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Study Report on Optimum Utilisation Plan of Ngoma 22 Irrigation Scheme

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ABSTRACT

The study was conducted in Ngoma 22 irrigation scheme located in Remera and Rurenge sectors of Ngoma District in Eastern Province of Rwanda between November 2018 and January 2019. It was recommended by RAB Board of Directors.

The methodology used encompasses the study area, sampling procedures, data collection and analysis tools. The main data collection tool used was FGD which targeted site agronomists and household head farmers producing rice, fruits and vegetables as high value crops in the scheme area. Through pair wise ranking technique most profitable cash crops in the scheme were ranked as follows: (1) tree tomato, (2) maracuja, (3) egg plants, (4) water melon, (5) tomato, (6) irish potatoes, (7) french beans, (8) onions, (9) carrots, (10) cabbages, (11) beetroots.

From this point of views, findings from the study show only two most profitable crops: maracuja with 696 Frw/kg followed by tree tomato with Frw 249 Frw/kg. The third ranked cash crop being Irish potato (with a loss of -40 Frw/kg), the fourth is egg plant with a loss of- 177 Frw.

The existing paddy rice production has shown a loss of – 270 Frw inspite the water availability all the year-round. Maize and bush bean show respectively losses of -543 Frw/kg and -1743 Frw. Hence it is understandable why farmers in the scheme area have already abandoned maize and beans cultivation.

Findings show also water fees (20,000 Frw/season) determined based on maintenance costs and farmers income.

For capacity building model, more than one thousand beneficiary farmers in Ngoma 22 Irrigation Scheme need strong farmer organisation for ownership of the scheme and increased profitability. To that effect, they need continued capacity building as stated in the tripartite IMTA: administrative and financial management, record keeping, and conflicts resolution management, integrated water management, operation and maintenance of irrigation infrastructures, best agricultural practices for sustainable farmers' organisations and commercial farming.

Key recommendations include fixing minimum prices for agricultural products in relation to costs of production- or setting subsidy prices, increase yield for each crop by meeting all requirements: lime, fertilisers and improvement of irrigation technologies in order to reach automatically increased yield. Farmers should continue to leave out traditional crops and adopt profitable cash crops identified in this study (e.g maracuja and tree tomato). They should also increase the ownership spirit through IWUA and cooperatives performance. They should adopt collective marketing of their products and pay water fees per season.

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ABBREVIATIONS AND ACCRONYMS

GAP: Good Agricultural Practices
FAO: Fund for Agriculture Organisation
IMTA: Irrigation Management Transfer Agreement
IWUA: Irrigation Water Users Associations
MINAGRI: Ministry of Agriculture and Animal Resources
JICA: Japanese International Cooperation Agency
PSTA: Plan Strategique pour la Transformation de l'Agriculture
RAB: Rwanda Agriculture and Animal Resources Development Board

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CHAPTER ONE
INTRODUCTION

➢ *Background*

Rwanda has abundant untapped water resources in the form of natural lakes, rivers, groundwater, marshlands and runoff. FAO AQUASTAT[1] estimates Rwanda internal renewable water resources of 31.9 x 109 m^3/year and the Irrigation Master Plan produced by MINAGRI in 2013 identifies potential irrigable area of nearly 590,000 ha^2.

Rwanda has a planning tool for rational exploitation of its soil and water resources intends to trigger an increase in crop production of both staple foods for local consumption and high-value products for export. It is in this line that Ngoma 22 irrigation scheme was established by JICA Project in 2016 on a total area of 306 ha. In order to maximize operations, maintenance and management of the Ngoma 22, different initiatives were implemented based on project document. In order to strimline farmers' ownership and participation, a tripartite irrigation transfer agreement was signed between MINAGRI, Ngoma district and farmers.

From June to December 2016, a team of experts from Japan under Project Soft Component Part has conducted with RAB a series of trainings on basic skills in line with scheme management These trainings included IWUA and cooperatives administrative and financial management (June 2016), record keeping (August 2016), conflicts resolution management (September 2016), integrated water management (October 2016), operation and maintenance of irrigation infrastructures including dam water storage test (November 2016) and good agricultural practices and cropping patterns (December 2016). Inspite these efforts, farmers still need a systematic coaching system to fully exploit the total area aof the scheme.

➢ *Problem Statement*

This irrigation project had high expectations including maximum water utilisation and increased crop productivity especially for fruits and vegetables. However, the current status of the scheme is not satisfactory mainly due to low exploitation (only 28.3% of the total area is exploited) while all irrigation infrastructures are in good conditions, the dam has spilled out and pumps are operational and post-harvest infrastructure availed.

The main challenge relates to land fragmentation (with an average of 27.27 Ares/HH) for a tototal number of 1100 households. These households are organised in both IWUA and 2 cooperatives without legal framework. There is no small farmer groups formed as recommended in Twigire Muhinzi model for accessing subsidised agricultural inputs (fertiliser and seeds). Other challenges include lack of professionalism in farming, limited skills and financial capacities of farmers, poor operation and maintenance of irrigation equipment including horse pipes, poor organization of farmers. In addition, a part of the scheme especially forests land was developed due to lack of compensation for owners.

➢ *Justification of the Assignment*

The assignment was given as one of the resolution no MIN 014/RAB/BoD/018/Res 20g of Ordinary meeting of the RAB Board of Directors held on 12/6/2018 and it was entitled "cost benefit analysis" for the exploitation of the irrigation scheme. The RAB Board has recommended the establishment of a technical team to carry out this important study. Reference made to the RAB Letter no 01.11/1286/018/PK/HQ of 25/07/2018; the assignment was adjusted in another RAB Board meeting of 14/8/2018 and it changed into **"**Optimum utilisation plan of Ngoma 22 irrigation scheme". This study lines up with national plan to optimize the valorisation of existing irrigation infrastructures and increase productivity per unit area in the country.

➢ *Objectives*

- *Overall Objective*

The overall objective of this assignment is to provide the guidelines for proper Water resources management and optimization of crop productivity in Ngoma 22 irrigation scheme.

- *Specific Objectives*

As specific objectives, this study provides on:

✓ Establishing guidelines for Water resources management in Ngoma 22 irrigation scheme;
✓ Updating cropping patterns and value chains in Ngoma 22;
✓ Studying the crops profitability and cost-benefit analysis for Ngoma 22 and
✓ Designing farmer's organization, capacity building and legal framework.

[1] Source : http://www.fao.org/nr/water/aquastat/countries_regions/RWA/
[2] Source : Rwanda Irrigation Master Plan, MINAGRI 2009

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CHAPTER TWO
METHODOLOGY

The methodology encompasses the study area, sampling procedures, data collection and analysis tools.

- *Study Area*

The study was carried out in Ngoma 22 Irrigation scheme working both in marshland and on hillsides. District and sector agronomists, local authorities at cell and village level, farmer promoters, farmer groups and cooperatives have been involved.

Table 1 Sector, Cells and Villages in Ngoma 22 Irrigation Scheme

Sectors	Cells	Villages
Remera	Ndekwe	Gikomero, Rugando, Ruhuha, Icyakabili, Rukore
Rurenge	Rujambara	Nyabaganza, Maseru, Mbonwa, Urusagara

- *Project Site (Photo)- ask Hakim/RAB-Topographe*

Fig 1 Project Site (Photo)- ask Hakim/RAB-Topographe
Source: JICA photo, May 2014

- *Sampling Procedures*

The data collection focused on Household head farmers. Selected farmers were farming rice, fruits and vegetables as high value crops in the scheme area. A total of 33 households heads were randomly invited from the two sectors by the site agronomists.

The survey was conducted on 26-27 November 2018 using FGDs. The FGDs (Appendix 2) had a pre-designed check-list focusing on 5 main elements: (1) location; (2) description of the groups; (3) high value crops selected on scientifically proven criteria, (4) water fees determined based on maintenance costs and farmers' income, (5) capacity building model for sustainable farmers organisations.

Pair wise ranking was the most used technique to rank profitable cash crops.

- *Preparation for Field Visits*

Preparation for the field visits included the trip agenda and communication with local authorities, the elaboration of the check-list for FGDs in the irrigation scheme.

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➢ *Data Collection Team*

Data were collected by a team comprised of 5 RAB staffs. The team was made up by the socio-economist researchers, Irrigation water users' specialists and a senior agronomist. The team was supported by field technicians to collect data.

➢ *Data Collection Tools*

The data collection tools included the review of existing documents (secondary data collection), kick- off meeting, field visit, focus group discussion using checklist (primary data collection), and validation workshop and participant observations. The researcher observed the physical settings of the scheme and took pictures.

The FGDs targeted farmer producer's groups and site agronomists. They were moderated by the researcher to ensure that each participant was given a chance to express her/him self while a rapporteur captured all participant's views through written notes. Appendix 2 shows the checklist that guided the focus group discussions to ensure that the relevant aspects of the study were discussed.

➢ *Data Entry and Analysis*

All data were entered in Excell dataset9 by the team within three days after the field data collection whereas they were analyzed using content analysis. Results are presented using tables and graphs where applicable.

➢ *Methodology for Financial and Economic Feasibility*

Three project profitability indicators are considered in this study:

- *Benefit -cost ratio (BCR):*

It is the ratio of the benefits of a project/proposal, expressed in monetary terms, relative to its costs, also expressed in monetary terms.

$$BCR = \frac{\text{Discounted value of incremental benefits}}{\text{Discounted value of incremental costs}}$$

If the benefit is higher than the cost, that is, a BCR greater than 1, the project is a good investment.

- *Net Present Value (NPV):*

It is the difference between the present value of cash inflows and the present value of cash outflows over a period of time.

$$\text{NPV}(i, \text{N}) = \sum_{t=0}^{N} \frac{\text{R}_t}{(1+i)^t}$$

Where

t is the time of the cash flow equal to 5 years for this project, *i* is the discount rate and R_t is the net cash flow, that is, cash inflow minus cash outflow, at time *t*.A positive NPV indicates a net benefit and a negative NPV a net loss.

- *Internal Rate of Return (IRR):*

It is a discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. The IRR is given by *i* in:

$$\text{NPV}\ (i, \text{N}) = \sum_{t=0}^{N} \frac{\text{R}_t}{(1+i)^t} = 0$$

The derivation of these indicators requires (i) benefit and cost stream which is generated in a spreadsheet developed in Microsoft excel to analyse relevant data, (ii) the period over which calculations are to be made, the life of the project being equals to five years and (iii) the discount rate equivalent here to the opportunity cost of capital as provided by MINECOFIN and equals to 13%.

There is a need for identifying and valuing costs and benefits that will arise considering different scenarios. All calculations are based on one hectare and projected to the whole size according to the cropping pattern.

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CHAPTER THREE
STUDY FINDINGS

The findings relate to the description of the irrigation scheme, the establishment of IWUA guidelines, the current and proposed cropping patterns, the major cash crops in the scheme, crop profitability analysis for 5 years' period and options/scenarios that would generate better returns.

A. Description of Ngoma 22 Irrigation Scheme Current Status

Table 2 Description of Ngoma 22 Irrigation Scheme Current Status

Infrastructure	Area occupied (ha)	Current status
Water reservoir	-Utilization possibility of river water: 1,110,000 m^3 -Dam capacity: 96,000 m^3 -Dam height: 14.9m	Water availability for crops irrigation and fish farming. But acquaculture is not yet introduced
Marshland	46	100% rice farming
Hillsides	260	18.8% only exploited
Total	306	28.3% only exploited

Traditional priority crops before the establishment of irrigation scheme were respectively banana, sorghum, maize, beans and vegetables.

Priority cash crops after the establishment of irrigation scheme are tree tomato, maracuja, egg plant, water melon, tomato, Irish potatoes; french beans, onions, carrots, cabbage and beetroots, according to the farmers.

B. Establishment of Water Resources Management Guidelines for Ngoma 22 Irrigation Scheme

Some of important guidelines provided by the Ministerial Order No.001/11.30 of 23/11/2011 establishing IIWUA in irrigation schemes cfr Official gazette No50 of 12/12/2011 include the following:

- Irrigation of water users list – to be elaborated by farmers themselves and technicians.
- Performance contract: agreements with stipulated rights and responsibilities signed between RAB, Districts and IWUA
- Irrigation Management transfer agreement (IMTA): Tripartite agreement between RAB, Districts and IWUA already signed 12/7/2018.
- Execution of IMTA by parties and capacity building of the farmers is on top priority to increase crop productivity.

C. Cropping Patterns and Value Chains in Ngoma 22 Irrigation Scheme

For crops selection, crops with high demand and high profitability were proposed as a policy for the agricultural plan, and the ones that have already been cultivated by farmers in the site due to adaptability to the soils and temperature are introduced. Increase of yield by year-round irrigation combined with improved farming technologies is also planned. At the marshland, existing paddy farming shall be continued in accordance with the national policy. At the hillsides, cabbages, eggplants, carrots, etc., with high consumption and higher preference are introduced along with tree tomatoes and coffee (Table 2).

Table 3 Reasons highlighted by JICA research for crop selection (under PRA)

Crops	Reasons for Selection
Paddy	Imported crop due to lack of domestic production. Crop being promoted in marshland as the national policy.
Maize	Highest demand (16.7kg/capita) in a cereal group than rice and sorghum. Many beneficiaries want to cultivate maize on hillside according to the baseline survey.
Bean / pulses	High demand (29.3kg/capita). Cultivating widely on hillside with mono and mixed cropping system with maize and other crops. Good for maintaining soil fertility.
Cabbage	Can be harvested 3 times a year with high demand for consumption.
Tomatoes	High consumption (4.3kg/person/year), and higher profitability, higher demand in markets.
Carrot	High preference and higher demand in market
Eggplant	Sector agronomist recommended due to preference by farmers
Tree Tomato	Selling not only local market but also Kigali city at higher price, higher demand, higher profitability, processable for juice and jam.
Coffee	Exporting crop with higher profit, suitable for sloped areas of the valley of the site

Source: JICA report, 2016

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➢ *Proposed Cropping Pattern during Project Development*

Present irrigable area of 64 ha (paddy: 35ha + hillside: 29ha) will be expanded to 300 ha by implementing project. The proposed cropping patterns by RAB-JICA before release of the scheme in 2016 are shown by Figure 2. The cropping pattern with higher cropping intensity considering more dryly season crops in response to availability of water is proposed as the figure shown below. Paddy is indispensable to substitute importing rice, and areas for other crops will be maximized to expand as much as possible depending on capacity of water availability of the planned dam. According to the District agronomist, proposed crops have been already cultivating by beneficial farmers in the site, and adapted to local climate and soil conditions, and have higher demand at local markets nearby.

