

**IMPROVEMENT OF COMMERCIAL MAIZE PRODUCTION FOR  
SUSTAINABLE ECONOMIC DEVELOPMENT OF FARMERS IN RUKOMA  
VILLAGE NGOMA DISTRICT, RWANDA**

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE  
REQUIREMENTS FOR THE DEGREE OF MASTER IN COMMUNITY  
ECONOMIC DEVELOPMENT OF THE OPEN UNIVERSITY OF  
TANZANIA**

**2017**

**CERTIFICATION**

The undersigned, certifies that I have read and hereby recommend for the acceptance by The Open University of Tanzania a project entitled, Improvement of Commercial Maize Production for Sustainable Economic Development of Farmers in Rukoma Village Ngoma District, Rwanda, in partial fulfillment of the requirements for the degree of Master of Community Economic Development of the Open University of Tanzania.

.....  
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.....  
Date

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.....  
Signature

.....  
Date

## **DEDICATION**

I graciously dedicate this work, first to the Lord God Almighty for His ever care and help, my husband UWIZEYE Fidele; my children MANZI Tristan Arsene, ICYEZA Laura Anaella, ICYEZA Laurie Grey and ISHEMA Laure Gretta for the love and tolerance they showed me throughout my tight-schedule of time of studies.

## **ACKNOWLEDGEMENT**

First and foremost, I give my supreme gratitude to the Almighty GOD whose role in giving me my life, parents and friends; also in sustaining my joy, keeping peace and providing me success cannot be measured or evaluated. My Special thanks go to few people, namely: my supervisor Professor Deus D. Ngaruko to whom I am indebted for having devoted his precious time to the supervision of this research, by carefully reading through the work from its scratch and by giving expertise guidance, advice and encouragement throughout the process.

I must also thank my immediate District Team and the Mayor of Ngoma District. I would also like to thank members of the District Council Management Team, my entire colleagues in Community Development Department, various extension staff, who always encouraged me to be devoted to success. I wish to extend special appreciation to my lecturers and MCED staff (2014), fellow MCED students for their constructive help and my husband UWIZEYE Fidele; my children MANZI Tristan Arsene, ICYEZA Laura Anaella, ICYEZA Laurie Grey and ISHEMA Laure Gretta, encouragements and criticisms in the course of preparing this work.

Many thanks are also due to Vice Principal Administration and Finance Mr. HABIMANA Kizito for her assistance and encouragement she accorded me in the course of this study.

## **ABSTRACT**

The purpose of this study was to determine the nature of intervention that can comprehensively enhance the economic situation of the farmers of Rukoma through commercial maize production. An opportunity that seems more of an untapped. Triangulation design was employed in this study because it measures the perception of farmers regarding their economic status, availability of resources for maize commercial production; and the availability of the market. Therefore, key informants incorporated ordinary people in the community: village, cell, sector and district officials as well as professionals from various institutions. In order to understand the real phenomena, self-administered questionnaires were used to measure people's economic status and the establishing of the new project under their supervision. The Community Need Assessment revealed that income poverty, was core problem caused by multifactor such concentration on growing of food crops that fetch very little to sustain a family, unreliable market, underutilization of land, lack of entrepreneurial skills, and lack of knowledge on agricultural skills. It was also revealed that agriculture was the community's major economic activity and commercial maize production was the priority crop that had untapped potential that would improve the social economic of the rural farmers. Using a participatory method, the farmers were trained on in agricultural skills on how to grow maize including study tours, processing of maize flour and marketing, Results from the present study showed that maize output increased from 1000 Kgs to 1500 Kgs per acre in the first season and it was projected to increase up to 1800 Kgs in the next season.as well as an increase of maize grain sales and access services and support for project implementation. Based on the project goal, objectives and activities planned have been met with exception of mid and annual evaluation that will be done after six months of project implementation. The present finding suggest that improved maize production, processing and marketing may serve as a sustainable way of improving economy and livelihood of farmers in the present study area.

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## LIST OF ABBREVIATIONS

BRALIRWA	Brasserie et Limonade rie du Rwanda
CBO	Community Based Organization
CED	Community Economic Development
CAN	Community Needs Assessment
DIMBOA	2,4-dihydroxy-7-methoxy-1,4-benzoxazin-3-one
EDPRS	Economic Development and Poverty Reduction Strategy
EICV	Enquête Intégrale sur les Conditions de Vie des ménages (Households Living Conditions Survey)
FAO	Food Agriculture Organization
GDP	Gross Domestic Product
GMO	Genetic Modified Organism
IMF	Institution de Micro-Finance
MINAGRI	Ministry of Agriculture
MIS	Monitoring Information System
NAP	National Agriculture Policy
NGOMIG	Ngoma Maize Investment Group Ltd.
NISR	National Institute Statistics of Rwanda
PNA	Participatory Needs Assessment
PRA	Participatory Rural Appraisal
PSTA	Strategic Plan for Agriculture Transformation
RBS	Rwanda Bureau of Standard
RIU	Research Into Use

RWF	Rwandan Francs
SPSS	Statistic Package for Social Science
SWOT	Strength Weakness Opportunity Threats
UN	United Nation
USDA	United State Development Agency
WFP	World Food Program

## **CHAPTER ONE**

### **PARTICIPATORY NEEDS ASSESSMENT**

#### **1.1 Background Information**

Participatory Needs Assessment is an approach that involves community to identify and assess their needs. It also involves community in identifying their opportunities that can be used as an alternative in meeting the community needs. Participatory approaches such as PRA, engage people in learning about their needs, available opportunities and working out actions required to address their needs. Participatory approaches toward needs assessment challenges the conventional biases that underrate local knowledge, values and solutions. In PNA, therefore, much emphasis is put on interactive learning, shared knowledge and values.

The idea and drive to study food production and marketing with an aim to improve community economic development is based on the place corn maize consumption takes in the physical health of a person; and not many seem to realize this. The level of corn maize production in Rwanda is significantly low compared to the general demand. Most corn like rice and wheat come from Kenya and Pakistan. Interestingly, according to reports, fruit and vegetable consumption is influenced by gender, age, income, education and family origin (Dittus, Hillers, and Beerman, 1995). Other studies suggest that education may influence nutritional knowledge about fruits and vegetables and consequently also influence their intake. Empirical findings also indicate that family origin and socioeconomic status affect the purchasing power of food, food choice, food preparation and food availability which in turn affects

consumption. Interestingly, (Wyse, Campbell, Nathan, and Wolfenden, 2011), studies have shown that preferences of fruit and vegetable consumption differ in males and females (Heim, Stang, and Ireland, 2009).

## **1.2 Community Profile**

### **1.2.1 Social Economic Activities**

Rukoma villagers are engaged in agriculture although production is usually affected by early sunny weather or scanty rainfall. Most of the people 90% in this Village depend on growing of crops. It is basically substance farming. As small as 7% of the people are self-employed in various business, only 2% are employees in government and non-government institutions. The main food crops of Rukoma are: soya, sorghum, cassava, maize, and sweet potatoes. Legume crops are beans, cowpeas, and groundnuts. Horticultural crops are mainly grown by those members of the community who have land, or who can afford to hire land, in swampy areas. These crops are: green beans, eggplant, onions, carrots, tomatoes, cucumbers and cabbages.

The major cash crops of the area include: rice, beans, cassava, sorghum, maize and sweet potatoes. With growing urban areas like Kayonza, Rwamagana, Ngoma, Kigali, and others, the demand for horticultural crops specifically tomatoes, carrots, and passion fruit, is growing very fast. With increase in the demand for cash crops, especially maize crops, there is need to give these the attention that they deserve. Other business activities exist in this area; for example: selling of vegetables, second-hand clothes and doing food vendors; mining and selling of construction stones and sand are also carried out by a few. Other activities that must be mentioned for increase income by selling in the village are; cassava, sorghum, banana and

beans. Others are involved in transport activities; like doing bicycle taxi, motor-cycle taxi.

In light of Ngoma livelihood initiative Cooperative, this targeted project is located in Rukoma Village of Nyagasozi Cell, situated in Sake Sector within Ngoma District in Eastern Region of Rwanda. The Eastern Province comprises seven Districts, namely: Ngoma, Bugesera, Gatsibo, Rwamagana, Kirehe, Nyagatare and Kayonza Districts. The region, led by a Governor is headquartered in Rwamagana. This region being also the largest in Rwanda, comprises the former provinces of Kibungo and Umutara, most of Kigali Rural, and part of Byumba.

According to map of Rwanda, Ngoma borders with Rwamagana District in the North, Bugesera in the West, Kirehe in the South, Kayonza in the East. Rukoma, for its part, is situated around 70km on main road to Kibungo Town. Ngoma District covers the average area of 1,554 km<sup>2</sup>. The population ranges around 246,751 people living in 12 sectors, 50 cells and 422 Villages. On average, therefore, this gives Rukoma, our study Village a population of 464 residents.

Rukoma, like nearly every other Village of Rwanda, is homogeneous as to its people, culture, and language. Up to 51% of the people are able to work. Children population (under 18 years) comprise of 48% of the total population. The Village has 113 households with an average household size of five people. While the climate is favorable for most times during wet season, it is not all that conducive for Agricultural during dry season. The soil texture is high on sand and this encourages easy permeating of water through sand into the earth on the one hand, and easy

evaporation of the moisture, on the other. Low water retention of soil affects yields and harvest of crops.

### **1.2.2 Socio-Economic Infrastructure**

The Village of Rukoma is situated on the main-road to Kibungo to Bugesera border – being only 70 kilometers away from Kibungo Township. The place is connected to main electric power grid. Rukoma has two primary schools; one nursery school, a health center. One of the primary schools is a government school and the other private. There are 2 CBO's one of which deals with community environment and the other support people living with health and environmental issues. There is a weekly market which facilitates the buying and selling of various products and a local open market which operates twice a week Tuesday and Friday.

### **1.2.3 Social Services**

The Village, like most parts of Rwanda today, has mobile communications network. Rukoma Village is well served by cellular phone network owned by MTN, TIGO, and AIRTEL. The Internet is not accessed due to location that cannot afford antenna of network, but at any place by use of modem maybe internet can come. Transport of persons and of goods is readily available. This is so due to the fact that the Village is situated along the busy tarmac road of Sake to Bugesera where it easy to get to Kigali; and has proximity to Kibungo, Sake, Bugesera.

## **1.3 Community Needs Assessment**

Community needs assessment for Rukoma Village was conducted with the purpose of examining the level of economic situation in the society, to identify and assess

needs and challenges in connection with resources and opportunities available that can be put to use by the community itself to improve the situation. Purposely the researcher chose to conduct the assessment study by involving the community with intent to enhancing clearer detection of real needs of the people in order to make appropriate interventions to the vital impediments. The researcher carried out the assessment using appropriate use of research design and research methods in order to obtain pertinent data. The assessment was done to help plan strategies and interventions which would bring a desirable change.

Findings of the research were expected to benefit the community, in particular, and the other villages as well as local areas, for a practical model. The study was expected to rekindle fresh interest in socio-economic development contribution of maize cash crops industry among the people around Rwanda. The research is expected to offer leaders a chance to compare notes and enhance profitable income to address the economic situation of Rwandan people through policy reviews and decision making. The study was expected, also, to further assist future researchers (or students) who would be interested in doing research on related topics and references, made available in the University library. Above all, this study was carried out to serve the researcher as an important requirement in completion of her studies toward the award of a Master's Degree in Community Economic Development; and also to increase her personal knowledge and skills in working with population on matters of community development.

### **1.2.1 Research Objectives**

This research targeted information gathering and data collection with regards to causes and size of economic challenge in that community; facilitating and soliciting for community's opinion and recommendations, which would lead to appropriate decision making by the people alongside practical experiences or records appropriate for decision making process. Furthermore, the study targeted helping the people of the community acquire better skills and more knowledge on using available opportunities to take responsibility to improve their lives on their own.

#### **1.3.1.1 Overall Objective**

The overall objective of this study was to determine the nature of intervention that can comprehensively enhance the economic situation of the people of Rukoma through commercial maize production.

