An Investment Appraisal for a Government Funded Irrigation Project

Octave Semwaga

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Approval of the Institute of Graduate Studies and Research

Prof. Dr. Elvan Yılmaz
Director

I certify that this thesis satisfies the requirements as a thesis for the degree of Master of Science in Banking and Finance.

Prof. Dr. Salih Katırcıoğlu
Chair, Department of Banking and Finance

We certify that we have read this thesis and that in our opinion it is fully adequate in scope and quality as a thesis for the degree of Master of Science in Banking and Finance.

Prof. Dr. Glenn Jenkins
Supervisor

Examining Committee

1. Prof. Dr. Glenn Jenkins

2. Asst. Prof. Dr. Hasan Altıok

3. Asst. Prof. Dr. Korhan Gokmenoglu

ABSTRACT

In Rwanda most public projects do not undergo deep economic analysis before they are implemented. Projects selection is done considering mostly qualitative criteria. However, it is very important to assess the financial viability of projects if private investors are to be potentially willing to invest in them. The Country has objective of becoming a middle-income one in 2020. Therefore the average growth rate of GDP has to be at least 11.5%. There is a political recognition that private sector has to take the lead in the economic development of the economy.

The Ministry of Agriculture and Animal Resources (MINAGRI) has to play a major role to achieve the economic targets of Rwanda. Agriculture sector employs 75% of the people. Modernizing the sector was identified as a key in the Rwanda vision 2020. One of the activities planned to boost crop production is increasing the area under irrigation. The target is to have 100,000 hectares irrigated in 2017 from the counted 24,000 hectares irrigated in 2012. MINAGRI has developed a project aiming at augmenting the area under irrigation. That project is called Government Funded Irrigation (GFI). It funds irrigation in various sites of the country. In one site, Mpanga, the Government developed hillside irrigation and farmers are now producing various commodities namely Maize on 600 ha, Beans on 500 ha, Tomatoes on 150 ha and Onions on 150 ha.

Attracting the private sector to work together with the Government in irrigation one needs to see if their schemes are feasible. This research conducts an appraisal of the Mpanga irrigation scheme project.

The study found that currently the NPV of the Government is highly negative because irrigation infrastructures are set free of charge for farmers and the Government gives subsidies on maize fertilizers. However, farmers are making money and they can make more if they are allowed to change the cropping pattern currently on the ground.

In incremental analysis, the study shows that farmers can contribute to the investment without losing on their current NPV, if they practice only Maize on 600 ha and Tomatoes on 800 ha in the Mpanga irrigation scheme.

Keywords: Cost-Benefit Analysis, Investment Appraisal, GFI Financing, Economic Development and Poverty Reduction Strategy, Government of Rwanda.

ÖZ

Rwanda'da çoğu kamu projelerinin gerçekleştirilmeden önce detaylı ekonomik analizleri yapılmıyor. Proje seçmeler birçok nitelikli kriterler göz önünde bulundurularak yapılır. Fakat özel yatırımcıların bu projeyi üstlenmeleri için projelerin finansal karlılığına değer biçmek çok önemlidir. Ülkenin 2020 yılı itibariyle orta gelir düzeyine erişme hedefi var. Bu hedefe ulaşılabilmesi için gayri safi yurtiçi hasılanın yıllık ortalama en az 11.5% artması gerekmektedir. Özel sektörün ekonominin kalkınmasına öncülük etmesi yaygın bir politik anlayışdır.

Rwanda'nın ekonomik hedeflerine ulaşılabilmesi için Tarım ve Hayvan Kaynakları Bakanlığının büyük bir rol üstlenmesi gerekmektedir. Tarım sektörü toplam istihdamın 75%'ine tekabül etmektedir. 2020 vizyonunda sektörün modernizasyonu kilit olarak tanımlanır. Mahsul üretimini çoğaltmak için sulama alanını genişletmek planlanan icraatlardan biridir. Amaç, 2012 itibariyle 24,000 hektarlık olan sulama alanını 100,000 hektara çıkarmaktır. Bu bağlamda bakanlık sulama alanlarını artırıcı devlet sermayeli sulama (DSS) olarak adlandırılan bir tasarı geliştirdi. Böylece, ülkenin çeşitli bölgelerinde sulama projelerinin finansmanı sağlanacak. Örneğin hükümet Mpanga'da bayır sulamayı geliştirdi ve çiftçiler şimdi 600 hektar alanda mısır, 500 hektar alanda baklagil ve 150'şer hektarlık alanlarda domates ve soğan üretiyorlar.

Özel sektörün sulama projesinde hükümetle ortak hareket edebilmesi için sözkonusu projenin yatırımcılar tarafından fizibıl olması gerekmektedir. Bu çalışmada Mpanga sulama tasarısının fizibilite çalışması yapıldı.

Bu çalışma hükümet perspektifinden bakıldığında tasarının net bugünkü değerinin çok zararlı olduğunu ortaya çıkardı. Bunun sebepleri, sulama tesisatının çiftçilere bedava verilmesi ve hükümetin mısır gübrelerine sübvansiyon sağlamasıdır. Diğer tarafdan, çiftçiler bu projeden kazançlı çıkıyor.

Marjinal analiz, çiftçilerin yalnızca 600 hektarlık mısır ve 800 hektarlık domates ekmeleri durumunda bile onlar için bu projenin bugünkü net değerinde bir kayıp yaşanmayacağını göstermiştir.

Anahtar Kelimeler: Fayda-Maliyet Analizi, Yatırım değerlendirme, DSS finansm anı, Ekonomik Kalkınma ve Yoksulluğu Azaltma Stratejisi, Rwanda Hükümeti.

DEDICATION

This Thesis is dedicated to You, Passy

See in each line of the writing

Your hand, your love

And the lovely relationship

We have crafted and implemented

Since 1999

ACKNOWLEDGMENT

This thesis is a contribution of people who brought me to love the area of investment appraisal and supported me to do this master program.

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My wife, my co-workers and all my friends were with me along this difficult journey with their love and understanding.

To all of you, I am expressing my humble gratitude and wish you all the blessings from the Heaven.

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LIST OF SYMBOLS / ABBREVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
C6H12O6	Glucose
CAADP	Comprehensive Africa Agriculture Development
CBA	Cost-Benefit Analysis
CBO	Community Based Organization
CCI	Crosscutting Issues
CIP	Crop Intensification Program
CO2	Carbon dioxide
COVAMIR	Cooperative for the Valorization of Mpanga Irrigation Scheme
EDPRS	Economic Development and Poverty Reduction Strategy
EICV	Enquête Intégrale sur des Condition de Vies the Ménages
EIRR	Economic Internal Rate of Return
ENR	Environment and Natural Resources
GDP	Gross Domestic Product
GFI	Government Funded Irrigation
GoR	Government of Rwanda
H_20	Water
Ha	Hectare
HIV	Human Immunodeficiency Various
ICT	Information Communication Technology
IRR	Internal Rate of Return
JRLOS	Justice, Rule of Law, Order and Security

Kg	Kilogram
L	Liter
MBA	Master of Business Administration
MINAGRI	Ministry of Agriculture and Animal Resources
MINECOFIN	Ministry of Finance and Economic Planning
MTEF	Medium Term Expenditure Framework
NDC	Non Communicable Disease
NPV	Net Present Value
O_2	Oxygen
PIC	Public Investment Committee
PIP	Public Investment Program
PPD	Project Profile Document
PSTA	Plan Strategic of Transformation for Agriculture
REMA	Rwanda Environment Management Authority
RWF	Rwandan Franc
TVET	Technical Vocational Education Training
USA	United States of America
VUP	Vision Umurenge Program

Chapter 1

INTRODUCTION

Ideally, government investment expenditures should be in the public interest. Such expenditures can be in the form of government investment, public-private partnership arrangements or other forms of government intervention. Therefore, investment appraisal of a project is critically important since it enables us to examine the incremental impact of the project. In other words, one needs to evaluate how net receipts, net cash flows or net economic benefits with the project in the presence of the project under study can be expected to differ from those that would prevail in its absence (Jenkins et al., 2013).

Traditionally, investment appraisal approaches have inclined to carry out financial analysis of projects separated from their economic evaluations. The integrated analysis appraises benefits and costs both financially and economically. In addition, since the project has different stakeholders who are mainly concerned with their own interests, cash flow statements can be generated for each such group in order to facilitate the analysis from different points of views.

This study concentrates on the investment appraisal of a government funded irrigation project and carries out analyzes from different point of views, specifically the farmers' point of view and the government point of view. Accordingly, this chapter of study gives an introduction to the topic of the thesis. The research topic is

justified, research question identified and the methodology to be used briefly explained. The chapter closes by showing the outlines of the thesis.

1.1 Justification

The Rwanda agricultural sector in the past five years has grown at rate of 6% per year for the last five years (Economic Development And Poverty Reduction Strategy Report, 2013). As the agricultural sector is the backbone of the Country's Economy more investments are being made in the sector. Currently Rwanda is implementing EDPRS2 (Economic Development and Poverty Reduction Strategy 2) with the aim of attaining an average annual growth rate of 11.5% of GDP. The target growth rate of the agriculture sector is 8.3% per year. The Ministry of Agriculture and Animal Resources has to implement projects with quantified economic outcomes. Most public projects are ,however, not being selected on the basis of scientific analysis. Such is the case with this Government Funded Irrigation project in Rwanda. It has already started its operations. As a government funded project, however, it is not superfluous to show how the project can be improved for the benefits of its stakeholders, namely, the cooperative, farmers and the government.

1.2 Problem Discussion

Agriculture contributes 47% to Rwanda's GDP and employs 75% of its labor force (PSTA report, 2009). Consequently, there is no way to plan for the development of Rwanda if that sector is ignored. In the Rwanda Vision 2020 document, agricultural modernization is identified as one of the six pillars. The others are: (i) Good Governance and a Capable State, (ii) Human Resource Development and a Knowledge-based economy, (iii) Private Sector-led Development, (iv) Infrastructure Development and (v) Regional and International Integration.

Modernizing agriculture requires various interventions aiming at increasing agricultural production by using the correct inputs, processing the agricultural produce efficiently and getting the highest prices for the commodities produced.

The increase of harvested quantities is a function of two variables namely the area under cultivation and the yield of the cultivated crop. In some countries farmers can choose to maximize the harvests by just increasing the size of their farms. However in a country like Rwanda, however, where the average farm size is 0.59 ha per household (Rwanda National Institute of Statistics, 2010), strategies have to be put in place to increase the quantity to be harvested per unit of surface area cultivated.

This is well understood by the Rwandan political leadership and all efforts are being deployed to achieve this objective. Raising the yields of crops necessitates among others the use of water. Development of irrigation is very important in Rwanda. In the past people were killed by famines mostly caused by the fact that agriculture is rain-fed in the country.

According to information got on Wikirwanda.org, the following famines were known in the Country:

1. Kijugunya in 1895
2. Ruyaga in 1902-1903
3. Rwakabaga in 1904-1905
4. Rumanurimbaba in 1917-1918
5. Gakwege in 1924-1925
6. Rwakayihura in 1928-1929

7. Ruzagayura in 1943-1944

Most of those famines were caused by the lack of rains. They had tremendous consequences in the country. For example, the Ruzagayura famine in 1943-44 killed 300,000 people and more than 75,000 people had to flee Rwanda for neighboring countries (www.gakondo.com). If we consider the current population growth of 3%, the population at that time was around 1.2 million which means that the hunger killed around a quarter of the Rwanda people.

