

Domestic Production of Ready to Use Therapeutic Food (RUTF) for Improved Nutrition

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ABSTRACT

Life expectancy at birth in Uganda is approximately 58.46 years in 2014. The infant mortality rate under the age of 5 is about 55 deaths per 1,000 children. Low-quality health facilities and the distance to health services is one of the major problems in Uganda. About 38% of children less than five years of age are stunted, nearly 16% of them are underweight, and 8.1% suffer from moderate and severe malnutrition.

Ready-to-use therapeutic food (RUTF) is a nutritional paste that is made from a recipe of peanuts, powdered milk, vegetable oil, sugar, vitamins and mineral mix (Wagh and Deore, 2015). It contains a therapeutic mix of nutrients to treat a child with Severe Acute Malnutrition SAM. The aim of this study, therefore, is to appraise a project aimed at promoting the domestic production of RUTF in Uganda. The appraisal will involve financial, economic, stakeholder and risk analysis of the proposed project.

Keywords: Ready-To-Use Therapeutic Food, Severe Acute Malnutrition, Cost-Benefit Analysis, Financial Analysis, Uganda, Economic Analysis, Sensitivity Analysis, Distributive Analysis.

ÖZ

Uganda'da ortalama yaşam süresi yaklaşık olarak 58.5 yıldır. 5 yaş altı çocuk ölümleri, 1,000 çocuk başına yaklaşık 55 olarak tahmin edilmektedir. Düşük kaliteli sağlık hizmetleri ve sağlık ocaklarına olan mesafe, Uganda'daki en büyük sorunlardan biridir. Beş yaş altı çocuklardan yaklaşık 38%'i bodur, 16%'sı normal kilonun altında, ve 8.1%'i gıdasız beslenmeden kaynaklanan hastalıklarla boğuşmaktadırlar.

Kullanıma hazır terapötik gıdası (RUTF), yer fıstığı, toz süt, bitkisel yağ, şeker, vitaminler ve çeşitli minerallerden yapılmış besleyici bir gıdadır (Wagh and Deore, 2015). Bu gıda şiddetli akut malnütrisyonuna yakalanmış çocukların tedavisi için gerekli olan terapötik besinler karışımını içerir. Bu çalışmanın amacı, Uganda'da RUTF'un yerli üretimini teşvik etmeyi amaçlayan bir projeyi değerlendirebilmektir. Değerlendirme, söz konusu projenin mali, ekonomik, paydaş ve risk analizlerinden oluşmaktadır.

Anahtar Kelimeler: Kullanıma Hazır Terapötik Gıda, Şiddetli Akut Malnütrisyonu, Maliyet-Fayda Analizi, Uganda, Mali Analiz, Ekonomik Analiz, Duyarlılık Analizi, Dağılım Analizi.

To My Lovely Family

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TABLE OF CONTENTS

ABSTRACT.....	iii
ÖZ	iv
DEDICATION	v
ACKNOWLEDGMENT.....	vi
LIST OF TABLES	x
LIST OF FIGURES	xi
LIST OF ABBREVIATIONS	xii
1 INTRODUCTION	1
1.1 Introduction.....	1
1.2 Aim of the Study.....	1
1.3 Methodology of the Study	2
1.4 Structure of the Study	2
2 LITERATURE REVIEW.....	4
2.1 What is RUTF?.....	4
2.2 Production of RUTF	6
2.2.1 Ingredients	6
2.2.2 Scale of Production.....	8
2.2.3 Aflatoxin Contamination	8
2.2.4 Quality Control and Quality Assurance.....	9
3 METHODOLOGY.....	11
3.1 Cost-Benefit Analysis.....	11
3.1.1 Financial Analysis	11
3.1.2 Economic Analysis	11

3.1.3 Risk Analysis.....	12
3.1.4 Stakeholder Analysis	12
4 FINANCIAL ANALYSIS	14
4.1 Capital Investment Requirement of the Project.....	14
4.2 Project Financing	16
4.2.1 Bank Overdraft	16
4.3 Project Revenues	17
4.3.1 Sales Prices (USD/kg)	17
4.3.2 Production and Inventory (kg/year).....	18
4.4 Operating Costs	19
4.4.1 Direct Labor.....	19
4.4.2 Indirect Labor	19
4.4.3 Physical Input Costs	22
4.4.4 Utilities	23
4.4.5 Other Direct Costs	23
4.4.6 Other Indirect Costs.....	23
4.5 Debt Service Coverage Ratio.....	25
4.6 Investment Decisions.....	26
5 ECONOMIC ANALYSIS.....	27
5.1 Introduction to Economic Analysis	27
5.1.1 Tradable Goods.....	27
5.1.2 Non-Tradable Goods	28
5.2 Economic Prices for Tradable and Non-Tradable Goods and Services.....	28
5.2.1 Economic Prices for Tradable Goods	28
5.2.4 Commodity Specific Conversion Factor	28

5.2.4.1 National Parameters	29
5.2.4.2 Importable Inputs Subject to Taxes	29
5.2.4.3 Exportable Inputs Subject to Taxes	30
5.2.4.4 Labor	30
5.3 Results of Economic Analysis	30
6 STAKEHOLDER ANALYSIS	33
6.1 Introduction to Stakeholder Analysis	33
7 RISK ANALYSIS	37
7.1 Scope of Risk Analysis	37
7.2 Result of Risk Analysis	37
7.2.1 Real Price of Physical Inputs	37
7.2.2 Expected Real Price of Production of RUTF	38
7.2.3 Additional Production of RUTF	39
7.2.4 Domestic Inflation	39
7.2.5 US Inflation	40
8 CONCLUSION	41
REFERENCES	44
APPENDICES	47
Appendix A: Total Cost Calculation	48
Appendix B: Conversion Factor for Domestic Transportation	52
Appendix C: Conversion Factor for Electricity and Other Utilities	53
Appendix D: Conversion Factor for Tradable Items	54

LIST OF TABLES

Table 1: Ready to Use Therapeutic Food Recipe.....	6
Table 2: A Standard Mixture of Vitamins Needed in Production of RUTF	7
Table 3: A Standard Mixture of Minerals Needed in Production of RUTF	7
Table 4: Investment Costs.....	15
Table 5: Project Financing (000 UGX).....	17
Table 6: Labor Requirement by the Project	20
Table 7: Total Labor Cost Calculation.....	21
Table 8: Imported Inputs Used in the Production of RUTF.....	22
Table 9: Domestic Sourced Inputs Used in the Production of RUTF.....	22
Table 10: Financial Cash Flows Statement: Owner's Perspective, Real.....	24
Table 11: Annual Debt Service and Loan Life Coverage Ratios.....	25
Table 12: Summary of Conversion Factors	31
Table 13: Economic Resource Flow Statement (000's UGX).....	32
Table 14: Distribution of Externalities.....	35
Table 15: Statement of Externalities	36
Table 16: Sensitivity Test for Real Price of Physical Inputs	38
Table 17: Sensitivity Test for Expected Real Price of Production of RUTF.....	38
Table 18: Sensitivity Test for Additional Production of RUTF.....	39
Table 19: Sensitivity Test for Domestic Inflation.....	40
Table 20: Sensitivity Test for US Inflation	40

LIST OF FIGURES

Figure 1: An Example of Packaged RUTF	4
Figure 2: Child Number One Eating Packaged RUTF	5
Figure 3: Child Number Two Enjoying Packaged RUTF.....	5

LIST OF ABBREVIATIONS

ADSCR	Annual Debt Service Coverage Ratio
CBA	Cost-Benefit Analysis
EIRR	Economic Internal Rate of Return
ENPV	Economic Net Present Value
EOCK	Economic Opportunity Cost of Capital
EOCL	Economic Opportunity Cost of Labor
FEP	Foreign Exchange Premium
FNPV	Financial Net Present Value
FIRR	Financial Internal Rate of Return
GNPV	Government Net Present Value
IRR	Internal Rate of Return
LLCR	Loan Life Coverage Ratio
NPV	Net Present Value
RUTF	Ready-To-Use Therapeutic Food
SAM	Severe Acute Malnutrition
VAT	Value Added Tax

Chapter 1

INTRODUCTION

1.1 Introduction

Uganda is a country in East Africa with a surface area of 241,550 square kilometers and a population of almost 39.03 million (World Bank 2015). It is a highly populated, but less developed country such that it is one of the poorest countries in the world, with 34.6 percent of the population spending less than 1.90 USD/day.

Life expectancy at birth in Uganda is approximately 58.46 years in 2014. The infant mortality rate under the age of 5 is about 55 deaths per 1,000 children. Low quality health facilities and the distance to health services is one of the major problems in Uganda. About 38% of children less than five years of age are stunted, nearly 16% of them are underweight and 8.1% suffer from moderate and severe malnutrition.

1.2 Aim of the Study

The objective of this project is to reduce the incidence of acute malnutrition in Uganda as well as to promote the domestic production of Ready-to-use therapeutic food (RUTF) in Uganda. Hence, it is an example of the integration of nutrition and agriculture. RECO Industries Ltd. is a local food producer in Uganda that is willing to undertake this project. The plan is for USAID to sign a 5-year purchase contract with the prospective local supplier and will buy a fixed quantity of RUTF each year from the producer. The USAID intervention through this purchase agreement will last throughout the project's operational life. By this purchase agreement, the local

producer agrees to produce RUTF that meets the USAID and government health regulations and standards. The producer is also responsible for the delivery of RUTF products to the health centers.

