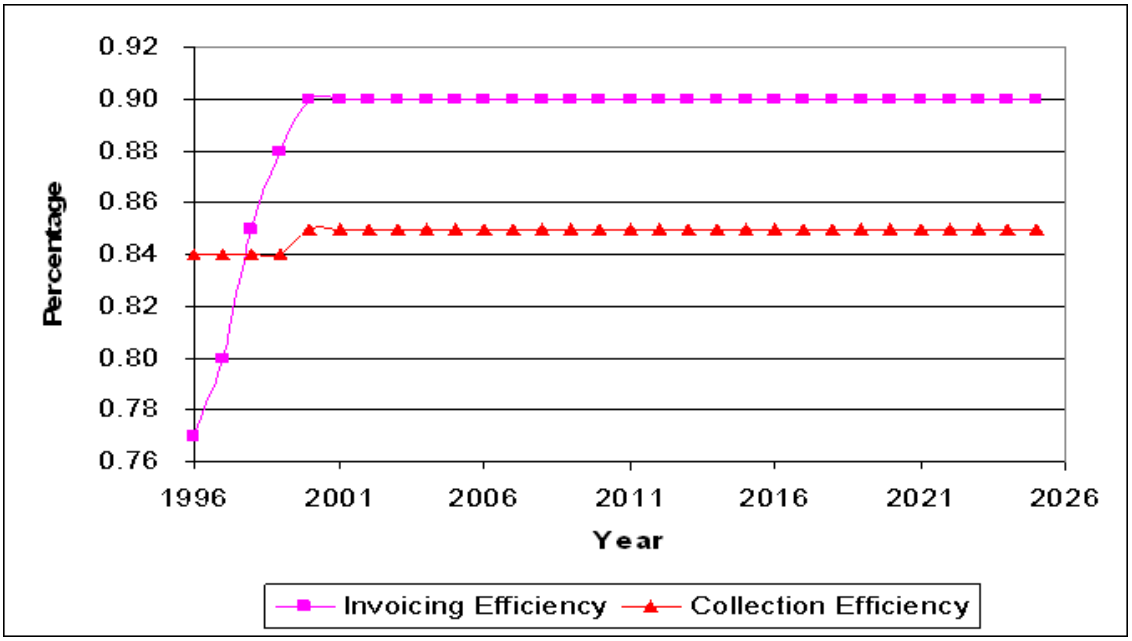


Figure 2: CESAN'S Targets for Improving Invoicing and Collection Efficiency for Water and Sewage Service

The following tables indicate that the water supply project is not likely to achieve financial autarky, despite a collective improvement of 10% in invoicing and collections. Any administrative improvement in CESAN should have positive effects on wastewater project. Consequently, when displaying the projects combined NPV, the project seems profitable, with increasing of 5% in the present goals for billing and collections. Indeed, CESAN should sustain its current goal for invoicing, at the same time enhancing 10% in collections, due to attain a NPV of R$1.35 MM for the project.

Table 11: Sensitivity of NPV of Water Project to Changes in Invoicing and Collection Efficiency

		Collection Efficiency					
		-15%	**-10%**	**-5%**	**0%**	**5%**	**10%**
Invoicing Efficiency	**-15%**	(11,272,429)	(10,399,214)	(9,525,998)	(8,652,783)	(7,779,567)	(6,906,352)
	-10%	(10,399,214)	(9,474,633)	(8,550,052)	(7,625,470)	(6,700,889)	(5,776,308)
	-5%	(9,525,998)	(8,550,052)	(7,574,105)	(6,598,158)	(5,622,211)	(4,646,265)
	0%	(8,652,783)	(7,625,470)	(6,598,158)	(5,570,846)	(4,543,533)	(3,516,221)
	5%	(7,779,567)	(6,700,889)	(5,622,211)	(4,543,533)	(3,464,855)	(2,386,177)
	10%	(6,906,352)	(5,776,308)	(4,646,265)	(3,516,221)	(2,386,177)	(1,256,134)

Table 12: Sensitivity of NPV of Combined (Water and Sewage) Project to Changes in Invoicing and Collection Efficiency

		Collection Efficiency					
		-15%	**-10%**	**-5%**	**0%**	**5%**	**10%**
Invoicing Efficiency	**-15%**	(12,993,936)	(11,378,155)	(9,762,373)	(8,146,591)	(6,530,810)	(4,915,028)
	-10%	(11,378,155)	(9,667,327)	(7,956,499)	(6,245,672)	(4,534,844)	(2,824,016)
	-5%	(9,762,373)	(7,956,499)	(6,150,626)	(4,344,752)	(2,538,879)	(733,005)
	0%	(8,146,591)	(6,245,672)	(4,344,752)	(2,443,833)	(542,913)	**1,358,007**
	5%	(6,530,810)	(4,534,844)	(2,538,879)	(542,913)	**1,453,053**	**3,449,018**
	10%	(4,915,028)	(2,824,016)	(733,005)	**1,358,007**	**3,449,018**	**5,540,030**

4.8 Sensitivity of NPV to Changes in Leakage and Stolen Water

Presently, CESAN does not obtain any monetary advantage from 28% percent of the water it provides, in order to water leakage and stealing through prohibited connections. The Utility also expects to decrease the proportion of non-revenue water to 13% during the project life. Every extra effort to restrict water discharge and to avoid illegal exploitation should improve the fiscal feasibility of the project. Although, the benefits should be moderate, because the gains will still continue to be compensate by poor billing and collections from the provision of extra water to charging customers. For instance, CESAN can enhance the monetary situation by only R$0.4MM throughout the providing 15% more water that would otherwise run away from water supply system. Reducing the level of non-revenue water also helps the financial position of the sewage collection plant, as its revenues are directly affected by the quantity of water supplied to paying customers. The reduction in level of non-revenue water helps the financial situation of the sewage collection plant, because its income directly impacted by the quantity of water fed to paying clients. In spite of CESAN's incapability to make significant amendments in fiscal situation, a reduction in stolen and water dripping could be quite effective if combined with additional enhancements in the amounts of invoicing and collections.

Table 13: Sensitivity of NPV to Changes in Leakage and Stolen Water

Change in the level of currently expected level for Leakage and Stolen Water	Water	Sewerage
	Financial NPV	**Financial NPV**
-15%	(5,290,330)	3,436,103
-10%	(5,366,911)	3,338,073
-5%	(5,469,433)	3,231,851
0%	(5,570,846)	3,127,013
5%	(5,701,237)	3,014,940
10%	(5,835,597)	2,902,706
15%	(5,968,169)	2,791,934

lower percentage = less leakage, base case assumes current target for level of leakage and stolen water

4.9 Sensitivity of NPV to Changes in Water Tariff

As far as revenue side, CESAN cannot increase prices due to main reasons. First, one goal of the project is to supply reasonable services to all inhabitants in the area. Second, an expected price is already close to income maximizing rates. The sensitivity analysis shows that a preliminary increase in the actual water tariff to R$1.05 should increase the water project fiscal NPV by R$ 1.4 MM. Any reduction in use should be more than increase in average income per cubic meter of water consumption balanced. Additional increases in the water tariff further than this point would persuade decreasing by clients, which lead to reduced revenue. Consequently, the NPV of the water project through increases in water tariffs would be decreased to R $ 1.05.

Water tariff cutback would raise CESAN amount of sales. The additional water supply consumers with the lower rate do not require the utility. This is because of fixed capacity of CESAN's water supply. The financial results of the project significantly would weaken, as sales decline rapidly if the price per cubic meter reduced.

The wastewater income is directly affected by the amount of water supplied to charging clients. A lower water content rate does not change the financial capacity of the wastewater project, because the steady supply of water avoid CESAN from enhancing supply, and wastewater fee stay unchanged. Water tariff regularly begin to decrease the amount of used water, which leads to decrease in revenue through the sewer system surcharge. Consequently, it is significant to know this insinuation for these two projects in the shaping of tariff formation to water supply project.

Table 14: Sensitivity of NPV to Changes in Water Tariff

R$	**Water**	**Sewerage**
	Financial NPV	**Financial NPV**
0.70	(10,132,609)	3,128,664
0.75	(8,990,720)	3,128,664
0.80	(7,848,831)	3,128,664
0.85	(6,706,941)	3,128,664
0.90	(5,570,846)	3,127,013
0.95	(4,712,758)	3,044,716
1.00	(4,236,003)	2,855,485
1.05	(4,153,497)	2,574,130
1.10	(4,477,210)	2,212,343
1.15	(5,261,592)	1,767,930
1.20	(6,507,181)	1,252,834
1.25	(8,295,303)	678,823
1.30	(11,155,806)	43,540

A fiscally best water tariff, would exploit revenues under the current conditions, is appreciated in subsequent graph. A tariff of R$ 1.05 per cubic of water supplies the most promising financial point of view for the combined project. Such a tariff was a significant amount of additional water sales, regardless of slight decline in revenue from the wastewater surcharge. It is essential to remind, however, that a higher level of tariff

adversely have an impact on goal of the project, that is the water provision for the poorest inhabitants of the area, as they may not be able to provide the service.