To mitigate country's problems which could be caused by the drought, Rwanda has a vision of increasing the area of irrigated agricultural land. Currently, the total area under irrigation is over 24,000 ha, including 1,442 ha of hillside irrigation, 22,554 ha of marshland irrigation and around 100 ha of small scale irrigation (garden plots with rainwater harvesting). The objective in the next five years is to have a total of 100,000 ha area under irrigation of which 65,000ha will be Marshland and 35,000 ha Hillside (PSTA III). Rwanda has 860 marshlands with a total surface area of 278,536 ha but 105,619 ha of those marshlands have to be protected for environmental purposes (REMA report, 2008)

The irrigation project has to be taken as a whole from the technical side including the setup of infrastructure and the management including the commercialization of the outputs. Moreover, the sustainability of irrigation projects - if schemes run by private people - cannot be achieved if they are not financially profitable furthermore they must be economically viable if they are government projects. This thesis analyzes the requirements to have irrigation projects carried out in a sustainable manner. The

case considered here is the GFI Project at Mpanga Irrigation Scheme. So far the Government has invested in this irrigation project. There is a need to shed light on the economic benefits or losses of the projects for the government and farmer cooperative which exploits the developed fields. Studies should also be carried out to make proposals of how the returns can be maximized.

This research has an objective of increasing revenues in Mpanga Irrigation Scheme, one of the sites of GFI project. The undertaken analysis is "with" and "without" the project. At each level the NPVs are calculated for the Government and Farmer Cooperative. Following this appraisal, an incremental analysis is done to assess what the farmers can gain from the project. Lastly, the sensitivity analysis was carried out to assess at which level the cooperative can contribute to the project investment without losing any of its potential NPV.

1.3 Research Objectives

The question is to find out how GFI can develop and ran irrigation schemes sustainably. Therefore, the first thing is to assess returns from the current exploited commodities. Secondly, the analysis is done to see which crops could be exploited more in order to maximize the economical returns of the project. Lastly, an incremental analysis permits one to assess the gains from the project's revisions. To summarize, the main objective of this study is to evaluate the outcomes of the irrigation system project by comparing the traditional case with the revised case based on an incremental analysis.

1.4 Methodology

For the purpose of this study, a model is developed to evaluate the outcomes of the project for the Farmer's Cooperative and for the Government of Rwanda.

Accordingly, the project, including its traditional benefits and costs, is taken into consideration and it is compared with the revised project's benefits and costs. Benefits and costs from the revisions will be calculated both for the Government and for the Cooperative.

From the nominal figures, real ones are calculated using the price index of Rwanda and real cash net flows are discounted to obtain the net present values for the farmers and the government. A discount rate of 12% is employed which reflects the opportunity cost of capital in Rwanda.

After calculating the net present values in the traditional case, an expansion of an existing crop will be proposed to maximize the returns using the solver function of Microsoft Excel. After the determination of the new cropping pattern, the real net cash flows will be calculated; discounted and net present values will be obtained. Then, the incremental cash flows will be obtained by calculating the differences between the project's traditional and the revised conditions. Lastly, a sensitivity analysis will be carried out to see up to which extent farmers could contribute to the irrigation investment once their profits are maximized.

To get information to put in the model, secondary and primary data are gathered. Various project documents were examined and the president of the cooperative as well as some MINAGRI officials were consulted to obtain the needed information. To make sure that results make sense, the draft report will be shared with the farmers, MINAGRI Director General and MINAGRI Irrigation Task Force members for their comments.

1.5 Research Structure

The study consists of five chapters. In chapter one, a relative broad description is given at the beginning, providing the reader with a background and discussion of issues related to the topic. Chapter two presents the literature review. Chapter three gives a description and justification of the methodological approaches chosen in this research. In chapter four the research results are presented, interpreted and discussed. Finally, conclusions and recommendations are presented in chapter five.

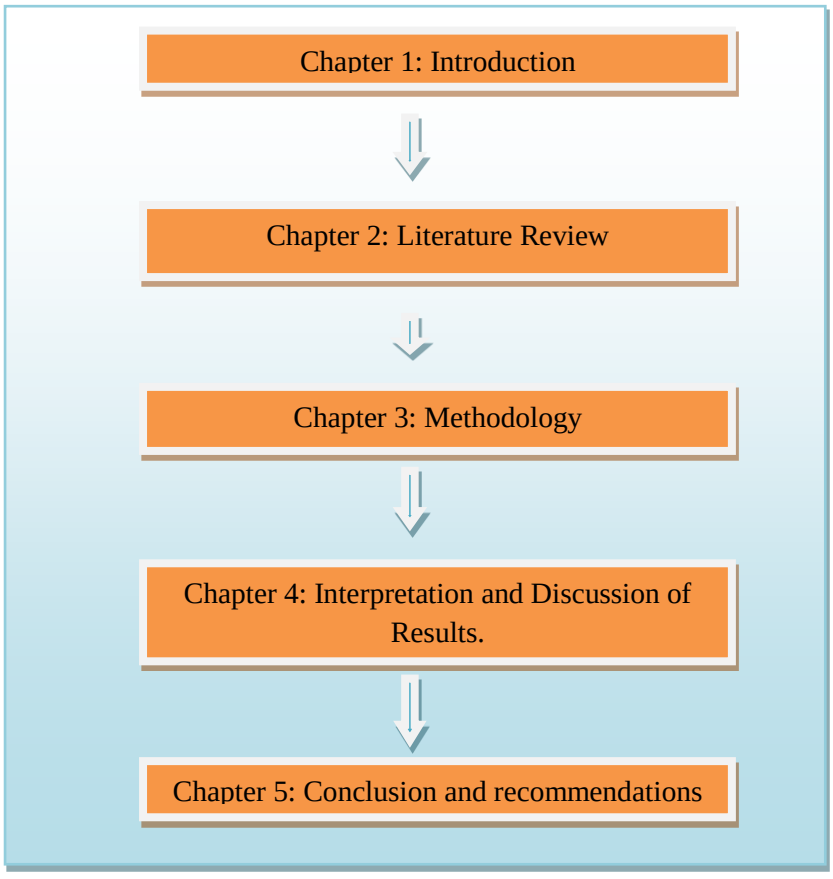

Figure 1: Disposition of the Report

1.6 Limitations of the Study

We will be dealing with human beings with their own interests and weaknesses. There is a possibility that some information obtained through interviews do not

reflect the reality or we may find that people we will be dealing with have forgotten the correct answers. In such cases, secondary data is used to check the accuracy of the responses from those interviews.

Other limitations of the study are related to the scope. Our assignment is to appraise the investment in the project's revisions . We had no ways to estimate the marketing cost in the revised-project case.

Chapter 2

LITERATURE REVIEW

2.1 Rwanda Planning Process

Rwanda has set broad objectives in its vision 2020. The vision document shows aspirations of the Country in 2020. In his forward message for the vision 2020, H.E Paul Kagame, the President of the Republic of Rwanda has stated.

The Vision 2020 is a reflection of our aspiration and determination as Rwandans, to construct a united, democratic and inclusive Rwandan identity, after so many years of authoritarian and exclusivist dispensation. We aim, through this Vision, to transform our country into middle - income nation in which Rwandans are healthier, educated and generally more prosperous. The Rwanda we seek is one that is united and competitive both regionally and globally.

To transform Rwanda into a middle-income country, six pillars have been identified to drive the Rwanda strategic Plans. Those pillars are the following:

- Reconstruction of social capital stabilized by good governance, sustained by a powerful state;
- Integration of agriculture sector to produce more efficiently associated with improved marketing framework;
- Improving the role of private sector by developing willingness to compete;

- Development of country-wide human resources and building a comprehensive plan for education, health, and ICT.
- Skills aimed at public sector, private sector and civil society. To be integrated with demographic, health and gender issues;
- Strengthening of infrastructure, accomplishing higher quality in transportation, energy and water supplies and ICT networks;
- Organization of domestic economic development and regional .

The Vision is implemented through District Development Plan and Sector strategies. Sectors for EDPRS 2 are the following: (i) Education, (ii) Agriculture, (iii) Health, (iv)Transport, (v) Water and Sanitation, (vi) Energy, (vii) Private Sector Development and Youth, (viii) Social Protection, (ix) Information Technology, (x) JRLOS (Justice, Rule of Law, Order and Security), (xi) ENR (Environment and Natural Resources), (xii) Urbanization and Rural Settlement, and (xiii) Public Financial Management. Regarding the Districts, Rwanda has 30 in four Provinces and the City of Kigali. Rwanda Districts are presented in the figure 2.

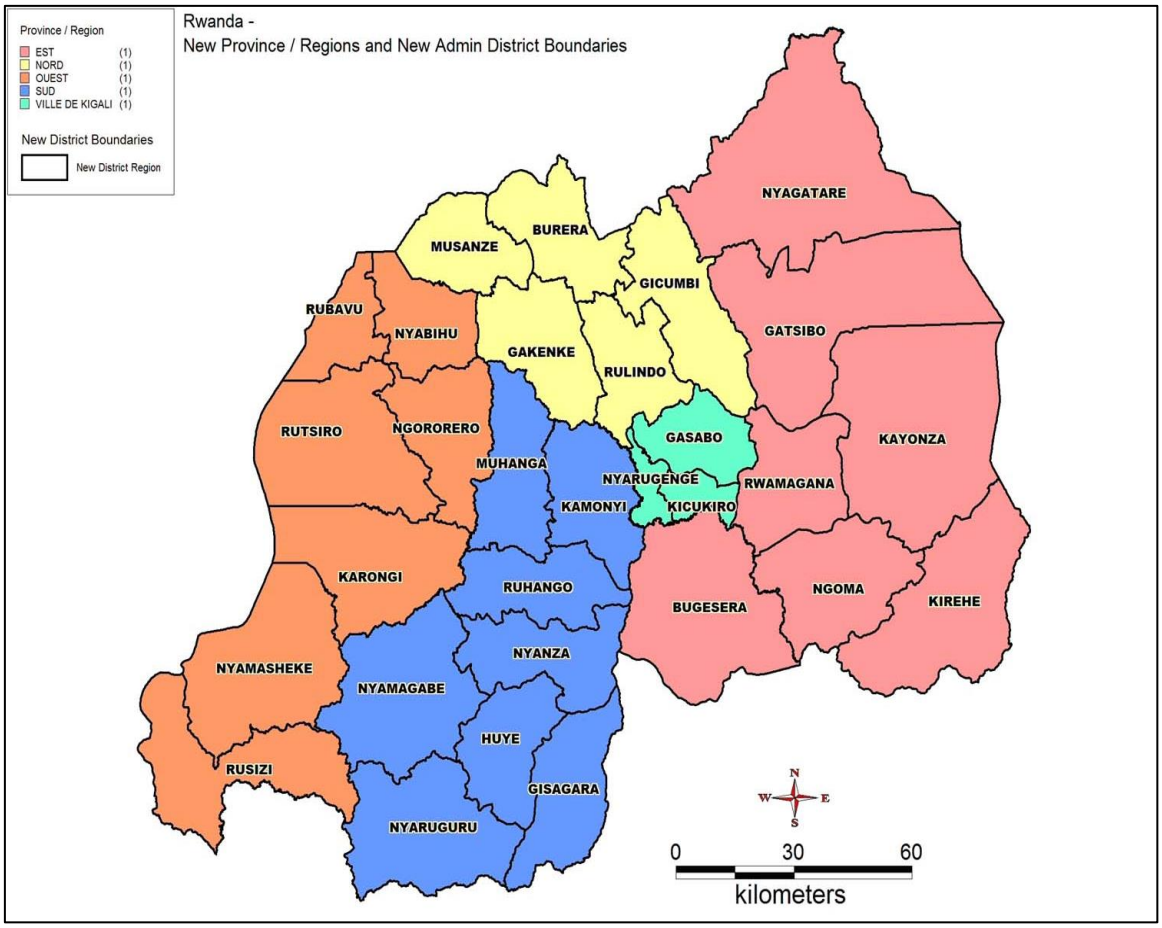

Figure 2: Administrative Map of Rwanda

Sectors develop their 5-year strategic plan taking into consideration priorities set in EDPRS and local priorities expressed by Districts. Considering what was put in sector strategic plans and specific local aspirations, districts develop their District Development Plans. After the sector strategies and District development plans are validated, they are implemented through the development of MTEF (Medium Term Expenditure Framework) which lasts three years. In MTEF, it is presented recurrent and non-recurrent budget which funds projects. Through MTEF, yearly Districts and Sectors develop Plans of Action containing budget and activities to be achieved in one year. Below there is a schema summarizing what was explained above. Notice that between EDPRS 2 and Vision 2020 there is 7-Year Government Program which

is a document containing what H.E the President of the Republic promised to the population in 2010 when he was elected.