1.3 Methodology of the Study

An integrated feasibility study of producing RUTF domestically which contains financial analysis, economic analysis, stakeholder analysis and risk analysis is been completed in this project. The analysis of the project was built through the modeling convention standard based on a widely-known standard called FAST modeling.

1.4 Structure of the Study

This research work has been divided into eight chapters which are as follows:

The main focus of the thesis has been introduced in Chapter 1.

Chapter 2 explains a brief overview on Ready to Used Therapeutic Food and the description of the method which will be used to process the production of domestic RUTF.

In Chapter 3 the methodology used in the study has been explained which helps to determine the possibility of project success.

Chapter 4 analyzes the financial viability of the project. In this chapter, all project outcomes such as ADSCR, LLCR, FNPV and FIRR will be examined to decide on the financial feasibility of the project.

Chapter 5 is dedicated to the project's economic analysis. ENPV and EIRR would determine whether the economy will benefit from the project or not.

Stakeholder analysis is explained in chapter 6. This chapter will describe the distribution of the externalities from the project to the beneficiaries or losers.

Chapter 7 describes the risk analysis on financial, economic and stakeholder analysis and recommends on how to decrease the risk.

Conclusion based on the findings in the previous chapters has been provided in chapter 8.

Chapter 2

LITERATURE REVIEW

2.1 What is RUTF?

Ready-to-use therapeutic food (RUTF) is a nutritional paste that is made from a recipe of peanuts, powdered milk, vegetable oil, sugar, vitamins and mineral mix (Wagh and Deore, 2015). It contains a therapeutic mix of nutrients to treat a child with Severe Acute Malnutrition SAM. The RUTF food product is consumed directly by the child and does not need to be mixed with water or other liquids. As it does not spoil quickly, it can be used as a therapeutic food on an outpatient basis. In this way both the child and its caregiver only need to visit a local health center periodically to receive supplies of the food (Latham, Jonsson, Sterken, and Kent 2010). Other treatments were milk-based and required child and caregiver to remain at clinic. As of now, Uganda is importing the RUTF food from abroad. An average of 10 to 15 kg of RUTF is needed for the full treatment of a malnourished child over a 6 to 8-week period.



Figure 1: An Example of Packaged RUTF



Figure 2: Child Number One Eating Packaged RUTF



Figure 3: Child Number Two Enjoying Packaged RUTF

RUTF is necessary for treatment of malnourished children due to several reasons.

First, it provides sufficient nutrients required for recovery. Second, it does not spoil

quickly, even after it is opened. Third, the risk of bacterial growth is low as RUTF is not water-based and does not need to be kept in a refrigerator. Fourth, it is easy to consume, without a close supervision and it is liked by children and also, it can be consumed while breastfeeding (UNICEF, 2009).

2.2 Production of RUTF

RUTF is a lipid-rich food. The lipids are small pieces of protein, carbohydrate, vitamins and minerals. A specific mixing process should be made to produce the RUTF mixture (Wagh and Deore 2015). The lipid particles of producing RUTF require to be stirred first and heated; and the rest of ingredients need to be added slowly to the lipids during an intense stirring. After mixing all ingredients, stirring speed should be increased for a few minutes and powdered ingredients should not be larger than 200 microns in order the mixture to be ready (Beesabathuni and Natchu, 2010). Oil could ease the mixing process. RUTF packaging can be done through factory bowls, mechanical devices or by hands. 23 suppliers are producing RUTF internationally or locally and among them Malawi, Congo, Niger, Ethiopia, Ghana, Sierra Leone and Burkina Faso have been able to produce local RUTF successfully (UNICEF, 2017).

2.2.1 Ingredients

Table 1: Ready to Use Therapeutic Food Recipe

Milk powder	30%
Sugar	28%
Peanut butter	25%
Vegetable oil	15%
Mineral vitamin mix	1.6%

Milk powder – Uganda could produce a standard milk powder domestically which is suitable to produce RUTF.

Sugar – Both brown and white sugar could be used in the production of RUTF. The sugar powder needs to be so small for the mixture to have a particle size no more than 200 microns.

Peanut butter – It can be made through groundnuts after being roasted and ground.

Vegetable oil – Several kinds of oil such as cottonseed oil, corn oil, soy oil and rapeseed oil could be used for RUTF production (Beesabathuni and Natchu, 2010).

Powdered vitamins and minerals – A standard mixture of vitamins and mineral which are needed in the production of RUTF and the amounts in 100 g of the powdered mix is as presented in Table 1 and Table 2 (Manary, 2006).

Table 2: A Standard Mixture of Vitamins Needed in Production of RUTF

Vitamins												
A	D	E	K	B1	B2	B6	B12	C	Biotin	Folic acid	Niacin	Pantothenic acid
57 mg	1 mg	1.25 g	1.30g	37.5g	116 mg	37.5mg	110 mg	3.3 g	4.1 mg	13 mg	332 mg	194mg

Table 3: A Standard Mixture of Minerals Needed in Production of RUTF

Minerals						
Potassium	Magnesium	Iron	Zinc	Copper	Iodine	Selenium
36 g	587 mg	704 mg	717 mg	92 mg	5 mg	1.54 mg

UNICEF has donated vitamins and minerals, and the World Food Program has donated milk, oil and sugar for RUTF production in Malawi (UNICEF, 2009).

2.2.2 Scale of Production

For producing RUTF, a mechanical mixer needs to be used. However, depending on the quantity of RUTF needed, different mixers will be used.

Small scale production is possible if no more than a few hundred kg of RUTF per week is required. Production can take place in a small room without any kinds of pests or rodents. A 40 L planetary bakery mixer can be used for RUTF preparation which has the capacity to mix 25 kg of RUTF. All ingredients need to be measured carefully and added to the mixer. The process takes 18 minutes, first slow, medium and then fast to prevent separation of the ingredients during storage. RUTF can be poured into 250 g plastic bottles or be packed by hand. The 250 g is the amount every malnourished child needs to be fed daily (Manary, 2006).

A commercial food processing company with appropriate machinery for mixing, grinding and packaging RUTF which could be found in pastry factories or industrial bakeries would be the best when 500 – 1500 kg of RUTF is needed per week.

An industrial production machine especially for RUTF is needed if more than 3000 kg of RUTF is required per week. The packaging would be done automatically and the production is at a high speed. An operator needs to add the ingredients to the mixer and remove them after from the packaging device (Wagh and Deore 2015).

2.2.3 Aflatoxin Contamination

Aflatoxins are poisonous and cancer-causing chemicals that are produced by certain molds (*Aspergillus flavus* and *Aspergillus parasiticus*) which grow in soil, decaying

vegetation, hay, and grains. They are regularly found in improperly stored staple commodities such as groundnuts (Abbas, 2015). Uganda is a tropical country with weather conditions favorable for microbial growth therefore, exposure to mycotoxins especially is unavoidable (Kaaya, 2011). Aflatoxins are extremely toxic and could cause acute infection, various types of cancer and potentially death in both humans and animals. The liver is the organ aflatoxin usually infects the most. It is almost impossible to identify the toxic person as the symptoms are not known yet. Aflatoxins contaminate approximately 25 percent of agricultural products worldwide and have negative public health implications. Little is known on the level of aflatoxins in foodstuffs in Kampala and yet open markets in sub-Saharan Africa have been implicated to have high risk of aflatoxin contamination (Osuret, Musinguzi, Mukama, Halage, Kaaya, Ssempebwa, and Wang, 2016).

2.2.4 Quality Control and Quality Assurance

RUTF must be examined for aflatoxins as well as heavy metals, pesticides, fat oxidation, moistness, fat and protein approximation, hydro content and minerals or vitamins dilutions (Beesabathuni and Natchu, 2010). Quality control is accomplished by adequate training and monitoring of the production staff, secure ingredient storage and product test for contaminants. There are standards that all food production companies including RUTF producers must implement. Peanuts need to be stored in a cool and dry place to reduce the fungal growth. Aflatoxin development is more frequent in tropical areas due to humidity, rainfalls and high variation in temperature.

Recommended methods to prevent aflatoxin contamination:

- Harvesting on time and immediately after harvesting, pods must be plucked off and dry as soon as possible
- Careful harvesting to avoid mechanical damage

- No soils should be contacted with the groundnuts while drying, remove dust
- Dry groundnuts within 48 hours after harvest
- Separate infected and healthy groundnuts, remove discolored, damaged, and shriveled groundnuts
- Manual shelling machines or hands are recommended
- Use clean and new polybags to store the groundnuts
- Control pests, rodents and insects during storage

Chapter 3

METHODOLOGY

3.1 Cost-Benefit Analysis

To evaluate the domestic production of RUTF in Uganda, cost-benefit analysis (CBA) was used. CBA estimates and totals up the equivalent money value of the benefits and costs to the community of projects to ascertain if they are beneficial or not. The appraisal methodology used for this study, also referred to as Integrated Investment Appraisal (IIA), is a multidimensional approach to evaluating a project. This means that not only are financial benefits and costs estimated, but also economic costs and benefits. IIA also involves stakeholder and risk analyses. Stakeholder analysis looks at who is affected by the project as well as the magnitude.

3.1.1 Financial Analysis

The financial analysis is a procedure that involves the arrangement of data in financial statements. Using investment criteria like Net Present Value (NPV) and Internal Rate of Return (IRR), the project's financial viability and sustainability are checked. Although defined as temporary endeavors, projects often last for many years so projections of incomes and expenses for the whole duration of the project are a significant attribute of the financial analysis.