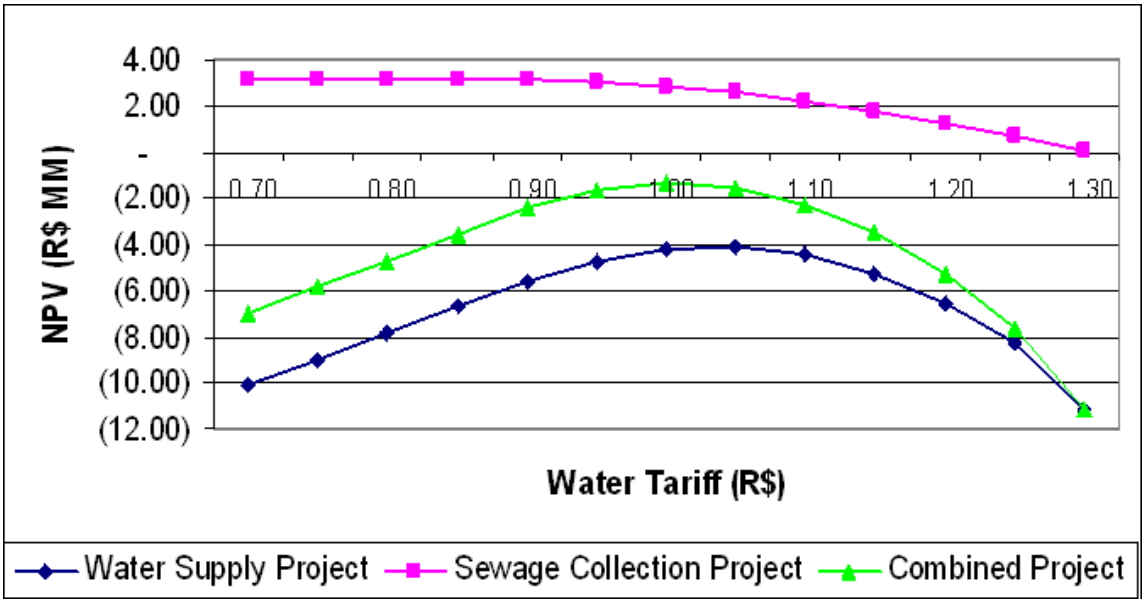


Figure 3: Optimal Water Pricing for Maximizing Financial NPV

4.10 Sensitivity of NPV to Changes in Sewerage Surcharge

Responsible consumers react to an increase in the sewer system because they would react to a rise in prices for water. This is because of the fact that sewage charges are used as a water surcharge, instead of separate fees for wastewater collection. The NPVs (based on a 0.05 increase in water or wastewater, for instance) differ, however, since the variation in revenue because of the changes in the sewer surcharge only for the wastewater project. The result on the water project is perceived to increase the corresponding reduction in water consumption as the price of water services. Otherwise, reduction of wastewater charge (of between R$ 0.14 and R$ 0.17) has no impact on water project NPV, as the presented network cannot deliver the increase in demand for water service. Although, small decreases in the sewer charge have an important effect

on wastewater project NPV. Indeed, the project could not be fiscally feasible when the award were lowered to R$ 0.14.

Table 15: Sensitivity of NPV to Changes in Sewerage Surcharge

R$	Water	Sewerage
	Financial NPV	Financial NPV
0.14	(5,565,031)	(754,401)
0.15	(5,565,031)	216,365
0.16	(5,565,031)	1,187,132
0.17	(5,565,031)	2,157,898
0.18	(5,570,828)	3,127,013
0.19	(5,603,981)	4,087,714
0.20	(5,637,135)	5,047,366
0.21	(5,692,565)	5,996,676
0.22	(5,756,756)	6,940,221
0.23	(5,834,597)	7,875,229

Table 16: Equity Point-of-View

Water NPV	Sewage NPV	Combined NPV
R$ -5.6 MM	R$ 3.1 MM	R$ -2.4 MM

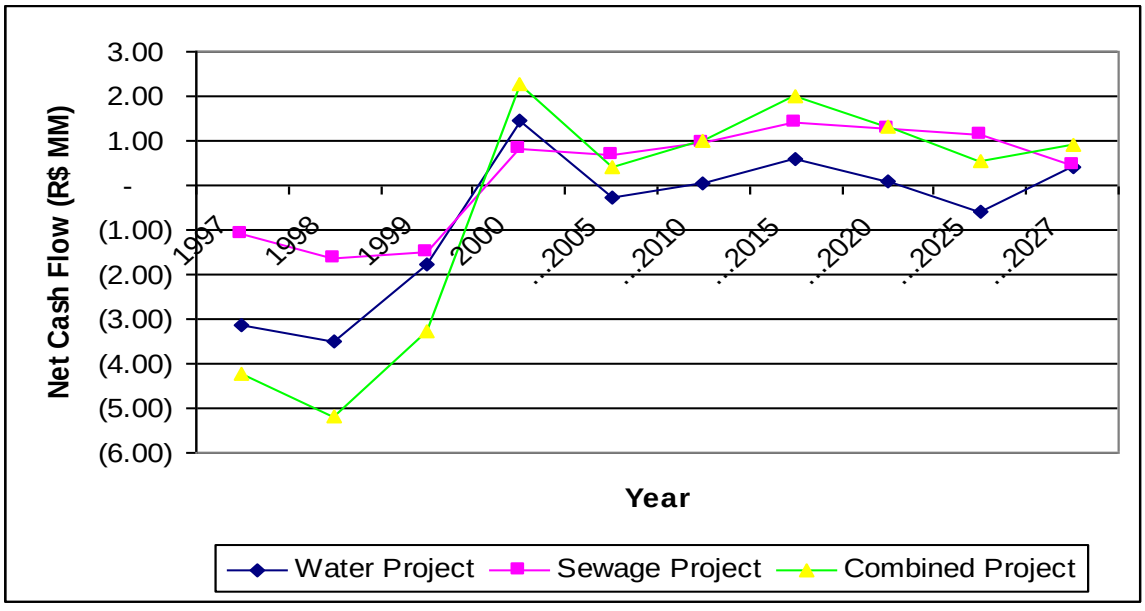


Figure 4: NET FINANCIAL CASH FLOW PROFILE OF PROJECT

The above graph shows the profiles of cash flow in water supply system, the sewage treatment plant, and the combined project. The graph illustrates that sanitation project cash flow is more reliable than for the water supply project. It also shows the impact when the two plants were considered as one project. The financial performance is promising for combined project. Indeed, the entire project is in a position to cover all financial debt over the project operation years, in spite of its disability to deserve a normal rate of return on equity capital.

The rate of financial profitability, earning from project operating activities, however, may be adequate, in light of the public unit type of the project. The Combination of the two projects efficiently causes the wastewater project to subsidize some of the water losses of project. It is significant to recognize, however, that the revenues collected and the quantity of wastewater effluent (to shape the operational expenses) are functions of the water supply project. This association between the two parts of the project makes it rational to eventually assess the two projects as one.

Chapter 5

ECONOMIC ANALYSIS

5.1 Overall Approach

The economic evaluation modifies all main cash flow elements from financial aspects terms to economic aspects through using specific commodity conversion factors. The project economic value is declared to be summation of all project economic advantages minus project resource expenses, applied to Brazil inhabitants. In local currency for evaluating financial and economic values, I utilize the price level as the numeraire. To perform the economic valuation, I primary approximate the state economic factors, containing the economic cost of foreign exchange and the economic cost of capital. Next, I continue with assessment of the economic achievement of pure water facilities and the wastewater and removal facilities. Lastly, I approximate each project inputs economic value. After that, I utilize economic values to change net financial cash flows into net economic benefits (Jayawardena et al, 1999).

5.2 Conversion from Net Financial Benefits to Net Economic Benefits

The economic rate of foreign exchange is different from financial rate of foreign exchange because of distortions, which generated through custom duties and quotas. In Brazil, The economic value of foreign exchange is anticipated 12.06% above the existing price in the market. The economic cost of capital (EOCK), which is used in economic analysis is defined as the minimum economic rate of return that either a private or public sector investment must earn if it is to contribute to the growth of the economy and here (in this project) evaluates the actual opportunity cost of resources in Brazil. The income impact of domestic saving, profit that gain from project investment in various divisions along with costs of overseas borrowing are considering in economic cost of capital calculation. The latest EOCK of Brazil is counted around 12.16%.