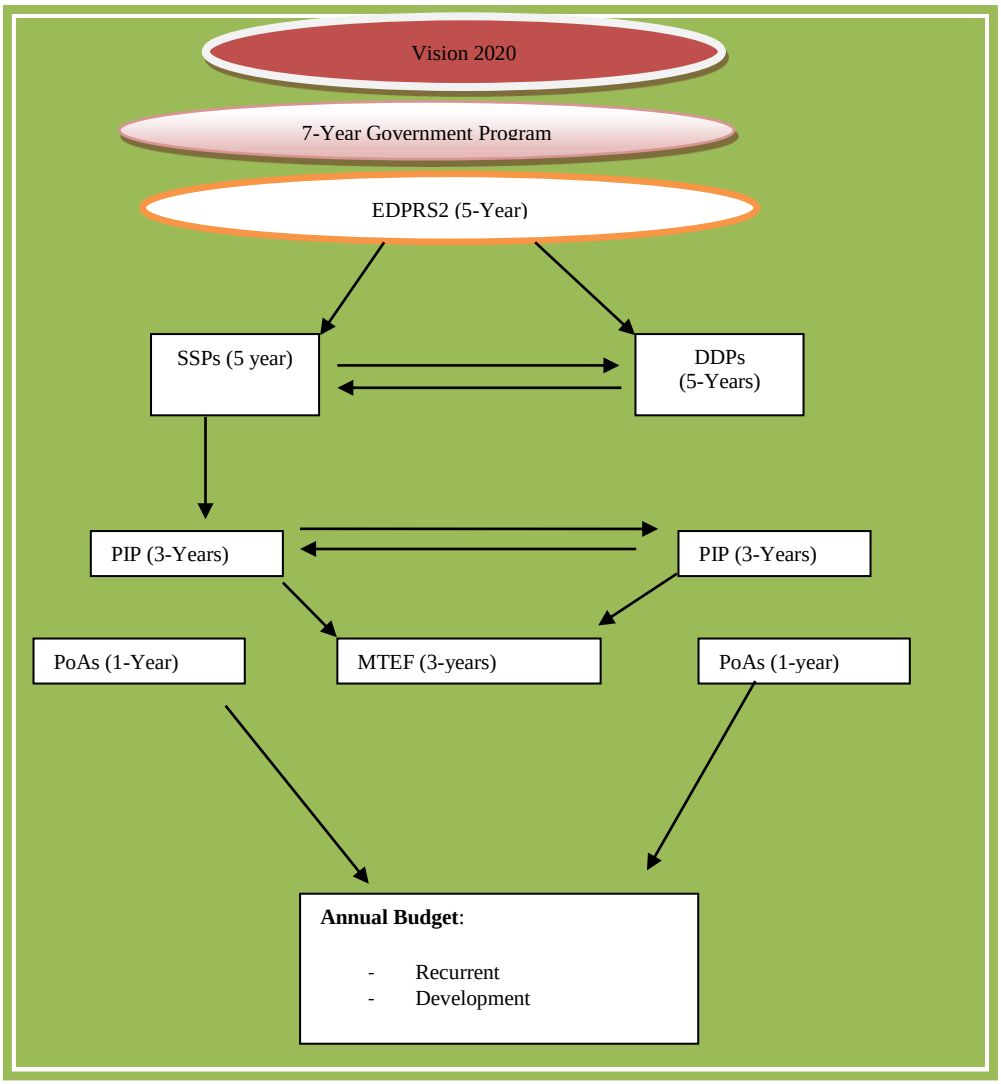

Figure 3: Rwanda Planning Process

The PIP (Public Investment Program) is a document containing a set of projects to be implemented in the next three years. Those projects are presented by various ministries to MINECOFIN which selects some to be funded in a specific budget year.

2.1.1 Gateway Process

In Rwanda projects are identified by sectors, sent to the Ministry of Finance and Economic Planning which takes some to fund. The figure below shows how a project is funded in Rwanda.

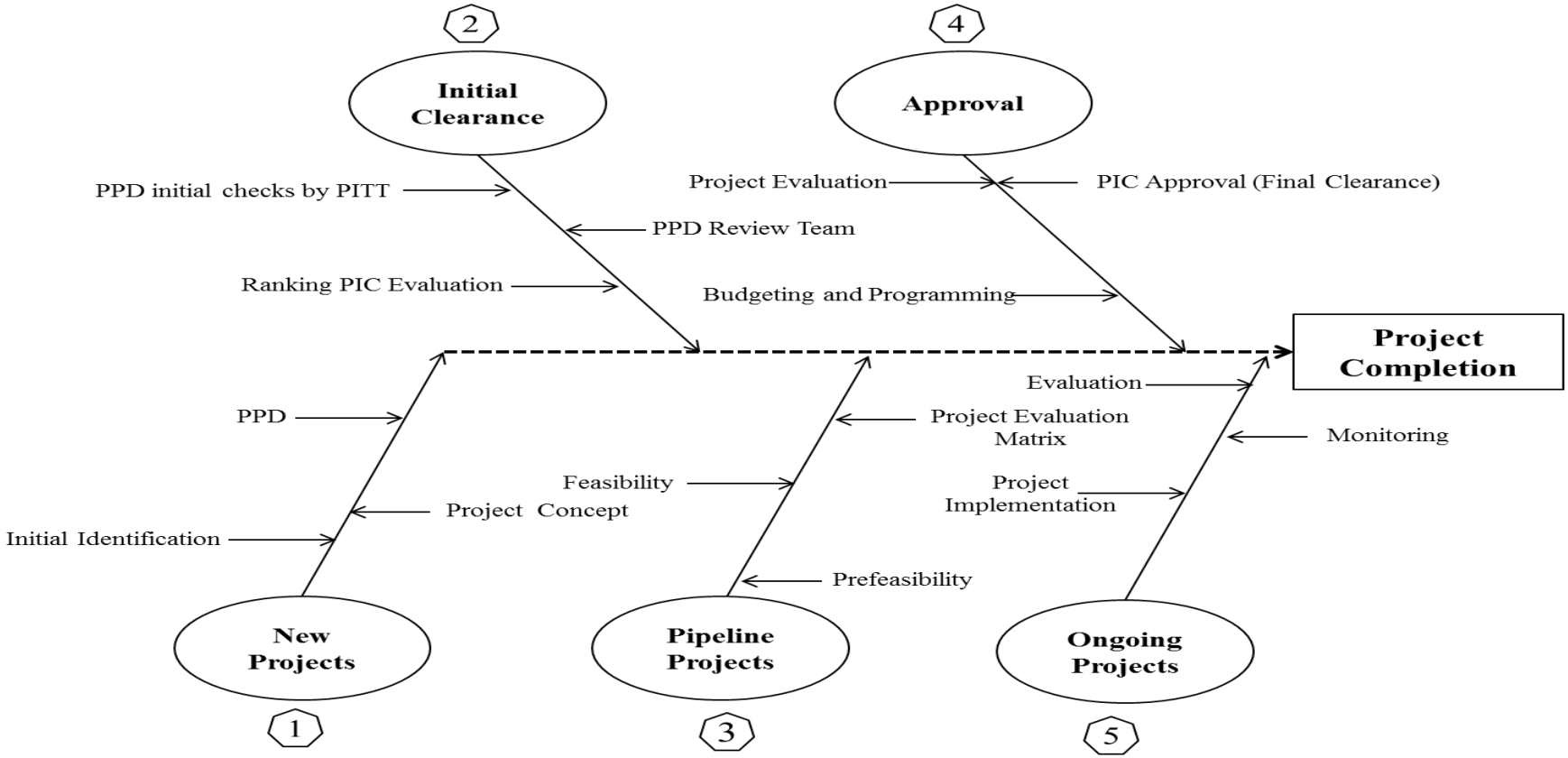

Figure 4: Gateway Process

Source: Individual Consultant (Senior Investment Expert) to Develop a Strategic Overview and General Orientation of the 2010-2012 Export-Oriented Public Investment Program (PIP)

The above figure shows that sectors identify projects which are sent to MINECOFIN. Those projects are called new projects. They are in effect project ideas sent in a form of concept notes. Technicians in charge of projects in the ministry of finance carry out an initial clearance and present their report to the Public Investment Committee (PIC) and the chosen projects become pipeline projects. The latter undergo the feasibility studies whose outcomes are ranked and the Public Investment Committee selects the best ones to be funded. The funded projects become ongoing ones.

2.1.2 Project Selection Process

Project selection is the process of evaluating a group of projects from various sectors and to select the most important ones which can fit the budget limits. Normally two basic types of selection models are known, namely numeric and non-numeric (Meredith, J. R., & Mantel Jr, S. J., 2011):

a. Nonnumeric models:
    - The Sacred Cow: The project is suggested by a senior and powerful official in the organization. The project is sacred in the sense that it will be maintained until successfully concluded, or until the boss, personally, recognizes the idea as a failure and terminates it;
    - The Operating Necessity: A project required to be implemented in order to keep the system operating;
    - The Competitive Necessity: This is the case when a company is threatened by its competitors and then finds it critical to implement a project to face its rivals;
    - Product Line Extension: The project is fudged to an extent at which it adjusts the production amount the firm is already producing , enhances an improper link, or extends the line in a new, efficient direction;

- Comparative Benefit Model: When projects which could benefit the organization, criteria like good, fair and poor are used to select some of them.

b. Numeric model (the model uses figures to rank projects):

- Payback Period: The initial amount of investment divided by the estimated annual cash inflows. This ratio evaluates the ability of the project to pay back the original investment amount. In other words, it calculates the number of periods expected for the project to generate the initial investment;
- Average Rate of Return: The ratio between the average annual profit (either before or after taxes) to the initial investment made. This ratio enables the investors to compare potential benefits of various investment opportunities;
- Discounted cash flows: Also referred to as the net present value method, the discounted cash flow method determines the present value of all cash flows by discounting them by the required rate of return;
- Internal Rate of Return: the discount rate that makes the net present value nil;
- Profitability Index: Also known as benefit-cost ratio; it is the net present value of all future expected cash flows divided by the initial cash investment.