3.1.2 Economic Analysis

The economic evaluation of a project is performed to establish the project's net benefits to society. It involves the quantifying and evaluation of the economic viability of the recommended project. It is an evaluation to check if the means used

in the project are employed effectively. The economic assessment transforms financial inflows and outflows into benefits and costs, to generate an economic resource record indicating the project's societal worth. A vital aspect of the economic analysis is its connection to the project cash flow statement, preserving coherence with the financial analysis. The project appraiser can commence complex studies into the project's economic and financial performance concurrently.

3.1.3 Risk Analysis

Because project appraisal involves the future projections of financial inflows and outflows based on deterministic values, the resultant uncertainty associated with projects is inevitable. The aim of the risk analysis therefore, is to recognize the risks that may affect the outcome of the project significantly. Although some risk variables can be contained, other risk variables are affected by external constraints that are uncontrollable by project managers. Risk analysis considers uncertainty or riskiness of the key variables.

3.1.4 Stakeholder Analysis

Stakeholder evaluation is conducted to see who are the groups gaining or suffering if the project is started. Because of stakeholder evaluation, a well-defined image of the status quo is portrayed. This possibly will influence the resources and starting of the project in multiple respects. Should this assessment reveal that project owners are gaining at the disadvantage of either the society or the government, at that instant despite a favorable FPNV, such as project may not see the light of day. Alternatively, assuming that bureaucratic pressures are present and the project has an unfavorable ENPV or FNPV but revealing that the government or promoters with governmental connections as gainers from the project, in the way that project may still be applied.

Preferably, the purpose here is to see whether poverty reduction goals and welfare expansion goals will be addressed by taking the project.

Chapter 4

FINANCIAL ANALYSIS

4.1 Capital Investment Requirement of the Project

All the results of financial analysis have been calculated based on the parameters and assumptions in the table of parameters. RUTF production is a 10-year project, and all project assets will be liquidated in year 11 at the end of the project. All investment costs are presented in real terms in year one prices. It is assumed that investment costs will not change in real terms over time, so the cost overrun factor is 0%.

These costs relate to the once-off capital purchases required for both production and distribution of RUTF to health centers. The project will use both existing facilities such as its land and building along with new investments such as machinery and vehicles. Purchase and installation of the machinery required for the production of RUTF will start in year one so that domestic producer can immediately start producing the RUTF in the same year.

The general market values of existing land and buildings are 50,000 USD and 200,000 USD, respectively. The machinery and equipment will be imported from outside. The CIF cost of all machinery is 950,000 USD in year one prices. Machinery imports of the project are exempt from import duty, and value added tax (VAT). Regarding transporting the machinery from port to the project area, the project will also pay 1% on top of its CIF price. Also, the project will bear 1% of CIF price as a

cost of handling and brokerage. All machinery equipment will be installed in the year one.

The project will deliver the RUTF food from the project site to the health centers by vehicles. Moreover, the project will also use the vehicles to collect groundnuts from local farmers. For these purposes, the project will purchase a total of three vehicles, total worth of 210,000 USD. Furthermore, the project will pay 1% of CIF price as a transportation cost to deliver vehicles to the project site and 1% of CIF price as the cost of handling and brokerage.

Table 4: Investment Costs

YEAR	1	
Investment Costs, Real (000 USD)		
Investment cost overrun	0%	
Land	50	000 USD
CIF cost of Machinery	950	000 USD
Local transport of the machinery and vehicles (% of CIF price)	1%	
Cost of handling and brokerage (% of CIF price)	1%	
Buildings	200	000 USD
CIF cost of Vehicles	210	000 USD
Investment Costs, Real (000 UGX)		
Land	000 UGX	122,500
CIF cost of Machinery	000 UGX	2,327,500
Cost of handling and transportation	000 UGX	46,550
Total cost of the machinery	000 UGX	2,374,050
Buildings	000 UGX	490,000
CIF cost of Vehicles	000 UGX	514,500
Cost of handling and transportation	000 UGX	10,290
Total cost of the vehicles	000 UGX	524,790
Total investment cost	000 UGX	3,511,340
Investment Costs, Nominal (000 UGX)		
Land	000 UGX	122,500

CIF cost of Machinery	000 UGX	2,327,500
Cost of handling and transportation	000 UGX	46,550
Total cost of the machinery	000 UGX	2,374,050
Buildings	000 UGX	490,000
CIF cost of Vehicles	000 UGX	514,500
Cost of handling and transportation	000 UGX	10,290
Total cost of the vehicles	000 UGX	524,790
Total investment cost	000 UGX	3,511,340

4.2 Project Financing

The first source of financing comes through a USD denominated term loan. The term loan in USD covers 70% of the machinery cost (CIF price) that is equal to 665,000 USD or an amount that is equivalent to 1,629,250,000 UGX in local currency.

The real interest rate of the loan is 9%, and the principal of the loan will be repaid in 4 equal consecutive annual installments starting at the beginning of the second year of RUTF production and sales. Interest accrued on the loan balance from previous period is paid on a continuous basis, starting from the date of signing of the loan agreement. The risk premium associated with this project loan is 2%. The company will finance the balance of the investment cost as equity.

4.2.1 Bank Overdraft

The second source of the project financing comes through a bank overdraft. It is given in local currency that mainly covers the ten-year period operational expenditures of the project. The amount of this loan is 200,000 USD, equivalent of 490,000,000 UGX. The entire loan will be drawn in year 1 and subject to the real interest rate of 9% on the principal amount.

The overdraft agreement is structured in a way that the interest accrued during a year will be paid at the beginning of the next year, whereas the principal amount will be repaid at the end of operation of the project. The risk premium associated with the interest rate paid on this project loan is 2%.

Table 5: Project Financing (000 UGX)

Year	1	2	3	4	5	6	7	8	9	10
Loan Disbursement										
Term Loan Disbursement	1,629,250	-	-	-	-	-	-	-	-	-
Bank Overdraft Disbursement	490,000	-	-	-	-	-	-	-	-	-
Loan Repayment										
Term loan repayment	-	622,120	548,983	479,578	413,751	-	-	-	-	-
Bank overdraft repayment	-	117,813	102,446	89,084	77,464	67,360	58,574	50,934	44,290	177,802

4.3 Project Revenues

Since the purchase and selling price of locally produced RUTF are both set in advance; revenues of the domestic producer are secured through the purchase contract. The sales volume and prices are specified within the contractual agreement signed between USAID and the domestic producer. The details of the contract price and quantities are provided.

4.3.1 Sales Prices (USD/kg)

The financial price of the RUTF produced by local producer has a fixed nominal value of 5.00 USD/kg for the first five years of the project's life according to the purchase contract. After this period, the factory is able to increase the price to compensate for the accrued inflation in the international price of the product over this period. In other words, all output sold from year five onward will be priced at the import price of 5.00USD/kg including delivery. The initial price of the product

delivered to the health centers is equal to the current financial cost of imports also delivered to the health centers.

Thus, the project will not receive extra compensation for the delivery of RUTF from factory to health centers as the price includes both production and delivery charges. Furthermore, the analysis implicitly assumes that nominal market exchange rate between UGX/USD will adjust itself over time to reflect the difference between the domestic level of inflation and the rate of inflation in USD.

4.3.2 Production and Inventory (kg/year)

Since the installation of machinery takes only a few days, the producer will be able to start producing RUTF in the year one. The local production of RUTF will start for part of the year and will continue producing to meet its obligations with USAID until the end of year 10. In year one, production will be 260,000 kg and will reach to 385,000 kg in the year two. The output will remain at 385,000 kg through the year 10.

All domestically produced RUTF by RECO Industries Ltd. will be purchased and delivered to the health centers for ten years. Out of the production every year from year one, 10% of production will be set apart as inventory for sale in the following year. All inventories will be disposed of in year 11. It is assumed that all the rest of production will be sold in the year that is produced.

The local producer will have the capacity to increase its production. In the base case, however, it is assumed that no additional production will be made for sale elsewhere during the life of the project.

4.4 Operating Costs

All production costs are presented in real terms and year one price. The nominal operating and production costs in the following years will be adjusted to the rate of inflation. The project will employ workers only from the local labor market.

4.4.1 Direct Labor

Unskilled Workers: The project will employ 18 unskilled workers during the project operational life. Each worker's monthly wage is 375,000 Ugandan Shilling (UGX).

4.4.2 Indirect Labor

Drivers: The project will employ three drivers during the project's operational life. Their monthly salary each is 450,000 UGX.

Managerial Staff: The project will employ three managerial level staff including a general manager, a production manager, and a quality control manager. The monthly real wage of the general manager is 2,000,000 UGX while both the production manager and the quality manager will each earn 1,500,000 UGX/month.

Administrative Staff: The project will employ secretaries, domestic workers and a bookkeeper from the local labor market. The project will employ a total of four administrative staff. Each type of administrative worker earns 600,000 UGX/month.

The project will employ workers only from the local labor market. The real wages of all employees are expected to remain the same throughout the project's life. The nominal wage rates in the following years will be adjusted to the domestic inflation rate. Also, unskilled workers, drivers and administrative workers will pay an average tax rate of 10% on their personal income to the government. High paying managerial occupations are subject to higher average income tax rate of 20%. In addition, the

project will pay an extra 10% of the before-tax wage as a social insurance contribution. The amount of labor requirement and costs of labor are summarized in table 6 and the total labor cost calculation is in table 7.