5.3 Economic Valuation of Outputs

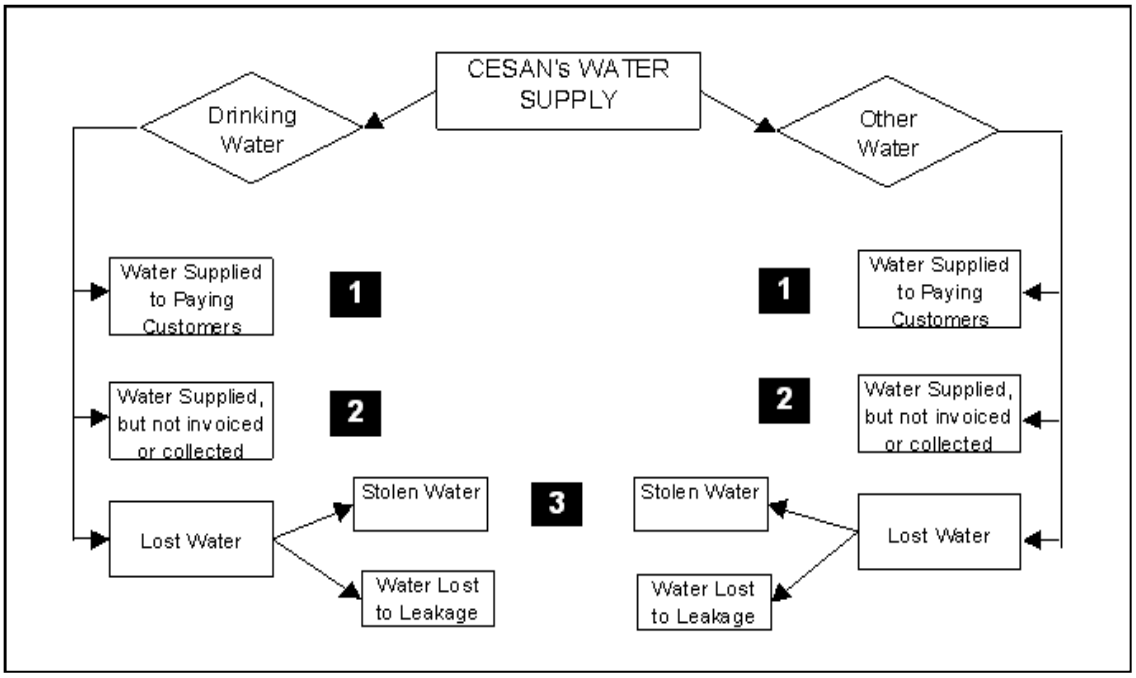


Figure 5: Breakdown of Economic Valuation of Water

The water economic evaluation is evaluated in the coming manner: in First step, I distinguish potable water from water, which used for any other intentions. Economic values of these two separate water uses differ considerably in contrast to financial assessment that is consistent. Moreover, if the water duties were to modify, the consumer's response to changing price will be derived from their exact water utilization. The potable water demand elasticity with considering its price appreciably is smaller than the consumption of water for other intentions. The users of water are break down to three categories. First cluster includes water consumers that they are paying water consumption fees (as can be seen in following figure). On this cluster, the water utilization economic value is an adaption to water fiscal income from water. The second cluster consists of the consumers, which serviced through CESAN, who do not pay, in order to invoicing deficiency and collection (as can be seen in following figure). Lastly, I divide stolen water that is separated into lost water and water lost due to leakage in supply system. The former has some economic value, despite the lack of any financial benefit, while the latter is a loss in both economic and financial terms. Thus, I estimate the economic valuation associated with drinking water and water used for other purposes for paying customers, for non-paying (i.e. non-invoiced) customers, and for stolen water.

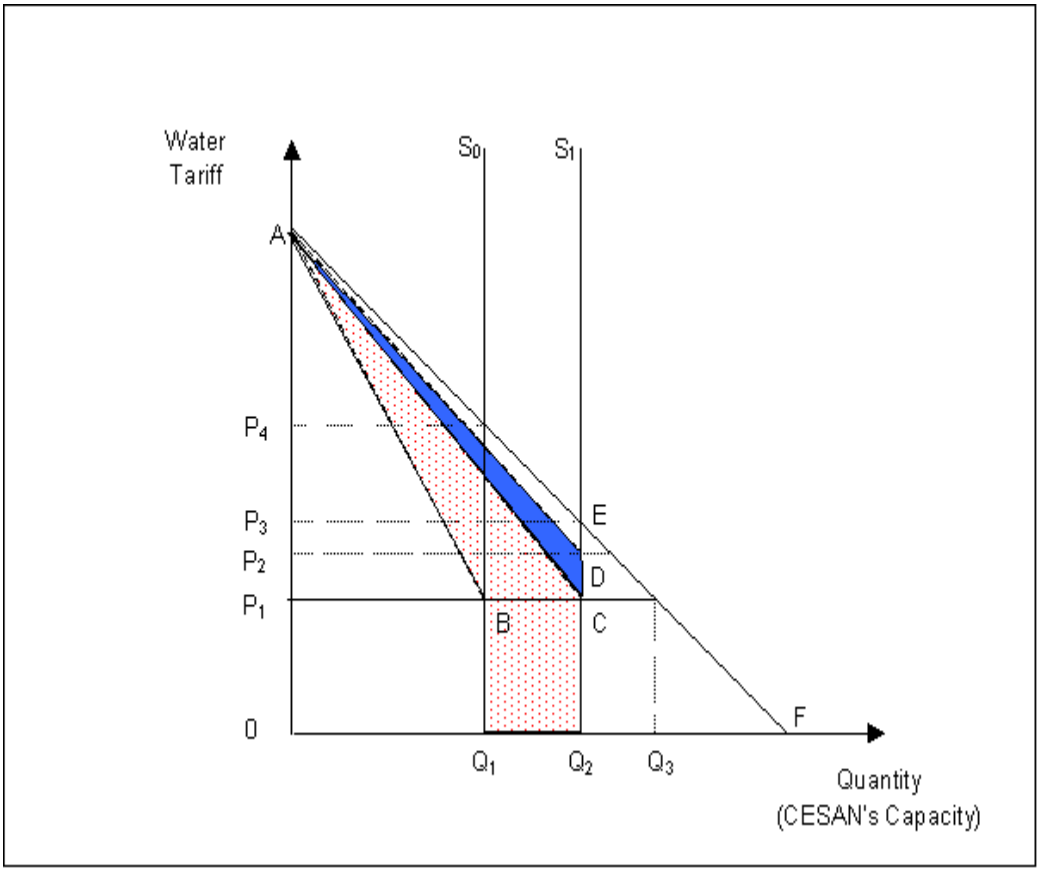


Figure 6: Economic Valuation of Water for Paying Customers

The graph above shows the economic assessment of potable water for paying consumers. The water supply demand in the Guarapari area is demonstrated through the demand curve AF, and the water service price is formed through CESAN at P_1. Therefore, there is a lack of water service, because the water demand at P_1 is Q_3, but CESAN's ability allows just one cubic meters of water a supply at Q_1. When the price of water is not fixed, the equilibrium level will be P4. Through the expansion of capacity, CESAN moves water-supplied amount to Q_2. The rationing of water can decrease, though it is still a water deficiency in P_1 price. In this project, the economic gain to paying water customers is anticipated through ACQ_2Q_1B surfaces.

This method of economic assessment can be useful for both, potable water and water used for other intentions by paying users. The maximum willingness-to-pay, however, would be much greater for potable water than for water that used for other intentions (R$3.90 and R$1.95 respectively), but CESAN's water duties and capacity stay same in both cases

It is significant to remember that in an insufficiency situation, rising in rate of water tariff will increase the economic benefits. Water consumption price would decrease. The released amount of water, although, would compensate a few of present deficiencies by being channeled to customers who's willingness-to-pay for the water service is higher than water consumers who abandoned the extra water. As it illustrate in Figure 6 CESAN keeps the existing water duties at P_1, and the water service ability is Q_2.

When the water price change to P_2, the economic benefit would raise through the quantity of ADC surface, made with no change in the total water amount. In addition with increasing in price, it will make the same impact up to point E (price P_3), at this point, there is equilibrium for water market, and the deficiency will be reduced. Any more increases in rate of water duties make water consumers to decrease their consumption, consequently reduce total economic benefits.

The water economic value in our analysis is considerably higher than its financial value. Persons who gain service through illegal methods also obtain some benefit, although CESAN is not able to recover any financial compensation from such customers. Therefore, an adjustment has to be made due to estimation of true economic effect of the

project. It would be wrong to suppose that the economic value of water that will not produce returns equal to market price of water for all units of water consumption, since many of the non-paying consumers may value the water service under the present price. Some customers may really value their water at a higher level than CESAN's water tariff rate, but reimburse nothing in order to the gaining method. The water evaluation that produces no returns is evaluating at 50 percent of the total among the maximum willingness-to-pay and the price, in order to this diffusion in assessment. Since the non-revenue water price is zero, the economic value is merely 50 percent of the maximum willingness-to-pay.