#### **1.3.1.2 Specific Objectives**

- (i) To describe the demographics of the maize farmers in Rukoma village by March 2015.
- (ii) To assess the nature of economic activities of the people in Rukoma Village by March 2015.
- (iii) To assess basic needs and difference potential needs that would make to resolve the economic predicaments of the people of Rukoma Village by May 2015.
- (iv) To identify the impact and challenges of marketing for maize farmers in Rukoma Village by May 2015.

### **1.3.2 Research Questions**

The research questions and the question in the questionnaire were set to fulfill the envisaged target of improving the maize farmer's income poverty reduction.

- (i) How are the locations of the Rukoma Community?
- (ii) Which are major activities productions undertaken by the community residents?
- (iii) What difference would maize crop growing and marketing make to resolve the economic predicaments of the people of Rukoma Village?
- (iv) How do the people in Rukoma Village make a living?
- (v) What is the impact of the project in relation to better life?
- (vi) What are the basic needs that are favorable in Rukoma Village?
- (vii) What kind of business do you think are potentially need and economically viable?
- (viii) What challenges do you think you may encounter in implementing the proposed project?
- (ix) What possibilities exist in adopting and establishing a sustainable income generating project of maize production and marketing in Rukoma Village?

### **1.3.3 Research Methodology**

During the selection of research method, the researcher considered the situation and conditions of subjects or respondents, time available, the quickest way to obtain data, and resources available for the study on fruit growing and marketing. Therefore, a number of research designs were chosen to calculate data obtained from data collection methods and tools developed. The research design was opted because data

from different respondents were collected at a single point in time. The methods, tools and instruments had to be systematic, valid, reliable, neutral and objective.

#### **1.3.3.1 Research Design**

The researcher opted for triangulation design in this study because the research sought to measure perception of people in Rukoma regarding their economic status, availability of resources for maize production and marketing; and the availability of the market to sell maize. Therefore, key informants were conducted with ordinary people in the community: Village, cell, sector and with district officials as well as professionals from various institutions. In order to understand the real phenomena, self-administered questionnaires were used to measure people's economic status and the establishing of the new project under their supervision. The targeted research population was 50 respondents and was drawn from Rukoma Village; and they were given questionnaires so as to get the fact information intended by the study.

#### **1.3.3.2 Sampling Technique**

The survey took place in Rukoma Village. The sample size was chosen using both probability and non-probability sampling methods. Probability sampling was used to get potential respondents for quantitative and qualitative study. A total of 50 respondents were randomly sampled from the community using simple random sampling. Out of 50 questionnaires all of the questionnaires were filled in and returned. The sample size used for quantitative data collection took into consideration of researcher's resources and possibility of making meaningful analysis of data collected. Also purposive sampling technique was used to select potential respondents who were conversant to the research topic.

### **1.3.3.3 Data Collection Methods**

Methods of data collection was used to acquire information from different levels being primary and secondary information, primary data was collected from the community through various data collection tools such as interview, observation and questionnaires. Secondary data information was delivered from different sources being District Planning Office, Community Development Officer, FBSA and Caritas Rwanda.

#### **1.3.3.3.1 Questionnaire**

Self administered structured questionnaire was distributed to the respondents with ability to write and read but also those who were unable to write were assisted by their fellow members. Both open and close ended questions were used to provide a room for some survey items to be critically analyzed; and if more information was needed, the respondents were asked to add extra information. The questionnaire helped in collecting general information about the interviewee such as age, sex, number of dependants, monthly income and level of education. Also it assisted in discovering the level of awareness and their perception towards poverty reduction process. The questionnaire purported to collect information concerning support of government and private institutions in community projects.

### **1.3.4 Data Analysis Methods**

Preparation for analysis of the current research included editing, screening, computer data entry and verification. After which quantitative data processing was carried out using Statistics Package for Social Science (SPSS) which helped the researcher prepare tables and frequency. The current study, therefore, used both qualitative and

quantitative analysis. Qualitative analysis included searching for patterns of data or events or behavior and making interpretation of meaning. After data collection, the researcher summarized data in tabular and diagrammatic forms; having analyzed facts so as to bring out their salient features, that is, patterns and relations; and converted the data into statements and conclusions which ultimately answered research objectives.

## **1.4 CNA Findings**

The findings from the community needs assessment (CNA) in Rukoma Village are presented below based on the method and type of data collection. Through the questionnaire the researcher was able to get information on personal particulars as well as general views on various issues regarding the community economic development. Also from the structured questionnaire with various stakeholders the researcher had an opportunity to get additional information which helped to enlarge the researcher's knowledge.

### **1.4.1 Demographic of Respondents Maize Farmers**

#### **1.4.1.1 Sex and Age of Respondents**

**Table 1: Sex Respondents**

<b>Respondents</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Male	28	56.0	56.0
Female	22	44.0	44.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

Table 1 shows the respondents (maize farmers) by sex. With an aim of getting information from both male and female, the researcher managed to get the desired response from the community. Out of fifty respondents, twenty eight were male which gives 56% and twenty two were female which gives 44%. In terms of age, most of the respondents were of the active age; as table below shows, the majority of the respondents ranged between 30 – 40 years old of age, their total number are twenty six which gives a 52%, followed by the range between 41 and 51 for the number of sixteen which gives 32%.

**Table 2: Age of Respondents**

<b>Respondents</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Between 19 and 29	8	16.0	16.0
Between 30 and 40	26	52.0	52.0
Between 41 and 51	16	32.0	32.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

#### **1.4.1.2 Education of Respondent**

**Table 3: Level of Education**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Adult education	13	26.0	26.0
Primary	17	34.0	34.0
Secondary	20	40.0	40.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

As regards educational level of the respondents as table above indicates that 40% of respondents had secondary education; 34% of respondents had primary education and 26% managed to have adult education. This tells that in the process of soliciting for information from community members or sensitizing them, the researcher ought to look for options to ensure respondents (maize farmers) who are unable to read or write get fully involved during the presentation or discussion.

#### 1.4.1.3 Occupation of Respondents

**Table 4: Occupation of Respondents**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Market vendor	13	26.0	26.0
Food crop grower	12	24.0	24.0
School teacher	3	6.0	6.0
Government employee	1	2.0	2.0
Taylor	2	4.0	4.0
Cultural artist	8	16.0	16.0
Construction worker	9	18.0	18.0
Other	2	4.0	4.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

Table 4 shows occupations of the respondents; in which the majority of the respondents is shown as market vendors and takes 26%, food crop grower takes a population indicated as 24%. Construction worker takes an activity vote of 18%.

Culture artiste takes 16%; school teacher takes 6%, while other activities together with tailor takes 4% government employee scored 6.7%. Since the Village is in the immediate neighborhood of Sake small township; and since the Village has a mixture of farmers, maize growers, business people, employees and other different activities, doing business becomes all the more beneficial. Furthermore, farmers of agricultural cash crops are faced with a problem of reliable market whereby many of them engage in petty business in order to supplement their income.

#### 1.4.1.4 Monthly Income of Maize Farmers

**Table 5: Monthly income**

<b>Respondents</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Below 80,000 Rwf	27	54.0	54.0
Between 81,000 and 160,000 Rwf	23	46.0	46.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

Table 5 shows that majority of 54% of the respondents make below 80,000 Rwf. With pressure of school fees, food, medical, taxes, and basic needs like accommodation, water, clothing, and travels, this indicates that almost 54% of the people face abject poverty. Those earning between 81,000 and 160,000 Rwf per month are business people and private sector employees, since those who are engaged in agriculture production are affected by frequent droughts and unreliable market. However fruit growers in focus group discussion revealed that the average yield from maize production is 75,000 Rwf.

## 1.4.2 Basic Need of Respondents Maize Farmers

### 1.4.2.1 Basic Need of Food

**Table 6: Basic Food Need**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Very Adequate	19	38.0	38.0
Adequate	30	60.0	60.0
Not Adequate	1	2.0	2.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

Table 6 shows that most basic human needs are not met by majority of Rukoma community. Only 38% of respondents stated that food-wise they are very adequately able to meet food requirements let alone getting nutritious food. For those engaged in agricultural activities, drought becomes the major constraints that greatly contribute to low production and for those who are employed in government and private sector they get low income, of which they cannot afford to meet food requirements and other family needs.

### 1.4.2.2 Basic Quality House Needs

**Table 7: Quality House Needs**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Very adequate	13	26.0	26.0
Adequate	25	50.0	50.0
Not Adequate	12	24.0	24.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

Table 7 shows that quality housing needs are not met by majority of maize farmers in Rukoma village. Only 26% of respondents stated that their accommodation needs are very adequately able to meet quality housing standards. Majority situation is in the reverse, as 24% said their housing situation is not adequate as to quality housing estimate. Again, for those engaged in construction activities, their pay is very small; and becomes the major constraints that greatly contribute to poor housing status. Same is true of those engaged in government, tailoring, food vendor activities, and such related activities.

#### 1.4.2.3 Basic Needs Security

**Table 8: Basic Security Needs**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Very Adequate	14	28.0	28.0
Adequate	30	60.0	60.0
Not Adequate	6	12.0	12.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

Table 8 indicates that security needs are met by majority of Rukoma community. A whole lot of 60% of respondents stated that their security needs are adequately met. Minority of only 12% said their security situation is Very adequate. Again, for those engaged in government activities, these are the people who have higher rating in security level. However, their pay is very small; and this becomes their major constraints that greatly contribute to some lack of adequate security. In all, the respondents indicated that the Village has adequate security, the situation is very

encouraging; hence, they live in peace as their investments are highly secured compared to years before when the people lived with social animosities and political instability. Generally, findings on table of basic needs show that the community is faced with both income and non-income poverty. Major basic needs were not met especially food and quality housing. One of the possible ways to solve non-income poverty is to address the problems of income poverty through sustainable and viable income generating activities.

#### 1.4.3 Findings on Economic Activities Undertaken in the Community

**Table 9: Economic Activities**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Fruit Selling	6	12.0	12.0
Second hand cloth selling	2	4.0	4.0
Government employees	1	2.0	2.0
Construction work	5	10.0	10.0
Crops growing/selling	10	20.0	20.0
Maize crops selling	16	32.0	32.0
Cultural art work	7	14.0	14.0
Fish farming	3	6.0	6.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

Having known that the community is faced with considerable signs of poverty, researcher took initiative to understand economic activities undertaken by the community. As table above indicates, eight activities were identified as common

economic activities. Venturing in crops growing/selling and maize production selling were seen as an activity with high rank 10% and 16% respectively followed by cultural art work with 7%; fruit selling with 6% which looked at interdependently. Individual members and groups especially women groups are engaged in both agricultural and horticultural activities. They are growing various types of crops; ranging from maize, sweet potatoes, cassava, beans, and bananas on the hills; to tomatoes, carrots, green vegetables, cucumbers and passion fruit along the rivers or swamps.

Also shop/market vendor and cultural arts are done. A good number of the people of the community residents are keeping indigenous chicken. Although these may be of more highly paying comparing to layers and broilers, the number of chickens one keeps is always low. Petty business that includes selling of vegetables, second hand clothes, and raw foods and are economic activities that depend on daily substance.

#### **1.4.4 Findings on Potential Needs of Maize Farmers**

Through the structured questionnaires the researcher requested the respondents to identify the potential needs that are sustainable economic activity project they think could improve their economic status. During this closed question exercise the respondents were very active in analyzing basing on capital investment, availability of raw materials (inputs), knowledge and experience and availability/reliability of market. From this exercise the researcher came to learn what is supposed to be considered when planning the project. The study revealed that among the activities being undertaken the maize production selling it scored high rank comparing to other activities. The Table below shows scores as per activity:

**Table 10: Potential Need for Community**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Fruit Selling	6	12.0	12.0
Second hand cloth selling	5	10.0	10.0
Crops growing/selling	5	10.0	10.0
Maize crops selling	21	42.0	42.0
Cultural art work	9	18.0	18.0
Fish farming	4	8.0	8.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

#### **1.4.5 Findings on Impact of Market for Maize Farmers in Rukoma Village**

At present, existing opportunity in the community in regard to maize production were little of it is being supplied in the local market. The demand for the crops is overwhelming. Local industries like; BRALIRWA brewery company is getting crops from as far as South Africa to maintain its out production and meet its customers' demands.