Table 6: Labor Requirement by the Project

Type	Number Employed	Wage per month(UGX)	Income Tax	Social Security Contribution by the Project
Unskilled	18	375,000	10%	10%
General Manager	1	2,000,000	20%	10%
Other Managerial	2	1,500,000	20%	10%
Administrative	4	600,000	10%	10%
Driver	3	450,000	10%	10%

Table 7: Total Labor Cost Calculation

YEAR		1	2	3	8	9	10
Months in a year	12						
Real wage growth	0%						
Social insurance contribution rate	10%						
Number of Unskilled Workers	18						
Monthly wage rate, Real	375						
Unskilled worker wages per year, Nominal	000 UGX	81,000	93,150	107,123	215,462	247,781	284,948
Social insurance contribution	000 UGX	8,100	9,315	10,712	21,546	24,778	28,495
Total direct labor cost	000 UGX	89,100	102,465	117,835	237,008	272,559	313,443
Number of managers	3						
Average monthly wage rate, Real	1,666.67						
Manager wages per year, Nominal	000 UGX	60,000	69,000	79,350	159,601	183,541	211,073
Social insurance contribution	000 UGX	6,000	6,900	7,935	15,960	18,354	21,107
Total manager wages per year, Nominal	000 UGX	66,000	75,900	87,285	175,561	201,896	232,180
Number of drivers	3						
Monthly wage rate, Real	450						
Driver wages per year, Nominal	000 UGX	16,200	18,630	21,425	43,092	49,556	56,990
Social insurance contribution	000 UGX	1,620	1,863	2,142	4,309	4,956	5,699
Total driver wages per year, Nominal	000 UGX	17,820	20,493	23,567	47,402	54,512	62,689
Number of administrative staff	4						
Monthly wage rate, Real	600						
Administrative staff wages per year, Nominal	000 UGX	28,800	33,120	38,088	76,609	88,100	101,315
Social insurance contribution	000 UGX	2,880	3,312	3,809	7,661	8,810	10,131
Total administrative staff wages per year, Nominal	000 UGX	31,680	36,432	41,897	84,269	96,910	111,446
Total indirect labor cost	000 UGX	115,500	132,825	152,749	307,232	353,317	406,315
Total Labor Costs	000 UGX	204,600	235,290	270,584	544,240	625,876	719,757

4.4.3 Physical Input Costs

The domestic RUTF food paste will include ingredients such as peanuts, milk powder, sugar, vegetable oil, vitamins, and stabilizer. A high proportion of the inputs required to produce RUTF can be sourced locally. For instance, ingredients such as peanuts, milk powder, sugar and vegetable oil are available and produced within the country although they are internationally traded goods. The remaining inputs must be imported at their CIF price. The detailed costs and input-output composition for the RUTF production is summarized in the tables below. It is important to note that given prices are inclusive of VAT.

Table 8: Imported Inputs Used in the Production of RUTF

Item	Cost of Input	Input Composition by weight for RUTF / Kg
Vitamins	14.00	1.5%
Stabilizer	12.40	1.0%

Table 9: Domestic Sourced Inputs Used in the Production of RUTF

Item	Cost of Input	Input Composition by weight for RUTF / Kg
Peanuts	1.60	26.0%
Milk Powder	5.60	25.0%
Sugar	2.40	27.0%
Vegetable Oil	1.60	19.5%

Change in real costs of all physical inputs is assumed to be 0%. As distinct from the other domestically supplied inputs, the project purchases peanuts directly from the local farmers. In this analysis, peanut losses due to poor quality are assumed to be 20%. Peanuts arriving at the factory are not grained, so the project will have to grain

them. The project will not pay any grade premium price for higher quality produce delivered by the farmers.

4.4.4 Utilities

There are non-traded services used such as electricity and other utilities such as water, telephone, sewage, etc. The project will pay a fixed and variable tariff on its electricity consumption. The VAT inclusive fixed cost and variable cost of electricity are UGX 6,048,000/year and UGX 35.28/kg of RUTF, respectively. The estimated cost for other utilities such as water, telephone and sewage is UGX 5,040,000/year.

4.4.5 Other Direct Costs

Other direct costs include fuel for transportation mainly from factory to warehouses and packaging of RUTF produced for sale. The project will pay 300 UGX/kg of RUTF (inclusive of VAT and excise tax) as fuel expenses for pick-up and delivery during its operations. Packaging costs including VAT are 0.154 USD/Kg of RUTF produced. It is composed of 80% traded imported inputs and 20% of non-traded materials.

4.4.6 Other Indirect Costs

These costs include items such as cultivation and seeds provided to farmers. The estimated indirect costs included VAT are 12,500,000 UGX/year. The nominal costs will be adjusted for the rate of domestic inflation.

Table 10: Financial Cash Flows Statement: Owner's Perspective, Real

Inflow												
	Total Cash Inflow	2,866,500	4,397,952	4,399,130	4,271,000	4,146,602	4,609,001	4,654,734	4,654,734	4,654,734	4,654,734	1,738,090
Outflow												
	Total investment cost	3,511,340	-	-	-	-	-	-	-	-	-	-
	Total labor cost	204,600	204,600	204,600	204,600	204,600	204,600	204,600	204,600	204,600	204,600	-
	Total imported input cost	320,360	445,256	431,254	431,254	431,254	431,254	431,254	431,254	431,254	388,129	-
	Total domestic sourced input cost	2,039,598	2,834,755	2,745,612	2,745,612	2,745,612	2,745,612	2,745,612	2,745,612	2,745,612	2,471,051	-
	Total operating expenses	2,684,036	3,641,473	3,534,137	3,534,137	3,534,137	3,534,137	3,534,137	3,534,137	3,534,137	3,203,542	-
Other												
	Changes in A/P	(123,972)	(64,042)	(17,048)	(21,714)	(21,714)	(21,714)	(21,714)	(21,714)	(21,714)	(5,185)	130,389
	Changes in C/B	318,500	180,932	46,388	45,037	43,725	107,249	61,516	61,516	61,516	61,516	(410,109)
	Total Cash Outflow	6,389,904	3,758,363	3,563,477	3,557,459	3,556,148	3,619,671	3,573,939	3,573,939	3,573,939	3,259,874	(279,720)
	Net Cash Flow (Before Tax and Financing)	(3,523,404)	639,589	835,653	713,541	590,454	989,330	1,080,795	1,080,795	1,080,795	1,394,860	2,017,810
	VAT refund paid on inputs	172,997	239,039	231,635	231,635	231,635	231,635	231,635	231,635	231,635	208,831	-
	Corporate tax payment	-	87,920	173,974	198,857	205,580	396,140	407,064	414,236	419,134	412,400	-
	Net Cash Flow (After Tax, Before Financing)	(3,350,407)	790,708	893,314	746,319	616,510	824,826	905,366	898,194	893,296	1,191,292	2,017,810
Project Financing												
Loan Disbursement												
	Term Loan Disbursement	1,629,250	-	-	-	-	-	-	-	-	-	-
	Bank Overdraft Disbursement	490,000	-	-	-	-	-	-	-	-	-	-
Loan Repayment												
	Term loan repayment	-	622,120	548,983	479,578	413,751	-	-	-	-	-	-
	Bank overdraft repayment	-	117,813	102,446	89,084	77,464	67,360	58,574	50,934	44,290	177,802	-
	Net Cash Flow After Financing	(1,231,157)	50,775	241,885	177,657	125,295	757,466	846,792	847,260	849,006	1,013,490	2,017,810

4.5 Debt Service Coverage Ratio

In order for production of RUTF to be successful, the project should be able to pay back the loan. In other words, Annual Debt Service Coverage Ratio (ADSCR) and Long Life Coverage Ratio (LLCR) should be above 1. ADSCR determines the whether the project is able to generate adequate net cash flow in order to pay the interest repayments and annual principal, and LLCR determines the ability of the project to obtain enough net cash flow in subsequent years to see whether bridge financing is needed if there is insufficient cash flow for the loan repayment. The ratios are presented in Table 11.

Table 11: Annual Debt Service and Loan Life Coverage Ratios

Investment period	#	1	2	3	4	5	6	7
Annual total debt repayment	000 UGX	850,923	861,515	864,864	859,138	135,485	135,485	135,485
Annual net cash flow	000 UGX	909,315	1,181,408	1,135,058	1,078,279	1,659,019	2,094,168	2,389,215
Annual Debt Service Coverage Ratio (ADSCR)		1.07	1.37	1.31	1.26	12.25	15.46	17.63

Investment period	#	1	2	3	4	5	6	7
Net cash flow during operation period		909,315	1,181,408	1,135,058	1,078,279	1,659,019	2,094,168	2,389,215
PV of Cash Flow Available for Debt Service (CFAFDS)	000 UGX	5,934,056	6,414,082	6,679,509	7,077,491	7,657,995	7,657,693	7,101,840
Outstanding balance of principal	000 UGX	1,854,299	1,505,498	1,056,904	490,000	490,000	490,000	490,000
Loan Life Coverage Ratio (LLCR)		3.20	4.26	6.32	14.44	15.63	15.63	14.49

According to table 11, the project can meet the annual loan repayment every year. ADSCR in year 1 to 4 is not so high which could be risky. However, in year 5 and afterward, there is enough liquidity for annual loan repayment. On the other hand, as

reflected by the LLCR results, the project generates sufficient cash flow for the loan repayment which means the production of RUTF is bankable.

4.6 Investment Decisions

Net Present Value (NPV) determines the distinction with regard to the present value of cash inflows and the present value of cash outflows. NPV is used in capital budgeting to examine the profitability of a projected investment or project. To accept a project, the NPV should be affirmative. In the production of RUTF, we have the NPV of 1,632,329,000 UGX which means the project is applicable.