The economic value may contain a value, which is not clear in customer's "willingness-to-pay" for facilities. The water value, which utilize for "non-drinking" reasons, shows public externalities value, which is related to the product. For instance, water sanitation system can decrease diseases, which are caused by water that any person may be vulnerable to; nevertheless, some consumer may not believe in value of this, because he cannot recognize the overall advantages that he receives .thus, the function of market demand that estimate consumer willingness-to-pay will underestimate the services value.

In this condition, the externality related to non-drinking water is not high .the World Bank study shows that the diseases occurrence in Guarapari in order to water-borne illnesses is extremely low. However, the overall water economic value in our project is considerably more than financial value due to the supply scarcity and the value placed on unpaid-for and illegally acquired water.

The external wastewater removal advantages, however, are important. The "non-use value" can divided into two major groups. The initial group contains the externalities created by wastewater removal in the society, counting the benefits that generating caused by living in an uncontaminated environment. The other group contains the gains to customers, which are not normally related to the service.

For instance, many people are not aware that the sewage service will help to maintain the purity of water sources from which drinking water is drawn. The resulting cleaner aquifer lead to a reduction in waterborne diseases, for which many consumers would be willing to spend financial resources, if they realized that this decrease in illness was a direct result of the sewage service. The unrealized nature of the benefits is not reflected in the consumer's willingness-to-pay for the project's services.

The research uses a contingent valuation survey due to evaluating the valuation of consumer. The contingent valuation analysis is based on a widespread study performing by the World Bank which conducting to estimate customer's willingness-to-pay for utilizing water supply and wastewater disposal facilities as well as any environmental benefits, which may be related to conducting project. Unlike the financial price in the water supply section, the price of wastewater removal does not provide a basis for estimation of consumers' valuation of the wastewater facility. Thus, our economic valuation of wastewater service is relying on study's consequence on families unit.

The research shows that people in Guarapari were keen on paying around R$0.49 per cubic meter for wastewater discarded if total gains of this service are definitely

measured. They put an extra value of R$0.35 for each "cubic meter" on the benefits of environmental improvement, which is consequent from wastewater disposal services. The entire environmental externality consists of a greater benefit for society, because the whole region population derives the benefits, whereas only the users paying can enjoy the wastewater service benefits.

5.4 Economic Valuation of Inputs

For maintaining the economic costs of inputs in the project, we use the conversion factor for every input element. Conversion factors convert each of the financial cash flow into the economic cost or benefit in the economic resource statement in the economic appraisal. In addition, conversion factors account for all modification in the domestic sales prices of non tradable goods, which can appear as a project result. Table 17 shows Commodity Specific conversion factors for all main project raw materials. As shown in the table, all inputs economic costs of project are smaller than their financial costs, because of high rate of taxes and import duties in Brazil, which compensated for increasing the economic burden of subsidies and foreign exchange premium. Because taxes and duties are transferring income from investors to others in the economy, thus theses distortions does not consider as a cost to the economy.

Table 17: Conversion Factors

CEMENT	0.873
STEEL	0.798
WOOD	0.873
BRICKS	0.952
SAND	0.945
600mm PIPES	0.820
PVC PIPES	0.941
MOTOR PUMPS	0.767
PUMP CONTROLLER	0.767
TRANSFORMERS	0.771
LABOR	0.462
CHEMICALS	0.825
ELECTRICITY	1.051
OTHER SERVICES	0.700

5.5 Results of Economic Analysis

The electricity conversion factor is one nearby, since there are existing four major market distortions that are likely to offset each other out. In labor part, the degree to which the project is concerned is obvious. The conversion factor of labor is very small, it is around .462, but it is not only due to high tax, but also in order to the protected wageworkers by Government. The economic cost of labor to society is very smaller than its financial cost, because the market value of payments for similar work is pretty less, than the payments paid by CESAN.

All other commodity specific conversion factors show that economic costs is less than financial costs, mainly because of market distortions ,such as taxes and duties .

The economic analyses outcomes show that, this project create significant economic benefits for the society. The wastewater project turns out to be a potentially good investment project for the country, because the service value, combined with the environmental benefits, far exceeds the construction costs and operating the project. The project net present value is nearly same to 350% of the cash value of investment and operation economic costs.

The economic analysis illustrated that, water project, which has a considerable NPV that is around 125% of the cash value of all economic costs to construct and run the project, is also very attractive for the country.

Table 18: Results of the Economic Analysis

(in million R$)	**Water Supply Project**	**Sewage Collection Project**
NPV of project* (PV of benefits - PV of costs)	**R$ 22.9 MM**	**R$ 35.1 MM**
PV of benefits*	**R$ 41.2 MM**	**R$ 45.8MM**
PV of costs*	**R$ 18.3 MM**	**R$ 10.7MM**

* Sum of values from 1997 to 2027

5.6 Sensitivity of Economic NPV to Changes in Water Tariff

The water project economic evaluation rises as the water duty[1] is various from R$0.70 to R$0.85 range. The rise in price encourages customers who are ready to pay for water under the new rate of duty to decrease their consuming .though, some users will be ready to pay more tariffs and use the liberate water. As the new users of liberate water worth the facilities more than last year consumers, the overall generated benefits of water project should rise. However, further price goes up, the economic NPV of the project would start to decrease, as soon as the present shortage is entirely released. When the water tariff is increasing to levels, which release the shortage, further price rises will encourage consumers to limit their consumption. The water economic value will be smaller, because the water consumption is lower. The lower water consumption leads to decrease economic NPV of the project. If the water duty is increased as much as R$ 1.30, the smaller consumption of water will decrease the economic benefits, which finally make economic NPV negative.

After the project investment completion and the beginning of its action, the project should be capable to meet the overall water demand in area for a short scarcity.

[1] Real Water Tariff

The wastewater service economic NPV stayed unchanged in the first price variety of R$0.70 to $0.85, since the amount of water supplied is still unchanged. The minimum water consumption price will raise the service demand, but CESAN is not in position to supply extra water, in order to its firm capacity. Thus the economic value, stay unchanged, because the quantity of water supplied by the project is same. As soon as reduction in water consumption, because its price goes up, the wastewater service economic value will decrease, due to less wastewater-requiring disposal.

Table 19: Sensitivity of Economic NPV to Changes in Water Tariff

R$	**Water**	**Sewerage**
	Economic NPV	**Economic NPV**
0.70	22,530,858	35,107,507
0.75	22,989,166	35,107,507
0.80	23,447,474	35,107,507
0.85	23,905,782	35,107,507
0.90	22,920,055	35,103,958
0.95	20,278,988	34,943,907
1.00	17,720,135	34,609,673
1.05	15,155,507	34,133,156
1.10	12,511,056	33,538,606
1.15	9,262,040	32,828,999
1.20	6,277,511	32,026,404
1.25	2,255,875	31,152,556
1.30	(2,635,690)	30,213,886

5.7 Sensitivity of NPV to Changes in Sewage Surcharge

Altering the wastewater surcharge has a same result to changing the water price, because the charge will be added to the water duty. Thus, by increasing water price, the economic benefits of the project decrease due to reduction of water consumption. For instance, when the surcharge rises more than R$ 0.17, the consequence of increasing in price, lead to decrease in economic NPV of project.

This is the result of decreasing in the quantity of water. Certainly, less water consumption cause lower economic benefit of wastewater project due to less wastewater disposal.

Table 20: Sensitivity of Economic NPV to Changes in Sewage Surcharge

R$	Water Units	Sewerage
	Economic NPV	Economic NPV
0.14	24,364,090	35,107,507
0.15	24,364,090	35,107,507
0.16	24,364,090	35,107,507
0.17	24,364,090	35,107,507
0.18	22,920,055	35,103,958
0.19	22,855,146	35,083,651
0.20	22,790,237	35,063,344
0.21	21,258,323	35,029,695
0.22	21,138,796	34,990,797
0.23	19,711,614	34,943,907

5.8 Sensitivity of NPV to Changes in Maximum Willingness-To-Pay for Water

The economic evaluation of the water project should be considerably various when the highest willingness-to-pay for water supply service in Guarapari were dissimilar from the research approximation. Because there is water rationing in order to the scarcity, the highest willingness to pay, together with water duty, defines the economic value of water facilities[2]. Greater maximum willingness-to-pay would be the consequence of greater evaluation of the water services through water users.

[2] Economic value = $(P_{max} + P_1)/2$, where P_{max} is the maximum "willingness-to-pay".

Nonetheless, the water project economic net present value is robust even if the estimations are as low as $2.00 for water and $1.00 for the other water consumption.