Stable production with higher land use ratio can be expected by improvement of irrigation condition. As for tomato production, beans/pulses will be introduced between two crops of it to prevent damage due to continuous cropping of tomatoes.

Currently, the beneficiaries have at disposal a community mobilisation officer, an agronomist and an irrigation Engineer paid by HORECO contracted with RAB. Water raised in June 2018 meaning two years later; (construction was completed in 2016). All the 2 years, only paddy rice farming continued in the marshland while the hillsides remained inexploited. –Big loss for farmers and exposed to hunger and malnutrition.

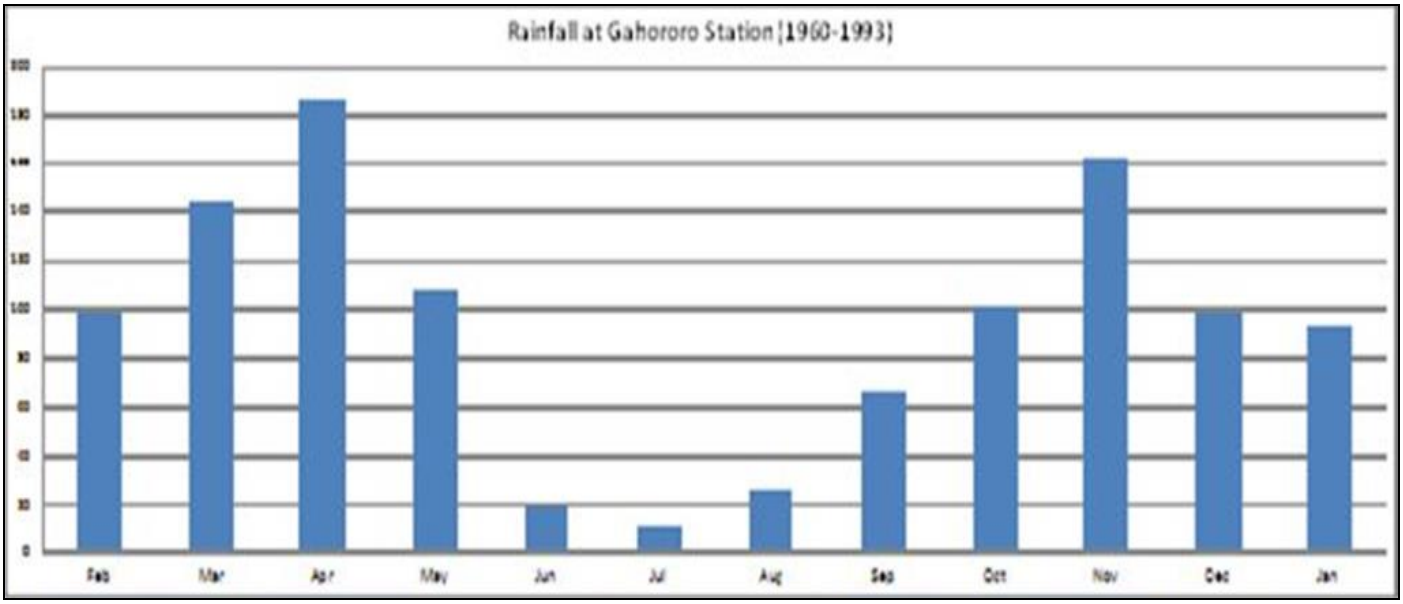

Fig 2 Crop Rotation Suggested for the Irrigated Scheme, JICA (June 2014)

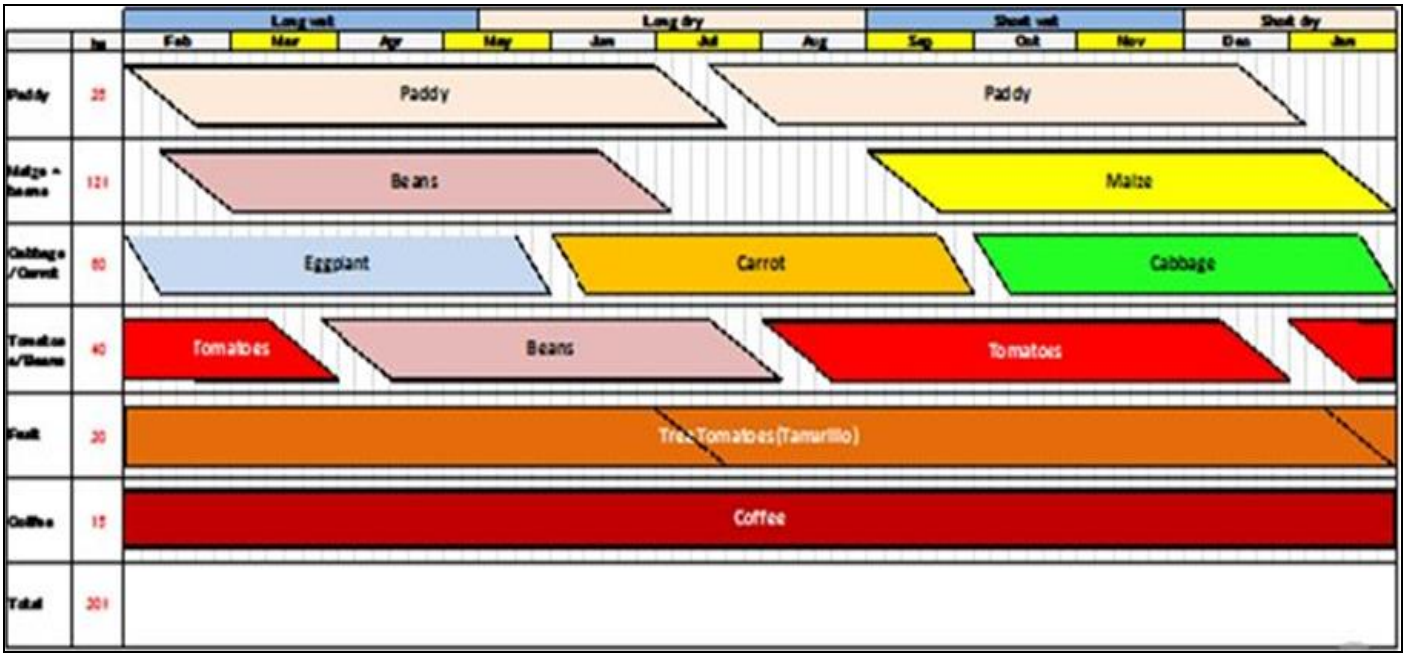

Fig 3 Proposed Cropping Pattern during Project Development, JICA, 2016

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Table 4 Existing crops in the scheme (November 2018)

Crops	Current Status
Paddy	Under 35 ha. In excellent conditions. Cultivated the whole year round
French beans	On hillside upper and lower canals but not preferred by many farmers (15%)
Cabbage	Can be harvested 3times a year with high demand for consumption but not for cash
Tomatoes	High consumption (4.3kg/person/year), and higher profitability, higher demand in markets.
Carrots	High preference and higher demand in market
Eggplants	Farmer producers group have already experienced 2 seasons- Rotation is not yet practiced
Tree Tomato	Selling not only local market but also Kigali city at higher price, higher demand, higher profitability, processable for juice and jam.

Inspite the inclusion in the previous agricultural plan, maize and beans were abandoned by farmers because they were convinced that they are less profitable.

D. Major Cash Crops in Ngoma 22 Irrigation Scheme

Two FGDs were conducted with a total of thirty-three (33) farmers including (19) males against (14) female's households' heads.

A pairwise ranking was done using PRA on 26-27/11/2018 to prioritise cash crops in Ngoma 22.

The major cash crops in Ngoma 22 Irrigation Scheme include respectively Tree tomato, Maracuja, egg plants, Water melon, tomato, Irish potatoes, French beans, Onions carrots, cabbage, Beetroots. The cropping of the above mentioned crops started in June 2018 with extensive water use for free.

Through pair wise ranking showed that the the most cash crops is tree tomato followed by maracuja and egg plant (Table 5). The main cash crops were ranked as follows:

Table 5 Preference Ranking for Cash Crops in Ngoma 22 Irrigation Scheme

Crop	Scores	Rank	Reasons
Tree tomato	10	1	Food and cash
Maracuja	9	2	Food and cash
Egg plant	7	3	Food and cash
Water melon	7	4	Cash
Tomatoes	7	5	Cash
Irish potatoes	5	6	Food and cash
French beans	4	7	Cash
Onions	3	8	Cash
Carrots	2	9	Cash
Cabbages	1	10	Food and cash
Beetroots (Betteraves)	0	11	Cash

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- *The Figure 3 shows Clearly how Farmers Perceive Cash Crops in the Scheme Area*

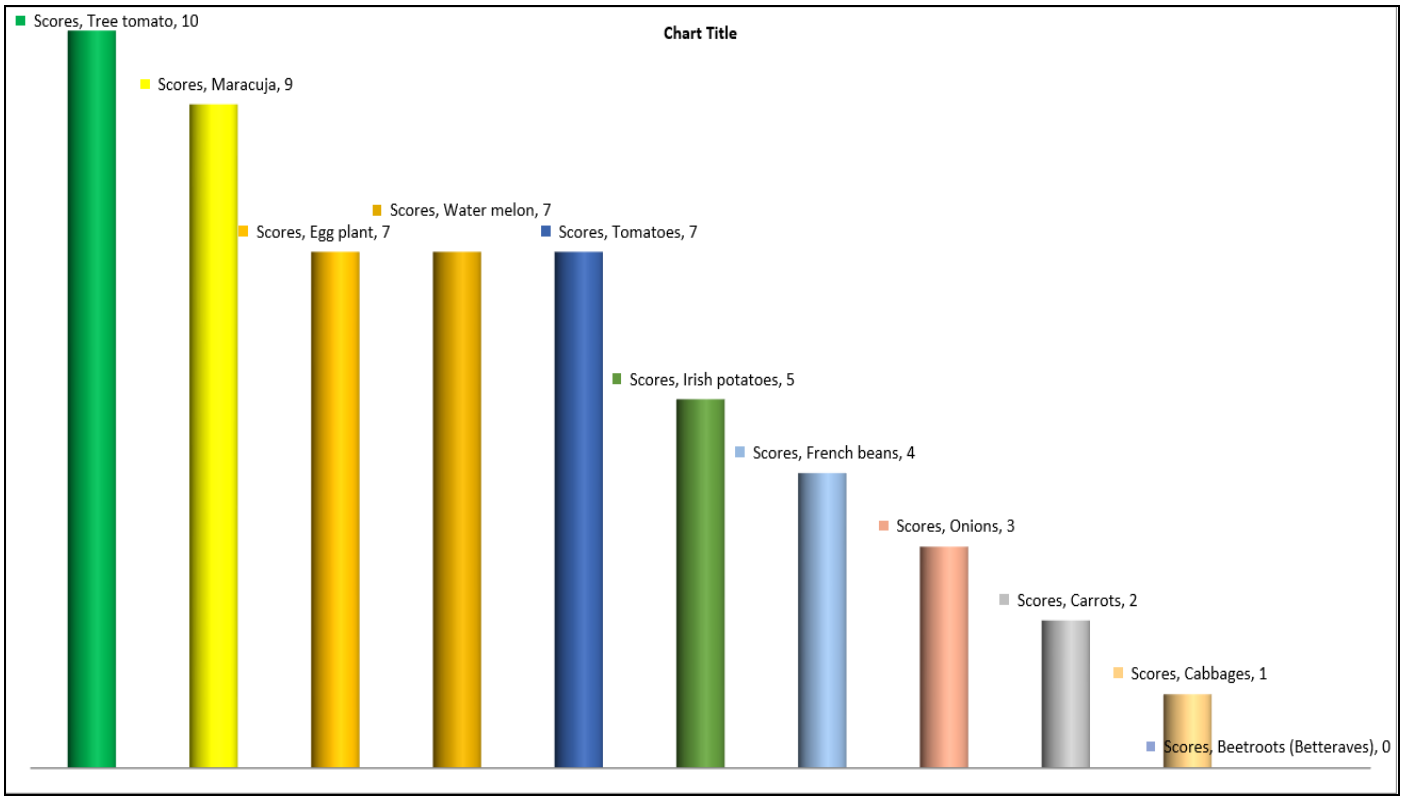

Fig 4 Scores for Cash Crops Ranked by Farmers

Thereafter, the participants reavealed the production costs for the 3 major cash crops all the way from production costs: seeds, fertiliser and pesticides acquisition, costs of labor from land preparation to marketing of produce, other costs (pumps, sheetings, plot hiring), finally they estimated their yield and income from each cash crop.

Data collected helped to elaborate Ngoma 22 Irrigation scheme Optimum Utilisation plan.

Calculations were based on production costs over the income obtained on farm and at market place (Appendix[3])

E. Crops Profitability in Ngoma 22 Irrigation Scheme

Only 2 ranked cash crops were shown profitable. The most profitable being Maracuja with 696 Frw/kg followed by Tree tomato with Frw 249 Frw/kg. The third ranked cash crop being *Irish potato* (-40 Frw/kg), the fourth is egg plant) with a loss of-177 Frw.

The existing paddy rice production has shown a loss of – 270 Frw inspite the water availability all the Year round. Maize and bush bean show respectively losses of -543 Frw/kg and -1743 Frw (Table 5). Hence it is understandable why farmers in the scheme area have already abandoned these last crops.

Table 6 Production Cost Versus Realistic Minimum Price up to Market Compared to Actual Prices at First year of Production

Ranking	Crops	Production cost up tomarket (Frw/kg)	Realistic Minimum price up tomarket (Frw/kg)	Actual Price (Frw/kg)	Benefit / Losses (Frw/kg)
1	Maracuja	451	564	1,200	696
2	Tree tomato	281	351	600	249
3	Irish potato	192	240	200	-40
4	Eggplant	301	377	200	-177
5	Rice	440	550	280	-270
6	Maize	560	699	150	-543
7	Bean	1,634	2043	300	-1,743

[3] Annexures : Cost- benefit analysis of listed crops

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As conclusion, the study recommends to the IWUA and cooperatives to invest in maracuja, tree tomato and Irish potato when targeting the local market while organizing farmers at National level to actively participate in farm records keeping and price setting based on production cost.