Internal Rate of Return (IRR) is a metric used in capital budgeting measuring the profitability of potential investments. The internal rate of return is a discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. IRR should be higher than the discount rate in order project to be acceptable. The financial discount rate in producing RUTF is equal to 13% and the IRR resulting from our model is 29% which means the project is reasonable to be taken.

Chapter 5

ECONOMIC ANALYSIS

5.1 Introduction to Economic Analysis

The model is based on the financial values of project parameters converted into equivalent economic values, along the lines of the fundamental ideologies of applied health economics. The economic value of a tradable commodity is determined by developing the financial value of the commodity by means of its Commodity Specific Conversion Factor (CSCF). The economic value of commodities is typically expected net of taxes and grants but consists of a foreign exchange premium due to alterations joined together with the markets for tradable commodities. They substitute the inflows and outflows within the financial cash flow statement.

5.1.1 Tradable Goods

It is of the essence to identify if goods and services used and produced as a result of the project's operations are tradable or non-tradable goods. Tradable commodities can either be importable or exportable. Tradable goods, like sugar and vegetable oil used in this project, involve additional non-tradable service charges like transportation costs and handling charges. Exportable commodities are generated locally but sold out of the country. Exportable goods include both traded commodities and the local utilization of similar commodities or near alternatives to the commodities that are exported. While imported commodities are produced in another country but are sold locally, importable commodities include the imports as well as all commodities generated and are sold locally which are near alternatives for

imported or possibly imported. The distinguishing feature of tradable goods is that changes in their demand or supply end up being revealed in the need for or supply foreign exchange.

5.1.2 Non-Tradable Goods

Non-tradable goods are those that cannot be traded universally. They include commodities which the demander and supplier are in the same location. For this project, non-tradable goods include electricity and domestic transportation.

5.2 Economic Prices for Tradable and Non-Tradable Goods and Services

5.2.1 Economic Prices for Tradable Goods

The economic value for tradable commodities gives reason for real supplies consumes by a project and hence are not the same as the prices (gross of tariffs and VAT) paid by demanders or the prices (gross of subsidies or net of export taxes) paid by suppliers. Taxes and subsidies are basically a relocation relating to the state and the traders therefore they are not part of the economic cost or benefit.

5.2.4 Commodity Specific Conversion Factor

A Commodity Specific Conversion Factor (CSCF) can be described as the proportion of a good's economic value to its financial value (Jenkins, Kuo and Harberger, 2013). The significance of a CSCF is that it can be applied to a cash flow in a project's financial statement into a resource in the project's economic statement. The following section below explains some of the national parameters applied to financial variables to convert them to economic values.

For an importable good, the formula for estimating the CF is as follows:

$$CF_i = \frac{EP_i}{FP_i}$$

Where:

CF_i is the conversion factor for the importable good

EP_i is the good's economic price

FP_i is the good's financial price

Both the financial and economic prices of the good are considered at the port.

If the importable good is subject to indirect taxes and tariffs, the CF the good can also be calculated and expressed as:

$$CF_i = \frac{(1+FEP)}{(1+t_i)(1+d_i)}$$

Where:

FEP is the foreign exchange premium

t_i is the tariff

d_i is the indirect tax

5.2.4.1 National Parameters

- The economic cost of capital (EOCK) for Uganda is taken as 12 percent real.
- Foreign exchange premium (FEP) is 8 percent (Kuo, Salci and Jenkins, 2015).
- The premium for non-tradable outlays (NTP) is -0.25 percent.

5.2.4.2 Importable Inputs Subject to Taxes

- Vitamins, stabilizers and packaging is subject to 5 percent handling fee and another freight and transport (proportion of CIF price). These inputs are also subject to 18 percent VAT.
- Diesel is subject to 18.8 percent excise duty and 18 percent VAT.
- Vegetable oil is subject to 18 percent VAT, 5 percent handling charges and 5 percent freight and transport.

- Sugar is also subject to 5 percent handling fees and another 5 percent for freight and transport as well as 18 percent VAT.

5.2.4.3 Exportable Inputs Subject to Taxes

- Ground nuts and milk powder do not attract import duty but they are subject to the 18 percent VAT and 3 percent transport charge from farm gate to the market and another 5 percent transport charge from market to point of export.

5.2.4.4 Labor

- The supply wage rate relative to the project wage rate is 90 percent.
- The market wage rate relative to the project rate is 80 percent.
- The economic opportunity cost of labor (EOCL) to the project is approximated with the supply value method.

5.3 Results of Economic Analysis

After applying the above outlined principles to the existing financial cashflow statements, the economic net present value (ENPV) and economic internal rate of return (EIRR) were obtained. The ENPV for the project is UGX 5.33 billion, which is approximately USD 2.17 million. The EIRR is 41 percent which is greater than the 12 percent economic discount rate. Table 13 represents the economic resource statement. As taxes are just a shift between the state and importers and exporters, the resource flow before taxes and net resource flow is the same. The resource flow is negative in year one but positive from year 2 onwards.

Table 12: Summary of Conversion Factors

Parameter		CF
Gross sales		1.085
Changes in accounts receivable		1.085
Liquidation value		
	Land	1
	Machinery	1.081
	Building	1
	Vehicles	1.081
Investment Cost		
	Land	1
	Machinery	1.081
	Building	1
	Vehicles	1.081
Operating Cost		
	Vitamins	0.917
	Stabilizers	0.917
	Packaging Material (imported share)	0.917
	Ground Nuts	1.09
	Milk Powder	1.09
	Sugar	0.839
	Vegetable Oil	0.917
	Packaging Material (domestic share)	0.831
Labor Cost		
	Workers	0.802
	Managerial Staff	0.803
	Drivers	0.802
	Administrative Staff	0.802
Other Input cost		
	Diesel cost for Local Transportation	0.774
	Electricity	0.886
	Other Utilities	0.886
Indirect Cost		
	Other indirect cost	0.788
	Changes in accounts payable	0.94
	Changes in cash balance	1
	VAT Payments	0
	Corporate Income Tax	0
Economic discount rate (real)	12%	%
NPV	5,325,250	000 UGX
IRR	41%	%

Table 13: Economic Resource Flow Statement (000's UGX)

Year	1	2	3	4	5	6	7	8	9	10	11
Sales quantity	260,000	385,000	385,000	385,000	385,000	385,000	385,000	385,000	385,000	385,000	-
Financial cost of importing RUTF	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250	-
Financial cost savings from producing domestic substitute	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250	12,250	-
Financial cost savings from producing an equivalent quantity of domestic substitute	3,185,000	4,716,250	4,716,250	4,716,250	4,716,250	4,716,250	4,716,250	4,716,250	4,716,250	4,716,250	-
Total Resource Inflow	3,110,153	4,920,820	5,066,800	5,068,266	5,069,689	5,000,766	5,050,386	5,050,386	5,050,386	5,050,386	1,844,151
Resource Outflow											
Total investment cost	3,746,203	-	-	-	-	-	-	-	-	-	-
Operating Expenses											
Total labor cost	164,155	164,155	164,155	164,155	164,155	164,155	164,155	164,155	164,155	164,155	-
Total imported input cost	293,630	408,105	395,271	395,271	395,271	395,271	395,271	395,271	395,271	355,744	-
Total domestic sourced input cost	2,065,582	2,870,870	2,780,591	2,780,591	2,780,591	2,780,591	2,780,591	2,780,591	2,780,591	2,502,532	-
Electricity cost	14,292	17,775	17,385	17,385	17,385	17,385	17,385	17,385	17,385	16,182	-
Other Utilities	4,463	4,463	4,463	4,463	4,463	4,463	4,463	4,463	4,463	4,463	-
Fuel cost	66,408	92,297	89,395	89,395	89,395	89,395	89,395	89,395	89,395	80,456	-
other indirect cost	9,850	9,850	9,850	9,850	9,850	9,850	9,850	9,850	9,850	9,850	-
Total operating expenses	2,618,380	3,567,516	3,461,110	3,461,110	3,461,110	3,461,110	3,461,110	3,461,110	3,461,110	3,133,382	-
Changes in A/P	(116,472)	(60,168)	(16,016)	(20,401)	(20,401)	(20,401)	(20,401)	(20,401)	(20,401)	(4,871)	122,501
Changes in C/B	318,500	180,932	46,388	45,037	43,725	107,249	61,516	61,516	61,516	61,516	(410,109)
Total Resource Outflow	6,566,610	3,688,280	3,491,482	3,485,746	3,484,435	3,547,958	3,502,226	3,502,226	3,502,226	3,190,027	(287,608)
Net Resource Flow Before Tax	(3,456,458)	1,232,541	1,575,318	1,582,520	1,585,255	1,452,808	1,548,160	1,548,160	1,548,160	1,860,359	2,131,758
VAT refund paid on inputs	-	-	-	-	-	-	-	-	-	-	-
Corporate tax payment	-	-	-	-	-	-	-	-	-	-	-
Net Resource Flow After Tax	(3,456,458)	1,232,541	1,575,318	1,582,520	1,585,255	1,452,808	1,548,160	1,548,160	1,548,160	1,860,359	2,131,758

Chapter 6

STAKEHOLDER ANALYSIS

6.1 Introduction to Stakeholder Analysis

The stakeholder evaluation is a procedure utilized to enable influential and policy reform procedures through integrating the essentials of those who have a claim or an interest in the project. With knowledge on interested parties, their concerns, and their ability to impede or support the implementation of a project. Stakeholders are all those who need to be regarded in attaining the project's aims and whose contribution and involvement are critical to the project's success. At the end of the day, all projects hinge on choosing interested parties with whom they can cooperatively labour on the road to objectives that will diminish or oppose the pressures to keynote goals like poverty alleviation.