Table 21: Sensitivity of NPV to Changes in Maximum Willingness-to-Pay for Water

Other Water (R$)	**Drinking Water (R$)**	**Water**
		Economic NPV
1.05	2.10	8,062,896
1.20	2.40	10,539,089
1.35	2.70	13,015,282
1.50	3.00	15,491,475
1.65	3.30	17,967,669
1.80	3.60	20,443,862
1.95	3.90	22,920,055
2.10	4.20	25,396,248
2.25	4.50	27,872,441
2.40	4.80	30,348,634
2.00	4.00	23,745,453
2.05	4.10	24,570,850
2.10	4.20	25,396,248

5.9 Sensitivity of NPV to Changes in Proportion of Drinking Water to Other Water

The base case evaluation supposes that 30 percent of the water of CESAN is used as potable water, whereas the other 70 percent is used for further intention. The water Consumers put a much higher value on potable water than on water used for further intention, in order to its fundamental requirements nature .thus , with increasing consumption of water for drinking intention, the economic value of water project will be increase.

For instance, the base case anticipates the economic value of potable water to be R$ 2.40, whereas the value put on other consumption of water is R$ 1.43. On the other hand, a decline in the proportion of water for drink, which will enhance the quantity of water used for further intention, would decrease the project economic benefit.

Table 22: Sensitivity of NPV to Changes in Proportion of Drinking Water to Other Water

	Water
	Economic NPV
15%	19,205,765
20%	20,443,862
25%	21,681,958
30%	22,920,055
35%	24,158,151
40%	25,396,248
45%	26,634,345
50%	27,872,441

5.10 Sensitivity of Economic NPV to Changes in the Valuation of Non-Revenue Water

The economic value of non-revenue water is anticipated to be the average among the maximum willingness to pay of consumers for potable water and others water consumption and zero, which is the price that consumers ready pay for water services.

For instance, when the economic value of non-revenue water were decreased to 70% of the anticipation (R$ 1.36 for drinking water and R$ 0.67 for other uses) in the base case, the net economic profit to society would be decrease nearly 15%. Otherwise, the economic NPV of the project would obtain a major increase, if the assessment were to rise.

Table 23: Sensitivity of Economic NPV to Changes in Valuation of Non-Revenue Water

Percentage of Original Estimate	WTP for Drinking Water	WTP for Other Water	Water Economic NPV
70%	1.37	0.68	19,567,015
80%	1.56	0.78	20,684,695
90%	1.76	0.88	21,802,375
100%	1.95	0.98	22,920,055
110%	2.15	1.07	24,037,735
120%	2.34	1.17	25,155,415
130%	2.54	1.27	26,273,095
140%	2.73	1.37	27,390,775

5.11 Sensitivity of NPV to Changes in Real Wage Increase

The impact of labor cost increasing is more important in the financial analysis than in the economic analysis. The explanation for the less impact of this on economic analysis is that the labors economic cost is significantly less than the financial expense on employee's wages.

Table 24: Sensitivity of NPV to Changes in Real Wage Increase

	Water	Sewerage
	Economic NPV	**Economic NPV**
1.00%	23,259,621	35,175,939
1.20%	23,196,231	35,162,375
1.40%	23,130,664	35,148,409
1.60%	23,062,838	35,134,028
1.80%	22,992,665	35,119,216
2.00%	22,920,055	35,103,958
2.20%	22,844,914	35,088,239
2.40%	22,767,144	35,072,042
2.60%	22,686,644	35,055,351
2.80%	22,603,307	35,038,147
3.00%	22,517,023	35,020,411
3.20%	22,427,678	35,002,127

5.12 Sensitivity of NPV to Changes in Contingent Valuation Assessment

The assessment of wastewater service and the environmental gains predict through the research carried out in Guarapari is a significant factor that contributes to the high economic profitability on the investment of wastewater project. We can also understand from the result of sensitivity analysis that the values are sufficient to the NPV considerably when the approximation were different. Nonetheless, if the benefits estimation of the service and the relevant ecological recovery were reduced by R$ 0.25 and R$ 0.20 for each cubic meter correspondingly, the water element of the project would be economically viable.

Table 25: Sensitivity of NPV to Changes in Contingent Valuation Assessment

Contingent Valuation of Environmental Recuperation Benefits (R$ per M^3)	Contingent Valuation of Sewage Service (R$ per M^3)							
		0.25	0.30	0.35	0.40	0.45	0.50	0.55
	0.20	14,413,945	16,524,800	18,635,654	20,746,509	22,857,363	24,968,217	27,079,072
	0.25	18,058,584	20,169,439	22,280,293	24,391,148	26,502,002	28,612,856	30,723,711
	0.30	21,703,223	23,814,078	25,924,932	28,035,787	30,146,641	32,257,496	34,368,350
	0.35	25,347,862	27,458,717	29,569,571	31,680,426	33,791,280	35,902,135	38,012,989
	0.40	28,992,501	31,103,356	33,214,210	35,325,065	37,435,919	39,546,774	41,657,628
	0.45	32,637,140	34,747,995	36,858,849	38,969,704	41,080,558	43,191,413	45,302,267
	0.50	36,281,779	38,392,634	40,503,488	42,614,343	44,725,197	46,836,052	48,946,906
	0.55	39,926,418	42,037,273	44,148,127	46,258,982	48,369,836	50,480,691	52,591,545

Table 26: Comparing Results from Financial Analysis

	Economic Analysis		**Financial Analysis**	
(in million R$)	**Water**	**Sewage**	**Water**	**Sewage**
NPV of project* (PV of benefits - PV of costs)	**R$ 22.9 MM**	**R$ 35.1 MM**	**R$ -5.6 MM**	**R$ 3.1 MM**
PV of benefits*	**R$ 41.2 MM**	**R$ 45.8MM**	**R$ 27.6 MM**	**R$ 20.9 MM**
PV of costs*	**R$ 18.3 MM**	**R$ 10.7MM**	**R$ 33.2 MM**	**R$ 17.8 MM**

Table 26 compares the finding of the financial and economic analysis of the two projects. The economic value of water benefits is more than the financial benefits of project, because consumers put greater economic value on water service. In addition, the economic assessment of expenses is considerably different from their financial evaluation. The economic resource costs are nearly half of the financial costs related with the project, mostly in order to the lower economic assessment of labor force.

The wastewater project indicates a higher discrepancy among economic and financial analysis. Much of this difference is because of the environmental advantages and values related with wastewater service, which the monetary markets are not able to replicate precisely.

A less important explanation for the divergence is that the economic expenses are about 40% smaller than project financial expenses.

The benefits of water service project are anticipated to be more than the financial values, by around 90 percent. The price of labor force and the less economic evaluation of other inputs lead to less total economic expenses and make the NPV of the project positive. This is in contrary with financial analysis result that makes NPV negative.

5.13 Distributional or Stakeholder Analysis

Table 27: Distribution of Externalities

	Total Externalities	Government	Consumers	Workers	Society
Water Supply Plant	R$ 29.9 MM	R$ 2.9 MM	R$ 24.7 MM	R$ 2.3 MM	R$ 0.0
Sewage Disposal Plant	R$ 35.1 MM	R$1.0 MM	R$ 6.3 MM	R$1.0 MM	R$25.2 MM
Combined Project	R$ 65.0 MM	R$ 3.9 MM	R$ 31.0 MM	R$ 3.3 MM	R$ 25.2 MM

The distribution of positive externalities - the difference between net economic benefits and net financial benefits, both discounted at the economic discount rate - illustrates who obtains benefits without bearing equivalent costs and vice versa. In table 27, we realize that the whole externalities value created by the wastewater removal project (R$ 35.2 MM) and for the water supply system (R$ 29.8 MM) are so extensive.

In both projects, the Government reaps direct financial benefits (R$ 3.9MM) through the collection of taxes and tariffs that are imposed on the inputs of the projects. Water consumers realize significant benefits(R$ 24.7 MM) since the project alleviates much of the burden caused by the pre-project water shortage and the resulting rationing of service. Additional externality benefits are obtained by those who steal water, since they do not pay for the services they acquire. The benefits to workers come mostly in the form of a wage premium that the Government pays over the supply price for equivalent labor.

Since the water supply project is labor intensive, the benefits to the workers are greater in this project than in the sewage disposal project (R$ 2.3 MM and R$ 1.0 MM, respectively). Nevertheless, consumers of the sewage service also obtain a consumer surplus of R$ 3.6 MM. The positive externalities captured by society at large from the operation of the sewage disposal plant reaches R$ 25.2 MM, which is much greater than the total financial cost of the project (R$ 17.8 MM). This positive externality is due to the large amount of benefit obtained through environmental improvement that the project is unable to show financially.

In the last evaluation, the water customers are the biggest winner in the water project, but the state and workers also realize a good distribution of the gains from the positive externalities. In the sanitation project case, most of the gains accrue to all of the inhabitants of the Guarapari, whereas the direct water users, workers and the government understand some profits. In conclusion, in both projects, there are no net negative externalities imposed on each stakeholder.