Getting crops from external market is stressful to local industries. Crops supplies to BRALIRWA alone would make a world of difference in the lives of these farmers. Availability of land is another factor. As compared to urban communities around, Rukoma area has access to land. Labour, too, being much more available in the Villages than in the towns. Community mobilization is another factor; it is far easier to mobilize community in the Villages than in towns.

#### 1.4.5.1 Impact of Maize on Increase of Individual Income

**Table 11: Impact of maize on Increase of Individual Income**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Very strongly	21	42.0	42.0
Strongly	22	44.0	44.0
Not strongly	7	14.0	14.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

The table above indicates that most of the respondents 44% considered maize crops growing and marketing could be strongly increase impact on community economic empowerment. Combining that with the votes of those who thought maize crops growing could be very strongly impact on individual income, the ratio rises to a whopping 42%. The reasons include available opportunities when compared to relatively manageable challenges given some expertise and some technical support. The researcher considers talking with such organizations like BRALIRWA crops producers, who are more than likely to come handy in supporting this vision.

#### 1.4.5.2 Impact on Decrease of Dependence

**Table 12: Impact on Decrease of Dependence**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Very strongly	16	32.0	32.0
Strongly	22	44.0	44.0
Not strongly	12	24.0	24.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

As Table 12 indicates respondents revealed that the growing and marketing of maize crops is economically viable as it is most likely to increase individual income that will allow them meet human basic needs and automatically decrease dependence on government and donor support. This will help maize farmers to know whether to progress the project or decline the project, once project is progress dependence will be decreased due to that maize farmers will have to work in community.

#### 1.4.5.3 Impact on Creation of Job Opportunities

**Table 13: Impact on Creation of Job Opportunities**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Very strongly	18	36.0	36.0
Strongly	21	42.0	42.0
Not strongly	11	22.0	22.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

As table above indicates, respondents revealed that the growing and marketing of maize crops is economically viable as it is most likely to increase the team income; and this will in effect allow group to absorb more labor in the community. Members of the group indicated that maize crops was not grown as a commercial crop and whatever plants that existed in a few farms were voluntary or seedlings that were obtained from forests from bird-dispersed seeds, and there were no yield records.

#### 1.4.6 Market Challenges in Implementation

Unreliable market as shown in table below the respondents considered as the main market challenge in implementation once it score 38%, also other market challenge in implementation of maize production of maize farmers in Rukoma village are

inadequate capital and lack of technical skills once they are scores 30% and 32% respectively as shown in table below. It was reported crop growing include long period of droughts in dry season and pests during growth.

**Table 14: Market Challenge**

<b>Responses</b>	<b>Frequency</b>	<b>Percent</b>	<b>Valid Percent</b>
Inadequate capital	15	30.0	30.0
Unreliable market	19	38.0	38.0
Lack of technical skills	16	32.0	32.0
<b>Total</b>	<b>50</b>	<b>100.0</b>	<b>100.0</b>

Lack of capital, therefore, is the major hindrance to establishment of economic businesses; so much so that production from agricultural activities, especially cash crops, has been dropped due to droughts and fall of prices of coffee and tea, for example. Loan conditions from commercial banks are stiff to an ordinary person due to lack of collateral. The study has revealed that lack of technical and entrepreneurship skills is a hindrance to many CBOs and individuals who are in economic business. Maize crops growing and marketing needs tools and equipments, storage and skillful and knowledgeable personnel for product quality control. As table above, indicates that they need support in terms training; use of chemicals; record keeping; customer care; leadership; and project management.

### **1.5 Community Needs Prioritization and Levelling of Need**

The community in Rukoma Village, through potential needs had a list of needs priorities. Through peer way, ranking the maize crops growing and marketing became the first proposed project whereas the second followed by general crops growing and selling produce sales.

**Table 15: Prioritization of Needs**

	Fruit Selling	Second hand cloth selling	Crops growing	Maize crops selling	Cultural art work	Fish farming	Score	Ranking
Fruit Selling		Fruit selling	Crops growing	Maize crops selling	Fruit selling	Fruit selling	4	3
Second hand cloth selling	Fruit selling		Crops growing	Maize crops selling	Second hand cloth selling	Second hand cloth selling	3	5
Crops growing	Fruit selling	Crops growing		Maize crops selling	Crops growing	Crops growing	4	2
Maize crops selling	Maize crops selling	Maize crops selling	Crops growing		Maize crops selling	Maize crops selling	5	1
Cultural art work	Fruit selling	Second hand cloth selling	Crops growing	Maize crops selling		Fish farming	1	6
Fish farming	Fruit selling	Fish farming	Crop growing	Maize crop selling	Fish farming		3	4

After the prioritization exercise the researcher realized that, the two activities are interdependent. This meant that establishing the reliable market maize crops growing go hand-in-hand with other actions being to increase food production through improving agricultural skills at large.

## **1.6 Conclusion**

Chapter one has dealt with participatory assessment which is an ideal and effective way of involving the community to identify their own problems, causes of the problem and existing opportunities. The findings have been useful in enabling the community to identify top ranking problem and planning for the interventions that can sustainably address the existing problem. The participatory needs assessment conducted in Rukoma Village revealed that income poverty is the major concern in the community. From this study the community members came to agree that maize crops production and marketing project would contribute to the improvement of socio-economic status. As they responded through questionnaires, experiences during the focus group discussion, in-depth interviews and general observations, the maize crops growing and market has been supported by significant stakeholders like district community development Officer, District Agricultural and Horticultural Development Officer, District Planning Officer, District Health Officer, Sector Executive Officer, Cell Executive Officer and professionals from Agricultural Training Institute of Ngoma. Thus the researcher has to make sure that the community members expectations were met, building on the existing team spirit.

## **CHAPTER TWO**

### **PROBLEM IDENTIFICATION**

#### **2.1 Background of Research Problem**

The researcher identified the socio-economic challenges of Rukoma Village, using participatory assessment; an important factor in both the identification of the problems affecting the village, as well as the process of planning the means to tackle those challenges for community's better living tomorrow. The assessment exercise, therefore, was able to help the researcher engage the community in determining major needs and problems in the community and planning the ways to handle them. On Rwanda's general national aspirations and planning records, EDPRS II (2013 – 2018): Rwanda's Economic Development and Poverty Reduction Strategy (EDPRS) provides a medium term framework for achieving the country's long term development aspirations as embodied in Rwanda Vision 2020, the six years Government of Rwanda (GoR) programme, as well as in the Millennium Development Goals. In handling agriculture, the Paper observes that the main program include intensification of sustainable production systems in crop cultivation and animal husbandry; building technical and organizational capacity of farmers; promoting commodity chains and agribusiness, and strengthening institutional framework of the sector at central and local levels.

Agricultural situation in Rwanda presents that Rwanda's agricultural sector faces a set of unique challenges. Due to the country's high population density, land is a scarce commodity, while labour is Rwanda's most abundant factor endowment. As a

result, soil fertility has deteriorated dramatically over time, while fertilizer use, both organic and inorganic, remains low. Furthermore, much of Rwanda's land is at a high risk of erosion, not least because of the need of smallholders to cultivate slopes of up to 55% and to bring land under cultivation that is not suited to this purpose. Food crops remain dominant in the agricultural sector, although farmers are beginning to shift slightly towards higher value food crops, such as fruit and vegetables, rice, sorghum, maize, groundnuts and soybeans.

The main agro-based export items are, in order: coffee, tea, hides and skins, and pyrethrum. Coffee and tea have growing international markets, but for the other export products the main markets are regional, with 68% of exports destined for Kenya and Uganda. The growth of coffee exports has been held back by fluctuating international coffee prices, but Rwandan producers are now moving into fully washed coffee including fine and specialty coffees for which they are gaining a substantial price premium. Centering on contribution of crops and vegetables, Rwanda PSTA – II (Final Report, 2009) presents that international prices for a number of vegetable crops also appear to be attractive for Rwanda, if organizational and quality issues can be surmounted (Gerhart, 1999). The paper emphasizes that expansion of agricultural exports will be critical to achieving the EDPRS II goal of sustained 7% growth in agricultural GDP. Rwanda's unique challenges, including small farm sizes and high rural poverty rates, make urgent the task.

The conducted study revealed that income poverty is a huge problem in Rukoma Village. Nearly half of the population, that is 54.0%, makes below 80,000 Rwf a month. The study has also been able to identify various contributing factors to

income poverty in the village. Major contributing factors facing crops farmers include: inadequate capital, drought, inadequate technical skills, and land degradation and fragmentation.

However, the study identified various opportunities within the community; among which were: availability of ready markets in and around Ngoma District where Rukoma Village is found. Another opportunity was FBSA and Caritas Rwanda which pledged willingness to work with Rukoma maize cooperative. The government of Rwanda expressed willingness to provide the group some technical support and did so by connecting the women to an interest group from different developed country who offered training on some aspects of maize crops production, namely: nursery establishment and production, as well as field establishment and crop management.

## **2.2 Problem Statement**

The challenge of small scale farmers is basically that of income poverty. This, to a greater extent, becomes both the driving force behind the cooperation of man and women; and also their greatest impediment. To this effect, the biting poverty causes to seek an undying way out of it; its influence ties, as it were hand from doing more in getting rid of daily challenges to their vision. The causes of income poverty are several, including: lack of technical (employable) skills, inadequate investment capital, and the situation of land fragmentation. Income poverty comes with lots of consequences in most families. It leads to inability to meet human basic needs. It may even lead to early deaths due to increase in infant mortality rate; pregnant mothers' mortality rate; as well as inability to treat opportune diseases. The rate

includes also families failing to meet human basic needs. These things, in the final analysis, lead to more poverty.

As a result, the study identifies several consequences of income poverty in Rukoma village, namely: most residents failing to fulfill basic family needs, specifically adequate food, and quality housing; meeting basic health-care, basic-sanitation, and other household needs. Most families in the village are facing other forms of non-income poverty as well, such as lack of adequate quality social services such as water, health and education, unemployment, and environmental degradation as the result of over population. This study provides link of information gaps by conducting detailed study that is meant to help to identify the viable and reliable economic activity that can be undertaken and that can contribute to sustainable economic development. In this way, the maize crop growing and marketing was itemized as specific and practical solution oriented.

### **2.3 Project Description**

The project is known as Rukoma maize crops Growing and Marketing Project for sustainable economic development of maize farmers in Rukoma Village. This project is located in Rukoma Village in the neighborhood of Ngoma, Bugesera, and Zaza Township markets in Ngoma District. This location is very ideal since it provides the produce important accesses to a huge number of people such as residents, passersby and visitors of the towns and neighboring villages. The project will be implemented by CBO known as IMPIDURAMATWARA Cooperative. The identification of this CBO was done after consultation and discussion with the key relevant stakeholders.

It is apparent that cooperative has a progressive economic base; strong, established premises; effective staff under efficient leadership team. It is a staffing that is exposed to regular training including training on entrepreneurship skills.

The chosen CBO expressed commitment to providing the member's capacity building, the farm's build-up, strengthening the cooperative leadership capacity, facilitating farm's technical consultancy and requirements thereof, soliciting for more financial channels and opportunities to enhance performance, facilitating the planning and funding of irrigation system to fight drought, and advocating for fair pricing of fruit and seedlings.

They are committed to starting the arrangements of business by March 2015; and project takes off by May 2015. Agricultural Training Institute of Bugesera has offered to support the Cooperative with as much technical advice as can be possible. Being the stakeholder that Agricultural Training Institute is the institute promised to support the CBO with what tools/equipment could be necessary.

### **2.3.1 Target Community**

The target community of this project is maize crops growers in Rukoma Village. The study has revealed that for the project to succeed and grow, maize crop growers have to improve the following: their individual farm skills, the quality of nursery seedlings, farm preparation and soil quality; provision of safer and stronger vine support poles and reels; introduction of mulching, farm irrigation, pest control

mechanisms, appropriate pruning; and provision of security especially for nursery seedlings and harvest time crops against human interferences especially thieves.