Table 7 Optimal Valorization Considering Five years of Plantation at Minimum Price set up basing on Production Cost

Crops	Production cost up to market Frw/kg	Minimum price up tomarket Frw	Total Production for 5 years (kg/ha)	Total Return for 5 years (Frw)	Investment cost for 5 years (rwf)	Return on investment for 5 years (rwf)	Score
Tree tomato	281	351	138,600	49,846,925	22,359,820	27,487,105	1
Eggplant	301	377	186,392	45,914,150	20,776,860	25,137,345	2
Maracuja	268	564	124,688	44,279,166	20,673,613	23,605,553	3
Irish potato	192	240	317,642	54,462,175	43,569,740	10,892,435	4
Rice	440	550	63,528	29,296,443	23,437,155	5,859,289	5
Bean	1,634	2,043	15,600	24,967,758	19,974,207	4,993,552	6
Maize	560	699	57,793	25,476,819	24,283,685	1,193,134	7

Considering 5 years' project plan and minimum price setting from production costs and farmer benefits estimated at 25%, the following crops will be considered Banana, Tree tomato, Eggplant, Maracuja.

They have to be cautious with egg plant and rice farming because if they could increase the productivity over time they can gain at the end of 3-4 years with strong proximity coaching.

The five years projection for the Irrigation scheme production plan was elaborated[4]. Results are shown below.

Table 8 Proposed crops for optimum valorization plan and yield projection estimates for 5 years (typical scenario 2)

Estimated production and return on investment	Estimated values			Actual situation			For future at minimum price			
Crops	Yield (Kg)/Ha	Production cost up tomarket for 5 years Frw/kg	Total Production for 5 years (gk)	Actual Price Frw	Actual Total Return Frw	Return on investment for 5 years (rwf)	Total Return for 5 years (Frw)	Investment for 5 years cost(rwf)	Return on investment for 5 years (rwf)	Score 2
Maracuja	*13,781*	*265*	*124,688*	*1,200*	*15,750,000*	*10,199,100*	*43,812,925*	*20,300,620*	*23,512,305*	*1*
Tree tomato	*15,360*	*291*	*138,600*	*600*	*9,000,000*	*4,205,900*	*49,786,925*	*22,311,820*	*27,475,105*	*2*
Irish potato	25,411	170	254,114	200	8,000,000	(292,600)	52,811,943	42,249,555	10,562,389	3
Eggplant	18,974	214	174,742	200	3,000,000	(857,633)	44,708,328	19,812,148	24,896,180	4
Rice	5,082	446	50,823	280	2,240,000	(1,314,954)	27,976,814	22,381,451	5,595,363	5
Bean	1040	1,295.75	10400	300	480000	(2,015,000)	16444990	13155992	3,288,998	6
Maize	3,868	496	38,676	150	900,000	(2,795,688)	23,282,323	18,407,771	4,874,552	7

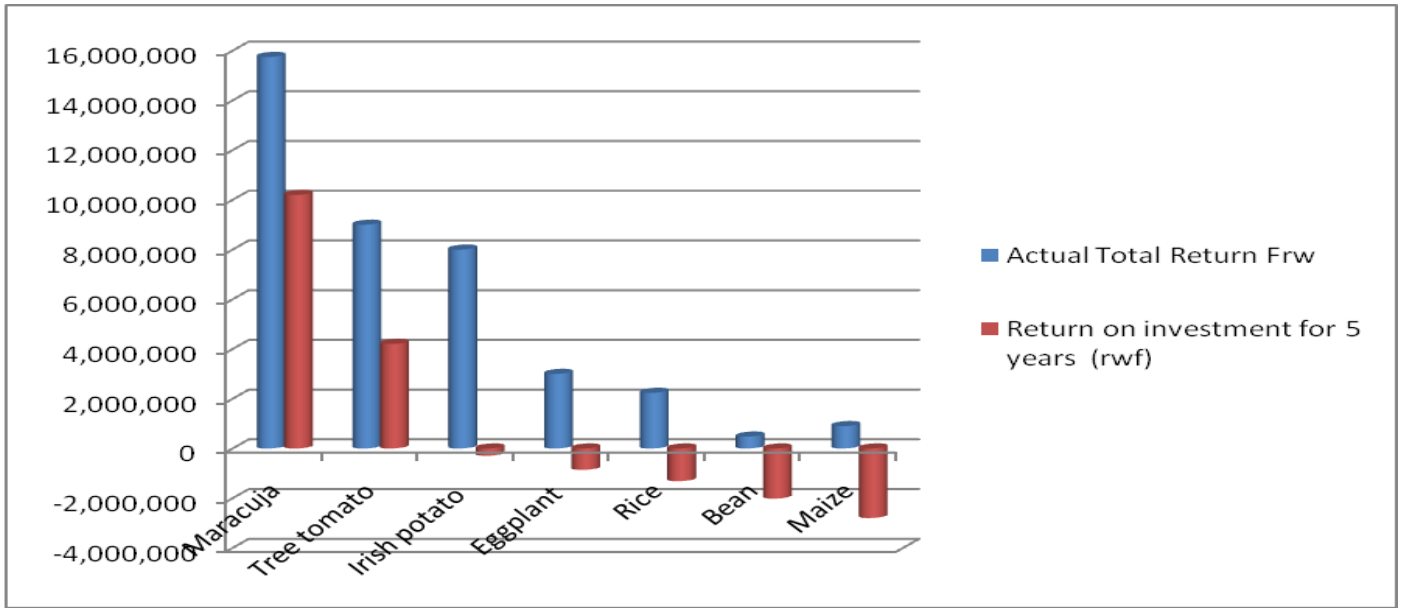

Fig 5 Return on Investment (rwf)

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F. Cropping Patterns and Scenarios in Ngoma 22 Irrigation Scheme

For marshland, the best proposition is lowland paddy, which is an established practice achieving good production of over 10T/ha/year and with scope for import substitution if long-grain varieties are selected. Currently, irrigated paddy yields in Ngoma 22 are above the regional average, in excess of 5 T/ha. The National Rice Strategy aims to raise this yield to 7 T/ha through use of improved varieties and better crop management.

For hillside irrigation, there is a baseline (only 92 ha exploited) and three proposed scenarios: 1) the whole area is exploited by 7 crops which are: Rice, Tree tomato, Eggplant, Maracuja, Potato, Maize, and Beans. 2) the whole area is exploited by 7 crops as in scenario 1 but with soil amendment (use of lime) and GAP to increase yield 3) the whole area is exploited using 3 crops: rice is 46ha, tree tomato 130ha and Maracuja 130ha.

➢ *Baseline*

The baseline is the actual situation of Ngoma 22. Only 92 ha out of 306 ha are exploited by the crops Rice (46 ha), Tree tomato (11 ha), Eggplant (22 ha) and Maracuja (13 ha). The fixation of price is not depending on cost of production criteria but on the supply and demand. This lead to high loss when the product is abundant or to high benefit if the product is rare and highly needed.

Table 9 Baseline in Ngoma 22

Crops	Hectares	Crops	Infrastructure	Note
Baseline in Ngoma 22	92ha/306 ha	Rice (46 ha), Tree tomato (11 ha), Eggplant (22 ha) and Maracuja (13 ha)	Water availability	The scheme is not fully exploited and farmers are exposed to hunger, malnutrition and poverty

Before moving to different scenarios, it was important to present cropping patterns.

➢ *Proposed Cropping Patterns for Optimum Utilisation and Valoration Plan*

Cropping patterns is characterized by perennial crops (Maracuja, Tree tomato), annual crops (Irish potato, Eggplant, bean, Maize) on Hillside and rice (remaining on the same land) in marshland. Crop rotation during the 5 years will concern only annual crops (Eggplant, bean, Maize) while perennial crops will be occupying the land in a permanent way during period. The proposed cropping patterns are presented in the table 9:

Table 10 Cropping Patterns Proposed for Ngoma 22

Season	Total land size (ha)	Maracuja	Tree tomato	Irish potato	Eggplant	Rice	Bean	Maize	Total Area covered /season/site (ha)
		ha	ha	ha	ha	ha	ha	ha	ha
Year 1									
A	306	70	60	40	30	46	25	35	306
B	306	70	60	35	30	46	25	40	306
C	306	70	60	-	30	-	-	-	160
Year 2									
A	306	70	60	40	25	46	30	35	306
B	306	70	60	35	25	46	40	30	306
C	306	70	60	-	25	-	-	-	155
Year 3									
A	306	70	60	30	40	46	25	35	306
B	306	70	60	35	40	46	25	30	306
C	306	70	60	-	40	-	-	-	170
Year 4									
A	306	70	60	30	25	46	40	35	306
B	306	70	60	35	25	46	40	30	306
C	306	70	60		25	-	-	-	155
Year 5									
A	306	70	60	30	40	46	25	35	306
B	306	70	60	35	40	46	30	25	306
C	306	70	60	-	40	-	-	-	170

➢ *Proposed Scenarios for Optimum Utilisation and Valoration Plan*

The analysis of current status and possible improvement plans for Ngoma 22 lead to three possible scenarios/options below detailled:

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- *Scenario 1*

In the scenario 1, the whole area of 306 ha is exploited by 7 crops which are: Rice, Tree tomato, Eggplant, Maracuja, Potato, Maize, and Beans dispatched as in table 8.

- *Yield*

The table bellow shows the yield of each crop. At the first year the yield considered is the one found at current status. At the following years the assumption is the increment of yield at 12% each year for seasonal crops. For Tree tomato and Maracuja, at the fourth year the yield decrease and will be replaced after 5 years.

Table 11 Crop Yield (kg/ha) for Five Years' Period

Crops	Year 1	Year 2	Year 3	Year 4	Year 5
Rice	4,000	4,480	5,018	5,620	6,294
Tree tomato	15,000	16,800	18,816	21,074	18,545
Eggplant	15,000	16,800	18,816	21,074	23,603
Maracuja	13,125	14,700	16,464	18,440	16,300
Potato	20,000	22,400	25,088	28,099	31,470
Maize	3,000	3,360	3,763	4,215	4,721
Beans	800	896	1,004	1,124	1,259

- *Fixed Prices for Produced Commodities*

The prices considered here are not depending on supply and demand but on minimum price fixed by Government policy while considering the cost of production.

Table 12 Suggested Minimum Price Fixed by GoR

Crops	Year 1	Year 2	Year 3	Year 4	Year 5
Rice	522	522	522	522	522
Tree tomato	600	600	600	600	600
Eggplant	342	342	342	342	342
Maracuja	367	367	367	367	367
Irish potato	218	218	218	218	218
Maize	591	591	591	591	591
Beans	1,634	1,634	1,634	1,634	1,634

In this scenario 1 the inputs used are still the same as baseline (without lime). There is no any other investment apart the existing.

- *Scenario 2*

In the scenario 2, the whole area is exploited by 7 crops which are: Rice, Tree tomato, Eggplant, Maracuja, Potato, Maize, and Beans. The increase of yield is a result from soil amendment (use of lime) and GAP

Table 13 Crop yield (Kg/ha) in scenario 2

	Year 1	Year 2	Year 3	Year 4	Year 5
Rice	5,000	5600	6272	7,000	7,000
Tree tomato	19,500	21,840	24,461	21,526	18,942
Eggplant	18,000	20,160	22,579	25,289	28,323
Maracuja	15,000	16,800	18,816	16,558	14,571
Irish potato	21,000	23,520	26,342	29,503	33,044
Maize	5,000	5,600	6,272	7,025	7,500
Beans	1,200	1,344	1,505	1,686	1,888

- *Fixed Prices for Produced Commodities in Scenario 2.*

N.B. The prices considered here are the same as scenario 1.

- *Scenario 3*

Crops considered here are the ones which are profitable plus rice which can't be rotated with other. The area occupied by rice is 46ha, tree tomato 130ha and Maracuja 130ha. Yields, prices and inputs are same as scenario 2.

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- *Yield*

Table 14 Yield

Crops	Year 1	Year 2	Year 3	Year 4	Year 5
Rice	5,000	5,600	6,272	7,000	7,00
Tree tomato	19,500	21,840	24,461	21,526	18,942
Maracuja	15,000	16,800	18,816	16,558	14,571

- *Price*

Tabe 15 Price

Crops	Year 1	Year 2	Year 3	Year 4	Year 5
Rice	522	522	522	522	522
Tree tomato	600	600	600	600	600
Maracuja	367	367	367	367	367

- *Summary of Financial Indicators (NPV, BCR and IRR)*

Table 16 Summary of Financial Indicators (NPV, BCR and IRR)

	NPV (Rfw)	BCR	IRR (%)
Baseline	(2,108,527,762)	1.85	None
Scenario 1	1,865,119,643	1.85	None
Scenario 2	3,047,981,917	2.20	700%
Scenario 3	5,289,106,571	3.10	1251%

At the current situation, the baseline NPV is negative (2,108,527,762) because the whole scheme is not utilised. There is an opportunity loss.

For the tree scenarios, the NPV consider the incremental from baseline is positive. When the BCR is more than 1 its means that income is more than expenditure. For the baseline and scenario 1 the BCR is same 1.85. With this only we cannot take decision. The scenario 3 shows the high BCR 3.10.

The IRR is superior to discount rate (13%) for scenario 2 and 3 but the best is the third scenario with 1251%. The baseline and scenario 1 don't show the IRR because there no investment. The scenario 3 is the most profitable:

✓ NPV: 5,289,106,571 Frw
✓ BCR: 2,8
✓ IRR: 1251%.

G. Summary of Financial Indicators and Viability Level

In the current situation, the baseline Financial NPV for Ngoma 22 is negative (-2,108,527,762 Frw) because the whole scheme is not utilised. For the three scenarios, the Financial NPV considers the incremental from baseline. When the BCR is more than 1 and IRR more than the discount rate, the scenario is profitable. Even if all the three scenarios are profitable, Scenario 3 is the best with NPV: 7, 307,192,892, BCR: 2,8 and IRR: 1251%.

Table 17 Baseline and Scenarios Financial Indicators

Scenario	Ha	Crops patterns/ha	Financial IRR (%)	Financial BCR	Financial NPV (Rfw)	Is it viable	Notes
Baseline	92	Rice (46 ha), Tree tomato (11 ha), Eggplant (22 ha) and Maracuja (13 ha)	None	<1	-2,108,527,762	No	Big loss of opportunity. Scheme not fully exploited. Other crops grown in this period occupied insignificant area
Scenario 1	306	Rice, Tree tomato, Eggplant, Maracuja, Potato, Maize, and Beans.	None	1.9	4,916,975,078	Yes*	Area occupied by each crop is changing with seasons and years due to crop rotation
Scenario 2	306	Rice, Tree tomato, Eggplant, Maracuja, Potato, Maize, and	898%	2.3	6,234,422,026	Yes**	Area occupied by each crop is changing with seasons and years due to crop

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		Beans.					rotation (as in table 8)
Scenario 3	306	Rice is (46ha), Tree tomato (130ha) and Maracuja (130ha).	1251%	2.8	7,307,192,892	Yes***	Scenario 3 is the most viable because it considers only the two highly profitable crops and rice in marshland – no other crop to resist water.