Chapter 6

RISK ANALYSIS

The cash flow projections in the static model of the financial and economic analyses do not account for the uncertainties and fluctuations in the real world. Monte Carlo simulations, a form of risk analysis, provide one of the most practical methods to approximate the dynamics and uncertainties of the real world. The risk analysis repeats the financial and economic analyses many times using distributions for the values of the most sensitive variables that affect the project. In preparation for these simulations, we conducted sensitivity analyses to identify the variables that significantly affect the outcomes of the projects. After identifying the sensitive variables, we distinguished from among them those that are within limited or full control of management and those that fall outside the control of CESAN. For example, the invoicing efficiency is a variable that clearly has an impact on the projects' financial viability. It also happens to be under CESAN's control. On the other hand, inflation can affect the outcome of the project, but CESAN cannot influence the inflation rate in Brazil. Furthermore, the contingent valuation estimates could be uncertain due to errors of estimation. All these variables contribute to the uncertainty of future project outcomes. Thus, they qualify as risk variables.

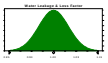
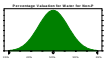
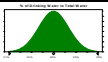
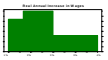
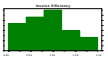
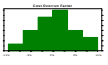
Table 28: Risk Variables and their Impact and Risk Significance

Risk variables	Impact and risk significance
Inflation	Large effects on working capital and interest rate on loans. Beyond management control; based on economic factors and policies.
Devaluation of real exchange rate	Large effects on the costs of tradable inputs, particularly on initial investment costs. Beyond management control.
Level of lost water	Effects financial as well as economic analysis. Larger amounts of lost water reduces financial revenue. Also effects economic benefits since stolen water is valued differently from bought water.
Valuation of non-revenue water	Value placed by consumers on water stolen from CESAN's network. No financial revenue is realized, but has economic value.
Ratio of Drinking Water to Total Water	Effects economic valuation of water project since consumers place a different economic value on drinking water than other uses of water
Real increase in wages	Large effects on the costs of labor. Influenced by government policies and market conditions; beyond management control.
Collection efficiency	Direct effect on revenues and profitability. The management controls the efficiency to a large extent.
Invoicing efficiency	Direct effect on revenues and profitability. The management controls the efficiency to a large extent.
Investment cost overruns	Direct increase of investment costs. Management can control it to a large extent.
Maximum willingness-to-pay for water	Determines economic value of water when there is rationing. Uncertainty is related to inaccuracy in estimate.
Valuation of sewerage service	Value derived from contingent valuation survey. Uncertainty is related to survey bias that may exist. Effects economic valuation of sewage.
Environmental recuperation benefits	Large effect on the economic valuation of environmental protection. Beyond management control; based on people's preferences.

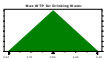
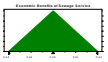
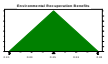
The objective of the risk analysis is to assess the impact of the variables in Table 28 on the project's outcome. Thereafter, the project managers can make their best efforts to optimize variables within their control and to reduce the risks faced by the project. An analyst can also determine the project's ability to withstand the impacts of variables such as inflation that are beyond the control of project managers.

To evaluate the impact of the risk variables on the project outcomes under various circumstances, we used a computer software package to generate random values for the variables, whose behavior was assessed through research and analysis.[3] We simulated 2,500 trials in our analysis. These simulations approximate the range of possible scenarios in real life, thereby giving us a probability distribution of financial and economic NPV of the two projects.

Table 29: Risk Variables and their Impact and Risk Significance

VARIABLE	DISTRIBUTION	RANGE	
Inflation Rate	Normal 	Mean Standard Dev.	10.00% 2.00%
Devaluation of real exchange rate (average over life of project)	Custom/ Step 	-15.0% to –10.0% -10.0% to -5.0% -5.0% to 0.0% 0.0% to 5.0% 5.0% to 10.0% 10.0% to 15.0%	0.10 0.15 0.25 0.25 0.15 0.10
Level of lost water (as ratio of target level)	Normal 	Mean Standard Dev.	1.00 0.05
Valuation of non-revenue water (as percentage of maximum willingness-to –pay)	Normal 	Mean Standard Dev.	50% 5%
Ratio of Drinking Water to Total Water	Normal 	Mean Standard Dev.	30% 3%
Real increase in wages	Custom/ Step 	1% to 2% 2% to 3% 3% to 4% 4% to 5%	0.20 0.50 0.20 0.10
Invoicing efficiency	Custom/ Step 	0.90 to 0.95 0.95 to 1.00 1.00 to 1.05 1.05 to 1.10 1.10 to 1.15	0.20 0.25 0.30 0.15 0.10
Investment cost overruns	Custom/ Step 	-15% to –10% -10% to –5% -5% to 0% 0% to 5% 5% to 10% 10% to 15%	0.05 0.15 0.25 0.30 0.15 0.10

[3] The computer software package we used is Crystal Ball produced by Decioneering Corporation, Denver, CO.

VARIABLE	DISTRIBUTION	RANGE	
Maximum willingness-to-pay for water	Triangular 	Minimum Likeliest Maximum	3.50 3.90 4.30
Valuation of sewerage service	Triangular 	Minimum Likeliest Maximum	0.44 0.49 0.54
Environmental recuperation benefits	Triangular 	Minimum Likeliest Maximum	0.31 0.35 0.38

Once identified, we also estimate a distribution and a range for each risk variable. Table 29 summarizes the specification we estimated for the variables.

Table 30: Economic and Financial NPV Based on Risk Analysis

	Water Supply Financial	Water Supply Economic	Sewage Disposal Financial	Sewage Disposal Economic
Expected NPV	R$ -5.8 MM	R$ 23.4MM	R$ 3.28 MM	R$ 35.0 MM
Standard Deviation	R$ 2.4 MM	R$ 2.4 MM	R$ 1.7 MM	R$ 1.4 MM
Probability of NPV > 0	0.87%	100%	98.7%	100%

Table 30 summarizes the results of our risk analysis. The expected NPV of the financial analysis of the water project alone is a negative R$ 5.8 MM, with no probability of the outcome being positive. The opposite is true for the Sewage Disposal plant, where the expected financial NPV is slightly positive. The expected NPV is significantly above zero, in the economic analysis of both the water and sewerage disposal project. The probability of a negative return is also zero, given the assumptions surrounding the specification of the variables.

Similarly, the expected economic value of the sewage project is high enough so that there is no probability of a negative outcome, given the assumptions used in the risk analysis. In other words, both projects are quite certain to provide a significant return to the economy of Espirito Santo. It is important to note, however, that much of the economic variability in the project stems from the uncertainty that may exist in the contingent valuation study.[4]

Since the expected NPVs for both projects are quite different from a break-even situation, changes in each of the projects NPV's may alter the viability of the combined project.

Table 31: Risk Analysis of the Combined (Water & Sewage) Project Financial NPV

Expected NPV	R$ -2.6 MM
Standard Deviation (σ)	R$ 4.0 MM
Probability of NPV > 0	26.33%

The expected value of the combined financial NPV is R$ -2.6 MM. There is, however, significant volatility in this estimate, as indicated by the high standard deviation. Furthermore, the probability of obtaining a positive NPV is only 26 percent. In fact, the results indicate that the possible NPVs can range from R$ –13.9 MM to R$10.3 MM.

[4] There are many biases that may exist in a contingent valuation that may lead to overvalued or undervalued results. For a more detailed explanation, refer to the following: Asian Development Bank, Economic Evaluation of Environmental Impacts, Manila, Philippines, 1996.

The financial NPV and its' standard deviation is not a sufficient indicator of the risks associated with this project, due to its public sector nature. A policy maker's likely objective in undertaking this project is to have it earn the minimum financial rate of return that would allow it to be sustainable, while generating the large economic benefits. Therefore, evaluating the risks associated with the yearly financial cash flows is more useful.

The investment stage risks are critical, since any changes in the estimated expenses will alter the required amounts of debt and equity. The highest investment costs occur in 1998, where the volatility in the expected costs is also large. The final year of investment (1999), however, may be more critical to the success of the project. The relative variability with respect to the expected NCF, indicated by the coefficient of variation, is at its highest in the third year of investment. Moreover, the expected financing may not be available in 1999, since resources may have already been utilized to finance shortfalls during the previous two years.

The expected net cash flows show that during the operational period, the combined project is able to financially sustain itself. There is still a certain amount of uncertainty regarding the project's ability to meet its financial obligations, especially during the phases of reinvestment.

Volatility during the period surrounding year 2005 can have a significant impact, since the project cash flows are not robust because of repayment of the loan. The project's financial condition also begins to deteriorate after the year 2020, as the financial revenues are unable to cover the real increase in the cost of labor. Therefore, volatility in the projects' estimated variables could have a significant impact on financial self-sufficiency.