- Scoring Model: In order to deal with the drawbacks of portability models, especially their disadvantage of having a single decision criterion, a number of models considering multiple criteria have been developed to evaluate the models:
    1. Unweighted 0-1 Factor Model: Projects are scored on each factor, depending on whether or not they qualify based on an individual criterion. The columns are summed up and projects with a sufficient number of qualifying factors are selected. That model uses several criteria in the decision process. All criteria are of equal importance and it allows for gradation of the degree to which a specific project meets the various criteria.
    2. Unweighted Factor Scoring Model:. This scaling of this model is based on a five-point approach varying from 5 proposed as very good to 1 proposed as very poor. The column of scores is summed, and projects with a total score exceeding some critical value are selected. A variant of this selection process might choose the highest-scoring projects.

In Rwanda we start the selection of projects by using unweighetd 0-1 factor where a project is assessed if it meets the following criteria: (i) Approval from the beneficiary ministry before and (ii) Content of the concept note which has to indicate the minimum amount of funding required for the project, and the financial years in which this funding will be required.

If the project qualifies for those two items, then we select the best by using the unweighetd factor scoring model. Here on a 1-5 scale projects are ranked according to their desirability, achievability and viability. Columns are summed and the projects with the highest scores are selected.

When we assess the desirability of a project, the following criteria are taken into account:

- Strategic importance at sector level
- Impact on extreme poverty eradication
- Support to strategic investments promoting linkages, long term transformation, growth, jobs & competitiveness
- Impact on export promotion at strategic level

For the achievability, analysts consider the following:

- Land availability & environmental impact
- Risk assessment (1 = high risk, 5 = low risk)

Lastly the viability of a project implies:

- Micro - impact of project in generating or saving foreign exchange
- Financial viability and sustainability
- Fiscal sustainability and affordability

However, in the Rwanda Investment Policy, the aim is to rank projects using economic rate of return as well stated in the following sentence:

Government shall classify investment undertaking into projects or ventures and prioritize those according to economic (EIRR), financial return and cost-effectiveness among other criteria.

2.2 Financial Statements

There are three standards financial statements: income statement, statement of cash flows and balance sheet. These financial statements represent different aspects of financial activities of firms. Firstly, income statements summarize financial activities of firms in a specific period and therefore could be a good source of information to realize how the firm has performed financially. Accordingly, a typical income statement firstly represent the revenues generated during the period out of which the associated costs will be extracted. There are other categories which would be deducted from revenues, such as:

- Costs of goods sold
- Marketing, governance and management costs
- Depreciation
- Amortization costs
- Taxes

So, the remainder is recognized as net income. It is also worth noting that income statements are indicators of business performance and they are not representing the cash flows to the firm.

A company needs cash to conduct business. Without it, there is no business. Undoubtedly, cash is required for any operating firm. In addition, the cash inflows and outflows of a firm play a critical role in financial activities. Therefore, cash flow

statements include insightful information about cash inflows or outflows being incurred by various transactions (Bygrave and Zacharakis, 2009).

The process of constructing the cash flow statement originates in the income statement. So, by adding the non-cash items as inflows, one is able to construct the cash flow statement. In addition, accounts payable, accounts receivables and depreciation should also be included in the cash flow statement. After these non-cash transactions are adjusted, the final outcome is a statement reporting all the cash transactions.

Another financial statement is balance sheet which reports all the assets, liabilities and equities being held by a firm. A balance sheet is known to be a snapshot of the firm in a specific period of time.

Assets are originally constructed by either liability or equity. Therefore, one can write equation 1 as below:

Asset =Liabilities + Shareholder equity Eq. 1

Typically, a balance sheet is represented by assets on the left side and liabilities and equities on the right side. The total amount of assets has to be balanced by the summation of total liabilities and shareholders' equity.

2.3 Construction of a Financial Cash Flow

In order to appraise a project financially, construction of the financial cash flow statement is required. In constructing a financial statement, all cash flows and cash

inflow amounts are identified. The difference between net cash inflows (receipts) and cash outflows (expenditure) is net cash flow.

In calculating cash receipts, it is very important to know that a sale does not mean that the cash was received. The money can be obtained later. The amount to be received later is recorded in project accounts as an asset called account receivable. Furthermore, some given debts could not be recovered. They are called uncollectable receivables:

Cash receipts for a period = Sales for the period + accounts receivable (beginning of the period) - Accounts receivable (end of the period) + bad debt Eq.2

For the expenditures, a company can acquire an item and pay for it later. The money that the company owes is registered as account payable. When computing the expenditures, we take into consideration the money that company will pay later as follows:

Expenditure= purchases + change in accounts payable Eq.3

Change in accounts payable = Accounts payable (beginning of the period) – accounts payable (end of the period) Eq.4

Cash balance is also taken into consideration. In addition, debt repayments obligate the project to create a reserve account which leads to increasing amount of cash holdings. Therefore, increasing the cash holdings is identified as cash outflows in the cash flow statements. In a parallel manner, decreasing the cash holdings is recognized as an inflow.

Last but not the least, when the project life ends, the remaining cash balance will be returned back to the project and is accounted as an inflow.

2.3.1 Use of Consistent Prices in the Cash Flow Forecast

Over the life of the project, the input and output prices are affected by various factors, mainly inflation. Therefore, prices have to be adjusted accordingly to reflect the movements.

2.3.2 Treatment of Assets

Assets depreciate as the project goes on. In order to include the cost of depreciation, allowances are considered over the life of the project which allows the deduction of depreciation expense from revenues. It should be notified that depreciation is non-cash expense and it is not taken into account in the project's cash flow profile.

2.3.3 Treatment of Land

Economically, there is an associated opportunity cost with the use of land in a project. Although land may be donated by the government, project operations may have positive or negative impacts in terms of value on the land.

2.3.4 Analysis of Project from Different Points of View

It is important in undertaking an investment to carry out the analysis from alternative viewpoints namely : the viewpoint of the owner, the banker, the government and the country .

From the banker's point of view, a project should generate sufficient cash flows in order to be implemented. In addition, the rate of return resulting from the project operation is another issue of importance from the banker's point of view.

Therefore, any project has to be appraised from the banker's point of view and in this framework financial benefits and costs are constructed in a financial model to evaluate whether the project is financially viable, whether the project needs loans to finance the investment expenditures and finally whether the projected cash flows are sufficient to meet debt obligations.

In order to evaluate the incremental benefits of a project, an analysis of incremental cash flow has to be conducted.

From the owner's point of view, the loans taken by the project have to be included in the cash flow statement as cash inflows, while interest payments are taken into account as cash outflows. However, from the banker's point of view, loans are not considered in the cash flow statement.

Similarly, grants offered by the government should be considered as cash inflows. To sum up, the owner's and banker's point of view differ only in the way that they take the financing into account (Jenkins et al., 2013).

It is also important to evaluate the project from the government's point of view. Some projects may need to be funded by the government or to be offered some subsidies. In addition, some projects can generate benefits via taxes and tariffs.

One of the main reasons that the project has to be analyzed from the government's point of view is to check whether the relevant sector of the government is able to fund the project or not.

In cases which a ministry of the government is the owner of the project, one could differentiate the different points of view according to their opportunity costs.

All mentioned above concentrates on the most common parties involved in a project, however there may be other stakeholders on whom the project may have some impacts. Therefore, in the financial analysis, all stakeholders are being considered and the way which the project affects them has to be analyzed.

Negative impacts have to be recognized to identify the communities affected. Then, one would be able to adjust these impacts properly. The main aim of distributional impact analysis is to evaluate the quality and quantity of negative impacts imposed by the project activities on stakeholders. It is worth noting that the range of affected communities could vary from suppliers to demanders, intermediaries and etc.

Economically speaking, there has to be an analysis from the country's point of view to evaluate the impacts of the implantation of the project on the country's economy and financial transactions. Evaluating from the county's point of view requires proper adjustments to project the economic values of project's cash flows.

The country's point of view is mainly focused on the amount of resources exploited to generate benefits for the country. Undertaking the project is sometimes associated with some distortions and even causes some activities to be hauled. Therefore, economic analysis has to take into account resources costs imposed by the project activities on the economy.

Chapter 3

RWANDA'S ECONOMIC DEVELOPMENT AND POVERTY REDUCTION STRATEGY (EPRS 2)

3.1 Presentation of EDPRS 2 thematic areas

EDPRS 2 is planned to be undertaken through four thematic strategies : economic transformation, rural development, productivity and youth employment and accountable governance. In the framework of economic transformation, the main aim is to develop the economy to an average growth rate of 11.5%. In addition, strategies have to trigger the industrial development of Rwanda in order to promote Rwanda to a middle-income country.

So, to accelerate the growth, it is planned to improve the infrastructure for the exporting sectors, to privatize the exporting sectors, to organize the importing sectors and to manage a sustainable economic development. Respectively, five main areas of priority are identified:

i. Improving the soft and hard infrastructure of Rwanda to strengthen the privatization process and promoting the accessibility of resources for the key sectors.
ii. Improving the Rwanda's exporting sectors access to international markets by establishing a new airport. Additionally, increasing the connectivity of Rwanda to neighbor countries by railways. All these would promote the exporting sector which could result in Rwandan economic development.

iii. Promoting privatization in order to attract foreign investors; organizing the national savings and improving the financial system of the country to attract more international financings; reforming the tax system to sustain the economic growth.
iv. Improving the economic geography of Rwanda by transforming secondary cities. Secondary cities are potential to be developed to play critical roles in the economic development via actives rather than agricultural ones.
v. Sustaining the economic development by considering green economy. So, secondary cities and villages would be developed sustainably.

Another thematic area is rural development targeting the poverty reduction by 14 percent by 2018. In order to implement this strategy, four priorities are defined as below (EDPRS II, 2013):

1. Managing the land use and human settlements. In this respect, a plan is being set up considering reconstruction of land allocations to assure the efficiency of rural settlements.
2. Improve the efficiency of agriculture sector by providing more advisory services and more access to agricultural markets.
3. Planning the reduction in poverty by social protections and supporting the poor community.
4. Improving the soft and hard infrastructures to enable more people to have access to economic opportunities and public goods.

Third thematic strategy is concentrated on the productivity and youth employment considering the increasing young population of Rwanda. Accordingly, it is planned

to create a minimum of 200,000 job opportunities per year. So, the following priorities are defined to facilitate the relevant improvements:

i. Developing the educational system in order to provide skilled and trained human resources for economic development.
ii. Improving the telecommunication infrastructure to provide more reliable internet and mobile phone services. Consequently, it would build a foundation for ICT trainings.
iii. Improving job opportunities by encouraging entrepreneurs and support the private sector to create more off-farm jobs (EDPRS II, 2013).

The last thematic area is the accountable governance by improving the service delivery which results in the national satisfaction. EDPRS II has planned to a target of more than 80 percent of satisfaction among citizens. It is also mentioned in the plan that the participation rate of people has to be increased. Similar as other thematic areas, some interventions are required to be undertaken to facilitate the strategy implantation :

i. Promote the nation's participation to ensure the ownership and sustainability in the development. Respectively, the media and other communication instruments have to be employed to attract the citizen's participation.
ii. Restoring the strength of service delivery of both public and private by constructing a customer-oriented framework and by reforming the customer service culture (EDPRS II, 2013).