Additionally, the group is expected to establish a maize crop nursery to supply members with planting material with the surplus sold to outside growers for extra income. With the additional income earned, the group members will be able to pay school fees for their children in schools and colleges, purchase better breeds of Horticultural for their family and access better healthcare facilities. Some group members will be able to invest in trading and maize mills. The group will eventually be able to bring piped drinking water to the village and use their existing rainwater dam to irrigate vegetables in the dry spell when prices are usually high. With the support of IMPINDURAMATWARA, the group will be able to start acquiring land of their own, hire more land and plant a further acreage of maize crop by August 2015. They will further be in the position to start planting a range of new vegetable varieties for home consumption and to test the local market.

### **2.3.2 Stakeholders**

The identified stakeholders in this particular research shall include: Community Based Organization IMPNDURAMATWARA Cooperative, District Community development Officer, District Agricultural Development Officer, District Planning Officer, Sector Executive Officer, Cell Executive Officer and professionals from Agricultural Training Institute of Bugesera. This team will contribute in one way or another to the success of the project as analyzed on Table below. The CBO will facilitate price negotiation and marketing of the crop. It will provide facilitation by

which the crop producers will be able to sell their produce, earn more and alleviate the biting poverty.

**Table 16: Roles and Expectations of Various Stakeholders**

No.	Name of Stakeholder	Role of Stakeholder	Expected Performance of Stakeholder
1.	Community Based Organization IMPINDURAMATWARA Cooperative	1.1 Establishment of maize crop growing, harvesting and sales in Rukoma; 1.2 Facilitating cooperative to excel in their vision to grow maize crop and increase production; 1.3 To advocate for the cooperative; ensuring there is provision of technical support to the CBO's. 1.4 Ensuring there is capacity building to the CBO in terms of Entrepreneurial operation skills; 1.5 Ensuring there is promotion of crops growing and production; 1.6 Ensuring there is improved variety of maize crop seedlings; 1.7 Ensuring there is process and planning for irrigation facility. 1.8 Ensuring there is counseling on Financial Institution and Support.	<ul style="list-style-type: none"> <li>• Maize crop growing, harvesting and sales achieved;</li> <li>• The sustainability of the project vision is ensured;</li> <li>• Agricultural objectives for the project are clear and achieved;</li> <li>• Increased income of maize sellers;</li> <li>• Improved standard of living from selling of crops;</li> <li>• Reliable market price of crop maintained.</li> <li>• Increased income capacity of the CBO to enhance regular care and support of the project realized.</li> <li>• Increased number of maize crop growers in the district enhanced;</li> <li>• Increased District GDP.</li> </ul>
2.	Agricultural Training Institute, Bugesera community development faculty	2.1 Provision of technical support to the CBO's; 2.2 Capacity building to the CBO in terms of Entrepreneurial operation skills; 2.3 Promotion of maize growing and production; 2.4 Promotion of improved variety of maize crops seedlings; 2.5 Process and planning for irrigation facility. 2.6 Counseling on Financial Institution and Support.	<ul style="list-style-type: none"> <li>• The sustainability of the project is ensured;</li> <li>• Agricultural objectives for the project are clear and achieved;</li> <li>• Increased income capacity of the CBO to enhance regular care and support of the project realized.</li> <li>• Increased number of maize growers in the district enhanced;</li> <li>• Increased District GDP.</li> </ul>

3.	District Community development Officer, District Agricultural Development Officer, District Planning Officer and other local leaders	<p>3.1 Provision of high patronage;</p> <p>3.2 In conjunction CBO: IMPINDURAMATWARA, to provide advice and facilitate capacity building training to the cooperative.</p> <p>3.3 To provide linkage with government on matters of report and development.</p> <p>3.4 Care and advocacy for the group;</p> <p>3.5 Linking up cooperative to other government agencies.</p>	<ul style="list-style-type: none"> <li>• Patronage of group offered at best interest of community development;</li> <li>• Care and advocacy for the group offered;</li> <li>• The Cooperative is linked to government agencies for further funding and care.</li> </ul>
4.	Local Finance institutions like RIMU	<p>4.1 To provide soft loans for land expansion;</p> <p>4.2 Funding for consultancy expertise on ground;</p> <p>4.3 Funding for land planning, utilization and fertilization;</p> <p>4.4 Funding for capacity building to CBO of entrepreneurial skills.</p>	<ul style="list-style-type: none"> <li>• Financially strong and capable CBO.</li> <li>• Reliable customers.</li> <li>• Increased District GDP</li> </ul>
5.	The Mass Media	<p>5.1 To provide awareness of the project and link with the population across the nation that promote growing of maize crop in the land;</p> <p>5.2 To provide awareness and publicity that promotes marketing of the cross across the nation.</p>	<ul style="list-style-type: none"> <li>• Increased number of maize crops customers</li> </ul>
6.	Population (including Rukoma community)	<p>6.1 The clientele that buys and uses maize crop to enhance family health</p> <p>6.2 Opportunity to emulate and become out-growers and generate income for themselves.</p>	<ul style="list-style-type: none"> <li>• Improved nutrition.</li> <li>• Skilled gained and shared</li> <li>• Improved income and better standard of living.</li> </ul>

### **2.3.3 The Project Goal**

The goal of the project is sustainable economic development of maize farmers and enhancement of their economic status with ultimate improvement of their standard of living. It is the goal of the project to ensure that its establishment will create a reliable supply of crops into the markets and industries whichever offers the better price. The project will inspire sustainable economic development of the maize farmers. The project will open the individual maize farmer's eyes on crop care, and this will enable the farmer get better farm skills and provide skill transfer support to their personal crops. The project will establish and grow more nursery plants which can help increase sales. Out growers will be created in the process. This presupposes increased harvest and sales during the year.

### **2.3.4 Project Objectives**

#### **2.3.4.1 General Objective**

The General Objective of the project is to enhance sustainable economic development through commercial maize production among maize farmers in Rukoma village by May 2015. In order to realize the project goal, the following specific objectives of the crop growing project will be realized.

#### **2.3.4.2 Specific Objectives**

- (i) To create awareness of 80 maize farmers in Rukoma village on commercial maize production by June 2015.

- (ii) To pass on 40 maize producers with management skills of the maize grain processing project by July 2015.
- (iii) To link maize farmers with reliable markets for the maize production of maize grain by the year 2015.
- (iv) To conduct monitoring and evaluation of the project after harvesting of maize grain product by mid and annually 2015.

## **2.4 Host Organization/CBO Profile**

FBISA (Fonds Belge de Sécurité Alimentaire) is the Host Organization taking on the improvement of Rukoma maize crop grower's project. It is located in Rukoma Village within Ngoma District. The group started in 2012 with 13 founder members; 40% of whom had originally worked in different area in Rwanda. It came into existence as local concerted response to the need of returnees from different country in which there was critical need for resettlement, household supplies, water, food, and medical supplies. The organization today has grown to local membership of 80 persons: 46 female and 34 male. The group was officially registered in 2010.

### **2.4.1 Host Organization**

The global program of the Belgian Fund for Food Security has the global objective of improving durably food and nutritional security of vulnerable groups at the level of the Nara and Nioro circles in Sahel, by favoring their access to the production factors, the technologies and markets and by strengthening the capacities of the local actors in the management of food security in local development (Khoury et al., 2014). Five Belgian

NGOs and UNCDF are contributing to the implementation of this program whose coordination is ensured by the Food Security Office supported by the FAO. The BFFS program targets a population estimated at more than 430 000 inhabitants, spread in 27 municipalities, on 2 Circles and 2 regions. UNCDF intervenes in the «support to local communities SLC» component of the program and its action contributes to strengthen the capacities of the actors for the analysis, planning, implementation and coordination of strategies to combat food insecurity, malnutrition at the national and local level (Pingali, Alinovi, and Sutton, 2005).

#### **2.4.2 CBO Leadership**

IMPINDURAMATWARA has a strong leadership of 10 Board Members, namely: Chairperson, Vice Chairperson, Secretary, Vice Secretary, the Treasure, and five Counselors. All of whom are female except the Secretary and three Counselors. The organization has a Clergy as its patron.

IMPINDURAMATWARA is run by a team of Executives (Management Team); the Secretary of the Board is its Executive Director. The Executive Director is supported by five Directors: Directors of Program, Operations, Finance, Missions and Human Resource.

#### **2.4.3 Vision Statement**

To lift vulnerable people, especially women and children, out of conflict and poverty and advocate for human dignity wherever it may be lacking.

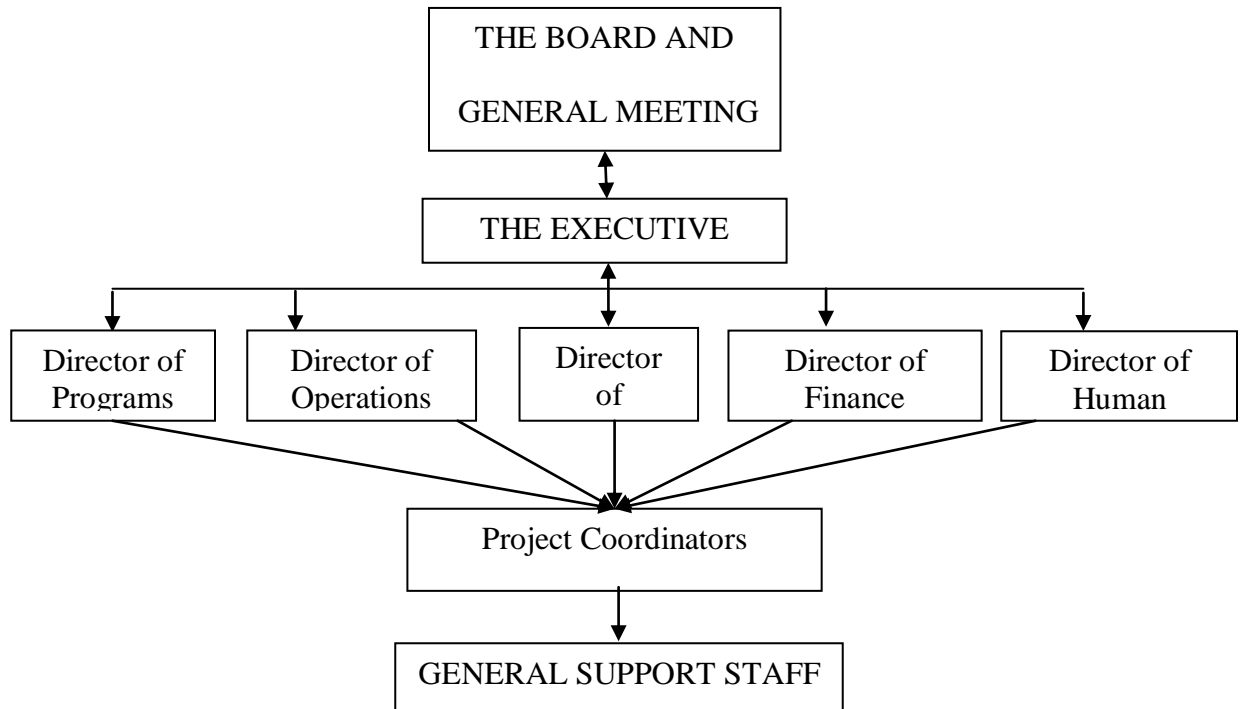
#### **2.4.4 Mission Statement**

IMPINDURAMATWARA exists to create leadership capacity of vulnerable people through awareness campaign, empower socially disadvantaged persons through economic tools, and bring hope to many through involvement of the victims first in Rwanda and then wherever else there may be need and possibility.

#### **2.4.5 Strategic Objectives**

The strategic objectives of IMPINDURAMATWARA are summarized in the following five:

- (i) To support people-based vision in fighting hunger, malnutrition, diseases, ignorance, poverty, and environmental degradation.
- (ii) To establish girl-centered Christian schools, do child sponsorship, establish orphanage homes; as well as, to educate and provide welfare to orphans, poor children and refugees in Rwanda.
- (iii) To establish various ministries and scholarships for women education.
- (iv) To conduct advocacy seminars and missions in Africa and the nations of the world concerning peace, hope and development for vulnerable people.
- (v) To provide effective and efficient use of resources at the highest level of integrity.