Table 32: Risk Analysis of the Yearly Real Net Cash Flows for Combined (Water & Sewage) Project from the Equity Point-of-View

	Investment Stage			**Operational Stage**						
Year	**1997**	**1998**	**1999**	**2000**	**…2005**	**…2010**	**…2015**	**2020**	**2025**	**2027**
Expected NCF (R$ MM)	-4.28	-5.22	-3.29	2.31	0.42	1.01	1.94	1.20	0.27	0.89
Standard Deviation (R$ MM)	0.35	0.44	0.29	0.38	0.57	0.56	0.60	0.74	0.99	0.07
Coefficient of Variation	0.08	0.08	0.09	0.16	1.35	0.56	0.31	0.61	3.62	0.08
Probability of NCF>0	0.0%	0.0%	0.0%	100.0%	75.4%	97.5%	100.0%	93.5%	65.9%	100.0%

The variability of the stakeholder impact estimations is also important in determining the success of a public sector project. The largest volatility is associated with the externalities obtained by consumers and society. Much of the variability in the surplus obtained by water consumers is due to some uncertainty in the estimation of their valuation of water. For example, the uncertainty in the estimate of maximum willingness-to-pay for water, which is a key determinant of the consumers' economic valuation of water, will cause far greater uncertainty than the original stakeholder estimate. The variability of the sewage project's impact on consumers and society is based on any biases pertaining to the contingent valuation study.

Consumers and society still stand to gain significantly despite the large volatility, due to the magnitude of the original assessment. The gains to government and labor are more constant, since they are based on more certain estimates of investment and of the labor required to operate the two plants.

Table 33: Risk Analysis of the Stakeholder Impacts

	Government	Consumers	Labor	Society*
WATER PROJECT				
Expected Externality	2.99	25.22	2.33	
Standard Deviation	0.19	2.13	0.21	
SEWAGE PROJECT				
Expected Externality	1.02	6.17	1.02	25.20
Standard Deviation	0.06	1.55	0.06	1.04

* Consumers are also part of the society

The variables that have the largest impact on the economic NPV can be easily identified. The largest impacts in both projects reflect possible variability in the level of invoicing and collection efficiency. Additionally, the water project is significantly affected by changes in the real exchange rate and cost overruns, due to the larger investment required. It is affected by variability in wages due to its large requirement of labor as well.

Chapter 7

CONCLUSION

7.1 Evaluation of the Project

The State of Espirito Santo's objectives for undertaking the water supply project and the sewage disposal project in the Guarapari region are five-fold: 1) to increase the supply of clean water for the residents in the region in order to alleviate current shortages; 2) to enhance sanitation services in the region by increasing sewage collection and treatment rates; 3) to improve environmental protection by treating sewage prior to discharge into regional water systems; 4) to improve financial self-sufficiency and management efficiency of CESAN; and 5) to make the water supply and sewage disposal services affordable for low income residents.

The water supply project effectively eliminates the shortage of clean water in the region by increasing the number of connections between residences and public water utilities and by expanding the supply made available to the existing connections. By implementing the project, CESAN is expected to achieve connections to over 98% of the residential areas and to increase the quantity of water supplied by 68%, which will eliminate much of the need for water rationing. Figure 8 identifies the breakdown of new connections. The biggest beneficiaries from the new connections should be the low-income families, who make up 50% of the new connections. CESAN expects to provide 52 cubic meters of water per person per year, falling only slightly below the current demand of 54 cubic meters. However, because the price is

set as one fixed rate, the service may not be affordable for the lowest income segments of the population; this is one of the reasons why there are persistent problems of free riders and uncollected bills. Hence, it might be advisable to alter the billing structure in such a way that might levy an access fee per month that could be differentiated by the approximate income of households, coupled with a lower marginal rate per cubic meter of water.

The risk analysis and the deterministic model, both indicate that the water supply

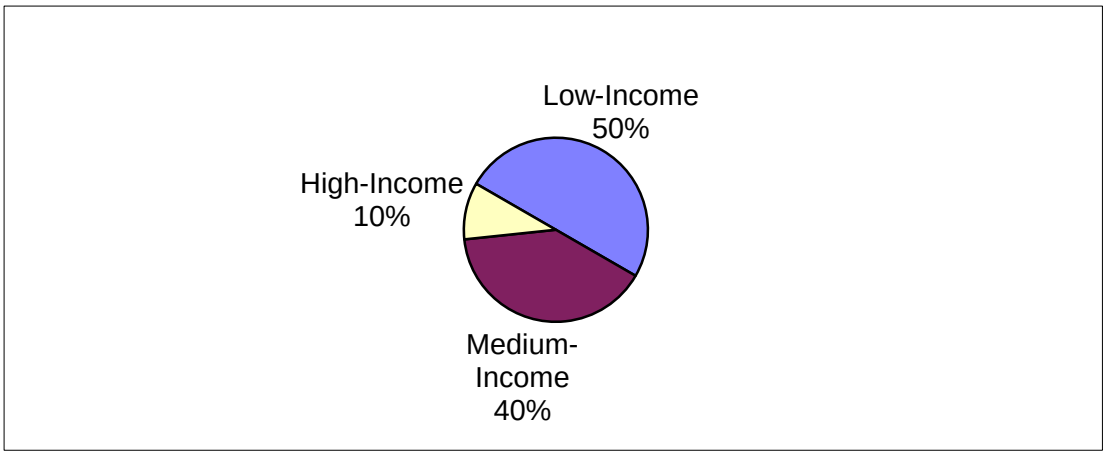


Figure 7: Breakdown of New Water Supply Connections

project should produce net economic benefits for society. The consumers of CESAN's water service reap most of the external benefits(R$ 24.7MM) produced by the project. The remaining externality is shared between the government (R$ 2.9MM) and workers (R$2.3). Due to the public sector rationale of the project, the government may want to use general public sector revenue in order to subsidize the financial loss of the project. The society as a whole, however, will benefit not only from eliminating water shortages, but also from the external economic gains received by consumers and workers.

There may be some non-use value of clean water that will become more evident in the future. Clean water supply prevents water-borne diseases, particularly as water sources become more contaminated by discharge of untreated waste. At present, health officials do not record a noticeable increase in water-borne diseases, because the water system in the project area has yet to reach the hazardous conditions found in the rest of the region. Nevertheless, even with the new sewage disposal project in full operation, more than 40% of the waste will still not be treated before it is discharged. Hence, the economic value of water may be undervalued in our analyses, since externalities from supplying clean water might increase significantly in the near future. This possible undervaluation strengthens the case for the water supply project, despite its poor financial performance.

The sewage disposal project is expected to significantly improve the conditions of the water systems in the region by reducing the volume of untreated waste discharged into rivers and into the ocean by 6 million cubic meters per year. The project plans to expand the collection capacity to over 11 million cubic meters over the life of the plant. The project increases the share of the population connected to sewage service from 13% to 46%. In addition, the project makes the service affordable for most low-income families by maintaining the utility prices at a relatively low R$ 0.18 per cubic meter. Figure 9 shows that the low-income families are expected to reap most of the benefits from the expansion of sewage services; they represent 82% of the new connections. Perhaps the sewage service is not affordable to all low-income people, since the problems of illegal connections and unpaid utility bills are currently serious. Still, a relatively low usage fee would attract more people into the public sewage network and help maintain cleaner water systems from which the drinking water is drawn. In turn, this larger pool of customers should keep

CESAN's cost of treating potable water low by requiring fewer chemicals to eradicate contaminants in the water supply.

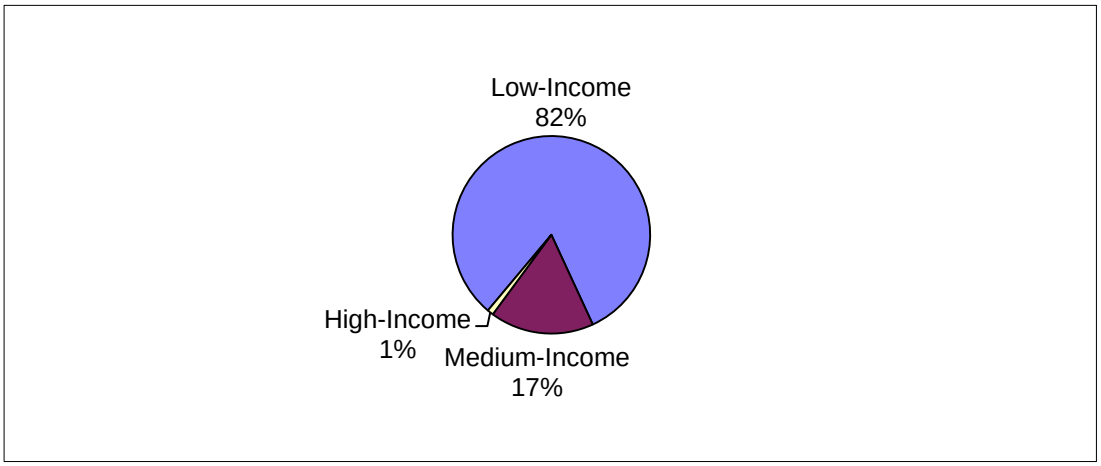


Figure 8: Breakdown of New Sewage Connections

The strongest case for undertaking the sewage disposal project is the enormous economic benefits it is expected to generate for society by preventing environmental degradation. While the financial NPV for the project is sound, the economic NPV is extremely robust. The positive externalities alone are greater than the total costs of investment and operations. The figures from our risk analysis - a mean financial NPV of R$ 3.1 MM and a mean economic NPV of R$ 35.0 MM – confirm our original hypothesis. After incorporating for the dynamics of the real world, we have a financially viable project that also produces large benefits for society. Hence, even if we use a lower contingent valuation proxy for the non-use value of benefits, the project remains highly attractive.