It should be notified here that some foundations has been built previously by EDPRS I. To list a few, one could mention the followings:

i. Stabilizing the economy by improving the macroeconomic system; accelerating the privatization and targeting poverty reduction.
ii. Sustaining the population growth.
iii. Improving the nutrition programs and increasing the food security
iv. Developing early-age education programs
v. Improving the health care system and provide more accessibility both financially and geographically to health care centers.
vi. Reconciling regional conflicts and stabilizing peace and security.
vii. Promoting the public finance governance by improving resource allocations and utilizing alternative financing resources. In addition, constructing a central information system to improve the efficiency of financial management (EDPRS I, 2009).

The quality of governance is determined by the Cross Cutting Issues (CCIs). Therefore, in EDPRS 2 some CCIs are considered as below :

i. Capacity building
ii. Environment and climate change
iii. Gender and family
iv. Regional integration
v. HIV/AIDS and NCDs
vi. Disaster management
vii. Disability & Social Inclusion

3.1.1 Agricultural Strategic Plan (2013-2018)

The Agricultural strategic plan called PSTA III (Plan Strategique de Transformation du Secteur Agricole III) was developed to achieve the 8.3% growth of agricultural sector set in EDPRS2. Agriculture sector finds contributes to all the four thematic areas of EDPRS2 as follows:

1) EDPRS Thematic Area 1: Economic Transformation
2) Agriculture must drive diversification of the economic base with more value added. Agriculture can interact with services and industry to drive a shift from production toward services through key programs including post-harvest facilities, marketing, input distribution networks, advisory services, mechanization services and others
3) EDPRS Thematic Area 2: Rural Development
4) The agricultural sector will permit the following to happen:
5) Increased rural household incomes through agricultural diversification and closer links with the value chains.
6) Modernization of agriculture to improve quality and quantity of production.
7) Natural resource and environmental management.
8) Rural infrastructure development to drive growth

EDPRS Thematic Area 3: Productivity and Youth Employment. For this thematic area, PSTA III foresees to carry out the following activities:

i. Education and skills development in the sector
ii. Entrepreneurship training focused on youths and venture capital funding for new youth-owned enterprises

EDPRS Thematic Area 4: Accountable Governance. In this area, the strategy plans institutional strengthening in the sector by:

i. Providing a framework for a greater role for the private sector
ii. Setting up mechanisms of inter-institutional coordination
iii. Promoting participatory approaches to research and extension, involving farmers

PSTA III contains what the Ministry of Agriculture plans to achieve in the next five years. On irrigation, targets are the following:

- New approaches to aggregate production of smallholders, for both the domestic and export markets.
- Continued investment in a CIP (Crop Intensification Program).
- Substantial increases in coffee yields through application of fertilizers.
- Increases in tea production through expanding the area under cultivation.
- Expansion of the fisheries sub-sector, under a new management approach.
- Expansion of the One-Cow program and its diversification to include other livestock species.
- Value chain development to facilitate agro-processing
- Reduction of post-harvest losses.

In this study , the interest is mainly on irrigation. The agricultural Strategic plan has identified irrigation as one of other priorities. Rwanda signed the Comprehensive Africa Agriculture Development Program (CAADP) compact which establishes in its Pillar I on Land and Water management that the Government should allocate at least 2% of public funds for irrigation development. Irrigation is important to increase

agricultural productivity through allowing multiple cropping and reducing vulnerability to weather shocks. The plan proposes continued investment in irrigated agriculture, to harness Rwanda's fresh water resources and increase production, and provide security to rural households.

The total area under irrigation was just over 24,000 ha in 2012, including 1,442 ha of hillside irrigation, 22,554 ha of marshland irrigation and around 100 ha of small scale irrigation (garden plots with rainwater harvesting). Ministry of Agriculture 2011-2017 plan the target is to build up an efficient irrigation system for an area of 100,000 hectares out of which 65,000 hectares are planned to be marshland and 35,000 hectares hillside.

In the Ministry of Agriculture plans also to earmark 20,000 hectares of land for private sector irrigation development. Private schemes would operate in the following way:

i. Their size would range from a minimum of 25 ha to a maximum of 500 ha.
ii. The Government would define eligible areas for irrigation in consultation with farmers who own the land.
iii. In agreement with farmers, the consolidated land for a scheme would be offered to private investors in the form of a long term lease. Investors would submit bids for the right to construct and operate the scheme. Lease contracts would cover all farmers on the land in a given area, and the monies for each year's lease payments to farmers would be deposited in advance of the year in a trust fund that in turn would make disbursements to the farmers at agreed intervals during the year.

iv. The leases would be tradable assets at a freely negotiated price between private parties. Leases could be renewed upon satisfactory performance and agreement of the farmers.

v. The leaseholder would agree to pay farmers an annual fee at least equal to what the farmers normally received from working the land.

vi. The leaseholder would design, in consultation with farmers, construct, operate and maintain the scheme, and would give priority to the participating farm families in hiring labor to cultivate and harvest the fields and to work in post-harvest activities. The leaseholder will also rehabilitate the scheme in the event that normal maintenance proves insufficient to forestall system degradation in the future.

vii. In the event the leaseholder failed to respect terms of the lease, s/he would be given a period to remedy the problems and, lacking a remedy, the Government would repossess the scheme with compensation to the leaseholder for investment costs and operates it or auctions it to a new leaseholder.

On agronomic side, water is very important for agricultural production. For a plant to produce glucose, the following equation is respected:

$$6\,CO_2 + 12\,H_2O + \text{photons} \rightarrow C_6H_{12}O_6 + 6\,O_2 + 6\,H_2O \qquad \text{Eq.5}$$

(carbon dioxide + water + light energy → glucose + oxygen + water)

Then without enough water, a plant cannot produce glucose. Consequently to increase crop production and raise farm income, irrigation has to play a big role as rains cannot be predicted accurately. They can come or not.

On MINAGRI side, different from what was done in the last five years, agricultural sector plans to engage more the private sector in irrigation as stated above. Therefore it is worthwhile to notice that irrigation projects have to be financially viable to attract the private sector. There is a need now to make the evaluation of the irrigation project to assess its viability. In this study we have taken a case study of Mpanga Irrigation Scheme, one of the sites developed under the Government Funded Irrigation (GFI) project.

3.2 Justification of Irrigation Program in Rwanda

The public irrigation in Rwanda has the objective of modernizing agriculture. Its objective is demonstrating successful modern agriculture by which many of the farmers could be attracted in the venture. At the same time, irrigation will allow farmers to produce agricultural crops that can effectively contribute to resolving the food crisis that often happens due to cyclical dry years or long dry periods.

The overall intention of the irrigation program is the intensification and modernization of agriculture to avoid dependence on rain fed agriculture in all parts of the country. For this to happen, all types of irrigated agriculture are utilized: pumping water from rivers and lakes, as well as constructing valley dam reservoirs to collect run-off and flood water during rains for use in irrigation during dry periods. The target is to irrigate 25 - 30 000 ha by the end of 2015 for Immediate Action Irrigation.

Agriculture is still the major engine of growth in Rwanda, the most densely populated country in Africa. The Rwandan economy is based predominantly on agriculture. The sector faces various challenges listed below and irrigation associated

with agricultural modernization would help resoling some of them. Indeed, there are substantial water resources available in the country which could be employed for the irrigation system.

Encountered problems to increase agricultural productivity are the following:

1. Excessively high percentage of the population lives by farming. The following are resultant effects being experienced:
   - Currently, agricultural sector is challenging to endure families consumption. This problem gets worse during the draughts and agriculture farms face lots of difficulties to satisfy families' demand.
   - In addition, conventional regeneration approaches of soil fertility are not efficiently effective and even they sometimes result in the breakdown of operating production units.
   - Soil fertility has been decreased significantly by deforestation caused by erosion. Moreover, another main concern is the declining production rate of animals and manure.
   - Another main issue is insufficient income earnings from the agricultural productions. Farmers do not generate enough benefits to earn their life.
2. Rwandan agriculture sector is only able to provide basic needs of farmers and without leaving any surplus for marketing. Also, farmers have been harvested their lands by traditional techniques for many decades and they have not been aware of modern techniques.
3. From the public services point of view, in order to improve the land care system, an appropriate institutional set up is required.

4. Most agriculture farms are only able to provide a subsistent production. Therefore, the production lack continuity of the supply of the products and an economic size of the production which also requires credibility (organized entity) of the suppliers.

3.3 GFI Site Selection Criteria

The role of MINAGRI, as a central governmental institution, is primarily intended as one of policy guidance, planning, assessment, resource allocation, regulation and oversight. Therefore, the project implementation would have to make the beneficiary farmer-groups at the center and the provincial and district level administration as facilitators. It is true that the beneficiary farmers are not organized into common interest groups. Hence, the GFI management has to be organized to handle coordinating such farmer group formation, facilitation and project implementation.

The regional/global institutions, particularly those working in maize production industry and agricultural extension research, irrigation, water resources, and input and output marketing could offer experience and know-how to have the GFI project well managed.

However, it is neither desirable nor possible for GOR ministries in general and for the Ministry of Agriculture in particular, to take over all aspects of service delivery in rural areas. Service delivery process could be privatized in terms of marketing and financial services. However, there are some issues which should be managed by the public sector such as maize farming, irrigation and water-harvesting extension, and it has been appeared that public sector involvement is substantially important, however, private sector could handle the knowledge transfer process

Government Funded Irrigation project can be considered as a program as various schemes are developed under GFI according to specified criteria.

In 2014, GFI is managing sites in 2 selected districts of Eastern province that are situated in its northern and southern tips. The districts were pre-selected based on an assessment of their potential for water-harvesting, irrigation and water management needs as well as incidence of population pressure and levels of food insecurity.

The major driving force in the selection of each of the specific project sites is availability of permanent water source that could be pumped year round if needed, ease of land leveling for irrigation, plus site suitability for the targeted maize crop.

3.4 GFI Components

The project comprises two main components to be implemented. The first component deals with:

i. Infrastructure, input and Support Services, which is partitioned into the following 5 sub-components:
    1. Site office establishment, mobilizing, training and empowering farmer beneficiaries and marketing entrepreneurs
    2. Comprehensive land husbandry work on rain-fed command area catchment land
    3. Provision and Installation of the entire irrigation infrastructure
    4. Command area management including operation and management of irrigation infrastructure
    5. Quarterly monitoring and evaluation for filtering best bets for improved planning and implementation

ii. The second major component is “strengthening staffs and institutions”. The professional manpower in Rwanda is limited. The government understands that realization of professional agriculture is very difficult when there is not critical mass of educated manpower that can advance “knowledge –to-action” possibilities widely and effectively.

3.5 GFI Key Performance Indicators

The intention of the project is to control water erosion and increase productivity of 30,250 ha through intensive and comprehensive land husbandry practices in 17 districts. It also aims at introducing water-harvesting and hillside irrigation on 10,000 ha in the 17 project districts where the 34 selected sub-watersheds are situated. Therefore, success in implementation of erosion control and increased productivity over 30,250 ha as well as the status of implementation of irrigated horticulture on 10,000 ha land are two major measures of success.

Likewise, the project is planned to intensify tree and forage legume integrated production on 5160 ha as a tool for erosion control and protection of downstream reservoirs. It is hoped that ecological forest development, where the tree crops are mixed in stand and uneven in age, will be demonstrated for effective ground protection and diversified income to the farm owners.

To list other performance measurement indicators, one can summarize as below:

i. More efficient production and a better outcome considering farmers participation.
ii. More efficient marginal labor productivity.

iii. Considerable improvement of the exporting sector, especially horticultural sector.
iv. Increase proportion of farmers implementing production of high value agricultural products.