**Source:** IMPINDURAMATWARA CBO

#### 2.4.6 IMPINDURAMATWARA CBO SWOT Analysis

Strengths, Weaknesses, Opportunities and Threats of IMPINDURAMATWARA CBO were identified as shown in the Table 17.

**Table 17: IMPINDURAMATWARA CBO/Project SWOT Analysis**

<b>No.</b>	<b>STRENGTH</b>	<b>WEAKNESS</b>	<b>OPPORTUNITIES</b>	<b>THREATS</b>
1.	Strong financial status and experience place the organization in a good light when it comes to lobbying for funding.	Coming in to drum support for a project that has got to take a whole year in order to start bearing some financial benefits to the women in support.	The availability of stakeholders rising to need of this project in various ways and see success in it all.	The situation of weather that escalates drought in the area and likely to cause poor yields.
2.	Strong and committed leadership with a number of those at the helm of leadership having appropriate and wide experience in international organizations.	The inability of the community to readily grasp the commitment of the team and cope with the largely professionals.	The government's willingness to support such initiative as that of IMPINDURAMATWARA.	The likely dictates of industrial consumers in matters of unfavorable pricing on one hand and overwhelming desire to control the production, on the other hand.
3.	Organization vision placing women at the center of their focus when it is run largely by women gives more emphasis to the success possibility of this project.	The organization having to spend lots of initial funds in support of the project while the poor women continue to suffer in the short-term who need similar sum of financial assistance in their respective families.	The willingness of the women to give their all and see hope tomorrow.	The expectation of the IMPINDURAMATWARA being too high.
4.	The organization run by professionals echoes great possibility of success in a project of this nature.	As an organization, IMPINDURAMATWARA has not had similar agricultural experience anywhere.	The highly anticipative market available with industrial producers of food from maize crops.	The competition which exists with other crops from outside.

**Source: Study Findings**

#### **2.4.7 The Roles of CED Student in the Project**

The role of CED student in this project is making sure that plans and activities are implemented as they are planned.

- (i) To mobilize and create awareness to Rukoma community members on maize crop growing and marketing;
- (ii) To facilitate capacity building to IMPINDURAMATWARA CBO leaders and project staff;
- (iii) To provide consultant services to IMPINDURAMATWARA CBO on seeking resources for project implementation;
- (iv) To facilitate the purchase of project tools and equipments;
- (v) To facilitate the entrepreneurship training and crop harvest handling to maize growers;
- (vi) To facilitate and coordinate the promotion of maize eating norms for better health;
- (vii) To facilitate the leaders and working staff by linking and networking with other Stakeholders and CBO's; and
- (viii) To collaborate with CBO leaders and other professionals to conduct monitoring and evaluation of the project.

#### **2.4.8 IMPINDURAMATWARA CBO's Roles**

- (i) To attend the entrepreneurial project management training;
- (ii) Facilitate/participate in the exercise community mobilization and awareness creation about the project;
- (iii) To facilitate capacity building and project staff;

- (iv) Provide consultant services to itself on seeking resources for Project implementation;
- (v) To market the maize crop produce;
- (vi) To seek material and non-material support from other stakeholders and development partnership that enhances and expands the project in the region;
- (vii) To purchase equipment's required for project take off;
- (viii) To keep records and submit reports to responsible parties and stakeholders;  
and
- (ix) To perform the administration routine.

## **CHAPTER THREE**

### **LITERATURE REVIEW**

#### **3.1 Introduction**

Rukoma community in Ngoma district faces the problem of income poverty due to low producer prices. Low income is of great concern of the rural community members in Ngoma district. Realizing the problem of low income, which caused by lack of efficient marketing systems of agricultural crops and lack of skills/technologies in value additions. Community initiatives for income poverty alleviation had to intervene into the matter and intend to reverse the situation by starting commercialized agriculture, which will eventually lead the community to improve its income level. The chapter contains theoretical and empirical literature review, policy review as well as the literature review summary. These parts intend to narrate on crops production, depict what have been done with others so far, and analyze different policies affect the project respectively (García-Berthou, 2007).

#### **3.2 The Theoretical Literature**

##### **3.2.1 Concept of Poverty and its Sustainability**

Poverty is complex and multidimensional phenomenon resulting from deeply imbedded structural imbalances in all realms of human existence, the state of economy, society, culture and the environment. Poverty is defined as lack of physical necessities, assets and income, he said that poverty includes but is more than being income poor. Poverty is also compounded by lack of access to research and extension services to train, markets and market information, also people in poverty are deprived of legal rights and of political clout to make their collective voice heard.

The existence of power differential is both a cause and a consequence of the income gap separating the haves from the have not. This power differential helps to keep people in poverty invisible, isolated, marginalized and vulnerable. Economists view poverty as income lowness but in broader sense of poverty is identified in terms of deprivation of capabilities means non availability of or exclusion from educational possibilities, health care, knowledge, political freedom (Berdica, 2002).

In addition to low incomes, poverty is reflected in poor health and low literacy levels and inadequate housing and living condition. It partially results from limited or no access and is further compounded by people's most often women lack of access to land credit, technology institutional and other productive assets and resources needed to ensure sustainable livelihood. In the deeply revealing "Voices of the Poor" series, Latour, (1993) describe a world where the poor are shackled by helplessness, shame and disempowerment. Narayan's "voices" express a frustration of increasing poverty and disparity caused by geography, gender, corruption, history, and lack of access to power and resources.

### **3.2.2 Maize farmers Livelihood**

A maize farmer's livelihood comprises the capabilities, assets, and activities required for a means of living. It is deemed sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities, assets, and activities both now and in the future, while not undermining the natural resource base. Maize farmers Livelihood approaches are conceptual frameworks that promote people-centered development. Livelihood approaches generate a deeper

understanding of the wide range of livelihood strategies pursued by people that poverty reduction measures address.

Livelihood approaches acknowledge the connections and interactions of the micro-cosmos of the livelihood of individuals, household and/or communities with the larger socio-economic, cultural and political context at the micro and macro levels. Livelihood approaches help to reconcile a holistic perception of sustainable livelihood with the operational need for focused development interventions. In other words, they give access to the complexity of poverty and livelihood while acknowledging the need to reduce complexity in a responsible way for drafting policies and designing programmes and projects (Devereux, 2001).

People-centered sustainable poverty reduction will be achieved only if external support focuses on what matters to people, understands the differences between groups of people and works with them in a way that is congruent with their current livelihood strategies, social environment and ability to adapt. Responsive and participatory: poor people themselves must be key actors in identifying and addressing maize farmer's livelihood priorities. Development agents need processes that enable them to listen and respond to the poor. Multi-level poverty reduction is an enormous challenge that will only be overcome by working at multiple levels, ensuring that micro-level activity informs the development of policy and an effective enabling environment, and that macro-level structures and processes support people to build upon their own strengths (Ifejika Speranza, Wiesmann, and Rist, 2014).

Sustainable there are four key dimensions to sustainability economic, institutional, social and environmental sustainability. All are important a balance must be found

between them. Dynamic: external support must recognize the dynamic nature of livelihood strategies, respond flexibly to changes in people's situation, and develop longer-term commitments. Livelihood approaches can be applied to work with any stakeholder group. To be effective in poverty programmes the Sustainable Livelihood approaches must be underpinned by a clear commitment to poverty reduction, meaning that activities should be designed to maximize livelihood benefits for the poor (Ellis, 1998).

### **3.2.3 Empowerment of Farmers**

It is a process of change by which individual or group with little or no power gain the power and ability to make choices that affect their lives. Empowerment is about changes, choice and power (Devereux, 2001). The structure of power who has it, its sources, how it is exercised, directly affects the choice that people are able to make in their lives. Empowerment goes beyond participation. It implies enabling people to understand the reality of their environment, reflect on the factors shaping that environment, and take steps to effect change to improve the situation.

### **3.2.4 Economic Development**

People economic wants are multitudinous and diverse. Biologically, humans need only air, water food, clothing and shelter. But in contemporary society we also seek the many goods and services associated with a comfortable or affluent standard of living. Fortunate society is blessed with productive resources, labor and managerial talents, tools and machinery, land and mineral deposits that are used to produce goods and services. Economics development is defined as the study of how society uses its scarce resource or more snappily, the science of choices.

Without scarce resource (land, labor, raw materials, capital, entrepreneurial spirit, time) there would be no need to make choices about how to use those things to greatest effect, and thus no need for economics (Bosch-Rekvelde, Jongkind, Mooi, Bakker, and Verbraeck, 2011). Economics helps people to make the right choices; at least, it shows them the most efficient way to use scarce resources in the process of achieving their goals. There is nothing dismal about that, the more efficiently scarce things are used the less they are wasted and the greater is the likelihood that people achieve their goals. But choosing to do one thing; means choosing not to do another (Bosch-Rekvelde et al., 2011).

### **3.2.5 Commercial Maize Production**

Maize is widely cultivated throughout the world, and a greater weight of maize is produced each year than any other grain (Ranum, Peña-Rosas, and Garcia-Casal, 2014). The United States produces 40% of the world's harvest; other top producing countries include China, Brazil, Mexico, Indonesia, India, France and Argentina. Worldwide production was 817 million tonnes in 2009 more than rice (678 million tonnes) or wheat 682 million tons (Natarajan, Nordin, and Rao, 1998).

In 2009, over 159 million hectares (390 million acres) of maize were planted worldwide, with a yield of over 5 tonnes per hectare (80 bu/acre). Production can be significantly higher in certain regions of the world; 2009 forecasts for production in Iowa were 11614 kg/ha (185 bu/acre). There is conflicting evidence to support the hypothesis that maize yield potential has increased over the past few decades. This suggests that changes in yield potential are associated with leaf angle, lodging resistance, tolerance of high plant density, disease/pest tolerance, and other

agronomic traits rather than increase of yield potential per individual plant (Schober and Bean, 2008).

### 3.2.5.1 Commercial Maize production Human Food



**Figure 1: Maize being Roasted Over an Open Flame in India**

Maize and cornmeal (ground dried maize) constitute a staple food in many regions of the world. Maize is central to Mexican food. Virtually every dish in Mexican cuisine uses maize. On form of grain or cornmeal, maize is the main ingredient of tortillas, tamales, pozole, atole and all the dishes based on them, like tacos, quesadillas, chilaquiles, enchiladas, tostadas and many more. In Mexico even a fungus of maize, known as huitlacoche is considered a delicacy.

Introduced into Africa by the Portuguese in the 16th century, maize has become Africa's most important staple food crop. Maize meal is made into a thick porridge in many cultures: from the polenta of Italy, the *angu* of Brazil, the mămăligă of

Romania, to cornmeal mush in the US (and hominy grits in the South) or the food called mealie pap in South Africa and sadza, nshima and ugali in other parts of Africa. Maize meal is also used as a replacement for wheat flour, to make cornbread and other baked products. Masa (cornmeal treated with limewater) is the main ingredient for tortillas, atole and many other dishes of Central American food (Roberts, 2009).

Popcorn consists of kernels of certain varieties that explode when heated, forming fluffy pieces that are eaten as a snack. Roasted dried maize ears with semihardened kernels, coated with a seasoning mixture of fried chopped spring onions with salt added to the oil, is a popular snack food in Vietnam. *Cancha*, which are roasted maize chulpe kernels, are a very popular snack food in Peru, and also appears in traditional Peruvian ceviche. Unleavened bread called makki di roti is popular bread eaten in the Punjab region of India and Pakistan. Chicha and *chicha morada* (purple chicha) are drinks typically made from particular types of maize. The first one is fermented and alcoholic, the second is a soft drink commonly drunk in Peru. Corn flakes are a common breakfast cereal in North America and the United Kingdom, and found in many other countries all over the world (Hay, 1995).