Stakeholder analysis, also known as distributional analysis, connects the financial analysis together with corresponding externalities regarding each involved group. The aggregate of analyses all through the numerous parties should sum up to the economic evaluation of the whole project. As the reason, it is probable to identify the involved parties who benefit and those parties who suffer a loss owing to the project. The bearing on the state is largely externalities as a result of taxes and other distortions due to government policies (Cooper, 2004).

According to Golder, a stakeholder analysis can help a project or programme identify:

- The concerns of all parties who may influence or be influenced by the project.
- Possible clashes or uncertainty that may make the project vulnerable.
- Prospects and connections that can be formed on during the endeavour operation.
- Parties that ought to be inspired to take part in various phases of the project.
- Strategies to decrease undesirable effects on underprivileged.

Table 14: Distribution of Externalities

Inflows		PV of Externalities	Government	Labor
	Sales Revenue	3,364,292	3,364,292	
	Changes in A/R	(51,995)	(51,995)	
Residual Values				
	Land	-	-	
	Machinery	20,643	20,643	
	Buildings	-	-	
	Vehicles	2,282	2,282	
	Total Inflow	3,335,222	3,335,222	-
Investments				
	Land	-	-	
	Machinery	192,345	192,345	
	Buildings	-	-	
	Vehicles	42,518	42,518	
	Total investment cost	234,863	234,863	
Operating Expenses				
Labor				
	Workers	(111,642)	(21,426)	(90,216)
	Managerial staff	(82,280)	(23,807)	(58,473)
	Drivers	(22,328)	(4,285)	(18,043)
	Administrative staff	(39,695)	(7,618)	(32,077)
	Total labor cost	(255,945)	(57,137)	(198,808)
Imported inputs				
	Vitamins	(100,223)	(100,223)	
	Stabilizer	(59,180)	(59,180)	
	Packaging	(58,798)	(58,798)	
	Total imported input cost	(218,201)	(218,201)	
Domestic sourced inputs				
	Ground nuts	267,263	267,263	
	Milk powder	719,554	719,554	
	Sugar	(596,009)	(596,009)	
	Vegetable oil	(148,903)	(148,903)	
	Packaging	(29,792)	(29,792)	
	Total domestic sourced input cost	212,112	212,112	
Utilities				
	Electricity cost	(13,802)	(13,802)	
	Other Utilities	(3,649)	(3,649)	
Other direct cost				
	Fuel cost	(158,302)	(158,302)	
Other indirect cost				
	Other indirect cost	(16,771)	(16,771)	
	Total operating expenses	(454,557)	(255,748)	(198,808)
Other				
	Changes in A/P	13,660	13,660	
	Changes in C/B	-	-	
	Total Outflow	(206,034)	(7,226)	(198,808)

Table 15: Statement of Externalities

INFLOWS		1	2	3	4	5	6	7	8	9	10	11
	Sales Revenue	270,725	538,248	671,613	801,094	926,804	400,881	400,881	400,881	400,881	400,881	-
	Changes in A/R	(27,073)	(15,379)	(3,943)	(3,828)	(3,717)	(9,116)	(5,229)	(5,229)	(5,229)	(5,229)	34,859
	Total Resource Inflow	243,653	522,869	667,670	797,266	923,088	391,765	395,652	395,652	395,652	395,652	106,060
OUTFLOWS												
Investments												
	Land	-	-	-	-	-	-	-	-	-	-	-
	Machinery	192,345	-	-	-	-	-	-	-	-	-	-
	Buildings	-	-	-	-	-	-	-	-	-	-	-
	Vehicles	42,518	-	-	-	-	-	-	-	-	-	-
	Total investment cost	234,863	-	-	-	-	-	-	-	-	-	-
Operating Expenses												
	Total labor cost	(40,445)	(40,445)	(40,445)	(40,445)	(40,445)	(40,445)	(40,445)	(40,445)	(40,445)	(40,445)	-
	Total imported input cost	(26,730)	(37,151)	(35,983)	(35,983)	(35,983)	(35,983)	(35,983)	(35,983)	(35,983)	(32,384)	-
	Total domestic sourced input cost	25,984	36,114	34,979	34,979	34,979	34,979	34,979	34,979	34,979	31,481	-
	Electricity cost	(1,846)	(2,296)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,246)	(2,091)	-
	Other Utilities	(577)	(577)	(577)	(577)	(577)	(577)	(577)	(577)	(577)	(577)	-
	Fuel cost	(19,392)	(26,953)	(26,105)	(26,105)	(26,105)	(26,105)	(26,105)	(26,105)	(26,105)	(23,494)	-
	other indirect cost	(2,650)	(2,650)	(2,650)	(2,650)	(2,650)	(2,650)	(2,650)	(2,650)	(2,650)	(2,650)	-
	Total operating expenses	(65,656)	(73,957)	(73,026)	(73,026)	(73,026)	(73,026)	(73,026)	(73,026)	(73,026)	(70,160)	-
	Changes in A/P	7,499	3,874	1,031	1,314	1,314	1,314	1,314	1,314	1,314	314	(7,888)
	Changes in C/B	-	-	-	-	-	-	-	-	-	-	-
	Total Resource Outflow	176,706	(70,083)	(71,995)	(71,713)	(71,713)	(71,713)	(71,713)	(71,713)	(71,713)	(69,847)	(7,888)
Net Resource Flow Before Tax		66,946	592,952	739,666	868,979	994,800	463,478	467,365	467,365	467,365	465,499	113,948
	VAT refund paid on inputs	(172,997)	(239,039)	(231,635)	(231,635)	(231,635)	(231,635)	(231,635)	(231,635)	(231,635)	(208,831)	-
	Corporate tax payment	-	(87,920)	(173,974)	(198,857)	(205,580)	(396,140)	(407,064)	(414,236)	(419,134)	(412,400)	-
Net Resource Flow After Tax		(106,051)	441,832	682,004	836,201	968,745	627,983	642,794	649,966	654,864	669,067	113,948

Chapter 7

RISK ANALYSIS

7.1 Scope of Risk Analysis

It is important to control Risk Analysis in Project appraisal as it helps to identify, analyze and interpret the expected changes from the results of the project according to financial, economic and stakeholder analysis. Sensitivity analysis identifies the risky parameters and determines the degree of uncertainty in each of them and helps to reduce the riskiness of the project. In RUTF production project, the risky variables are the real price of physical inputs, expected real price of production of RUTF, additional production of RUTF, domestic and foreign inflation.

7.2 Result of Risk Analysis

7.2.1 Real Price of Physical Inputs

An increase in the price of inputs reduces the ENPV, FNPV, GNPV and ADSCR since it increases the total cash outflow and the reverse increases the values of the final outcomes. Labor remains constant since it is not affected by the price of inputs. Lower ADSCR brought about by an increase in input price means that the project will not be able to offset the debt thus it is a risky variable.

Table 16: Sensitivity Test for Real Price of Physical Inputs

	Financial NPV	ADSCR 1	ADSCR 2	ADSCR 3	ADSCR 4	Economic NPV	Government NPV
	000 UGX	#	#	#	#	000 UGX	000 UGX
+15.0%	(240,155)	0.58	0.96	0.86	0.62	2,466,822	2,435,817
+10.0%	397,664	0.78	1.12	0.95	0.83	3,419,632	2,731,317
+5.0%	1,020,302	0.96	1.21	1.13	1.04	4,372,441	3,041,777
0%	1,632,329	1.07	1.37	1.31	1.26	5,325,250	3,362,624
-5.0%	2,244,356	1.18	1.53	1.49	1.47	6,278,060	3,683,471
-10.0%	2,849,906	1.32	1.69	1.68	1.68	7,230,869	4,010,601
-15.0%	3,455,051	1.46	1.85	1.86	1.89	8,183,678	4,338,124

7.2.2 Expected Real Price of Production of RUTF

The decrease in expected price of RUTF reduces the FNPV, ENPV, and GNPV. The reduction in the price of up to USD 3.50 poses a risk to the FNPV. However, the ADSCR remains constant in the repayment period because the RUTF price is contractually fixed at USD5.00.

Table 17: Sensitivity Test for Expected Real Price of Production of RUTF

	Financial NPV	ADSCR 1	ADSCR 2	ADSCR 3	ADSCR 4	Economic NPV	Government NPV
	000 UGX	#	#	#	#	000 UGX	000 UGX
6.5	3,628,143	1.07	1.37	1.31	1.26	8,690,987	4,604,379
6.0	2,962,872	1.07	1.37	1.31	1.26	7,569,075	4,190,460
5.5	2,297,600	1.07	1.37	1.31	1.26	6,447,162	3,776,542
5.0	1,632,329	1.07	1.37	1.31	1.26	5,325,250	3,362,624
4.5	967,057	1.07	1.37	1.31	1.26	4,203,338	2,948,706
4.0	301,786	1.07	1.37	1.31	1.26	3,081,426	2,534,788
3.5	(397,582)	1.07	1.37	1.31	1.26	1,959,514	2,156,884

7.2.3 Additional Production of RUTF

Increase in production impacts positively on FNPV due to an increase in the proportion of sales that would be sold hence increasing total inflow. However, a change in production is negatively related to ENPV and GNPV, because the increase in inputs used are a cost to the economy and would have earned foreign exchange for the economy if it was exported thus the decline. The change in production is estimated to occur after year five. Thus it does not affect the ADSCR. It is not a risky variable.