3.6 GFI Financing

The total proposed Project cost over the four years is US$200 million(around RWF 120 billion), of which the GOR and the beneficiaries and the GoR would finance US$ 30 million and the Donor provides US$ 170.0 million (90 Million in loan and 70 Million in grants).

The Donor is expected to make a commitment for the first phase amounting to US$ 50 million, with subsequent commitments reflected by addenda to the Grant Agreement. GoR funds are considered parallel financing to the project and hence would not be subject to donor's procedures.

The bulk of the expense is on permanent or semi-permanent infrastructures such as Radical Terraces that may serve over a century (with good management and care) and on construction of valley-dam reservoirs which serve for decades.

other notable expenses are to be incurred in the development of enlightened manpower at scholars' level and at community level.

For the benefits of the project, GFI design had identified a set of commodities and the objective was to increase their yields at the hillside level where erosion control activities had to be undertaken and in the irrigated areas. For the latter, the yield for

maize was supposed to increase from 2.1 to 8.4 T/Ha; the one for beans from 1.3 to 8 T/Ha and the yield for potatoes was supposed to pass from 18 to 35 T/ha.

Chapter 4

METHODOLOGY

The methodology used in this study consists of gathering secondary and primary data, processing the data and discussing them before producing the final report.

4.1 Secondary Data Gathering

Normally, there are numerous sources of information. Some sources provide formal information such as carefully written reports describing survey results, whereas others present information informally.

The secondary data will be found in relevant documents in line with this topic. In this vein were read public reports and books and also the literature presented in the Internet.

4.2 Primary Data

In the purpose of collecting the data, an interview with the management in charge of GFI in the Ministry of Agriculture and Animal Resources was carried out. The objective was to obtain the cost of the investment made at the Mpanga Irrigation Scheme. Data were collected using an interview guide called sometimes unstructured questionnaire.

From his answers, a field visit where GFI operates was undertaken. The president of the farmer cooperative which exploits the area was asked using a questionnaire to

shed light on the real field problems as well as how farmers think the project should be managed in order to reach its objectives.

4.3 Data Processing and Analysis

Obtained data was scrutinized to identify important points to be taken into account in the analysis. The evaluation of the project intends to identify better ways of making the project more economically and financially profitable. Therefore, a cost-benefit analysis (CBA) is being undertaken. In the framework of CBA, the present value of costs and benefits are taken into consideration by projecting the revenues and costs of the project compounded at a discount rate. This analysis is being conducted to evaluate how efficiently the project exploits economic resources. The estimated present values are being compared to the alternatives in order to conduct an investment appraisal. In addition, the financial analysis is being conducted based on the projected revenues and costs generated by the project operations.

The foundation of financial analysis is built on the market prices of project inputs and outputs while the economic analysis evaluates the project from the economy's point of view by considering the economic prices.

Some indicators are defined based on the net cash flows of the projects such as NPV IRR and benefit to cost ratio which are used to analyze the project both financially and economically. The net present value (NPV) criteria could be defined as below:

$$NPV(i, N) = \sum_{t=0}^{N} \frac{R_t}{(1+i)^t} \quad \text{Eq. 6}$$

where:

t– the time of the cash flow

i – the discount rate (the rate of return that could be earned on an investment in the financial markets with similar risk.); the opportunity cost of capital

R_t – the net cash flow i.e. (cash inflow – cash outflow), at time t .

In this context, the discount rate is the opportunity rate of the money or the cost of capital. The discount rate in this project is 12% according to the saving rate given by banks in Rwanda for substantial amounts.

From the capital budgeting point of view, the internal rate of return or IRR is the discount rate which makes the net present value of cash flows of a project equal to zero. So, this criteria could be used to rank mutually exclusive projects. IRR could also be compared against a benchmark rate in order to determine whether the project generates sufficient returns or not.

One of the main problems with the IRR criteria is that it sometimes results in multiple rates rather than an unique rate. Therefore, its reliability would be questioned when the project has multiple periods of negative cash flows. Generally speaking, the net present value criteria is recognized to be the most reliable criteria in the project evaluations.

At the end of the period, the salvage value of the investments is estimated. To determine that amount, the assets market values must be taken into account as well as the economic life of them. The price at which assets will be sold will be in relation with their economic depreciation.

The analysis carried out took into consideration the stakeholders of the project namely: (i) cooperative of farmers and (ii) government.

The benefits of the project are related to the sale of agricultural outputs but the government benefits also from a fees paid by the cooperative. Regarding costs, there are labor, inputs, maintenance, water and electricity, land and investment costs.
Figure 5 summarizes items related to costs and benefits considered in this study.

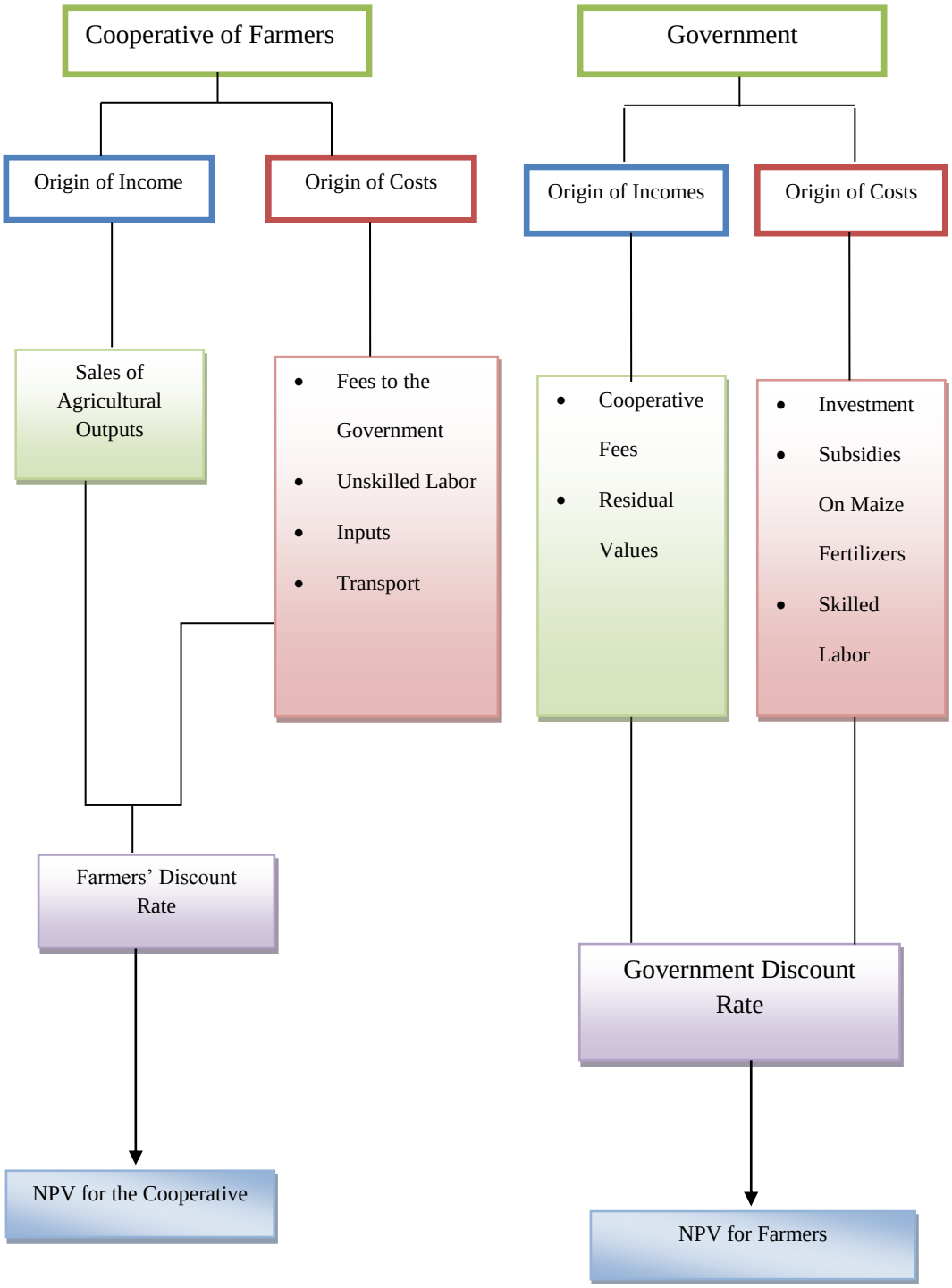

Figure 5: Drivers of Income and Costs Considered in the Analysis

The analysis started by what is currently the revenues and costs of the current situation. The NPV for the farmers was then maximized and taking into consideration the change of the cropping pattern to be carried out. That proposed combination of crops is what is referred to as “revised” case of the project while the current status is referred to as “traditional” case of the project.

At the end, the incremental analysis was carried out and a sensitivity analysis with the portion of investment to be made by farmers identified. The aim was to assess if farmers could make such an investment in the irrigation scheme without losing money.

4.4 Result discussions

This study involved the use of information from the person in charge of the project at the Ministerial level and the representative of the farmers exploiting the developed land. Other data came from secondary sources such as annual reports, the Ministry of Agriculture plan of actions, agricultural sector strategic plan, Rwanda vision 2020, EDPRS2, and budget reports. Analyses of the obtained results was implying looking at what it is written in the literature and what was found in the primary gathered data. From the discussion of the findings, proposals were drawn to maximize the investments set up.

4.5 Data Reliability and Validity

The validity implies the researcher makes sure that correct operational measures are utilized in the study by adopting multiple tests of evidence.

Multiple sources of evidence were employed including interviews with technicians, farmers and documentation such as annual reports, plan of action, EDPRS2, sector

strategy and reports. In addition, some documents are provided as evidences to which references are being made. The information was gathered from knowledgeable people in accordance with our research objective.

The main concern of reliability measures is to evaluate how accurately the data is collected. In other words, reliability tests show whether the researcher is able to get similar outcomes, ceteris paribus.

In this research we used different data collection techniques to make sure that collected data are reliable.

Interviews are arranged in the presence of the MINAGRI officials and the president of the cooperative. In this way, any unclear question could be explained so as to obtain the correct answer from the respondent. Before the production of the final report, findings were presented to MINAGRI and their inputs were included in the final report.

A field visit of the farm was also carried out as a check on the accuracy of the interviews conducted elsewhere.

4.6 Information Use

In the final step of the research process, the researcher prepared a final report. The report explains the research process as well as the obtained results. The first part of the report presents a summary of the findings and the reader can quickly see what conclusions have been reached.

The graph below summarizes activities carried out at the level of producing the report.