Maize can also be prepared as hominy, in which the kernels are soaked with lye in a process called nixtamalization; or grits, which are coarsely, ground hominy. These are commonly eaten in the Southeastern United States, foods handed down from Native Americans, who called the dish sagamite (Wrigley, 2009).



**Figure 2: Dried Maize Mote, also known as Hominy, is used in Mexican Cuisine**

The Brazilian dessert canjica is made by boiling maize kernels in sweetened milk. Maize can also be harvested and consumed in the unripe state, when the kernels are fully grown but still soft. Unripe maize must usually be cooked to become palatable; this may be done by simply boiling or roasting the whole ears and eating the kernels right off the cob. Sweet corn, a genetic variety that is high in sugars and low in starch, is usually consumed in the unripe state.

Such corn on the cob is a common dish in the United States, Canada, United Kingdom, Cyprus, some parts of South America, and the Balkans, but virtually unheard of in some European countries. Corn on the cob was hawked on the streets

of early 19<sup>th</sup> century New York City by poor, barefoot "Hot corn Girls", who were thus the precursors of hot dog carts, churro wagons, and fruit stands seen on the streets of big cities today (Parker and Blodgett, 2010). The cooked, unripe kernels may also be shaved off the cob and served as a vegetable in side dishes, salads, gamishes, etc. Alternatively, the raw unripe kernels may also be grated off the cobs and processed into a variety of cooked dishes, such as maize purée, tamales, pamonhas, curau, cakes, ice creams, etc.

Maize is a major source of starch. Cornstarch (maize flour) is a major ingredient in home cooking and in many industrialized food products. Maize is also a major source of cooking oil (corn oil) and of maize gluten. Maize starch can be hydrolyzed and enzymatically treated to produce syrups, particularly high-fructose corn syrup, a sweetener; and also fermented and distilled to produce grain alcohol. Grain alcohol from maize is traditionally the source of Bourbon whiskey. Maize is sometimes used as the starch source for beer. Within the United States, the usage of maize for human consumption constitutes about 1/40<sup>th</sup> of the amount grown in the country. In the United States and Canada, maize is mostly grown to feed livestock, as forage, silage (made by fermentation of chopped green cornstalks), or grain. Maize meal is also a significant ingredient of some commercial animal food products, such as dog food. Maize is also used as a fish bait, called "dough balls". It is particularly popular in Europe for coarse fishing (Agu, Bringhurst, and Brosnan, 2006).

Most historians believe maize was domesticated in the Tehuacan Valley of Mexico. The Olmec and Mayans cultivated it in numerous varieties throughout Mesoamerica, cooked, ground or processed through nixtamalization. Beginning about 2500 BC, the

crop spread through much of the Americas. The region developed a trade network based on surplus and varieties of maize crops. After European contact with the Americas in the late 15th and early 16th centuries, explorers and traders carried maize back to Europe and introduced it to other countries.

Maize spread to the rest of the world because of its ability to grow in diverse climates. Sugar-rich varieties called sweet corn are usually grown for human consumption as kernels, while field corn varieties are used for animal feed, various corn-based human food uses (including grinding into cornmeal or masa, pressing into corn oil, and fermentation and distillation into alcoholic beverages like bourbon whiskey), and as chemical feedstock (Ranum et al., 2014). Maize is the most widely grown grain crop throughout the Americas, with 332 million metric tons grown annually in the United States alone. Approximately 40% of the crop 130 million tons is used for corn ethanol (de Vendômois, Roullier, Cellier, and Séralini, 2009).

Genetically modified maize made up 85% of the maize planted in the United States in 2009 (Ridley et al., 2002). Prior to their domestication, maize plants only grew small, one-inch long corn cobs, and only one per plant. Many centuries of artificial selection by the indigenous people of the Americas resulted in the development of maize plants capable of growing several cobs per plant that were usually several inches long each (Gáspár, Kálmán, and Réczey, 2007). An influential 2002 study by Matsuoka et al. has demonstrated that, rather than the multiple independent domestications model, all maize arose from a single domestication in southern Mexico about 9,000 years ago. The study also demonstrated that the oldest surviving maize types are those of the Mexican highlands. Later, maize spread from this region

over the Americas along two major paths. This is consistent with a model based on the archaeological record suggesting that maize diversified in the highlands of Mexico before spreading to the lowlands (Shephard, Thiel, Stockenström, and Sydenham, 1996).

### **3.3 The Empirical Literature**

#### **3.3.1 Structure and Physiology**

The maize plant is often 2.5 m (8 ft) in height, though some natural strains can grow 12 m (40 ft) (Peiffer et al., 2014). The stem has the appearance of a bamboo cane and is commonly composed of 20 internodes of 18 cm (7 in) length (Koch, Sillett, Jennings, and Davis, 2004). A leaf grows from each node, which is generally 9 cm (3.5 in) in width and 120 cm (4 ft) in length. Ears develop above a few of the leaves in the midsection of the plant, between the stem and leaf sheath, elongating by ~ 3 mm/day, to a length of 18 cm (7 in) (60 cm or 24 in being the maximum observed in the subspecies (Boomsma et al., 2010).

They are female inflorescences, tightly enveloped by several layers of ear leaves commonly called husks. Certain varieties of maize have been bred to produce many additional developed ears. These are the source of the "baby corn" used as a vegetable in Asian cuisine. The apex of the stem ends in the tassel, an inflorescence of male flowers. When the tassel is mature and conditions are suitably warm and dry, anthers on the tassel dehisce and release pollen. Maize pollen is anemophilous (dispersed by wind), and because of its large settling velocity, most pollen falls within a few meters of the tassel (Weber et al., 2007).

Elongated stigmas, called silks, emerge from the whorl of husk leaves at the end of the ear. They are often pale yellow and 7 in (178 mm) in length, like tufts of hair in appearance. At the end of each is a carpel, which may develop into a "kernel" if fertilized by a pollen grain. The pericarp of the fruit is fused with the seed coat referred to as "caryopsis", typical of the grasses, and the entire kernel is often referred to as the "seed". The cob is close to a multiple fruit in structure, except that the individual fruits (the kernels) never fuse into a single mass. The grains are about the size of peas, and adhere in regular rows around a white, pithy substance, which forms the ear (Van Inghelandt, Melchinger, Martinant, and Stich, 2012).

An ear commonly holds 600 kernels. They are of various colors: blackish, bluish-gray, purple, green, red, white and yellow. When ground into flour, maize yields more flour with much less bran than wheat does. It lacks the protein gluten of wheat and, therefore, makes baked goods with poor rising capability. A genetic variant that accumulates more sugar and less starch in the ear is consumed as a vegetable and is called sweet corn. Young ears can be consumed raw, with the cob and silk, but as the plant matures (usually during the summer months), the cob becomes tougher and the silk dries to inedibility. By the end of the growing season, the kernels dry out and become difficult to chew without cooking them tender first in boiling water (Wallace, Larsson, and Buckler, 2014).

Planting density affects multiple aspects of maize. Modern farming techniques in developed countries usually rely on dense planting, which produces one ear per stalk (Sacks, Deryng, Foley, and Ramankutty, 2010). Stands of silage maize are yet denser (Kgasago, 2006), and achieve a lower percentage of ears and more plant matter.

Maize is a facultative short-day plant (Valadabadi and Farahani, 2010) and flowers in a certain number of growing degree days  $> 10^{\circ}\text{C}$  ( $50^{\circ}\text{F}$ ) in the environment to which it is adapted (De Leon and Coors, 2002). Photoperiodicity can be eccentric in tropical cultivars such that the long day's characteristic of higher latitudes allows the plants to grow so tall that they do not have enough time to produce seed before being killed by frost.

These attributes, however, may prove useful in using tropical maize for biofuels. The magnitude of the influence that long nights have on the number of days that must pass before maize flowers is genetically prescribed (Kucharik, 2008) and regulated by the phytochrome system (Sangoi, 2001).

Immature maize shoots accumulate a powerful antibiotic substance, 2,4-dihydroxy-7-methoxy-1,4-benzoxazin-3-one (DIMBOA). DIMBOA is a member of a group of hydroxamic acids (also known as benzoxazinoids) that serve as a natural defense against a wide range of pests, including insects, pathogenic fungi and bacteria. DIMBOA is also found in related grasses, particularly wheat. A maize mutant (bx) lacking DIMBOA is highly susceptible to attack by aphids and fungi. DIMBOA is also responsible for the relative resistance of immature maize to the European corn borer (family Crambidae). As maize matures, DIMBOA levels and resistance to the corn borer decline. Because of its shallow roots, maize is susceptible to droughts, intolerant of nutrient-deficient soils, and prone to be uprooted by severe winds (Butrón, Chen, Rottinghaus, and McMullen, 2010).



**Figure 3: Maize Kernels**

While yellow maizes derive their color from lutein and zeaxanthin, in red-coloured maizes, the kernel colouration is due to anthocyanins and phlobaphenes.

### **3.3.2 Origin**

Maize is the domesticated variant of teosinte. The two plants have dissimilar appearance, maize having a single tall stalk with multiple leaves and teosinte being a short, bushy plant. The difference between the two is largely controlled by differences in just two genes. Several theories had been proposed about the specific origin of maize in Mesoamerica (Gassmann, Petzold-Maxwell, Keweshan, and Dunbar, 2011):

- (i) It is a direct domestication of a Mexican annual teosinte, *Zea mays* ssp. *parviglumis*, native to the Balsas River valley in south-eastern Mexico, with up to 12% of its genetic material obtained from *Zea mays* ssp. *mexicana*

through introgression. This theory was further confirmed by the 2002 study of Matsuoka et al.

- (ii) It has been derived from hybridization between a small domesticated maize (a slightly changed form of a wild maize) and a teosinte of section *Luxuriantes*, either *Z. luxurians* or *Z. diploperennis*.
- (iii) It has undergone two or more domestications either of a wild maize or of a teosinte. (The term "teosinte" describes all species and subspecies in the genus *Zea*, excluding *Zea mays* ssp. *mays*).
- (iv) It has evolved from a hybridization of *Z. diploperennis* by *Tripsacum dactyloides*.

In the late 1930s, Paul Mangelsdorf suggested that domesticated maize was the result of a hybridization event between unknown wild maize and a species of *Tripsacum*, a related genus. This theory about the origin of maize has been refuted by modern genetic testing, which refutes Mangelsdorf's model and the fourth listed above (Bergvinson, Hamilton, and Arnason, 1995).

The teosinte origin theory was proposed by the Russian botanist Nikolai Ivanovich Valivov in 1931 and the later American Nobel Prize-winner George Beadle in 1932 (Barry and Alfaro, 1994). It is supported experimentally and by recent studies of the plants' genomes. Teosinte and maize are able to cross-breed and produce fertile offspring. A number of questions remain concerning the species, among them:

- (i) How the immense diversity of the species of sect. *Zea* originated,

- (ii) How the tiny archaeological specimens of 3500–2700 BC could have been selected from a teosinte, and
- (iii) How domestication could have proceeded without leaving remains of teosinte or maize with teosintoid traits earlier than the earliest known until recently, dating from ca. 1100 BC.

The domestication of maize is of particular interest to researcher's archaeologists, geneticists, ethno botanists, geographers, etc. The process is thought by some to have started 7,500 to 12,000 years ago. Research from the 1950s to 1970s originally focused on the hypothesis that maize domestication occurred in the highlands between the states of Oaxaca and Jalisco, because the oldest archaeological remains of maize known at the time were found there.

### **3.3.3 Connection with 'parviglumis' subspecies**

Genetic studies led by John Doebley identified *Zea mays* ssp. *parviglumis*, native to the Balsas River valley in Mexico's southwestern highlands, and also known as Balsas teosinte, as being the crop wild relative teosinte genetically most similar to modern maize (Kruger, Van Rensburg, and Van den Berg, 2012). This has been confirmed by further more recent studies, which refined this hypothesis somewhat. Archaeobotanical studies published in 2009 now point to the middle part of the Balsas River valley as the more likely location of early domestication; this river is not very long, so these locations are not very distant. Stone milling tools with maize residue have been found in an 8,700-years old layer of deposits in a cave not far from Iguala, Guerrero (Abel, Berhow, Wilson, Binder, and Hibbard, 2000).