Table 18: Sensitivity Test for Additional Production of RUTF

	Financial NPV	ADSCR 1	ADSCR 2	ADSCR 3	ADSCR 4	Economic NPV	Government NPV
	000 UGX	#	#	#	#	000 UGX	000 UGX
+30%	2,232,651	1.07	1.37	1.31	1.26	2,925,502	320,212
+20%	2,032,544	1.07	1.37	1.31	1.26	3,725,418	1,334,349
+10%	1,832,437	1.07	1.37	1.31	1.26	4,525,334	2,348,486
0%	1,632,329	1.07	1.37	1.31	1.26	5,325,250	3,362,624
-10%	1,432,220	1.07	1.37	1.31	1.26	6,125,166	4,376,763
-20%	1,232,110	1.07	1.37	1.31	1.26	6,925,083	5,390,903
-30%	1,031,997	1.07	1.37	1.31	1.26	7,724,999	6,405,046

7.2.4 Domestic Inflation

The increase in domestic inflation slightly reduces the values of FNPV, ENPV, GNPV and ADSCR since the increase in total cost is almost outweighed by the increase in total benefits as a result of domestic inflation. Therefore, domestic inflation is not a risky variable since it impacts slightly on the outcome.

Table 19: Sensitivity Test for Domestic Inflation

	Financial NPV	ADSCR 1	ADSCR 2	ADSCR 3	ADSCR 4	Economic NPV	Government NPV
	<i>000 UGX</i>	#	#	#	#	<i>000 UGX</i>	<i>000 UGX</i>
18.00%	1,521,225	1.03	1.32	1.27	1.21	5,231,389	3,382,510
17.00%	1,557,581	1.04	1.34	1.28	1.22	5,262,141	3,376,022
16.00%	1,594,610	1.06	1.36	1.30	1.24	5,293,424	3,369,395
15%	1,632,329	1.07	1.37	1.31	1.26	5,325,250	3,362,624
14.0%	1,670,757	1.08	1.39	1.33	1.27	5,357,635	3,355,708
13.0%	1,709,911	1.09	1.41	1.35	1.29	5,390,593	3,348,646
12.0%	1,749,812	1.11	1.42	1.36	1.30	5,424,140	3,341,434

7.2.5 US Inflation

The increase in US inflation reduces the FNPV and ADSCR but increases the ENPV and GNPV with a slight amount. The decrease in ADSCR and FNPV is due to the increased cost of imported inputs resulting from increased foreign value for the imports due to foreign inflation. The increase in US inflation increases ENPV and GNPV since the conversion factor for importable inputs is less than one thus reducing total cost. As a result, this variable is not a risky variable since it results in a slight change in the outcome and the final results are all greater than zero.

Table 20: Sensitivity Test for US Inflation

	Financial NPV	ADSCR 1	ADSCR 2	ADSCR 3	ADSCR 4	Economic NPV	Government NPV
	<i>000 UGX</i>	#	#	#	#	<i>000 UGX</i>	<i>000 UGX</i>
4.50%	1,362,524	1.01	1.26	1.13	0.99	5,345,751	3,659,763
4.00%	1,450,805	1.03	1.29	1.19	1.08	5,339,044	3,562,544
3.50%	1,540,726	1.05	1.33	1.25	1.17	5,332,211	3,463,513
3%	1,632,329	1.07	1.37	1.31	1.26	5,325,250	3,362,624
2.5%	1,725,655	1.09	1.41	1.37	1.34	5,318,158	3,259,831
2.0%	1,820,748	1.11	1.45	1.43	1.43	5,310,931	3,155,086
1.5%	1,917,654	1.13	1.49	1.50	1.52	5,303,566	3,048,339

Chapter 8

CONCLUSION

The appraisal of the domestic production of RUTF project was undertaken using the integrated investment appraisal method which includes the financial analysis, economic analysis, stakeholder analysis and risk analysis to determine a long-run feasibility of this project.

Financial analysis evaluates the total sustainability of the project from the banker's perspective to see whether the cash flow generated by the project is enough to pay the debt without any defaults. Project financing is provided by a loan and a bank overdraft. The results of the financial analysis demonstrate that the RUTF project is financially feasible as it has an FNPV of UGX 1,632,329,000 and FIRR of 29% which is higher than the opportunity cost of fund of 13%. Meanwhile, the ADSCR and LLCR results indicate that sufficient net cash flow would be earned to repay the annual debt.

According to the economic analysis, the project will be highly beneficial to the entire economy as a whole since we have an ENPV of 5,325,250,000 UGX and EIRR of 41% which is much higher than the project real economic discount rate of 12%. The project will obviously add more to the Ugandan economy if it is applied.

The stakeholder analysis determines the individuals who gain or lose and the size of the benefit or loss. According to the analysis, government and labor are identified as the key stakeholders. According to the results obtained from the distributive analysis, both the government and labor will be benefiting by 3,362,624 UGX and 198,808 UGX, respectively.

Several critical input parameters were examined via sensitivity analysis to evaluate their impact on the result of the project. The identified parameters are the real price of physical inputs, expected real price of production of RUTF, additional production of RUTF, domestic and foreign inflation which could have a notable impact on the project result. Increasing the real price of physical inputs, domestic and the US inflation would have an adverse impact on the project outcome and increasing the expected real price of RUTF production as well as additional RUTF production would have a positive influence on the project results.

In order to reduce the introduction of aflatoxin into the food chain, it is of outmost importance for the government to put in place the right policies as well as create more awareness about it. Aflatoxin is one of the several mycotoxins. Besides, the ministry of agriculture should ensure that farmers are discouraged from the use of poor seedlings which leads to soil contamination. Instead, they should be encouraged to imbibe the post-harvest principle which discourages the exposure of harvested products.

In conclusion, domestic RUTF production is only potentially feasible if all the identified risky variables are efficiently controlled to realize the highest returns possible to the labor and the economy. In addition, if there is no customer to buy the

RUTF after year five that USAID contract ends, there would be a significant risk, as there is no guarantee that RUTF could be sold after the fifth year. RECO, the food producer, would need to find the potential customers who are willing to make an off-take contract which obligates the buyers of RUTF to provide credit support to the project and to share in its risks.

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APPENDICES

Appendix A: Total Cost Calculation

Year		1	2	3	8	9	10	11
Physical Inputs								
Imported Inputs								
Price Index - US	<i>Index</i>	1.00	1.03	1.06	1.23	1.27	1.30	1.34
Nominal exchange rate	<i>UGX/USD</i>	2,450	2,735	3,054	5,299	5,916	6,606	7,375
Total Production	<i>kg</i>	286,000	397,500	385,000	385,000	385,000	346,500	-
Thousand	1000	#						
VAT on taxable inputs	18%	%						
Change in real price of physical inputs	0%	%						
Vitamins								
Cost of vitamins per kg inclusive of VAT	14	<i>USD/kg</i>						
Input composition by weight for RUTF per kg	1.5%	%						
Total cost of vitamins	<i>000 UGX</i>	147,147	235,191	261,964	526,903	605,939	627,147	-
VAT paid on vitamins	<i>000 UGX</i>	22,446	35,877	39,961	80,375	92,431	95,666	-
Stabilizer								
Cost of stabilizer per kg inclusive of VAT	12.4	<i>USD/kg</i>						
Input composition by weight for RUTF per kg	1.0%	%						
Total cost of stabilizer	<i>000 UGX</i>	86,887	138,875	154,684	311,124	357,792	370,315	-
VAT paid on stabilizer	<i>000 UGX</i>	13,254	21,184	23,596	47,460	54,579	56,489	-
Packaging								
Packaging costs per kg of RUTF inclusive of VAT	0.154	<i>USD/kg</i>						
Share of imported packaging	80%	%						
Total cost of inputs imported for packaging	<i>000 UGX</i>	86,326	137,979	153,686	309,117	355,484	367,926	-
VAT paid on inputs imported for packaging	<i>000 UGX</i>	13,168	21,048	23,444	47,153	54,226	56,124	-
Total cost of imported inputs including VAT	<i>000 UGX</i>	320,360	512,044	570,333	1,147,144	1,319,216	1,365,388	-
Unit cost of imported inputs per kg including VAT	<i>000 UGX</i>	1.12	1.29	1.48	2.98	3.43	3.94	-
VAT payments on imported inputs	<i>000 UGX</i>	48,868	78,108	87,000	174,988	201,236	208,280	-
Domestic sourced inputs								
Price Index - US	<i>Index</i>	1.00	1.03	1.06	1.23	1.27	1.30	1.34

Nominal exchange rate	UGX/USD	2,450	2,735	3,054	5,299	5,916	6,606	7,375
Total Production	kg	286,000	397,500	385,000	385,000	385,000	346,500	-
Thousand	1,000	#						
VAT on taxable inputs	18%	%						
Change in real price of physical inputs	0%	%						
Ground nuts								
Cost of ground nuts per kg	1.60	USD/kg						
Input composition by weight for RUTF per kg	26.0%	%						
Loss of ground nuts due to quality problems	20%	%						
Premium paid by the project	0%	%						
Total cost of ground nuts	000 UGX	364,364	582,377	648,673	1,304,713	1,500,420	1,552,935	-
Milk powder								
Cost of milk powder per kg	5.60	USD/kg						
Input composition by weight for RUTF per kg	25.0%	%						
Total cost of milk powder	000 UGX	980,980	1,567,939	1,746,427	3,512,689	4,039,593	4,180,978	-
Sugar								
Cost of sugar per kg inclusive of VAT	2.40	USD/kg						
Input composition by weight for RUTF per kg	27.0%	%						
Total cost of sugar	000 UGX	454,054	725,732	808,346	1,625,873	1,869,754	1,935,196	-
VAT paid on sugar	000 UGX	69,262	110,705	123,307	248,015	285,217	295,199	-
Vegetable oil								
Cost of vegetable oil per kg inclusive of VAT	1.60	USD/kg						
Input composition by weight for RUTF per kg	19.5%	%						
Total cost of vegetable oil	000 UGX	218,618	349,426	389,204	782,828	900,252	931,761	-
VAT paid on vegetable oil	000 UGX	33,349	53,302	59,370	119,414	137,327	142,133	-
Packaging								
Packaging costs per kg of RUTF inclusive of VAT	0.154	USD/kg						
Share of domestic packaging	20%	%						
Total cost of domestic inputs for packaging	000 UGX	21,582	34,495	38,421	77,279	88,871	91,982	-
VAT paid on domestic inputs for packaging	000 UGX	3,292	5,262	5,861	11,788	13,557	14,031	-
Total cost of domestic sourced inputs including VAT	000 UGX	2,039,598	3,259,969	3,631,072	7,303,383	8,398,890	8,692,851	-