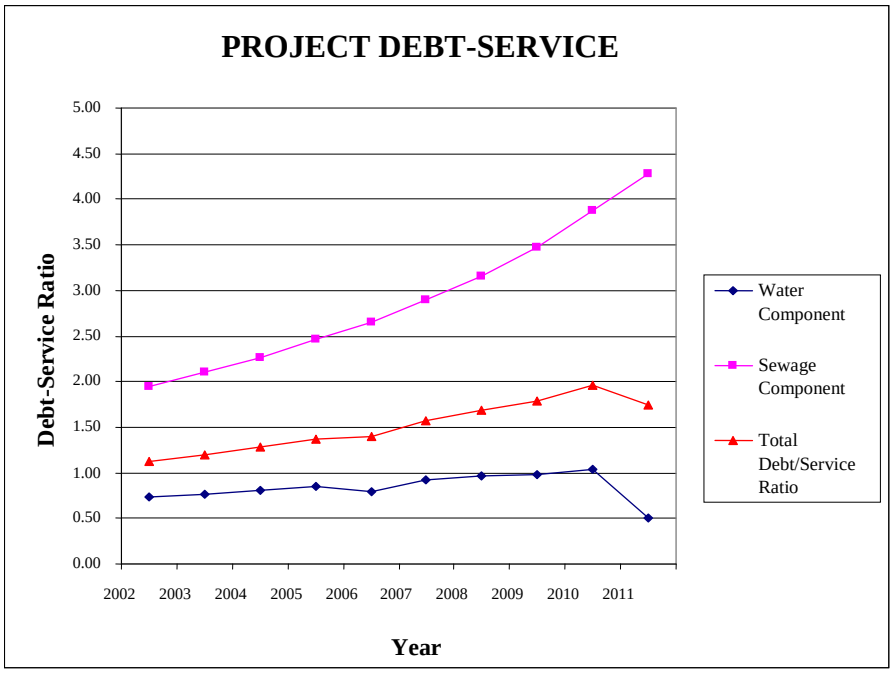


Figure 9: Debt-Service Ratios for Project Financing

Despite the strong economic prospect, it is still critical for the project to be financially self-sufficient. Espirito Santo cannot expect outlays from the federal government to cover serious financial shortfalls, mainly because inflation in recent years has prompted the central government to curtail subsidies. The preceding graph illustrates the debt service ratios for the two project components. The sewage project can clearly repay its portion of the loan, since the net cash flows before deducting financing costs are more than double those of the repayments. The robustness in the debt-service ratio in the sewage project is due to the lower loan amount (due to smaller investment costs) and the consistently high operational profits. The water project, on the other hand, is unable to make most payments through its operational surpluses. In other words, an additional infusion of equity is needed in order to sustain the payments without defaulting on the loan. A combined project scenario presents a debt service ratio that is greater than one, implying that the loan repayments can be sustained through operational profits. However, there is reason

for caution, as the project is barely able to make the loan repayments during the initial years of operation. Such a low debt-service ratio indicates that a small variation in operating income could place the project in financial difficulty.

Assessment of efficiency and profitability of the two projects should be focused on four key issues: invoicing efficiency, collection efficiency, water leakage and losses, and the cost of labor. In our static financial analysis, the water project has a negative financial NPV. Despite the positive financial NPV, the sewage project can also be further improved by effectively changing the above mentioned factors. To raise the revenues, CESAN has to increase the rate at which it invoices and collects bills for the services that it renders. Currently, CESAN expects to improve its invoicing efficiency from 77% to 90% and its collection efficiency from 84% to 85% over the life of the project. Clearly, this rate of increase in efficiency is not sufficient to make the water project financially profitable. By having one flat rate for services, CESAN neither harness possible revenues from customers on the upper end of the demand curve nor attracts potential consumers on the lower end of the demand curve. An improved pricing policy via block pricing can also enhance the profitability of the projects directly.

On the expense side, the high cost of labor is the main reason for generating inadequate financial net benefits from the projects. The cost of labor is higher in public sector projects than in private sector operations because CESAN is paying a significant premium above-market rates to its workers. The premium is not justified on any market principle, yet it is maintained for political reasons. Since labor costs make up over 33% of total costs in the water supply project and 12% of the sewage

disposal project, paying the workers at 25% to 40% above the market rate easily turns a profitable venture into a financial failure.

In conclusion, CESAN is not expected to achieve financial self-sufficiency and management efficiency in this water project, because its performance in the four important areas described above is expected to remain below par. Furthermore, the sewage project also falls short of achieving an optimal financial return. As long as the combined project is unable to post a positive NPV, CESAN cannot reduce the price of the utility's services to make them more accessible to the poorest segments of society. Ironically, attaining self-sufficiency is associated with being able to provide basic services to every resident. In other words, if CESAN were able to capture additional revenues through improved collections and invoicing efficiency, they would be able to reduce the water tariff. A lower price of water would increase the accessibility to water service for lower income consumers in Guarapari.

REFERENCES

Asian Development Bank, Economic Evaluation of Environmental Impacts, Manila, Philippines, 1996.

Brealy, R. S. Myers, Principles of Corporate Finance, McGraw Hill, 1991.

Diamond, Peter A. and Jerry A. Hausman, “Contingent Valuation: Is Some Number Better than No Number?" Journal of Economic Perspectives 8, 1994, pp. 45-64.

Foster, V. 2005. “Ten Years of Water Service Reform in Latin America: Toward and Anglo-French Model.” Water Supply and Sanitation Sector Board, Discussion Paper Series No 3, The World Bank Group.

Government of India, M. o. (February 2010). APPROACH PAPER ON DEFINING PUBLIC PRIVATE PARTNERSHIPS Discussion Note.

Harberger, Arnold C., Glenn P. Jenkins, Manual: Cost Benefit Analysis of Investment Decisions, Harvard Institute for International Development, Cambridge, MA, 1997.

Humplick, Frannie, Alyse Kudat, Samer Madanat, “Modeling Household Responses to Water Supply: A Service Quality Approach” Working Paper, World Bank, Washington DC, 1993.

Humplick, Frannie, “Valuing Direct and Indirect Benefits of Water Supply and Sanitation Projects: Application to Project Investment Analysis”, World Bank, Washington DC, 1995.

Jenkins, Glenn P., "The Valuation of Stakeholder Impacts in Cost-Benefit Analysis", Development Discussion Paper 631, HIID, Cambridge, MA, April 1998.

Jenkins, Glenn P., Pastor Lorenzo Jr., Gangadhar P. Shukla, “Potable Water Supply Expansion: The Manila South Water Distribution Project”, Harvard Institute for International Development, Cambridge, MA, 1996.

Laurent Thorrance et. al, A. F. (2007). Organization of a regional conference on Public-Private Partnerships in Dakar. *UNCCIAS*.

Migara S. Jayawardena, Glenn. P. Jenkins and Gangadhar P. Shukla (1999). Control of Water and Coastal Pollution: An Appraisal for Espirito, Brazil. *Harvard Institute for International Development* , Paper No. 682.

Pearce, David W., Anil Markandya, Environmental Policy Benefits: Monetary Evaluation, OECD, Paris, 1989, pp. 35-47.

Portney, Paul R. “The Contingent Valuation Debate: Why Economists Should Care”, Journal of Economic Perspectives 8, 1994, pp. 19-43.

Savvides, Savvakis, “Risk Analysis in Investment Appraisal”, Project Appraisal, Beach Tree Publishing, 1994.

Stavins, Robert N., *Saving the Tuolumne*, case study, John F. Kennedy School of Government, Harvard University, Cambridge, MA, 1986.

Stephenson, D. 2005. Water Services Management IWA, London, UK.

Tietenberg, Tom, Environmental and Natural Resource Economics, Harper Collins Inc, New York, NY, 1996.

united nations. (2005). Public private partnerships for service delivery: water and sanitation. *economic commission for Africa Third meeting of the Committee on Human Development and Civil Society* . Addis Ababa, Ethiopia: united nations, economic and social council,.

World Bank, Staff, Appraisal Report (SAR): Espirito Santo Water and Coastal Pollution Management Project, World Bank, Washington DC, 1996.