Significance level: *Less profitable, ** middle profitable, *** most profitable

H. What are the Market Opportunities for Ngoma 22 Irrigation Scheme ?

The availability of export opportunities is critical in identifying whether the scheme will be able to access higher value international markets (withpotentiallyhigher financial returns) or only domestic markets (limited in terms of prices and volume). These factors strongly influence the potential size of the scheme. A summary of export opportunities is presented below

Table 18 Opporunity and Market Outlook

Crop	Opportunity	Market outlook
Rice	High yields possible (7 T/ha in the long run) but many smalls growers/buyers/outlets	**Market Outlook**: Uncertain (lack of Domestic market security), too much Competition for exports but local consumption could exclude imports
Tree tomatoe	Strong demand for all varieties; Sustained prices; supply deficient in the next 1 to 5years	**Market Outlook**: Highly attractive but risk of pest losses and needs high quality seed, fertiliser/insecticide
Maracuja	Strong demand for all varieties; Sustained prices; supply deficient in the next 1 to 5years	**Market Outlook**: Highly attractive but risk of pest losses and needs high quality seed, fertiliser/insecticide

I. Designing Farmer's Organization (Names), Capacity Building and Legal Framework

More than one thousand beneficiary farmers in Ngoma 22 Irrigation Scheme need strong farmer organisation for ownership of the scheme and increased profitability. To that effect, they need continued capacity building as stated in the tripartite IMTA: administrative and financial management, record keeping, conflicts resolution management, integrated water management, operation and maintenance of irrigation infrastructures, best agricultural practices.

J. Capacity Building Plan

Dispite the training realized during the period of the development of the scheme, refresher training must be organised yearly to increase the managing capacity of farmers. In the long run the farmers must own the Irrigation scheme and pay technical staff and cover operational and maintenance costs of the irrigation infrastructures.

Table 19 Refresher Course and Capacity Building Plan for Ngoma 22 Irrigation Scheme

Types of training	Responsible	Timeline[5]
Best agricultural practices	RAB, HoReCo and Districts	January 2019
Administrative and financial management	RAB, HoReCo and Districts	January 2019
Record keeping	RAB, HoReCo and Districts	February 2019
Conflicts resolution management	RAB, HoReCo and Districts	March 2019
Integrated water management	RAB, HoReCo and Districts	April 2019
Operation and maintenance of irrigation infrastructures	RAB, HoReCo and Districts	May 2019

Apart from the class training to be organized for each type of training, for best agricultural practices, farmers will be continually trained (on farm training) through demo plots and FFSs.

[5] Starting time- June up to December 2016

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CHAPTER FOUR
CONCLUSION AND RECOMMENDATIONS

A. Conclusion

The study has described the water resources management guidelines for Ngoma 22 irrigation scheme as per Ministerial Order N°001/11.30 of 23/11/2011 establishing IWUA in irrigation schemes (MINAGRI, 2011). It updated the cropping patterns for IWUA and cooperatives. Traditional crops such maize, beans/pulses and sorghum are no longer grown because the availability of water has proven that farmers should move to high value crops. It revealed profitable crops through a cost-benefit analysis per crop and extended crop returns on 5 years' period. It has also designed the farmer organisation model for capacity building and legal framework.

B. Recommendations

- The Government of Rwanda (MINAGRI in collaboration with MINICOM) should fix minimum prices for agricultural products in relation to costs of production. Prices regulation will avoid market fluctuations discouraging farmers and fear to invest in agriculture. This require periodic recording of costs by farmers during the production period.
- The Government of Rwanda should introduce ***subsidized prices*** system in agriculture given that some prices are lowered by the imported products (external influence) as sometime the product cost is lower than those from Rwanda (ex. Pakistan rice versus Bugarama rice).
- To maximize production and profitability from the scheme, MINAGRI and RAB should introduce outgrowing system and contract farming where private companies may lease one portion of land for production and serving as a model farm and where local farmers are learning from. Therefore, the remaining area is used by farm owners to produce for the company or model farmer;
- Farmers should apply GAP to increase yield for each crop. Yield increase will automatically generate early benefits.
- Farmers should continue adopt profitable cash crops identified in this study (e.g maracuja and tree tomato).
- Farmers should increase ownership of irrigation scheme operation maintenance and valorisation through IWUA and cooperatives'performance.
- Farmers should adopt collective marketing of their products and contract farming system.
- Farmers should pay the water fees per season as calculated in this study (20,000 Frw) which would cover operations and maintenance as well as reserve funds for future heavy rehabilitation works.
- Farmers should ensure proper operation and management of existing post-harvest and handling infrastructures to facilitate production and stabilise market prices.
- RAB should organise regularly refresher trainings to increase the managing capacity of farmers. Farmers are to be continuously assisted and trained for better GAP respects (on farm training) with qualified and dynamic field staff. In the long run, the farmers should own the Irrigation scheme and pay technical staff.
- RAB should continue the capacity building of farmers and prepare an exit strategy for leaving the scheme in their hands. Rehabilitate the irrigation infrastructure at the pre-defined period as lifespan (20-25 years) of the scheme.
- RAB sould introduced Fisheries/Acquaculture in the dam/reservoir for optimum management and utilization of the scheme.
- Ngoma District should keep mobilisation campaign and awareness for water resource use. It should provide technical and managerial support to IWUA and cooperatives as well as the monitoring and evaluation of their performance contract.
- The District should approve their annual work plans and budgets, resolve amicably any disagreement between WU and cooperatives. This requires regular monitoring of seasonal farming activities within the command area.
- The District should support IWUA to organise community work activities. In the short run, it should monitor water fee collection and use for operations and maintenance management.
- The District should also mobilise horticulture projects which can support farmers in their endeavours; particularly, establishment of tree nurseries in the scheme is paramount to protect both canals and other irrigation infrastructure within the scheme.
- INATEK and other higher learning institutions should create interest for students through field visits, research activities in agriculture domain (soil stability, water, and drainage and catchment protection) and agribusiness.

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APPENDICES

APPENDIX 1: ROADMAP FOR CONDUCTING THE STUDY

SN	ACTIVITY	Expected results	Timeline	Place	Responsibles / Participants
1	Field visit of Ngoma 22 irrigation scheme;	Overview of the irrigation scheme	20-21st August-2018	Ngoma District	All team members
2	Draft concept note and guidelines on Optimum utilisation plan of Ngoma 22 irrigation scheme;	The concept note including Indicators, methodology , strategy and , Questionnaire are set up	04th September, 2018	Kigali	All team members
3	Workshop for validation of concept and guidelines on Optimum utilization plan of Ngoma 22 irrigation scheme;	The concept note including Indicators, methodology , strategy and , Questionnaire validated	14th September, 2018	Kigali	DDG AR&TT, Ag HoD-LIM Team members, Ngoma District representatives, Ngoma 22 based RAB field Staff and other relevant partners
4	Data collection on field	Primary data collected	24th to 28th September, 2018	Ngoma District	Focus group discussion
5	Desk work and production of the draft report	Primary and secondary data collected are analyzed and draft report produced	3rd -14th October 2018	Musanze District	All team members
6	Submission of draft report	Draft Report officially submitted	17th October, 2018	Kigali	
7	Presentation and validation of the draft report	Draft Report validated	20th October 2018	Kigali	All team members
8	Production and submission of the final report	Final Report submitted officially	27th-28th October 2018	Kigali	Team leader
9	Inputs from DDG inserted in the final report	Final report submission	8th -11th January 2019	Musanze	All team members

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APPENDIX 2: QUESTIONNAIRE

A. Annex (Questionnaire, checklist)

➢ *Water fees determined based on maintenance cost and farmer's income;*

- Land size (Are);
- Production cost for selected crops;
- Income from selected crops (Revenues);
- Maintenance cost for irrigation infrastructures;
- Suggested water fees;
- Cropping rotation;
- Market accessibility;
- Finance accessibility;
- Post-harvest and handling;

➢ *High value crops are selected based on scientifically proven criteria;*

- Pairwise ranking of crops listed by farmers;

➢ *Capacity building model is developed for sustainable farmer's organization;*

- Level of farmer's organization;
- Obtained trainings;
- Study tours;
- Gaps in capacity building;
- Capacity building needs assessmen.

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APPENDICES 1. TREE TOMATO PRODUCTION COST AT SCENARIO ONE

SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	I. Nursery preparation				
1	First tillage	Wage (HJ)	2	800	**1,600**
2	Second tillage	Wage (HJ)	2	800	**1,600**
3	Poudring	Wage (HJ)			**0**
4	Sowing	Wage (HJ)	2	800	**1,600**
5	Fertilizers application	Wage (HJ)	2	800	**1,600**
6	*Follow up*	Wage (HJ)	2	800	*1,600*
	Sous Total				**8,000**
	II. Land preparation				
7	First tillage	Wage (HJ)	60	800	48,000
8	Second tillage	Wage (HJ)	40	800	32,000
9	Weeds removal	Wage (HJ)	20	800	16,000
10	Hole digging	Wage (HJ)	2,500	70	175,000
11	Poudring	Wage (HJ)			0
	Sous Total				**271,000**
	III. Main activities in cropping				
12	Carrying organic fertilizer	Fuso	**2**	**20,000**	40,000
13	applying organic fertilizers in the soil	Wage (HJ)	30	800	24,000
14	Application of NPK / DAP	Wage (HJ)	8	800	6,400
15	Lime application	Wage (HJ)	60	800	48,000
16	Transportation of seedling / seeds	Wage (HJ) or FUSO	4	800	3,200
17	Transplantation and planting (sowing-Hole making)	Wage (HJ)	12	800	9,600
18	Staking	Wage (HJ)			0
19	Mulching	Wage (HJ)	4	800	3,200
20	Mulch transportation	Fuso / Wage (HJ)	24	800	19,200
21	First weeding	Wage (HJ)	24	800	19,200
22	Application of Urea (1/2)	Wage (HJ)	8	800	6,400
23	Second weeding	Wage (HJ)	24	800	19,200
24	Application of Urea (1/2)	Wage (HJ)	5	800	4,000
25	Third weeding	Wage (HJ)	12	800	9,600
26	Application of Urea ()	Wage (HJ)			0
27	Fourth weeding	Wage (HJ)	12	800	9,600
28	Linguee / Gardienage (birds, thieves)	Wage (HJ)			0
29	application of pesticides	Wage (HJ)	80	1,000	80,000
30	Cleaning of Irrigation channels	Wage (HJ)	80	1,000	*80,000*
31	Hygienic activities in the field	Wage (HJ)	200	800	160,000
32	*Water application/ Irrigation (Half of the time of crop cycle)*	Wage (HJ)	100	800	80,000
33	**Sous Total**	Wage (HJ)	*60*	*1,500*	*90,000*
	IV. Season preparation / input mobilization				**711,600**
	Leasing land				
34	Buying NPK	ha	1	100,000	**100,000**
35	Buying DAP	kg	300	655	**196,500**
36	Buying UREA	kg			**0**
37	Buying Lime	kg	100	606	**60,600**
38	Buying Rapid ferti / Polyfeed	liter	3	600	**1,800**
39	Buying Polyfeed	kg	3	3,500	**10,500**
40	Buying pots sachet	kg	25	3,000	**75,000**
41	Buying organic fertilizer	kg	10,000	28	**280,000**
42	Buying mulch	Fagot	1,850	200	**370,000**
43	Buying trees (including transport) / rops / Iron wire for staking / staking	Number			**0**

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
44	Buying clou for stalking / staking	kg			**0**
45	Buying irrigation equipment	SSIT Kit			**0**
46	Buying fuel	Liter			**0**
47	Buying sprayer pump	Number	2	15,000	**30,000**
48	Buying Fungicide Beam	kg			**750,000**
49	Buying Fungicide Commando	kg			**0**
50	Buying Fungicide Rhidomil	kg	50	15,000	**750,000**
51	Buying Fungicide Dithane M45	kg	50	3,500	**175,000**
52	Buying Fungicide DECOBRA	kg	20	3,500	**70,000**
53	Buying **other** fungicides (Precise)	kg			**0**
54	Buying Insecticide Cypermethrine	Liter	50	4,000	**200,000**
55	Buying Insecticide Rocket	Liter	5	12,000	**60,000**
56	Buying Insecticide DUDU	Liter			**0**
57	Buying Insecticide IMIDACROPRIDE	Liter			**0**
58	Buying **other** insecticides (Precise)	Liter			**0**
59	Buying Benlate (Guhungira)	g			**0**
60	*Buying seeds / Iseedlings*	kg	*1*	***40,000***	***40,000***
61	*Buying machete*	*pcs*	*1*	*1,000*	***1,000***
62	*Buying hoe*	*pcs*	*2*	*2,000*	***4,000***
63	*Buying pickaxe (igitiyo)*	*pcs*	*1*	*3,000*	***3,000***
64	*Buying fauche(Akayuya)*	*pcs*	*1*	*1,500*	***1,500***
65	*Buying wheelbarrow*	*pcs*	*1*	*40,000*	***40,000***
66	*Wage (HJ) in buying and follow up of needed input and tools*	Wage (HJ)	*4*	*1,000*	***4,000***
67	*Transport for buying and follow up of needed input and tools*	*Frw*	*3*	*1,600*	***4,800***
	Sous Total				**3,227,700**
	V. Farm follow up				
68	Permanent technical assistant (Transport included)	Wage (HJ)	12	5,000	*60,000*
69	Field visit (2/8 hours per day, each week in crop cycle)	Wage (HJ)	12	800	*9,600*
70	Transport to visit field (two time a month, in crop cycle)	Frw	20	1,000	*20,000*
71	Accommodation fees-Lunch when visiting field (two time a month, in crop cycle)	Frw	20	1,000	*20,000*
	Sous Total				**109,600**
	VI. Harvesting activities				
72	*Cutting/uprooting/gathering*	Wage (HJ)	*40*	*800*	*32,000*
73	*Carrying in hands*	Wage (HJ)			*0*
74	*Slashing / shelling*	Wage (HJ)			*0*
75	Buying sheeting for Slashing / shelling	pcs	2	7,000	14,000
76	*Carrying harvest from Slashing / shelling place to drying ground*	Wage (HJ)			*0*
77	*Drying*	Wage (HJ)			*0*
78	*Winnowing*	Wage (HJ)			*0*
79	Filling in Sacs / crate/ carton, and measuring	one Sac / crate/ carton	2	800	*1,600*
80	Guardian	Wage (HJ)			0
81	Carrying (drying ground -Stock)	Wage (HJ)			0
82	Buying Sacs / crate/ carton, and measuring	pcs			0
83	buying sacs to carry harvest to drying ground	pcs			0
84	Wire to close the sacs	pcs			0
85	Cost for loading car to the transformation unit/ Industry / on market	Kg	2	800	1,600