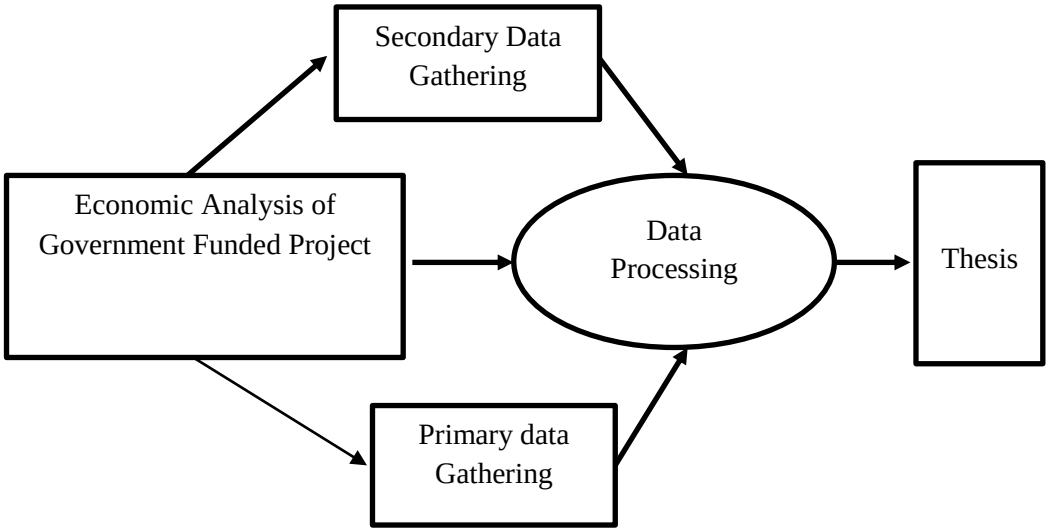

Figure 6: Sequences of Activities

Chapter 5

INTERPRETATION AND DISCUSSION OF RESULTS

5.1 Presentation of the Area of the Study

The irrigated area has 600 ha. Water is pumped and sprinklers distribute it. The area is located in Eastern Province, Kirehe District, Mpanga Sector, Mpanga Cell and Kabuye I Village.

The scheme is called Mpanga and the cooperative that exploits is the Cooperative for Valorization of Mpanga Irrigation Scheme (COVAMIR) created in 2012. It has 300 effective members among them 196 men and 104 women. And then, other 400 farmers practice their activities in the scheme and their production is marketed by the cooperative but they are not fully cooperative members. A total of 700 households benefit from the Mpanga Irrigation scheme.

The irrigation scheme was availed to the cooperative on 15 January 2013. At the beginning farmers were producing only maize for season A (Mid-September to mid-February) and ordinary beans in the Season B (Mid-February to Mid-June). The other Rwanda season is Season C (Mid-June to Mid-September). Season A and B are rainy seasons whereas season C is the dry one. For food availability purpose, the government wants farmers to produce Maize only in season A. It is only in 2013 that farmers have started producing vegetables (Tomatoes and Onions) and a special variety of beans called “coltan”.

For activities related to the selling of agricultural outputs, farmers have a permanent customer for any quantity of beans produced, but for other crops they need to find ways of marketing them at the harvest time.

MINAGRI helps the Cooperative by hiring key skilled people which are: (i) Contract manager, (ii) Agronomist, (iii) Irrigation Engineer, (iv) Site Coordinator and (v) Electromechanical. In addition, irrigation infrastructures were set up by the Government and farmers buy fertilizers for maize at a 50% of its cost. The rest of the cost is borne by the government. The cooperative is obliged to pay the government RWF 15,000,000 per year.

5.1.1 Maize in Mpanga Irrigation Scheme

Maize is cultivated in season A on 600 hectares. The source of costs for farmers in maize production are related to land preparation, crop tendering, input cost and harvest activities. Nominal costs for year 0 are presented in Table 1.

Table 1: Costs for Maize Production (RWF per Hectare)

Source of cost	Cost (RWF)
Unskilled labor	89,451,600
Seeds	6,389,400
DAP	5,990,063
Urea	5,031,653
Supermethrine	1,277,880
Organic Manure	63,894,000

It is also important to notice that farmers reported 2% of grain losses in maize production. For the benefits, maize has a yield of 4 tons per hectare and the weighted average selling price is RWF 251 per Kg. The price is expected to decrease by 0.02% per year and the yield will increase by 1% yearly.

Mpanga farmers get 4 tons per hectare, which is a very good yield because in 2002, Rwanda was talking of a yield of 3.5 tons per hectare. However, the yield is around 50% of the one proposed in the initial project documents of 8.4 tons per hectare. For the post-harvest losses, Mpanga farmers have less than the national average and even do better than their Uganda neighbors. In Rwanda losses are estimated at 18.9% while in Uganda we talk of 15%.

For the labor cost, we think it is underpriced. It represents only 14% of the cost of labor in seed production. Subsidies could also have an impact in this very low figure.

5.1.2 Beans in Mpanga Irrigation Scheme

In Mpanga, two types of bean varieties are exploited: (i) ordinary beans and (ii) Coltan Beans. Area occupied by beans is 500 hectares and the production in done in season B. Nominal costs for farmers in year 0 for beans are related to two items: (i) Unskilled labor (RWF 71,348,300 and (ii) Seeds (RWF 15,973,500). After harvest losses are estimated to be 10%.

For the benefits, all the two beans varieties have a yield of 1.5 Ton per hectare and the selling price is RWF 600 per Kg for Coltan and RWF 500 per Kg for ordinary beans.

Considering what was found in the literature, in Mpanga irrigation scheme, bean yields are acceptable but more efforts need to be deployed to get 8 tons per hectare mentioned in GFI project document. For after harvest losses, 10% are low comparing with what Rwanda knows: 22%. However, figures related to cost per hectare – around $300- are totally different from what was found by Douglas J. et al. and Mick C. et al (2008) . They found between $2,468 and $2,555 respectively; around 8 times the cost reported by Mpanga farmers. We think the reasons come from massive government subsidies but also underpricing of family labor.

5.1.3 Tomatoes in Mpanga Irrigation Scheme

In Mpanga, tomatoes are exploited in season C on 150 hectares. Table 2 shows costs in tomatoes production.

Table 2: Costs for Tomato Production (RWF per 150 Hectare)

Source of cost	Cost (RWF)
Seeds	1,945,572
Unskilled Labor	26,356,275
DAP	11,980,125
Urea	5,031,653
Dithane M45	19,168,200
Rava	51,115,200
Organic Manure	31,947,000
Mulching	4,312,845

Losses after harvest are estimated to be 40% of the total production. For the benefits, tomatoes have a yield of 20 tons per hectare and the selling price is RWF 150 per Kg.

Farmers have a long way to go to improve tomatoes yield. The potential for Rwanda is a yield tomato of 30 tons per hectare and farmers have only 20 tons per hectare. However farmers do well in terms of post-harvest losses which can amount to around 90% according to a study conducted by Babaloa in Nigeria. Regarding mulching and labor cost, farmers have low cost. For mulching, the cost is RWF 27,000 per hectare whereas in United States the cost is around RWF 150,000. For the unskilled labor, farmers are inefficient: RWF 165,762 and only around RWF 135,000 in United States. Differences in costs for mulching can be explained by used material. In USA farmers use plastic and in Rwanda they use grasses. Regarding the cost of labor, we think farmers underestimate their family labor but also the fact that all the activities are done manually whereas in USA field labor is from machines.

5.1.4 Onions in Mpanga Irrigation Scheme

In Mpanga, onions are exploited in season C on 150 hectares. After harvest losses are estimated at 30% of the total production. Nominal costs incurred by farmers in year 0 per 150 hectares are the following:

i. Seeds: RWF 18,030,791
ii. Urea: RWF 5,358,207
iii. Organic Manure: RWF 8,505,090
iv. Unskilled labor cost: RWF 38,655,870

For the benefits, onions have a yield of 6 tons per hectare and the selling price is RWF 150 per Kg. Yields obtained in Mpanga Scheme is very low. The highest yield is 30 tons per hectare found in Israel and the lowest is 3 tons per hectare found in Vietnam. The average world yield is 17.66 tons per hectare. However 30% after harvest are acceptable. Losses lie between 61.8% and 14% (Hurst, W.C et al (1985). Regarding the labor cost, farmers are very inefficient because a study conducted in Vietnam has shown that the labor cost is around RWF 75,600 per hectare and Mpanga farmers use RWF 243,118; more than 3 times what is found in Vietnam. This can be explained by the fact Rwanda farmers have not yet mastered the technology of onion production.

5.2 Traditional Project Case

According to the traditional status of the project, the cooperative exploits 1,400 hectares portioned among the following crops:

- Maize: ha 600 in season A
- Ordinary Beans: ha 250 in season B
- Coltan Bean: ha 250 in season B
- Tomatoes: ha 150 in season C
- Onions: ha 150 in season C

The analysis of traditional-project scenario reveals that net present value (NPV), in real terms and a discount rate of 12, is positive, valued RWF 5,419,498,512, from the cooperative's perspective while it is negative RWF - 8,863,927,638 from the government's perspective (Table 3). To calculate the NPV in traditional scenario of the project, the parameters are identified and cash flows are projected accordingly. Table of parameters is represented in detail in the Appendix.

Table 3: Traditional Project Case Real Net Cash Flows from Government's and Cooperative's Perspective (12 percent discount rate)

Government's Perspective										
Year	0	1	2	3	4	5	10	15	20	21
Net Cash Flow (Real)	-9,069,228,600	-36,806,254	-38,653,504	-40,574,644	-42,572,630	-44,650,535	-56,355,324	-70,595,990	-87,921,937	6,281,537,160
NPV @ 12% = - 8,863,927,638										
Cooperative's Perspective										
Year	0	1	2	3	4	5	10	15	20	21
Net Cash Flow (Real)	0	784,795,408	838,880,489	852,015,807	865,279,824	878,673,802	1,041,735,239	1,118,846,011	1,199,809,195	53,332,709
NPV @ 12% = 5,419,498,512										

5.3 Revised Project Case

In order to evaluate the incremental benefits of the project, a comparison of with-project and without-project scenarios is insightful. Therefore, net cash flows are similarly projected for revised-project case and NPVs are calculated accordingly. (Table 4). As it is appeared, the cooperative's NPV has increased significantly due to the production implementation (from RWF 5,419,498,512 in the traditional case to RWF 15,652,443,739 in the revised case). In other words, the revision of the project potentially adds to the wealth of the farmers almost twice.

The main problem here is switching from a high protein bean production to high value tomato. Processing of highly perishable non-storable crops, such as tomato, is typically promoted for two reasons: as a way of absorbing excess supply, particularly during gluts that result from predominantly rain-fed cultivation; and to enhance the value chain through a value-added process. Therefore, increasing the proportion of tomatoes, as being a perishable good, market prices will collapse. In order to control additional tomatoes, it would be required to have a tomato processing plant, perhaps a tomato paste plant.

Table 4: Revised Project Case Results from Government's and Cooperative's Perspective (12 percent discount rate)

Government's Perspective										
Year	0	1	2	3	4	5	10	15	20	21
Net Cash Flow (Real)	-9,069,228,600	-36,806,254	-38,653,504	-40,574,644	-42,572,630	-44,650,535	-56,355,324	-70,595,990	-87,921,937	6,281,537,160
NPV @ 12% = - 8,863,927,638										
Cooperative's Perspective										
Year	0	1	2	3	4	5	10	15	20	21
Net Cash Flow (Real)	0	1,837,648,140	1,953,991,733	1,982,670,042	2,011,629,341	2,040,872,383	2,191,442,006	2,349,534,007	2,515,524,198	108,307,118
NPV @ 12% = 15,652,443,739										

5.4 Incremental Cash Flow Analysis

Analyzing the additional cash flow generated by taking on a project is also of great importance when an appraisal is being conducted. The incremental cash flow analysis is mainly done to compare the traditional and revised project scenarios to evaluate whether the stakeholders benefit from the revisions of the project or they are better off with the traditional project. Therefore, this study has conducted an incremental cash flow analysis to evaluate the incremental cash flows generated by the revisions of the project from the farmer's point of view. According to the Table 5, the incremental net cash flows from the farmers' point of view results in a positive incremental NPV for the farmers. In other words, revising the project improves the wealth state of farmers positively and they are better off with revisions in comparison with the traditional case.