Unit cost of domestic sourced inputs per kg including VAT	000 UGX	7.13	8.20	9.43	18.97	21.82	25.09	-
VAT payments on domestic sourced inputs	000 UGX	105,903	169,269	188,538	379,217	436,100	451,363	-
Utilities								
Operation period	Flag	1	1	1	1	1	1	-
Price Index - Domestic	Index	1.00	1.15	1.32	2.66	3.06	3.52	4.05
Total Production	kg	286,000	397,500	385,000	385,000	385,000	346,500	-
Thousand	1,000	#						
VAT on taxable inputs	18%	%						
Electricity costs								
Fixed electricity tariff per year	6,048	000 UGX						
Variable electricity tariff per kg of RUTF	35.28	UGX/kg						
Fixed electricity cost per year	000 UGX	6,048	6,955	7,998	16,088	18,501	21,276	-
Variable electricity cost per year	000 UGX	10,090	16,127	17,963	36,131	41,550	43,004	-
Total electricity cost per year	000 UGX	16,138	23,083	25,962	52,218	60,051	64,280	-
VAT paid on electricity	000 UGX	2,462	3,521	3,960	7,966	9,160	9,805	-
Other utilities								
Other utilities costs	5,040	000 UGX						
Other utilities costs per year	000 UGX	5,040	5,796	6,665	13,407	15,417	17,730	-
VAT paid on other utilities	000 UGX	769	884	1,017	2,045	2,352	2,705	-
Other direct costs								
Fuel cost								
Fuel costs per kg of RUTF inclusive of VAT and excise tax	300	UGX/kg						
Total fuel costs per year	000 UGX	85,800	137,138	152,749	307,232	353,317	365,683	-
VAT paid on fuel cost	000 UGX	13,088	20,919	23,301	46,866	53,896	55,782	-
Other indirect costs								
Other indirect costs per year	12,500	000 UGX						
Total indirect costs per year	000 UGX	12,500	14,375	16,531	33,250	38,238	43,973	-
VAT paid on indirect costs	000 UGX	1,907	2,193	2,522	5,072	5,833	6,708	-
Total direct and indirect costs including VAT	000 UGX	119,478	180,391	201,907	406,107	467,023	491,667	-
Unit direct and indirect cost per kg including VAT	000 UGX	0.42	0.45	0.52	1.05	1.21	1.42	-
VAT payments on direct and indirect costs	000 UGX	18,225	27,517	30,799	61,949	71,241	75,000	-
Total input costs including VAT								
	000 UGX	2,479,436	3,952,404	4,403,312	8,856,634	10,185,129	10,549,907	-

Unit input cost per kg including VAT	<i>000 UGX</i>	8.67	9.94	11.44	23.00	26.45	30.45	-
Total VAT payments on inputs	<i>000 UGX</i>	172,997	274,895	306,337	616,154	708,577	734,643	-

Appendix B: Conversion Factor for Domestic Transportation

Inputs			Ax (Quantity)	Unit Cost Pi (distorted)	Unit Cost Pim (undistorted)	Demand Elasticity	Supply Elasticity	Wd	Ws
Tradable items									
	Fuel (Diesel)		1.00	115,997,700	82,746,747				
	Depreciation		1.00	42,058,333	42,058,333				
	Maintenance		1.00	36,000,000	36,000,000				
	Return to Capital		1.00	60,564,000	46,587,692				
Non-tradable items									
	Insurance		1.00	24,000,000	20,338,983	-0.20	1.00	0.17	0.83
	License		1.00	3,300,000	3,300,000	-0.20	1.00	0.17	0.83
	Driver labor cost		3.00	16,200,000					
	Total								
	P ^d = Financial Value =	330,520,033					FEP	8.5%	
	VAT	18%					Premium on Non-Tradable Outlays (NTP)	-0.25%	
	P ^s = P ^m =	280,101,723					W ^s P ^s + W ^d P ^d =	313,713,930	
	%T =	77%					W ^d P ^m d* =	26,142,827	
	%NT =	23%					Ws(T Distortions + NT Distortions) =	20,150,828	
	Supply elasticity =	1.00	W ^s =	0.33			Value of FEP =	18,341,274	
	Demand elasticity =	-2.00	W ^d =	0.67			Value of NTP =	(160,805)	
	Effective Tax Rate (d*) =	14%					Economic Value =	285,600,743	
	CF		0.864						

Appendix C: Conversion Factor for Electricity and Other Utilities

$P^d = \text{Financial Value} =$	1000	Demand Elasticity	Supply Elasticity
VAT	18%	-1.00	3.00
$P^s = P^m =$	847.5		
$W^s P^s + W^d P^d =$	885.6	W_d	W_s
		0.25	0.75
CF	0.886		

Appendix D: Conversion Factor for Tradable Items

		Financial Value (LC)	CF for NT Services	Value of FEP (LC)	Economic Value (LC)
Conversion factor for machinery and vehicles					
FEP					
CIF Price	8.5%	1,000		85	1,085
(+) Import Duty (% of CIF Price)	0%	-			
(+) Value Added Tax (% of CIF Price+ Import Duty)	0%	-			
(+) Handling (% of CIF Price)	1%	10	0.90		9
(+) Freight & Transport (% of CIF Price)	1%	10	0.864		8.64
Project-site Price		1,020			1,102.64
CF		1,081			
Conversion factor for diesel					
Foreign Exchange Premium (FEP)					
CIF Price	8.5%	1000		85.0	1,085
(+) Import Duty (% of CIF Price)	0%	-			
(+) Excise duties on diesel (% of CIF Price + Import Duty)	18.8%	188			
(+) Value Added Tax (% of CIF Price + Import Duty + Excise tax)	18%	214			
Market Price		1,402			1,085
CF		0.774			

Conversion factor for vitamins, stabilizers and packaging

FEP

CIF Price

(+) Import Duty (% of CIF Price)

(+) Value Added Tax (% of CIF Price+ Import Duty)

(+) Handling (% of CIF Price)

(+) Freight & Transport (% of CIF Price)

Project-site Price

CF

	Financial Value (LC)	CF for NT Services	Value of FEP (LC)	Economic Value (LC)
	8.5%			
	1000		85	1,085
	0%			
	180			
	50	0.90		45
	50	0.864		43.20
	1,280			1,173
	0.917			

Conversion factor for vegetable oil

FEP

CIF Price

(+) Import Duty (% of CIF Price)

(+) Value Added Tax (% of CIF Price+ Import Duty)

(+) Handling (% of CIF Price)

(+) Freight & Transport (% of CIF Price)

Project-site Price

CF

	Financial Value (LC)	CF for NT Services	Value of FEP (LC)	Economic Value (LC)
	8.5%			
	1000		85	1,085
	0%			
	180			
	50	0.90		45
	50	0.864		43.20
	1,280			1,173
	0.917			

Conversion factor for sugar

FEP

CIF Price

(+) Import Duty (% of CIF Price)

(+) Value Added Tax (% of CIF Price+ Import Duty)

(+) Handling (% of CIF Price)

(+) Freight & Transport (% of CIF Price)

Project-site Price

CF

	Financial Value (LC)	CF for NT Services	Value of FEP (LC)	Economic Value (LC)
	8.5%			
	1000		85	1,085
	10%			
	198			
	5%	0.90		45
	50	0.864		43.20
	1,398			1,173.20
	0.839			

Conversion factor for ground nut and milk powder

FEP

FOB Price (UGX)

(-) Cost of transport, market-point of export

Market Price

(+) Cost of transport, market-project

(+) VAT

Project-site Price

CF

	Financial Value (LC)	CF for NT Services	Value of FEP (LC)	Economic Value (LC)
	8.5%			
	1,000		85	1,085
	5%	0.864		43.2
	950.00			1,041.80
	3%	0.864		24.62
	28.50			
	0			
	978.50			1,066.42
	1.090			

Conversion factor for local labor

Supply wage rate relatively project wage	90%
Market wage rate relatively project wage	80%

	Wp	Wa	Ws	Personal Tax	Social Security	Hd	Ws(1-T)	HdWa(T+SS)	EOCL	CF
Workers	412.5	371.3	330.0	10%	10%	90%	264	67	331	0.802
Managerial staff	1,833.3	1,650.0	1,466.7	20%	10%	90%	1,027	446	1,472	0.803
Drivers	495.0	445.5	396.0	10%	10%	90%	317	80	397	0.802
Administrative staff	660.0	594.0	528.0	10%	10%	90%	422	107	529	0.802