A primitive corn was being grown in southern Mexico, Central America, and northern South America 7,000 years ago. Archaeological remains of early maize ears, found at Guila Naquitz Cave in the Oaxaca Valley, date back roughly 6,250 years; the oldest ears from caves near Tehuacan, Puebla, date ca. 3,450 BC (D R Piperno and Flannery, 2001). Maize pollen dated to 7300 cal B.P. from San Andres, Tabasco, on the Caribbean coast has also been recovered (Smith, 1997). Little change occurred in ear form until ca. 1100 BC when great changes appeared in ears from Mexican caves: maize diversity rapidly increased and archaeological teosinte was first deposited.

Perhaps as early as 2500 BC, maize began to spread widely and rapidly. It was first cultivated in what is now the United States, at several sites in New Mexico and Arizona, about 2100 BC (Dolores R Piperno, Ranere, Holst, Iriarte, and Dickau, 2009). As it was introduced to new cultures, new uses were developed and new varieties selected to better serve in those preparations. Maize was the staple food, or a major staple (along with squash, Andean region potato, quinoa, beans, and amaranth), of most pre-Columbian North American, Mesoamerican, South American, and Caribbean cultures.

The Mesoamerican civilization was strengthened upon the field crop of maize, through harvesting it, its religious and spiritual importance and how it impacted their diet. Maize formed the Mesoamerican people's identity. During the first millennium AD, maize cultivation spread from Mexico into the US Southwest and during the following millennium into the US Northeast and southeastern Canada, transforming

the landscape as Native Americans cleared large forest and grassland areas for the new crop (Zárate, 2000).

It is unknown what precipitated its domestication, because the edible portion of the wild variety is too small and hard to obtain to be eaten directly, as each kernel is enclosed in a very hard bivalve shell. However, George Beadle demonstrated that the kernels of teosinte are readily "popped" for human consumption, like modern popcorn. Some have argued it would have taken too many generations of selective breeding to produce large, compressed ears for efficient cultivation. However, studies of the hybrids readily made by intercrossing teosinte and modern maize suggest this objection is not well founded. In 2005, research by the USDA Forest Service suggested that the rise in maize cultivation 500 to 1,000 years ago in what is now the southeastern United States corresponded with a decline of freshwater mussels, which are very sensitive to environmental changes (Backwell et al., 2009).

NISR revealed that about 70% of all the interviewed farmers in the agro ecological zone in Rwanda mentioned that low prices and lack of reliable markets as one of the major. Low price and lack of reliable market for agricultural products is a great challenge for the farmers in Rwanda. Knowledge, attitude and practice revealed that most farmers produce are sold at a lower price which results in the increase of poverty due to low income obtained through sales of their produce. It is estimated that about 65% of the agricultural producers for domestic products in Rwanda are affected by market forces which lead to low producer prices and reliable markets thus reducing cash available to farmers to meet production cost (NISR, 2012).

Generally low price and unreliable market is the result of many and often mutually reinforcing factors including lack of awareness on the quality parameters, poor marketing information on the requirement of the domestic market, low volumes of the produce, and lack of training on marketing strategies, lack of reliable storage facilities. Women are most disadvantaged because of low literacy level and traditionally they are left behind in being sent to school. This phenomenon makes them lack access to market information and other improved technologies. Studies prove that the importance of women as farmers has been recognized for some times though it has not been sufficiently taken into account when developing and disseminating agricultural technologies (D R Piperno and Flannery, 2001).

An assessment of the adoption of agricultural technologies done by NISR outline the concept of sustainable livelihood approach as to be compatible with actor oriented perspective on the use of agricultural technologies, The assumption underlying this approach is that at any particular time, people pursue various livelihood outcomes (health, income) by drawing a range of assets (financial, human, social and physical capital) to pursue a variety of activities. In addition, these livelihood outcomes are the result of both external fluctuations and farmers' own action (Government of Rwanda, 2012). Further, the approach change is viewed as taking place within a defined context including the farmers' resources and the external environment over which the farmer has little control and which keeps on changing (Smith, 1997).

### **3.4 The policy Review**

Maize was identified as a priority crop by the Government of Rwanda within the context of the national crop intensification program as it plays an important role in

food security and income generation for the majority of Rwandese. Maize contributes to poverty reduction and has thus been particularly targeted in Ngoma District's Performance Contracts and District Development Plans as a crop with high potential to contribute significantly to its development agenda. So, maize seemed the obvious choice for research into use Rwanda as one of its priority areas and the Ngoma District was selected because it is a major maize producing area. The Maize Innovation Platform was established in June 2008. Initially 55 members were recruited, drawn from along the value chain for maize (MINAGRI, 2013).

The objectives were agreed to be:

- (i) Addressing constraints related to maize production and markets
- (ii) Promoting use of new knowledge by many people to increase profitability of the maize value chain
- (iii) Developing improved organizational arrangements in the maize value chain

The Maize Innovation Platform held a two-day workshop in October 2009 and follow up workshops in December to formalize arrangements and to enable a business plan to be completed by January 2010. The platform's activities quickly became high profile: In October 2010 the Rwandan cabinet decided that the World Food Day activities should focus on Ngoma District. Addressing constraints and developing improved organizational arrangements.

### **3.4.1 Market Systems Policy**

Research into use facilitated research identified inadequate trading and marketing systems as key bottlenecks for maize development in Ngoma District. To be successful the platform needed to play a pro-active role in policy dialogues, such as

the District Joint Action Forum. Research into use therefore appointed a consultant to support the programme to help to strengthen the capacity of the Maize Innovation Platform. What emerged was the commercial trading arm of the platform which is called NGOMIG - Ngoma Maize Investment Group Ltd.

### **3.4.2 Access to Credit and Tackling Exploitative Trading**

The platform highlighted a major constraint as the lack of access to credit. This meant getting fertilizer and paying for labour was difficult. Profitability is hit as many farmers sell crops when they are still in the field to ease their cash flow. This practice is called 'kosta imyaka' and is a major cause of poverty in rural area. Independent reports have commented on the exploitative nature of this way of trading as the price is lower than the price at harvest and much lower than the price post-harvest. The issue for the platform was that unless they could stop kosta imyaka there was no chance of farmers being able to purchase improved farm inputs such as better seed, fertilizer or labour. In December 2009 the platform met with representatives of banks and other financial institutions in order to agree on specific actions for improving agricultural financing, especially for maize farmers. This involved setting up a programme known as warrantage (MINAGRI, 2013).

### **3.4.3 Promoting New Knowledge Policy**

The Maize Innovation Platform has been exploring ways of promoting new knowledge and increasing profitability along the maize value chain. The platform reviewed the information needs of the value chain. The most commonly expressed needs were: details of government programmes and instructions; information on

plant diseases; news of innovations; and details of markets. The platform initiated a communication campaign to promote best practices related to crop husbandry, targeting proper use of improved varieties of seeds and appropriate fertilizers. The platform facilitated farmer learning events during December 2009 and a Farmer Field School was established in March 2010. This is an approach, which supports community learning in areas of husbandry and crop intensification through 'learning by doing'. The platform also organized a Maize Innovation Day (January, 2011).

The platform has specifically targeted local authorities as they are increasingly involved in conveying messages and advice to farmers. To tackle the issue of an ineffective extension service, the platform piloted a community-based system whereby volunteer farmers act as coaches and advisors to their neighbors. These were recruited by the District Agricultural Officer and representatives of the Rwanda Development Organisation with training taking place in January 2010. To drive demand for research outputs, research into use worked with a consultant to undertake a comprehensive review of RNRRS and other research outputs that are relevant to maize in Rwanda. A participatory process for assessing the relevance of these research outputs will lead to the selection of a few of them to be processed into user-friendly materials for wide dissemination (MINAGRI, 2013).

The platform proposed setting up at least three Maize Innovation Centres in areas with the highest concentration of maize farmers in Ngoma District. This initiative uses group of farms around the maize drying yard/sheds, constructed under research into use support, as its nucleus. The intention is to use farmers' fields and other existing infrastructure to test and demonstrate a series of relevant research outputs

and contribute to take up of appropriate innovations. Maize Innovation Centres also serve as community interaction for learning and sharing lessons. A concept document defines how different stakeholders coordinate their interventions in order to develop this into a powerful institutional innovation. Research into use provides financial support for the establishment of two post-harvest and processing infrastructures for the benefit of platform members. The platform has also conducted a multiplication of an early-maturing variety of maize. It is estimated that some 4,000 households will benefit from this new variety as a result of research into use's investment (Government of Rwanda, 2012).

#### **3.4.4 Warrantage**

Research into use Rwanda facilitated meetings of the Maize Innovation Platform. They were concerned about the plight of cash-strapped maize farmers who were selling their crops whilst they were still in the fields, in a process known as 'kosta imyaka'. In the journal *African Studies review* researcher An Ansoms described this practice as the "most exploitative system I came across... pure exploitation of their vulnerability to the benefit of the better-off party in this transaction." This approach resulted in very low prices being paid: Rwandan Francs (RWF) 70,000 per tonne (around US\$ 100) when sold in the field to traders compared to RWF 150,000-160,000 per tonne (around US\$ 250) when traded in post-harvest markets. Research into use realised that they could not get poor farmers to purchase better farm inputs or invest in new techniques without addressing this issue, because the farmers concerned were trapped in cycles of poverty. RIU Rwanda looked around for an approach and within the RNRSS database they found details of the warehouse receipt

systems from the Crop Post Harvest Programme (MINAGRI, 2013). They developed plans under the francophone name warrantage.

Warrantage is an approach originally used by European farmers in the 19th century. According to FAO, to operate it needs three essential elements to be in place: 'a well functioning farmer's association, an interested local bank or other financial institution and a safe place where to store the produce. Crucially too, the crop used to guarantee loans must be non-perishable and its price must have a proven record of rising in the months after harvest.

Finally, agricultural produce as a guarantee for a bank loan needs to be recognized by the banking legislation of the country concerned.' research into use Rwanda facilitated the establishment of a warrantage scheme. This involved bringing in consultants with the required expertise and then removing the bottlenecks to the introduction of warrantage, including providing an initial grain supply as surety. Research into use Rwanda had already supported the establishment of the Ngoma Maize Investment Group (NGOMIG) Ltd) and soon recruited Duterimbere IMF (Institution de Micro-Finance) as its banking partner (MINAGRI, 2013).

Research into use's approaches often involves the private sector. But in some situations there is such an imbalance between the buyers and sellers that these weaknesses can easily be exploited - as in this case. RIU Rwanda saw this problem and realized that warrantage offered a practical way forward. Instead of allowing excess profits to be generated by the traders, a partnership between the Ngoma Maize Investment Group (NGOMIG) Ltd (a commercial offshoot from the Maize

Innovation Platform) and the Duterimbere IMF bank has allowed farmers to get loans at preferential interest rates using their grain as surety. The bank and the farmers decide on the most appropriate time to enter the maize market to maximise the income to the farmers. The warrantage scheme has also meant that many previously un-banked farmers have opened bank accounts (Government of Rwanda, 2012).

Research into use organized training in the operation of the warrantage programme which attracted over 60 members of the Maize Innovation Platform. They worked with facilitators from the international fertilizer development center's CATALIST project and met with representatives of Duterimbere IMF and the Rwanda Development Organisation. To start implementing the warrantage system on maize in Ngoma District, farmers and cooperatives pledged 250 tonnes of maize and NGOMIG and Duterimbere IMF agreed to set up a stock management committee to manage the maize stock and ensure its security. They also ensured industry-standard storage procedures are applied to ensure high quality of the produce (MINAGRI, 2013).