Table 5: Incremental Net Cash Flow and NPV for the Farmers

Revised-Project Net Cash Flow for Cooperative										
Year	0	1	2	3	4	5	10	15	20	21
Net Cash Flow (Real)	0	1,837,648,140	1,953,991,733	1,982,670,042	2,011,629,341	2,040,872,383	2,191,442,006	2,349,534,006	2,515,524,198	108,307,118
Traditional-Project Net Cash Flow for Cooperative										
Year	0	1	2	3	4	5	10	15	20	21
Net Cash Flow (Real)	0	784,795,408	838,880,489	852,015,807	865,279,824	878,673,802	1,041,735,239	1,118,846,011	1,199,809,195	0
Incremental Net Cash Flow for Cooperative										
Year	0	1	2	3	4	5	10	15	20	21
Incremental Net Cash Flow (Real)	0	1,052,852,733	1,115,111,244	1,130,654,235	1,146,349,517	1,162,198,581	1,149,706,767	1,230,687,996	1,315,715,002	108,307,118

5.5 Sensitivity Analysis

As shown in the previous section, the NPV of incremental net cash flows leads to a positive incremental NPV for the farmers. It is also worth testing what if the farmers contribute to the investment cost and to what extent they can contribute and continue getting a positive incremental NPV. Therefore, a sensitivity analysis is conducted and the results are shown in the Table 6. According to the sensitivity analysis results, farmers could contribute to the investment cost and benefit from positive incremental NPV.

Table 6: Sensitivity Analysis (Portion of the Farmers Contribution to the Investment Costs)

	NPV Cooperative		NPV Government		Cooperative Incremental NPV
Portion	**Traditional**	**Revised**	**Traditional**	**Revised**	
	7,112,326,998	15,652,443,739	(8,863,927,638)	(8,863,927,638)	8,530,091,876
0%	7,112,326,998	15,652,443,739	(8,863,927,638)	(8,863,927,638)	8,530,091,876
5%	7,112,326,998	15,228,053,141	(8,863,927,638)	(8,439,537,040)	8,076,630,446
10%	7,112,326,998	14,803,662,543	(8,863,927,638)	(8,015,146,442)	7,623,169,016
15%	7,112,326,998	14,379,271,945	(8,863,927,638)	(7,590,755,844)	7,169,707,586
20%	7,112,326,998	13,954,881,347	(8,863,927,638)	(7,166,365,246)	6,716,246,156
25%	7,112,326,998	13,530,490,749	(8,863,927,638)	(6,741,974,648)	6,262,784,726
30%	7,112,326,998	13,106,100,151	(8,863,927,638)	(6,317,584,050)	5,809,323,296
35%	7,112,326,998	12,681,709,553	(8,863,927,638)	(5,893,193,452)	5,355,861,866
40%	7,112,326,998	12,257,318,955	(8,863,927,638)	(5,468,802,854)	4,902,400,436
45%	7,112,326,998	11,832,928,357	(8,863,927,638)	(5,044,412,256)	4,448,939,006
50%	7,112,326,998	11,408,537,759	(8,863,927,638)	(4,620,021,658)	3,995,477,576
55%	7,112,326,998	10,984,147,161	(8,863,927,638)	(4,195,631,061)	3,542,016,146
60%	7,112,326,998	10,559,756,563	(8,863,927,638)	(3,771,240,463)	3,088,554,716
65%	7,112,326,998	10,135,365,965	(8,863,927,638)	(3,346,849,865)	2,635,093,286
70%	7,112,326,998	9,710,975,367	(8,863,927,638)	(2,922,459,267)	2,181,631,856
75%	7,112,326,998	9,286,584,769	(8,863,927,638)	(2,498,068,669)	1,728,170,426
80%	7,112,326,998	8,862,194,171	(8,863,927,638)	(2,073,678,071)	1,274,708,996
85%	7,112,326,998	8,437,803,573	(8,863,927,638)	(1,649,287,473)	821,247,566
90%	7,112,326,998	8,013,412,975	(8,863,927,638)	(1,224,896,875)	367,786,136
95%	7,112,326,998	7,589,022,377	(8,863,927,638)	(800,506,277)	(85,675,294)
100%	7,112,326,998	7,164,631,779	(8,863,927,638)	(376,115,679)	(539,136,724)

Chapter 6

CONCLUSION

6.1 Conclusion

An appraisal of Government Funded Irrigation was carried out for Mpanga Irrigation Scheme. The developed area is exploited and managed by a farmer cooperative named COVAMIR (Cooperative for the Valorization of Mpanga Irrigation Scheme). Farmers were given developed fields by the Government of Rwanda and they benefit from subsidies on Maize inputs. Costs undergone by farmers are inputs and unskilled labor Maize, Tomato, beans and Onions produced at Mpanga Irrigation scheme and revenues come from the sale of those commodities. On its side, the Government has made investments and pays for skilled labor to get only a cooperative fee paid yearly. The financial analysis of the project from the farmers' cooperative point of view and the government point of view has revealed that in the traditional case, the real NPV for the cooperative is RWF 5,419,498,512 whereas the one for the Government will be RWF - 8,863,927,638 in the current situation.

The incremental net cash flows from the farmers' point of view results in a positive incremental NPV for the farmers. In other words, revising the project improves the wealth state of farmers positively and they are better off with-revisions in comparison with traditional project case.

In order to increase the cooperative income and to see if farmers can contribute to the investment without losing money; NPV for farmers could be maximized and then become RWF 15,652,443,739 if the scheme was exploited only with maize at 600 ha and tomatoes at 800 ha. After getting those figures, the sensitivity analysis was undertaken and results have shown that farmers can contribute to the investment cost of the project's revisions and still have a positive NPV.

The main issue here would be switching from a high protein bean production to high value tomato. Processing of highly perishable non-storable crops, such as tomato, is typically promoted for two reasons: as a way of absorbing excess supply, particularly during gluts that result from predominantly rain-fed cultivation; and to enhance the value chain through a value-added process. In order to control additional tomatoes, it would be required to have a tomato processing plant, perhaps a tomato paste plant.

In summary, the revisions would lead to a better state of wealth for the farmers according to the incremental analysis of NPV and according to the sensitivity analysis, the farmers might also be able to contribute to the program up to an extent. However, two issues have to be considered; firstly, the perishability of tomatoes; and secondly, the economic ability of farmers to contribute to the project.

6.2 Policy Implications

The outcomes of this study might provide some insights for policy makers on economic development decision makings. One would suggest the following policy implications such as contributing to the investment costs, farmers would need to contract loans. Government should set ways to permit farmers to have long-term

loans and to help them paying back easily like through the water users association fees.

Considering the exports, diversification of output markets should be carried out to reduce the decrease of export price in some years. Once tomatoes are massively exploited, farmers will definitely export processed tomatoes and the following strategies could be put in place:

- Government should work on its macroeconomic policy to deal with issues related to real exchange rate;
- Strengthening farmers in contracting for production and delivery of tomatoes at the beginning of the planting season at the contract prices;
- In case there is an outside operator, Government to make sure he/she has the raw tomato throughout the year at the agreed contract price, even if the price on local market goes up;
- Protecting farmers to continue selling their produce at the agreed contract price even if the local price for tomatoes goes down.

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APPENDIX

TRADITIONAL PROJECT

TABLE 1

Benefits						
		Maize	Beans Coltan	Bean Ordinary	Tomatoes	Onions
Area under cultivation TRADITIONAL Project	Ha	600	250	250	150	150
Area under cultivation REVISED Project (Tomatoes)	Ha	600			800	
Number of harvests per year	number	1	1	1	1	1
Yield	T/Ha	4	1.5	1.5	20	6
Price per Ton (Highest)	RWF	220,000	600,000	500000	150000	400000
Price per Ton (Lowest)	RWF	200,000	500,000	250000	150000	300000
Duration of the lowest Price	Month	3	3	4	6	6
Duration of the highest Price	Month	9	9	8	6	6
Variation of the weighted average price	%	-0.02%	-0.02%	-0.02%	-0.02%	-0.02%
Variation of the production	%	1%	1%	1%	1%	1%
1 Ton	Kg	1,000				
One year	month	12				

TRADITIONAL PROJECT

TABLE 1 (Continued)

Costs						
Labor Cost						
Unskilled labor		Maize	Beans Coltan	Bean Ordinary	Tomatoes	Onions
First and second tilling	Amount per Ha	50,000	40,000	40,000	40,000	60,000
Sowing	Amount per Ha	36,000	20,000	20,000	30,000	12,000
First Weeding	Amount per Ha	30,000	24,000	24,000	18000	60,000
Second Weeding	Amount per Ha		12,000	12,000		30000
Pesticide Spraying	Amount per Ha	-	-		20,000	0
Harvesting	Amount per Ha	24,000	18,000	18,000		30,000
Fertilizer application	Amount per Ha	-	-		12000	
Drying	Amount per Ha		5,000	5,000	0	20,000
Watering	Amount per Ha		15,000	15,000	45000	30,000

TRADITIONAL PROJECT

TABLE 1 (Continued)

Skilled labor						
Contract manager	Amount/month	1,012,353				
Agronomist	Amount/month	672,017				
Irrigation Engineer	Amount/month	672,017				
Site Coordinator	Amount/month	672,017				
Electromechanical	Amount/month	672,017				
variation of cost	% of total cost	0.04				
Inputs						
Quantity		Maize	Beans Coltan	Bean Ordinary	Tomatoes	Onions
Seeds	Kg/Ha	25	60	60	0.58	2
Fertlizer						
DAP per Ha	T	0.025	0	0	0.1	0
Urea per Ha	T	0.025	0.0000	0	0.05	0.05
Pesticides						
Kg/Ha				40		
Supermethrine	L	0.5				
Rava	L				32	
Organic manure	T	10	0		20	5
Dithane M45	Kg/Ha				40	

TRADITIONAL PROJECT

TABLE 1 (Continued)

cost						
DAP	Per KG	750	750	750	750	750
Urea	Per KG	630	630	630	630	630
Seeds	FRW per KG	400	600	400	21000	53000
Organic manure	RWF/kg	10	10	10	10	10
Mulching	RWF/Ha	-	-	0	27000	0
Dithane M45	RWF/kg				3000	
Supermethrine	L	4,000				
Rava	RWF/L				10000	
Governement Subsidies						
Input						
Fertilizer	% of Fertilizer cost	50%				
Investment						
Warehouse fees	RWF	38,000,000				
Irrigation Infrastructure	RWF	6,920,228,600				
Pump, Pipes, Sprinklers & Installation	RWF	11,000,000				
Portion of Invetsment cost paid by the Cooperative		0%				

TRADITIONAL PROJECT

TABLE 1 (Continued)

Economic life of Investment (Years)		50				
Paid to the Water Usera Association	RWF/Year/Ha	58,000				
Government	RWF/Year	15,000,000	From the Water Users Association			
Land (Cost)	RWF/Ha	1,500,000				
After Harvest losses	% of production	-2%	-10%	-10%	-40%	-30%
Commercialisation						
Transport RWF/Ton)	per ton	5000				5000
Working Capital						
Account receivable	% of sales	3%				
Account payable	% of input cost	1%				
Cash balance	% of sales	0.50%				
National and Cooperative Parameters						
Inflation Rate		6.49%				
Discount Rate for the Government		12%				
Discount Rate for the Cooperative		12%				
Project Duration (Years)		20				