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
86	water fees (Where WUA exists)	ha	1	20,000	20,000
	Sous Total				**69,200**
	Total cost per ha (direct running cost)				**4,397,100**
	VII. Additional costs (indirect costs)				
87	Contribution to cooperative	Contribution	1	5,000	5,000
88	Contribution to cooperative union	Contribution			0
89	Contribution to the federation	Contribution			0
90	Land taxes	ha			0
	Sous Total Additional costs (indirect costs)				**5,000**
	Total cost per ha (direct running cost +indirect costs)	Frw			4,402,100
	Yield (kg/ha)	kg			15,000
	Loan (if any)	Frw			394,700
91	Interest on loan at 19% per year in the cropping period	Frw			
	Production cost of 1 kg	Frw			293
92	Benefit of farmer at 25%	Frw			73
	Selling price at farm gates (Production cost of 1 kg + Benefit of farmer)				**367**
	VIII. Marketing and selling				
93	**Carrying the harvest on market**	Wage (HJ)	**40**	**1,000**	40,000
94	**Hiring car for harvest transportation to market**	**Van**	**20**	**20,000**	400,000
	Sub-total Marketing and selling	Frw			**440,000**
	Additional cost up to the market	Frw			**29**
	Product cost at market (Production cost of 1 kg + Additional cost up to the market)	Frw			**323**
	Benefit of farmer at market at 25%	Frw			**81**
	Selling price at market level (Product cost at market + Benefit of farmer at market at 25%)	Frw			**404**
	Basic prices				
	Proper and logic basic price at Market	Frw			**404**
	Actual price on market	Frw			**600**
	Benefit/loss	Frw			**196**

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APPENDICES 2. RICE PRODUCTION COST AT SCENARIO ONE

SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	I. Nursery preparation				
1	First tillage	Wage (HJ)	3	1,000	**3,000**
2	Second tillage	Wage (HJ)	2	1,000	**2,000**
3	Poudring	Wage (HJ)	2	1,000	**2,000**
4	Sowing	Wage (HJ)	1	1,000	**1,000**
5	Fertilizers application	Wage (HJ)	1	1,000	**1,000**
6	*Follow up*	Wage (HJ)	*3*	*1,000*	*3,000*
	Sous Total				**12,000**
	II. Land preparation				
7	First tillage	Wage (HJ)	60	1,000	60,000
8	Second tillage	Wage (HJ)	40	1,000	40,000
9	Weeds removal	Wage (HJ)	20	1,000	20,000
10	Hole digging	Wage (HJ)			0
11	Poudring	Wage (HJ)	50	1,000	50,000
	Sous Total				**170,000**
	III. Main activities in cropping				
12	Carrying organic fertilizer	Fuso	**1**	**20,000**	20,000
13	applying organic fertilizers in the soil	Wage (HJ)	30	1,000	30,000
14	Application of NPK / DAP	Wage (HJ)	2	1,000	2,000
15	Lime application	Wage (HJ)	60	800	48,000
16	Transportation of seedling / seeds	Wage (HJ) or FUSO			0
17	Transplantation and planting (sowing-Hole making)	Wage (HJ)	50	1,000	50,000
18	Staking	Wage (HJ)			0
19	Mulching	Wage (HJ)			0
20	Mulch transportation	Fuso / Wage (HJ)			0
21	First weeding	Wage (HJ)	50	1,000	50,000
22	Application of Urea (1/2)	Wage (HJ)	2	1,000	2,000
23	Second weeding	Wage (HJ)	50	1,000	50,000
24	Application of Urea (1/2)	Wage (HJ)	2	1,000	2,000
25	Third weeding	Wage (HJ)	40	1,000	40,000
26	Application of Urea ()	Wage (HJ)	2	1,000	2,000
27	Fourth weeding	Wage (HJ)	20	1,000	20,000
28	Linguee / Gardienage (birds, thieves)	Wage (HJ)	75	1,000	75,000
29	application of pesticides	Wage (HJ)	*3*	*1,000*	*3,000*
30	Cleaning of Irrigation channels	Wage (HJ)	23	1,000	23,000
31	Hygienic activities in the field	Wage (HJ)	5	1,000	5,000
32	*Water application/ Irrigation (Half of the time of crop cycle)*	Wage (HJ)	*24*	*1,000*	*24,000*
33	**Sous Total**				**446,000**
	IV. Season preparation / input mobilization				
	Leasing land	ha	1	100,000	**100,000**
34	Buying NPK	kg	200	655	**131,000**
35	Buying DAP	kg			**0**
36	Buying UREA	kg	100	606	**60,600**
37	Buying Lime	kg	5,000	50	**250,000**
38	Buying Rapid ferti / Polyfeed	liter			**0**
39	Buying Polyfeed	kg			**0**
40	Buying pots sachet	kg			**0**
41	Buying organic fertilizer	kg	10,000	28	**280,000**
42	Buying mulch	Fagot			**0**
43	Buying trees (including transport) / rops / Iron wire for staking / staking	Number			**0**
44	Buying clou for stalking / staking	kg			**0**
45	Buying irrigation equipment	SSIT Kit			**0**

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
46	Buying fuel	Liter			**0**
47	Buying sprayer pump	Number	1	15,000	**15,000**
48	Buying Fungicide Beam	kg	1	15,000	**15,000**
49	Buying Fungicide Commando	kg			**0**
50	Buying Fungicide Rhidomil	kg	8	15,000	**112,500**
51	Buying Fungicide Dithane M45	kg			**0**
52	Buying Fungicide DECOBRA	kg			**0**
53	Buying **other** fungicides (Precise)	kg			**0**
54	Buying Insecticide Cypermethrine	Liter	8	5,000	**37,500**
55	Buying Insecticide Rocket	Liter	5	12,000	**60,000**
56	Buying Insecticide DUDU	Liter			**0**
57	Buying Insecticide IMIDACROPRIDE	Liter			**0**
58	Buying **other** insecticides (Precise)	Liter			**0**
59	Buying Benlate (Guhungira)	g	60	17	**1,020**
60	*Buying seeds / Iseedlings*	kg	*25*	***400***	***10,000***
61	*Buying machete*	*pcs*	*1*	*1,000*	***1,000***
62	*Buying hoe*	*pcs*	*1*	*2,000*	***2,000***
63	*Buying pickaxe (igitiyo)*	*pcs*	*1*	*3,000*	***3,000***
64	*Buying fauche(Akayuya)*	*pcs*	*1*	*500*	***500***
65	*Buying wheelbarrow*	*pcs*	*1*	*40,000*	***40,000***
66	*Wage (HJ) in buying and follow up of needed input and tools*	Wage (HJ)	*10*	*1,000*	***10,000***
67	*Transport for buying and follow up of needed input and tools*	*Frw*	*3*	*1,600*	***4,800***
	Sous Total				**1,133,920**
	V. Farm follow up				
68	Permanent technical assistant (Transport included)	Wage (HJ)	0	10,000	*0*
69	Field visit (2/8 hours per day, each week in crop cycle)	Wage (HJ)	6	1,000	*6,000*
70	Transport to visit field (two time a month, in crop cycle)	Frw	12	1,000	*12,000*
71	Accommodation fees-Lunch when visiting field (two time a month, in crop cycle)	Frw	12	2,000	*24,000*
	Sous Total				**42,000**
	VI. Harvesting activities				
72	*Cutting/uprooting/gathering*	Wage (HJ)	*20*	*1,000*	*20,000*
73	*Carrying in hands*	Wage (HJ)	*8*	*1,000*	*8,000*
74	*Slashing / shelling*	Wage (HJ)	*25*	*1,000*	*25,000*
75	Buying sheeting for Slashing / shelling	pcs	4	10,000	40,000
76	*Carrying harvest from Slashing / shelling place to drying ground*	Wage (HJ)	*10*	*1,000*	*10,000*
77	*Drying*	Wage (HJ)	*10*	*1,000*	*10,000*
78	*Winnowing*	Wage (HJ)	*25*	*1,000*	*25,000*
79	Filling in Sacs / crate/ carton, and measuring	one Sac / crate/ carton	25	200	5,000
80	Guardian	Wage (HJ)	10	1,000	10,000
81	Carrying (drying ground -Stock)	Wage (HJ)	10	1,000	10,000
82	Buying Sacs / crate/ carton, and measuring	pcs	50	260	13,000
83	buying sacs to carry harvest to drying ground	pcs	34	260	8,840
84	Wire to close the sacs	pcs	1	900	900
85	Cost for loading car to the transformation unit/ Industry / on market	Kg	5,000	2	10,000
86	water fees (Where WUA exists)	ha	1	20,000	20,000
	Sous Total				**215,740**
	Total cost per ha (direct running cost)				**2,019,660**
	VII. Additional costs (indirect costs)				
87	Contribution to cooperative	Contribution	5	5,000	25,000

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
88	Contribution to cooperative union	Contribution			0
89	Contribution to the federation	Contribution	1	5,000	5,000
90	Land taxes	ha	1	45,417	45,417
	Sous Total Additional costs (indirect costs)				**75,417**
	Total cost per ha (direct running cost +indirect costs)	Frw			2,200,413
	Yield (kg/ha)	kg			5,000
	Loan (if any)	Frw			831,600
91	Interest on loan at 19% per year in the cropping period	Frw			105,336
	Production cost of 1 kg	Frw			440
92	Benefit of farmer at 25%	Frw			110
	Selling price at farm gates (Production cost of 1 kg + Benefit of farmer)				**550**
	VIII. Marketing and selling				
93	**Carrying the harvest on market**	Wage (HJ)			0
94	**Hiring car for harvest transportation to market**	**Van**			0
	Sub-total Marketing and selling	Frw			**0**
	Additional cost up to the market	Frw			**0**
	Product cost at market (Production cost of 1 kg + Additional cost up to the market)	Frw			**440**
	Benefit of farmer at market at 25%	Frw			**110**
	Selling price at market level (Product cost at market + Benefit of farmer at market at 25%)	Frw			**550**
	Basic prices				
	Proper and logic basic price at Market	Frw			**550**
	Actual price on market	Frw			**280**
	Benefit/loss	Frw			**-270**

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APPENDICES 3. MARACUJA PRODUCTION COST AT SCENARIO ONE

SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	I. Nursery preparation				
1	First tillage	Wage (HJ)	2	800	**1,600**
2	Second tillage	Wage (HJ)	2	800	**1,600**
3	Poudring	Wage (HJ)			**0**
4	Sowing	Wage (HJ)	2	800	**1,600**
5	Fertilizers application	Wage (HJ)	2	800	**1,600**
6	*Follow up*	Wage (HJ)	2	800	*1,600*
	Sous Total				**8,000**
	II. Land preparation				
7	First tillage	Wage (HJ)	60	800	48,000
8	Second tillage	Wage (HJ)	40	800	32,000
9	Weeds removal	Wage (HJ)	20	800	16,000
10	Hole digging	Wage (HJ)	2,500	70	175,000
11	Poudring	Wage (HJ)			0
	Sous Total				**271,000**
	III. Main activities in cropping				
12	Carrying organic fertilizer	Fuso	**2**	**20,000**	40,000
13	applying organic fertilizers in the soil	Wage (HJ)	30	800	24,000
14	Application of NPK / DAP	Wage (HJ)	8	800	6,400
15	Lime application	Wage (HJ)	60	800	48,000
16	Transportation of seedling / seeds	Wage (HJ) or FUSO	4	800	3,200
17	Transplantation and planting (sowing-Hole making)	Wage (HJ)	12	800	9,600
18	Staking	Wage (HJ)			0
19	Mulching	Wage (HJ)	10	800	8,000
20	Mulch transportation	Fuso / Wage (HJ)	24	800	19,200
21	First weeding	Wage (HJ)	24	800	19,200
22	Application of Urea (1/2)	Wage (HJ)	8	800	6,400
23	Second weeding	Wage (HJ)	24	800	19,200
24	Application of Urea (1/2)	Wage (HJ)	5	800	4,000
25	Third weeding	Wage (HJ)	12	800	9,600
26	Application of Urea ()	Wage (HJ)			0
27	Fourth weeding	Wage (HJ)	12	800	9,600
28	Linguee / Gardienage (birds, thieves)	Wage (HJ)			0
29	application of pesticides	Wage (HJ)	80	1,000	*80,000*
30	Cleaning of Irrigation channels	Wage (HJ)	200	800	160,000
31	Hygienic activities in the field	Wage (HJ)	100	800	80,000
32	*Water application/ Irrigation (Half of the time of crop cycle)*	Wage (HJ)	*60*	*1,500*	*90,000*
33	**Sous Total**				**636,400**
	IV. Season preparation / input mobilization				
	Leasing land	ha	1	100,000	**100,000**
34	Buying NPK	kg	300	655	**196,500**
35	Buying DAP	kg			**0**
36	Buying UREA	kg	100	606	**60,600**
37	Buying Lime	kg	5,000	50	**250,000**
38	Buying Rapid ferti / Polyfeed	liter	3	600	**1,800**
39	Buying Polyfeed	kg	3	3,500	**10,500**
40	Buying pots sachet	kg	25	3,000	**75,000**
41	Buying organic fertilizer	kg	10,000	28	**280,000**
42	Buying mulch	Fagot	1,850	200	**370,000**
43	Buying trees (including transport) / rops /	Number	1,000	1,500	**1,500,000**

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	Iron wire for staking / staking				
44	Buying clou for stalking / staking	kg	100	800	**80,000**
45	Buying irrigation equipment	SSIT Kit			**0**
46	Buying fuel	Liter			**0**
47	Buying sprayer pump	Number	2	15,000	**30,000**
48	Buying Fungicide Beam	kg			**0**
49	Buying Fungicide Commando	kg			**0**
50	Buying Fungicide Rhidomil	kg	50	15,000	**750,000**
51	Buying Fungicide Dithane M45	kg	50	3,500	**175,000**
52	Buying Fungicide DECOBRA	kg	20	3,500	**70,000**
53	Buying **other** fungicides (Precise)	kg			**0**
54	Buying Insecticide Cypermethrine	Liter	50	4,000	**200,000**
55	Buying Insecticide Rocket	Liter	5	12,000	**60,000**
56	Buying Insecticide DUDU	Liter			**0**
57	Buying Insecticide IMIDACROPRIDE	Liter			**0**
58	Buying **other** insecticides (Precise)	Liter			**0**
59	Buying Benlate (Guhungira)	g			**0**
60	*Buying seeds / Iseedlings*	kg	*1*	***45,000***	***45,000***
61	*Buying machete*	*pcs*	*1*	*1,000*	***1,000***
62	*Buying hoe*	*pcs*	*2*	*2,000*	***4,000***
63	*Buying pickaxe (igitiyo)*	*pcs*	*1*		***0***
64	*Buying fauche(Akayuya)*	*pcs*	*1*	*1,500*	***1,500***
65	*Buying wheelbarrow*	*pcs*	*1*	*40,000*	***40,000***
66	*Wage (HJ) in buying and follow up of needed input and tools*	Wage (HJ)	*4*	*1,000*	***4,000***
67	*Transport for buying and follow up of needed input and tools*	*Frw*	*3*	*1,600*	***4,800***
	Sous Total				**4,309,700**
	V. Farm follow up				
68	Permanent technical assistant (Transport included)	Wage (HJ)	12	5,000	*60,000*
69	Field visit (2/8 hours per day, each week in crop cycle)	Wage (HJ)	12	800	*9,600*
70	Transport to visit field (two time a month, in crop cycle)	Frw	20	1,000	*20,000*
71	Accommodation fees-Lunch when visiting field (two time a month, in crop cycle)	Frw	20	1,000	*20,000*
	Sous Total				**109,600**
	VI. Harvesting activities				
72	*Cutting/uprooting/gathering*	Wage (HJ)	*40*	*800*	*32,000*
73	*Carrying in hands*	Wage (HJ)			*0*
74	*Slashing / shelling*	Wage (HJ)			*0*
75	Buying sheeting for Slashing / shelling	pcs	2	7,000	14,000
76	*Carrying harvest from Slashing / shelling place to drying ground*	Wage (HJ)			*0*
77	*Drying*	Wage (HJ)			*0*
78	*Winnowing*	Wage (HJ)			*0*
79	Filling in Sacs / crate/ carton, and measuring	one Sac / crate/ carton	2	800	1,600
80	Guardian	Wage (HJ)			0
81	Carrying (drying ground -Stock)	Wage (HJ)			0
82	Buying Sacs / crate/ carton, and measuring	pcs			0
83	buying sacs to carry harvest to drying ground	pcs			0
84	Wire to close the sacs	pcs			0
85	Cost for loading car to the transformation unit/ Industry / on market	Kg	2	800	1,600

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
86	water fees (Where WUA exists)	ha	1	20,000	20,000
	Sous Total				**69,200**
	Total cost per ha (direct running cost)				**5,403,900**
	VII. Additional costs (indirect costs)				
87	Contribution to cooperative	Contribution	1	5,000	5,000
88	Contribution to cooperative union	Contribution			0
89	Contribution to the federation	Contribution			0
90	Land taxes	ha			0
	Sous Total Additional costs (indirect costs)				**5,000**
	Total cost per ha (direct running cost +indirect costs)	Frw			5,483,893
	Yield (kg/ha)	kg			13,125
	Loan (if any)	Frw			394,700
91	Interest on loan at 19% per year in the cropping period	Frw			74,993
	Production cost of 1 kg	Frw			418
92	Benefit of farmer at 25%	Frw			104
	Selling price at farm gates (Production cost of 1 kg + Benefit of farmer)				**522**
	VIII. Marketing and selling				
93	**Carrying the harvest on market**	Wage (HJ)	**40**	**1,000**	40,000
94	**Hiring car for harvest transportation to market**	**Van**	**20**	**20,000**	400,000
	Sub-total Marketing and selling	Frw			**440,000**
	Additional cost up to the market	Frw			**34**
	Product cost at market (Production cost of 1 kg + Additional cost up to the market)	Frw			**451**
	Benefit of farmer at market at 25%	Frw			**113**
	Selling price at market level (Product cost at market + Benefit of farmer at market at 25%)	Frw			**564**
	Basic prices				
	Proper and logic basic price at Market	Frw			**564**
	Actual price on market	Frw			**1,200**
	Benefit/loss	Frw			**636**

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APPENDICES 4. BEAN PRODUCTION COST AT SCENARIO ONE

SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	I. Nursery preparation				
1	First tillage	Wage (HJ)			**0**
2	Second tillage	Wage (HJ)			**0**
3	Poudring	Wage (HJ)			**0**
4	Sowing	Wage (HJ)			**0**
5	Fertilizers application	Wage (HJ)			**0**
6	*Follow up*	Wage (HJ)			*0*
	Sous Total				**0**
	II. Land preparation				
7	First tillage	Wage (HJ)	60	800	48,000
8	Second tillage	Wage (HJ)	40	800	32,000
9	Weeds removal	Wage (HJ)	20	800	16,000
10	Hole digging	Wage (HJ)			0
11	Poudring	Wage (HJ)			0
	Sous Total				**96,000**
	III. Main activities in cropping				
12	Carrying organic fertilizer	Fuso	**1**	**20,000**	20,000
13	applying organic fertilizers in the soil	Wage (HJ)	30	800	24,000
14	Application of NPK / DAP	Wage (HJ)	2	800	1,600
15	Lime application	Wage (HJ)	60	800	48,000
16	Transportation of seedling / seeds	Wage (HJ) or FUSO			0
17	Transplantation and planting (sowing-Hole making)	Wage (HJ)	50	800	40,000
18	Staking	Wage (HJ)			0
19	Mulching	Wage (HJ)			0
20	Mulch transportation	Fuso / Wage (HJ)			0
21	First weeding	Wage (HJ)	50	800	40,000
22	Application of Urea (1/2)	Wage (HJ)	2	800	1,600
23	Second weeding	Wage (HJ)	50	800	40,000
24	Application of Urea (1/2)	Wage (HJ)	2	800	1,600
25	Third weeding	Wage (HJ)			0
26	Application of Urea ()	Wage (HJ)			0
27	Fourth weeding	Wage (HJ)			0
28	Linguee / Gardienage (birds, thieves)	Wage (HJ)			0
29	application of pesticides	Wage (HJ)	*3*	800	*2,400*
30	Cleaning of Irrigation channels	Wage (HJ)	23	800	18,400
31	Hygienic activities in the field	Wage (HJ)	5	800	4,000
32	*Water application/ Irrigation (Half of the time of crop cycle)*	Wage (HJ)	*24*	800	*19,200*
33	**Sous Total**				**260,800**
	IV. Season preparation / input mobilization				
	Leasing land	ha	1	100,000	**100,000**
34	Buying NPK	kg			**0**
35	Buying DAP	kg	200	737	**147,400**
36	Buying UREA	kg	50	606	**30,300**
37	Buying Lime	kg	5,000	50	**250,000**
38	Buying Rapid ferti / Polyfeed	liter			**0**
39	Buying Polyfeed	kg			**0**
40	Buying pots sachet	kg			**0**
41	Buying organic fertilizer	kg	20,000	30	**600,000**
42	Buying mulch	Fagot			**0**
43	Buying trees (including transport) / rops / Iron wire for staking / staking	Number			**0**
44	Buying clou for stalking / staking	kg			**0**

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
45	Buying irrigation equipment	SSIT Kit			**0**
46	Buying fuel	Liter			**0**
47	Buying sprayer pump	Number	1	15,000	**15,000**
48	Buying Fungicide Beam	kg			
49	Buying Fungicide Commando	kg	3	15,000	**37,500**
50	Buying Fungicide Rhidomil	kg			**0**
51	Buying Fungicide Dithane M45	kg			**0**
52	Buying Fungicide DECOBRA	kg			**0**
53	Buying **other** fungicides (Precise)	kg			**0**
54	Buying Insecticide Cypermethrine	Liter			**0**
55	Buying Insecticide Rocket	Liter	3	5,000	**12,500**
56	Buying Insecticide DUDU	Liter			**0**
57	Buying Insecticide IMIDACROPRIDE	Liter			**0**
58	Buying **other** insecticides (Precise)	Liter			**0**
59	Buying Benlate (Guhungira)	kg	20	1,700	**34,000**
60	*Buying seeds / Iseedlings*	kg	*40*	***550***	***22,000***
61	*Buying machete*	*pcs*			***0***
62	*Buying hoe*	*pcs*			***0***
63	*Buying pickaxe (igitiyo)*	*pcs*			***0***
64	*Buying fauche(Akayuya)*	*pcs*			
65	*Buying wheelbarrow*	*pcs*			***0***
66	*Wage (HJ) in buying and follow up of needed input and tools*	Wage (HJ)			***0***
67	*Transport for buying and follow up of needed input and tools*	*Frw*			***5,000***
	Sous Total				**1,253,700**
	V. Farm follow up				
68	Permanent technical assistant (Transport included)	Wage (HJ)	0	10,000	*0*
69	Field visit (2/8 hours per day, each week in crop cycle)	Wage (HJ)	3	800	*2,400*
70	Transport to visit field (two time a month, in crop cycle)	Frw	12	3,000	*36,000*
71	Accommodation fees-Lunch when visiting field (two time a month, in crop cycle)	Frw	12	2,000	*24,000*
	Sous Total				**62,400**
	VI. Harvesting activities				
72	*Cutting/uprooting/gathering*	Wage (HJ)	*20*	800	*16,000*
73	*Carrying in hands*	Wage (HJ)	*8*	800	*6,400*
74	*Slashing / shelling*	Wage (HJ)	*50*	800	*40,000*
75	Buying sheeting for Slashing / shelling	pcs	4	10,000	40,000
76	*Carrying harvest from Slashing / shelling place to drying ground*	Wage (HJ)	*13*	800	*10,400*
77	*Drying*	Wage (HJ)	*2*	800	*1,920*
78	*Winnowing*	Wage (HJ)	*17*	800	*13,600*
79	Filling in Sacs / crate/ carton, and measuring	one Sac / crate/ carton	6	200	1,200
80	Guardian	Wage (HJ)	10	800	8,000
81	Carrying (drying ground -Stock)	Wage (HJ)	10	800	8,000
82	Buying Sacs / crate/ carton, and measuring	pcs	12	260	3,120
83	buying sacs to carry harvest to drying ground	pcs	34	260	8,840
84	Wire to close the sacs	pcs	1	900	900
85	Cost for loading car to the transformation unit/ Industry / on market	Kg	1,200	2	2,400
86	water fees (Where WUA exists)	ha	1	20,000	20,000
	Sous Total				**180,780**
	Total cost per ha (direct running cost)				**1,853,680**

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	VII. Additional costs (indirect costs)				
87	Contribution to cooperative	Contribution	5	5,000	25,000
88	Contribution to cooperative union	Contribution			0
89	Contribution to the federation	Contribution			0
90	Land taxes	ha			0
	Sous Total Additional costs (indirect costs)				**25,000**
	Total cost per ha (direct running cost +indirect costs)	Frw			1,961,229
	Yield (kg/ha)	kg			1,200
	Loan (if any)	Frw			651,700
91	Interest on loan at 19% per year in the cropping period	Frw			82,549
	Production cost of 1 kg	Frw			1,634
92	Benefit of farmer at 25%	Frw			409
	Selling price at farm gates (Production cost of 1 kg + Benefit of farmer)				**2,043**
	VIII. Marketing and selling				
93	**Carrying the harvest on market**	Wage (HJ)			0
94	**Hiring car for harvest transportation to market**	**Van**			0
	Sub-total Marketing and selling	Frw			**0**
	Additional cost up to the market	Frw			**0**
	Product cost at market (Production cost of 1 kg + Additional cost up to the market)	Frw			**1,634**
	Benefit of farmer at market at 25%	Frw			**409**
	Selling price at market level (Product cost at market + Benefit of farmer at market at 25%)	Frw			**2,043**
	Basic prices				
	Proper and logic basic price at Market	Frw			**2,043**
	Actual price on market	Frw			**300**
	Benefit/loss	Frw			**-1,743**

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APPENDICES 5. EGGPLANT PRODUCTION COST AT SCENARIO ONE

SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	I. Nursery preparation				
1	First tillage	Wage (HJ)	2	800	**1,600**
2	Second tillage	Wage (HJ)	2	800	**1,600**
3	Poudring	Wage (HJ)			**0**
4	Sowing	Wage (HJ)	2	800	**1,600**
5	Fertilizers application	Wage (HJ)	2	800	**1,600**
6	*Follow up*	Wage (HJ)	2	800	*1,600*
	Sous Total				**8,000**
	II. Land preparation				
7	First tillage	Wage (HJ)	60	800	48,000
8	Second tillage	Wage (HJ)	40	800	32,000
9	Weeds removal	Wage (HJ)	20	800	16,000
10	Hole digging	Wage (HJ)	13,333	10	133,333
11	Poudring	Wage (HJ)			0
	Sous Total				**229,333**
	III. Main activities in cropping				
12	Carrying organic fertilizer	Fuso	**2**	**20,000**	40,000
13	applying organic fertilizers in the soil	Wage (HJ)	30	800	24,000
14	Application of NPK / DAP	Wage (HJ)	8	800	6,400
15	Lime application	Wage (HJ)	60	800	48,000
16	Transportation of seedling / seeds	Wage (HJ) or FUSO	4	800	3,200
17	Transplantation and planting (sowing-Hole making)	Wage (HJ)	12	800	9,600
18	Staking	Wage (HJ)			0
19	Mulching	Wage (HJ)	4	800	3,200
20	Mulch transportation	Fuso / Wage (HJ)	24	800	19,200
21	First weeding	Wage (HJ)	24	800	19,200
22	Application of Urea (1/2)	Wage (HJ)	8	800	6,400
23	Second weeding	Wage (HJ)	24	800	19,200
24	Application of Urea (1/2)	Wage (HJ)	5	800	4,000
25	Third weeding	Wage (HJ)	12	800	9,600
26	Application of Urea ()	Wage (HJ)			0
27	Fourth weeding	Wage (HJ)	12	800	9,600
28	Linguee / Gardienage (birds, thieves)	Wage (HJ)			0
29	application of pesticides	Wage (HJ)	80	1,000	*80,000*
30	Cleaning of Irrigation channels	Wage (HJ)	200	800	160,000
31	Hygienic activities in the field	Wage (HJ)	100	800	80,000
32	*Water application/ Irrigation (Half of the time of crop cycle)*	Wage (HJ)	*60*	*1,500*	*90,000*
33	**Sous Total**				**631,600**
	IV. Season preparation / input mobilization				
	Leasing land	ha	1	100,000	**100,000**
34	Buying NPK	kg	300	655	**196,500**
35	Buying DAP	kg			**0**
36	Buying UREA	kg	100	606	**60,600**
37	Buying Lime	kg	5,000	50	**250,000**
38	Buying Rapid ferti / Polyfeed	liter	3	600	**1,800**
39	Buying Polyfeed	kg	3	3,500	**10,500**
40	Buying pots sachet	kg			**0**
41	Buying organic fertilizer	kg	30,000	28	**840,000**
42	Buying mulch	Fagot	1,850	200	**370,000**
43	Buying trees (including transport) / rops / Iron wire for staking / staking	Number			**0**
44	Buying clou for stalking / staking	kg			**0**
45	Buying irrigation equipment	SSIT Kit			**0**

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
46	Buying fuel	Liter			**0**
47	Buying sprayer pump	Number	2	15,000	**30,000**
48	Buying Fungicide Beam	kg			**0**
49	Buying Fungicide Commando	kg			**0**
50	Buying Fungicide Rhidomil	kg	50	15,000	**750,000**
51	Buying Fungicide Dithane M45	kg	50	3,500	**175,000**
52	Buying Fungicide DECOBRA	kg	20	3,500	**70,000**
53	Buying **other** fungicides (Precise)	kg			**0**
54	Buying Insecticide Cypermethrine	Liter	50	4,000	**200,000**
55	Buying Insecticide Rocket	Liter	5	12,000	**60,000**
56	Buying Insecticide DUDU	Liter			**0**
57	Buying Insecticide IMIDACROPRIDE	Liter			**0**
58	Buying **other** insecticides (Precise)	Liter			**0**
59	Buying Benlate (Guhungira)	g			**0**
60	*Buying seeds / Iseedlings*	kg	*2*	***25,000***	***50,000***
61	*Buying machete*	*pcs*	*1*	*1,000*	***1,000***
62	*Buying hoe*	*pcs*	*2*	*2,000*	***4,000***
63	*Buying pickaxe (igitiyo)*	*pcs*	*1*	*3,000*	***3,000***
64	*Buying fauche(Akayuya)*	*pcs*	*1*	*1,500*	***1,500***
65	*Buying wheelbarrow*	*pcs*	*1*	*40,000*	***40,000***
66	*Wage (HJ) in buying and follow up of needed input and tools*	Wage (HJ)	*4*	*1,000*	***4,000***
67	*Transport for buying and follow up of needed input and tools*	*Frw*	*3*	*1,600*	***5,000***
	Sous Total				**3,222,900**
	V. Farm follow up				
68	Permanent technical assistant (Transport included)	Wage (HJ)	12	5,000	*60,000*
69	Field visit (2/8 hours per day, each week in crop cycle)	Wage (HJ)	12	800	*9,600*
70	Transport to visit field (two time a month, in crop cycle)	Frw	20	1,000	*20,000*
71	Accommodation fees-Lunch when visiting field (two time a month, in crop cycle)	Frw	20	1,000	*20,000*
	Sous Total				**109,600**
	VI. Harvesting activities				
72	*Cutting/uprooting/gathering*	Wage (HJ)	*40*	*800*	*32,000*
73	*Carrying in hands*	Wage (HJ)			*0*
74	*Slashing / shelling*	Wage (HJ)			*0*
75	Buying sheeting for Slashing / shelling	pcs	2	7,000	14,000
76	*Carrying harvest from Slashing / shelling place to drying ground*	Wage (HJ)			*0*
77	*Drying*	Wage (HJ)			*0*
78	*Winnowing*	Wage (HJ)			*0*
79	Filling in Sacs / crate/ carton, and measuring	one Sac / crate/ carton	2	800	1,600
80	Guardian	Wage (HJ)			0
81	Carrying (drying ground -Stock)	Wage (HJ)			0
82	Buying Sacs / crate/ carton, and measuring	pcs			0
83	buying sacs to carry harvest to drying ground	pcs			0
84	Wire to close the sacs	pcs			0
85	Cost for loading car to the transformation unit/ Industry / on market	Kg	2	800	1,600
86	water fees (Where WUA exists)	ha	1	20,000	20,000
	Sous Total				**69,200**
	Total cost per ha (direct running cost)				**4,270,633**
	VII. Additional costs (indirect costs)				
87	Contribution to cooperative	Contribution	1	5,000	5,000

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
88	Contribution to cooperative union	Contribution			0
89	Contribution to the federation	Contribution			0
90	Land taxes	ha			0
	Sous Total Additional costs (indirect costs)				**5,000**
	Total cost per ha (direct running cost +indirect costs)	Frw			4,382,291
	Yield (kg/ha)	kg			16,000
	Loan (if any)	Frw			842,033
91	Interest on loan at 19% per year in the cropping period	Frw			106,658
	Production cost of 1 kg	Frw			274
92	Benefit of farmer at 25%	Frw			68
	Selling price at farm gates (Production cost of 1 kg + Benefit of farmer)				**342**
	VIII. Marketing and selling				
93	**Carrying the harvest on market**	Wage (HJ)	**40**	**1,000**	40,000
94	**Hiring car for harvest transportation to market**	**Van**	**20**	**20,000**	400,000
	Sub-total Marketing and selling	Frw			**440,000**
	Additional cost up to the market	Frw			**28**
	Product cost at market (Production cost of 1 kg + Additional cost up to the market)	Frw			**301**
	Benefit of farmer at market at 25%	Frw			**75**
	Selling price at market level (Product cost at market + Benefit of farmer at market at 25%)	Frw			**377**
	Basic prices				
	Proper and logic basic price at Market	Frw			**377**
	Actual price on market	Frw			**200**
	Benefit/loss	Frw			**-177**

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APPENDICES 6. MAIZE PRODUCTION COST AT SCENARIO ONE

SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	I. Nursery preparation				
1	First tillage	Wage (HJ)			**0**
2	Second tillage	Wage (HJ)			**0**
3	Poudring	Wage (HJ)			**0**
4	Sowing	Wage (HJ)			**0**
5	Fertilizers application	Wage (HJ)			**0**
6	*Follow up*	Wage (HJ)			*0*
	Sous Total				**0**
	II. Land preparation				
7	First tillage	Wage (HJ)	60	800	48,000
8	Second tillage	Wage (HJ)	40	800	32,000
9	Weeds removal	Wage (HJ)	20	800	16,000
10	Hole digging	Wage (HJ)			0
11	Poudring	Wage (HJ)			0
	Sous Total				**96,000**
	III. Main activities in cropping				
12	Carrying organic fertilizer	Fuso	**1**	**20,000**	20,000
13	applying organic fertilizers in the soil	Wage (HJ)	30	800	24,000
14	Application of NPK / DAP	Wage (HJ)	2	800	1,600
15	Lime application	Wage (HJ)	60	800	48,000
16	Transportation of seedling / seeds	Wage (HJ) or FUSO			0
17	Transplantation and planting (sowing-Hole making)	Wage (HJ)	50	800	40,000
18	Staking	Wage (HJ)			0
19	Mulching	Wage (HJ)			0
20	Mulch transportation	Fuso / Wage (HJ)			0
21	First weeding	Wage (HJ)	50	800	40,000
22	Application of Urea (1/2)	Wage (HJ)	2	800	1,600
23	Second weeding	Wage (HJ)	50	800	40,000
24	Application of Urea (1/2)	Wage (HJ)	2	800	1,600
25	Third weeding	Wage (HJ)			0
26	Application of Urea ()	Wage (HJ)			0
27	Fourth weeding	Wage (HJ)			0
28	Linguee / Gardienage (birds, thieves)	Wage (HJ)			0
29	application of pesticides	Wage (HJ)	*3*	800	*2,400*
30	Cleaning of Irrigation channels	Wage (HJ)	23	800	18,400
31	Hygienic activities in the field	Wage (HJ)	5	800	4,000
32	*Water application/ Irrigation (Half of the time of crop cycle)*	Wage (HJ)	*24*	800	*19,200*
33	**Sous Total**				**260,800**
	IV. Season preparation / input mobilization				
	Leasing land	ha	1	100,000	**100,000**
34	Buying NPK	kg			**0**
35	Buying DAP	kg	200	737	**147,400**
36	Buying UREA	kg			**0**
37	Buying Lime	kg	5,000	50	**250,000**
38	Buying Rapid ferti / Polyfeed	liter			**0**
39	Buying Polyfeed	kg			**0**
40	Buying pots sachet	kg			**0**
41	Buying organic fertilizer	kg	30,000	30	**900,000**
42	Buying mulch	Fagot			**0**
43	Buying trees (including transport) / rops / Iron wire for staking / staking	Number			**0**
44	Buying clou for stalking / staking	kg			**0**

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
45	Buying irrigation equipment	SSIT Kit			**0**
46	Buying fuel	Liter			**0**
47	Buying sprayer pump	Number	1	15,000	**15,000**
48	Buying Fungicide Beam	kg	3	15,000	**37,500**
49	Buying Fungicide Commando	kg			**0**
50	Buying Fungicide Rhidomil	kg			**0**
51	Buying Fungicide Dithane M45	kg			**0**
52	Buying Fungicide DECOBRA	kg			**0**
53	Buying **other** fungicides (Precise)	kg			**0**
54	Buying Insecticide Cypermethrine	Liter	3	5,000	**12,500**
55	Buying Insecticide Rocket	Liter	5	12,000	**60,000**
56	Buying Insecticide DUDU	Liter			**0**
57	Buying Insecticide IMIDACROPRIDE	Liter			**0**
58	Buying **other** insecticides (Precise)	Liter			**0**
59	Buying Benlate (Guhungira)	kg	60	17	**1,020**
60	*Buying seeds / Iseedlings*	kg	*30*	***2,304***	***69,120***
61	*Buying machete*	*pcs*			***0***
62	*Buying hoe*	*pcs*			***0***
63	*Buying pickaxe (igitiyo)*	*pcs*			***0***
64	*Buying fauche(Akayuya)*	*pcs*			***0***
65	*Buying wheelbarrow*	*pcs*	*1*	*40,000*	***40,000***
66	*Wage (HJ) in buying and follow up of needed input and tools*	Wage (HJ)			***0***
67	*Transport for buying and follow up of needed input and tools*	*Frw*			***5,000***
	Sous Total				**1,637,540**
	V. Farm follow up				
68	Permanent technical assistant (Transport included)	Wage (HJ)	3	5,000	*15,000*
69	Field visit (2/8 hours per day, each week in crop cycle)	Wage (HJ)	6	800	*4,800*
70	Transport to visit field (two time a month, in crop cycle)	Frw	12	3,000	*36,000*
71	Accommodation fees-Lunch when visiting field (two time a month, in crop cycle)	Frw	12	2,000	*24,000*
	Sous Total				**79,800**
	VI. Harvesting activities				
72	*Cutting/uprooting/gathering*	Wage (HJ)	*20*	800	*16,000*
73	*Carrying in hands*	Wage (HJ)	*8*	800	*6,400*
74	*Slashing / shelling*	Wage (HJ)	*50*	800	*40,000*
75	Buying sheeting for Slashing / shelling	pcs	4	10,000	40,000
76	*Carrying harvest from Slashing / shelling place to drying ground*	Wage (HJ)	*13*	800	*10,400*
77	*Drying*	Wage (HJ)	*10*	800	*8,000*
78	*Winnowing*	Wage (HJ)	*17*	800	*13,600*
79	Filling in Sacs / crate/ carton, and measuring	one Sac / crate/ carton	25	200	5,000
80	Guardian	Wage (HJ)	10	800	8,000
81	Carrying (drying ground -Stock)	Wage (HJ)	10	800	8,000
82	Buying Sacs / crate/ carton, and measuring	pcs	50	260	13,000
83	buying sacs to carry harvest to drying ground	pcs	34	260	8,840
84	Wire to close the sacs	pcs	1	900	900
85	Cost for loading car to the transformation unit/ Industry / on market	Kg	5,000	2	10,000
86	water fees (Where WUA exists)	ha	1	20,000	20,000
	Sous Total				**208,140**
	Total cost per ha (direct running cost)				**2,282,280**
	VII. Additional costs (indirect costs)				

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
87	Contribution to cooperative	Contribution	1	5,000	5,000
88	Contribution to cooperative union	Contribution			0
89	Contribution to the federation	Contribution			0
90	Land taxes	ha			0
	Sous Total Additional costs (indirect costs)				**5,000**
	Total cost per ha (direct running cost +indirect costs)	Frw			2,365,991
	Yield (kg/ha)	kg			5,000
	Loan (if any)	Frw			621,400
91	Interest on loan at 19% per year in the cropping period	Frw			78,711
	Production cost of 1 kg	Frw			473
92	Benefit of farmer at 25%	Frw			118
	Selling price at farm gates (Production cost of 1 kg + Benefit of farmer)				**591**
	VIII. Marketing and selling				
93	**Carrying the harvest on market**	Wage (HJ)	**40**	800	32,000
94	**Hiring car for harvest transportation to market**	**Van**	**20**	**20,000**	400,000
	Sub-total Marketing and selling	Frw			**432,000**
	Additional cost up to the market	Frw			**86**
	Product cost at market (Production cost of 1 kg + Additional cost up to the market)	Frw			**560**
	Benefit of farmer at market at 25%	Frw			**140**
	Selling price at market level (Product cost at market + Benefit of farmer at market at 25%)	Frw			**699**
	Basic prices				
	Proper and logic basic price at Market	Frw			**699**
	Actual price on market	Frw			**150**
	Benefit/loss	Frw			**-549**

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APPENDICES 7. IRISH POTATO PRODUCTION COST AT SCENARIO ONE

SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	I. Nursery preparation				
1	First tillage	Wage (HJ)	2	800	**1,600**
2	Second tillage	Wage (HJ)	2	800	**1,600**
3	Poudring	Wage (HJ)			**0**
4	Sowing	Wage (HJ)	2	800	**1,600**
5	Fertilizers application	Wage (HJ)	2	800	**1,600**
6	*Follow up*	Wage (HJ)	2	800	*1,600*
	Sous Total				**8,000**
	II. Land preparation				
7	First tillage	Wage (HJ)	60	800	48,000
8	Second tillage	Wage (HJ)	40	800	32,000
9	Weeds removal	Wage (HJ)	20	800	16,000
10	Hole digging	Wage (HJ)			0
11	Poudring	Wage (HJ)			0
	Sous Total				**96,000**
	III. Main activities in cropping				
12	Carrying organic fertilizer	Fuso	**2**	**20,000**	40,000
13	applying organic fertilizers in the soil	Wage (HJ)	30	800	24,000
14	Application of NPK / DAP	Wage (HJ)	8	800	6,400
15	Lime application	Wage (HJ)	60	800	48,000
16	Transportation of seedling / seeds	Wage (HJ) or FUSO	4	800	3,200
17	Transplantation and planting (sowing-Hole making)	Wage (HJ)	12	800	9,600
18	Staking	Wage (HJ)			0
19	Mulching	Wage (HJ)			0
20	Mulch transportation	Fuso / Wage (HJ)			0
21	First weeding	Wage (HJ)	24	800	19,200
22	Application of Urea (1/2)	Wage (HJ)	8	800	6,400
23	Second weeding	Wage (HJ)	24	800	19,200
24	Application of Urea (1/2)	Wage (HJ)	5	800	4,000
25	Third weeding	Wage (HJ)	12	800	9,600
26	Application of Urea ()	Wage (HJ)			0
27	Fourth weeding	Wage (HJ)	12	800	9,600
28	Linguee / Gardienage (birds, thieves)	Wage (HJ)			0
29	application of pesticides	Wage (HJ)	80	1,000	*80,000*
30	Cleaning of Irrigation channels	Wage (HJ)	200	800	160,000
31	Hygienic activities in the field	Wage (HJ)	100	800	80,000
32	*Water application/ Irrigation (Half of the time of crop cycle)*	Wage (HJ)	*60*	*1,500*	*90,000*
33	**Sous Total**				**609,200**
	IV. Season preparation / input mobilization				
	Leasing land	ha	1	100,000	**100,000**
34	Buying NPK	kg	300	655	**196,500**
35	Buying DAP	kg			**0**
36	Buying UREA	kg			**0**
37	Buying Lime	kg	5,000	50	**250,000**
38	Buying Rapid ferti / Polyfeed	liter	3	600	**1,800**
39	Buying Polyfeed	kg	3	3,500	**10,500**
40	Buying pots sachet	kg			**0**
41	Buying organic fertilizer	kg	20,000	28	**560,000**
42	Buying mulch	Fagot			**0**
43	Buying trees (including transport) / rops / Iron wire for staking / staking	Number			**0**
44	Buying clou for stalking / staking	kg			**0**
45	Buying irrigation equipment	SSIT Kit			**0**

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
46	Buying fuel	Liter			**0**
47	Buying sprayer pump	Number	2	15,000	**30,000**
48	Buying Fungicide Beam	kg			**0**
49	Buying Fungicide Commando	kg			**0**
50	Buying Fungicide Rhidomil	kg	50	15,000	**750,000**
51	Buying Fungicide Dithane M45	kg	50	3,500	**175,000**
52	Buying Fungicide DECOBRA	kg	20	3,500	**70,000**
53	Buying **other** fungicides (Precise)	kg			**0**
54	Buying Insecticide Cypermethrine	Liter	50	4,000	**200,000**
55	Buying Insecticide Rocket	Liter	5	12,000	**60,000**
56	Buying Insecticide DUDU	Liter			**0**
57	Buying Insecticide IMIDACROPRIDE	Liter			**0**
58	Buying **other** insecticides (Precise)	Liter			**0**
59	Buying Benlate (Guhungira)	g			**0**
60	*Buying seeds / Iseedlings*	kg	*3,000*	***300***	***900,000***
61	*Buying machete*	*pcs*	*1*	*1,000*	***1,000***
62	*Buying hoe*	*pcs*	*2*	*2,000*	***4,000***
63	*Buying pickaxe (igitiyo)*	*pcs*	*1*	*3,000*	***3,000***
64	*Buying fauche(Akayuya)*	*pcs*	*1*	*1,500*	***1,500***
65	*Buying wheelbarrow*	*pcs*	*1*	*40,000*	***40,000***
66	*Wage (HJ) in buying and follow up of needed input and tools*	Wage (HJ)	*4*	*1,000*	***4,000***
67	*Transport for buying and follow up of needed input and tools*	*Frw*	*3*	*1,600*	***5,000***
	Sous Total				**3,362,300**
	V. Farm follow up				
68	Permanent technical assistant (Transport included)	Wage (HJ)	12	5,000	*60,000*
69	Field visit (2/8 hours per day, each week in crop cycle)	Wage (HJ)	12	800	*9,600*
70	Transport to visit field (two time a month, in crop cycle)	Frw	20	1,000	*20,000*
71	Accommodation fees-Lunch when visiting field (two time a month, in crop cycle)	Frw	20	1,000	*20,000*
	Sous Total				**109,600**
	VI. Harvesting activities				
72	*Cutting/uprooting/gathering*	Wage (HJ)	*40*	*800*	*32,000*
73	*Carrying in hands*	Wage (HJ)			*0*
74	*Slashing / shelling*	Wage (HJ)			*0*
75	Buying sheeting for Slashing / shelling	pcs	2	7,000	14,000
76	*Carrying harvest from Slashing / shelling place to drying ground*	Wage (HJ)			*0*
77	*Drying*	Wage (HJ)			*0*
78	*Winnowing*	Wage (HJ)			*0*
79	Filling in Sacs / crate/ carton, and measuring	one Sac / crate/ carton	2	800	1,600
80	Guardian	Wage (HJ)			0
81	Carrying (drying ground -Stock)	Wage (HJ)			0
82	Buying Sacs / crate/ carton, and measuring	pcs			0
83	buying sacs to carry harvest to drying ground	pcs			0
84	Wire to close the sacs	pcs			0
85	Cost for loading car to the transformation unit/ Industry / on market	Kg	2	800	1,600
86	water fees (Where WUA exists)	ha	1	20,000	20,000
	Sous Total				**69,200**
	Total cost per ha (direct running cost)				**4,254,300**
	VII. Additional costs (indirect costs)				
87	Contribution to cooperative	Contribution	5	5,000	25,000

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
88	Contribution to cooperative union	Contribution			0
89	Contribution to the federation	Contribution	1	5,000	5,000
90	Land taxes	ha			0
	Sous Total Additional costs (indirect costs)				**30,000**
	Total cost per ha (direct running cost +indirect costs)	Frw			4,366,393
	Yield (kg/ha)	kg			25,000
	Loan (if any)	Frw			648,100
91	Interest on loan at 19% per year in the cropping period	Frw			82,093
	Production cost of 1 kg	Frw			175
92	Benefit of farmer at 25%	Frw			44
	Selling price at farm gates (Production cost of 1 kg + Benefit of farmer)				**218**
	VIII. Marketing and selling				
93	**Carrying the harvest on market**	Wage (HJ)	**40**	**1,000**	40,000
94	**Hiring car for harvest transportation to market**	**Van**	**20**	**20,000**	400,000
	Sub-total Marketing and selling	Frw			**440,000**
	Additional cost up to the market	Frw			**18**
	Product cost at market (Production cost of 1 kg + Additional cost up to the market)	Frw			**192**
	Benefit of farmer at market at 25%	Frw			**48**
	Selling price at market level (Product cost at market + Benefit of farmer at market at 25%)	Frw			**240**
	Basic prices				
	Proper and logic basic price at Market	Frw			**240**
	Actual price on market	Frw			**200**
	Benefit/loss	Frw			**-40**

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APPENDICES 8. FORMAT FOR PRODUCTION COST RECORDS AND ANALYSIS

	Calculation of '*Production cost*' in Agriculture				
	Cropping season: …….				
	District: ……				
	Cooperative (if any):……..				
	Crop and variety: Irish potato				
	Area: …. ha				
	Farm owner names: ……..				
	Telefone: 07…				

SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
	I. Nursery preparation				
1	First tillage	Wage (HJ)			
2	Second tillage	Wage (HJ)			
3	Poudring	Wage (HJ)			
4	Sowing	Wage (HJ)			
5	Fertilizers application	Wage (HJ)			
6	*Follow up*	Wage (HJ)			
	Sous Total				
	II. Land preparation				
7	First tillage	Wage (HJ)			
8	Second tillage	Wage (HJ)			
9	Weeds removal	Wage (HJ)			
10	Hole digging	Wage (HJ)			
11	Poudring	Wage (HJ)			
	Sous Total				
	III. Main activities in cropping				
12	Carrying organic fertilizer	Fuso			
13	applying organic fertilizers in the soil	Wage (HJ)			
14	Application of NPK / DAP	Wage (HJ)			
15	Lime application	Wage (HJ)			
16	Transportation of seedling / seeds	Wage (HJ) or FUSO			
17	Transplantation and planting (sowing-Hole making)	Wage (HJ)			
18	Staking	Wage (HJ)			
19	Mulching	Wage (HJ)			
20	Mulch transportation	Fuso / Wage (HJ)			
21	First weeding	Wage (HJ)			
22	Application of Urea (1/2)	Wage (HJ)			
23	Second weeding	Wage (HJ)			
24	Application of Urea (1/2)	Wage (HJ)			
25	Third weeding	Wage (HJ)			
26	Application of Urea ()	Wage (HJ)			
27	Fourth weeding	Wage (HJ)			
28	Linguee / Gardienage (birds, thieves)	Wage (HJ)			
29	application of pesticides	Wage (HJ)			
30	Cleaning of Irrigation channels	Wage (HJ)			
31	Hygienic activities in the field	Wage (HJ)			
32	*Water application/ Irrigation (Half of the time of crop cycle)*	Wage (HJ)			
33	**Sous Total**				
	IV. Season preparation / input mobilization				
	Leasing land	ha			
34	Buying NPK	kg			
35	Buying DAP	kg			
36	Buying UREA	kg			
37	Buying Lime	kg			

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
38	Buying Rapid ferti / Polyfeed	liter			
39	Buying Polyfeed	kg			
40	Buying pots sachet	kg			
41	Buying organic fertilizer	kg			
42	Buying mulch	Fagot			
43	Buying trees (including transport) / rops / Iron wire for staking / staking	Number			
44	Buying clou for stalking / staking	kg			
45	Buying irrigation equipment	SSIT Kit			
46	Buying fuel	Liter			
47	Buying sprayer pump	Number			
48	Buying Fungicide Beam	kg			
49	Buying Fungicide Commando	kg			
50	Buying Fungicide Rhidomil	kg			
51	Buying Fungicide Dithane M45	kg			
52	Buying Fungicide DECOBRA	kg			
53	Buying **other** fungicides (Precise)	kg			
54	Buying Insecticide Cypermethrine	Liter			
55	Buying Insecticide Rocket	Liter			
56	Buying Insecticide DUDU	Liter			
57	Buying Insecticide IMIDACROPRIDE	Liter			
58	Buying **other** insecticides (Precise)	Liter			
59	Buying Benlate (Guhungira)	g			
60	*Buying seeds / Iseedlings*	kg			
61	*Buying machete*	*pcs*			
62	*Buying hoe*	*pcs*			
63	*Buying pickaxe (igitiyo)*	*pcs*			
64	*Buying fauche(Akayuya)*	*pcs*			
65	*Buying wheelbarrow*	*pcs*			
66	*Wage (HJ) in buying and follow up of needed input and tools*	Wage (HJ)			
67	*Transport for buying and follow up of needed input and tools*	*Frw*			
	Sous Total				
	V. Farm follow up				
68	Permanent technical assistant (Transport included)	Wage (HJ)			
69	Field visit (2/8 hours per day, each week in crop cycle)	Wage (HJ)			
70	Transport to visit field (two time a month, in crop cycle)	Frw			
71	Accommodation fees-Lunch when visiting field (two time a month, in crop cycle)	Frw			
	Sous Total				
	VI. Harvesting activities				
72	*Cutting/uprooting/gathering*	Wage (HJ)			
73	*Carrying in hands*	Wage (HJ)			
74	*Slashing / shelling*	Wage (HJ)			
75	Buying sheeting for Slashing / shelling	pcs			
76	*Carrying harvest from Slashing / shelling place to drying ground*	Wage (HJ)			
77	*Drying*	Wage (HJ)			
78	*Winnowing*	Wage (HJ)			
79	Filling in Sacs / crate/ carton, and measuring	one Sac / crate/ carton			
80	Guardian	Wage (HJ)			
81	Carrying (drying ground -Stock)	Wage (HJ)			
82	Buying Sacs / crate/ carton, and measuring	pcs			

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SN	Activities	Unit of measurement	Quantity	Cost of one unit (Frw)	Total Cost (Frw)
83	buying sacs to carry harvest to drying ground	pcs			
84	Wire to close the sacs	pcs			
85	Cost for loading car to the transformation unit/ Industry / on market	Kg			
86	water fees (Where WUA exists)	ha			
	Sous Total				
	Total cost per ha (direct running cost)				
	VII. Additional costs (indirect costs)				
87	Contribution to cooperative	Contribution			
88	Contribution to cooperative union	Contribution			
89	Contribution to the federation	Contribution			
90	Land taxes	ha			
	Sous Total Additional costs (indirect costs)				
	Total cost per ha (direct running cost +indirect costs)	Frw			
	Yield (kg/ha)	kg			
	Loan (if any)	Frw			
91	Interest on loan at 19% per year in the cropping period	Frw			
	Production cost of 1 kg	Frw			
92	Benefit of farmer at 25%	Frw			
	Selling price at farm gates (Production cost of 1 kg + Benefit of farmer)				
	VIII. Marketing and selling				
93	**Carrying the harvest on market**	Wage (HJ)			
94	**Hiring car for harvest transportation to market**	**Van**			
	Sub-total Marketing and selling	Frw			
	Additional cost up to the market	Frw			
	Product cost at market (Production cost of 1 kg + Additional cost up to the market)	Frw			
	Benefit of farmer at market at 25%	Frw			
	Selling price at market level (Product cost at market + Benefit of farmer at market at 25%)	Frw			
	Basic prices				
	Proper and logic basic price at Market	Frw			
	Actual price on market	Frw			
	Benefit/loss	Frw			

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APPENDICES 9. AGRICULTURE CALENDAR FOR 3 SEASONS

Activity		MONTHS OF YEAR																							
		August		September		October		November		December		January		February		March		April		May		June		July		August	
		15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30	15	30
												Season B - Typical for bean															
		Season A - Typical for maize																		Season C - Typical for Vegetatbles							
Land preparation	First tillage																										
	Second tillage																										
	OM& DAP																										
Sowing / Transplantation																											
Pests and diseases management																											
1st Weeding																											
Urea application																											
2nd Weeding																											
Harvesting																											
Marketing and selling																											

OM& DAP: Organic matter and DAP application