Research into use agreed financial support for poor maize farmers who cannot contribute to the initial stock through NGOMIG by providing additional resources as a start-up/trigger in constituting the maize stock. It was also agreed that this becomes a revolving fund to enable other poor farmers to benefit from the system beyond RIU's existence. The District of Ngoma committed support to the initiative by providing storage facilities to NGOMIG. This was facilitated by the Maize Platform as part of its advocacy role. On delivery of their maize harvests to the warrantage

warehouse, Duterimbere IMF advanced loans totalling RWF 9.3 million (US\$ 15,775) to farmers, which represented 60% of the value of their crops. The second payment (40%), less interest and warehouse charges, will be made in January 2011. Beneficiaries decided on that particular period for second payment as by then they will be in need for cash for critical family expenses such as school fees for their children, labour for the next maize harvest or contributions to medical insurance schemes (Government of Rwanda, 2012).

Individual farmers and farmers' cooperatives were recruited through several meetings, visits to the warrantage site, visits to specific farmers' cooperatives and through a weekly broadcast on Ngoma Community Radio. The farmers were responsible for the delivery of their own maize to the warrantage centre. They used a variety of transport including bicycles, animal traction and small trucks. The World Food Programme is also keen to partner NGOMIG on scaling up the warrantage programme. So far only Duterimbere IMF is involved in the warrantage pilot and the partnership were made at local level.

The money is paid directly to the beneficiary in case of individual farmers or to the cooperative representative in case of a cooperative. In case of a cooperative, it is expected that the representative distributes the money to farmer members. Other financial institutions are, however, interested to scale up warrantage as indicated in the recent workshop organized by the Ministry of Agriculture. So far, there have not been any repayment problem as the agreement between NGOMIG and Duterimbere IMF on warrantage provides for one repayment at selling time. It is assumed that the repayment rate should be 100% (NISR, 2012).

### **3.4.5 Quality Control**

The maize quality control is conducted in the warehouse compound by knowledgeable staff, trained by World Food Programme (WFP) and Rwanda Bureau of Standards (RBS). The quality control aims at effective compliance with relevant RBS standards for the purpose of consumer protection and trade promotion. When the produce shows general compliance, it is accepted and re-packed into polypropylene bags weighing 50 kg each. If the quality does not comply with requirements of relevant standards, the farmer is given a choice to clean up his consignment once more so that he/she upgrades it to acceptable level. In the worse situation, the produce is rejected (refused) and the consignment takes it back home or he/she is advised to sell it to other buyers for different uses e.g. animal feeds.

As warrantage is primarily dealing with giving more value to maize stocks, maintaining high quality of the produce is a prerequisite to the success of the operation. Therefore, farmers supplying their maize to the warrantage warehouse were informed and trained on quality standards required by NGOMIG. They had in particular to pay attention to moisture content and avoid any impurities, such as sand and other types of grains. The quality control aims at effective compliance with relevant Rwanda Bureau of Standards standards for the purpose of consumer protection and trade promotion. When the maize supplied by farmers showed general compliance, it was accepted and re-packed into 50 kg polypropylene bags. If the quality did not comply with requirements of the relevant standards, the farmer was given a choice to clean up his consignment once more so that he/she upgrades it to acceptable level. In the worse situation, the maize was rejected and the consignment

either taken back home by the farmer or sold to other buyers for different uses, e.g. animal feeds (NISR, 2012).

Research into use Rwanda with its banking partner has developed a mechanism that will enable more farmers to access fertilizers using their projected maize harvest as collateral through the warrantage scheme in time for the 2011 harvest. Apart from presenting the benefits of the warrantage during various meetings, no other incentives were given to farmers - the farmers understood and appreciated the value of their involvement as they even learned from their neighbours or friends who had participated.

As in other innovations, research into use Rwanda worked with the 'first movers', and these will influence those are more risk averse. Now research into use is building on the current momentum gained by the warrantage scheme to speed up adoption by a higher number of beneficiaries. They are aiming to reach 5000 farmers by May 2011, which they consider to be just the beginning (NISR, 2012).

#### **3.4.6 National Agriculture Policy in Rwanda**

Although over 80% of the population in the country is supported by agricultural livelihoods, GDP from this sector ranges between 30 to 40%, which is low compared to the number of people working in the sector. Aware of the importance of agriculture to socio-economic development and low productivity and performance, the Government of Rwanda developed a National Agriculture Policy (NAP) in 2004. It is from the NAP that the PSTA program was conceived.

It is the obligation and the right of every leader and every citizen to participate fully in translating into practice the aims and objectives of this policy as well as prepare and implement in all level, from household to village, district, regional and national level. Thus, the establishment of maize crops for sustainable development is one of the strategies that encourage small farmers to change the mode of production from solely subsistence to commercial trade (MINAGRI, 2013).

### **3.5 Literature Review Summary**

The gap observed in the empirical literature is that none of the case study countries had organized marketing channels for rural crop products especially perishables. Although, the marketing system is not well organized but there is a lot of opportunities for farmers to sell their crops in big industry and urban market provided they are organized in groups and trained in good agricultural practices technologies to have better quality and presentable vegetables which could fetch higher prices.

Good policies and strategies are available if the implementers are to adhere to them for political support of varied projects regarding marketing of agricultural produce; however the major gap that affects many communities and Rukoma community inclusive is the networking and coordination of activities within the same locality for effective supply chain management. Effort is fragmented and not transparent. Many people do not know policy opportunities available to them for their development. Implementation of this particular project will fill this gap through awareness creation and mind shift of the community because they will be seeking information as an important prerequisite in due course of implementing the project.

## **CHAPTER FOUR**

### **PROJECT IMPLEMENTATION**

#### **4.1 Introduction**

This chapter contains information on how the project was planned; and actions taken at each step of project implementation. It analyses product and output from the project, activities undertaken to meet the objective, resources required, responsible personnel and time frame to accomplish the project. It also analyses tentative budget for purchasing tools, equipment and other running expenses. Furthermore, it shows commitments of various stakeholders as they showed great interest to support the project implementation during the interview focus group discussions. These commitments include IMPINDURAMATWARA CBO the implementer of the project which has committed, on the onset, a fund of 3,040,000 Rwf for capacity building, supplies, and establishment of the project and the farm.

The project annual budget was 3,040,000 Rwf. Out of the total budget 2,500,000 cash was a contribution from CBO members and FBSA as Host organization. The rest was donated in terms of equipment worthy 1,500,000 Rwf by Caritas Rwanda, and beneficiaries contributed work force. All resources and inputs are in place. Costing of items and for project equipment was done in collaboration with Ngoma Livelihood Initiative leaders, sector institutions and local government authorities professions. The procurement was done by Rukoma leaders and technical personnel from the Ngoma local government authorities. The project budget was developed as Table 21 indicates.

There are other stakeholders, potentially willing to provide support, namely: District Community development Officer, District Agricultural Development Officer, District Planning Officer, Sector Executive Officer, Cell Executive Officer, professionals from Agricultural Training Institute of Rwamagana. Others include maize grain producing industries, the local media, and financial institutions like RIM Banks. This team will contribute in one way or another to the success of the project as analyzed before. The CBO will facilitate price negotiation and marketing of the maize grain. It will provide facilitation by which the maize producers will be able to sell their produce, earn more and alleviate the biting poverty.

Outputs from the project include, therefore, identified stakeholders interested in the project, available and reliable market for maize grain, skills development on entrepreneurial skills, project equipment. The anticipated project product was sustainable economic development of maize farmers in Rukoma village. The impact of the project will be realized later as the project is at the initial stage. Thus the monitoring will be after harvesting and annual evaluation of the project by 1st December 2015.

#### **4.2 Product and Output**

The expected product and output of the establishment of commercial maize production for sustainable economic development of maize farmers in rukoma village in ngoma district are in the table below. The outcome is expected to be reached after realization of income from maize grain business.

**Table 18: Product and Output**

Objective	Output	Activity
To create awareness of 80 maize farmers in Rukoma village on commercial maize production by June 2015.	One operation conducted.	Disseminate adverts
	75 community members attended the meeting.	Outsource experts
To pass on 40 maize producers with management skills of the maize grain processing project by July 2015. \\	At least one training on how to start processing project.	Organize training
	Meeting for stakeholders conducted.	To organize stakeholders meeting.
	Maize producers attend the meeting.	Conduct training
		Outsource experts.
	A sum of 2,500,000 Rwf acquired.	To prepare project budget
		Consult different stakeholders to supply.
To link maize farmers with reliable markets for the maize production of maize grain by the year 2015.	Newspaper adverts reported.	Prepare advert
	At least three wholesale buyers contracted.	Mention large scale maize buyers
		Signing contract with buyers
To conduct monitoring and evaluation of the project after harvesting of maize grain product by mid and annually 2015.	Maize production project inaugurated.	Selecting and appointing invitees
	Monitoring and evaluation participatory project report.	Prepare monitoring and evaluation
		Conduct monitoring and evaluation

In order to meet the goal the following activities were planned and to be accomplished with the exception of inauguration of commercial maize production project and evaluation of project implementation that would take place after the project take off.

### **4.3 Project Planning**

Project planning is the major component in the project development process. The project planning involved the following major steps: (i) Identifying project objectives; (ii) Sequencing activities; (iii) Identifying responsible person for carrying out the activities; (iv) Identifying land, facilities, seeds, packing materials, chemicals, equipments and service needed; (v) Preparing the budget

#### **4.3.1 Implementation Plan**

In order to ensure smooth implementation of the project, a work plan was prepared indicating different activities to be carried out, the required resources, time frame and person responsible for each project objective. The project implementation of the project involved different stakeholders physically and others were consulted at their working places to get their views especially on technical aspects. The host organization IMPINDURAMATWARA CBO leaders were fully engaged from the beginning in this as they are key implementers of the project. The implementation follows the project implementation plan as shown on table below. Among the major activities in project implementation are securing community participation, coordination of activities, monitoring and evaluation.

**Table 19: Project Implementation Plan**

Objective	Output	Activity	Implementation plan month												Resource needed	Responsible person
			1	2	3	4	5	6	7	8	9	10	11	12		
To create awareness of 80 maize farmers in Rukoma village on commercial maize production by June 2015.	One operation conducted	Disseminate adverts													Human, Funds, Time, Stationery	CBO staff, CED Student, Community and local leaders, Stakeholders
	75 community members attended the meeting	Outsource experts													Human, Stationery	CBO staff, Host organization,
To pass on 40 maize producers with management skills of the maize grain processing project by July 2015. \\	At least one training on how to start processing project.	Organize training													Funds, Time	Host organization, FBSA and Caritas Rwanda
	Meeting for stakeholders conducted.	To organize stakeholders meeting.													Stationery, Human	CBO staff, FBSA and Caritas Rwanda
	Maize producers attend the meeting.	Conduct training													Human, Time, Funds	Host organization Local leaders
		Outsource experts.													Human, Stationery	CBO staff, Host organization
	A sum of 2,500,000 Rwf acquired	To prepare project budget													Human and time	CBO staff, Local leaders
		Consult different stakeholders to supply.													Human, Funds Time	Community local leaders, Host organization
To link maize farmers with	Newspaper adverts reported.	Prepare advert													Stationery, Funds,	CBO staff, Community and

reliable markets for the maize production of maize grain by the year 2015.																local leaders, Stakeholders
	At least three wholesale buyers contracted.	Mention large scale maize buyers													Human, Funds, Stationery, Transport	CBO staff Community and local leaders, FBSA and Caritas Rwanda
		Signing contract with buyers													Human, Funds, Stationery	CBO staff Community and local leaders, FBSA and Caritas Rwanda
To conduct monitoring and evaluation of the project after harvesting of maize grain product by mid and annually 2015.	Maize production project inaugurated.	Selecting and appointing invitees													Funds, Human, Transport Time	CBO staff Community and local leaders, FBSA and Caritas Rwanda, Other Stakeholders
	Monitoring and evaluation participatory project report.	Prepare monitoring and evaluation													Time, Human	Host organization, Stakeholders
		Conduct monitoring and evaluation													Funds, Human, Monitoring and evaluation plan	Host organization, Stakeholders

The implementation of the project involves maize farmers, CBO members, and extension staff with different professions from the local government authority and sector institutions. Constant coordination has been done to prevent duplication of activities, to promote efficiency and to reduce costs. Monitoring has been carried out for checking whether the work is proceeding according to the plan.

Implementation means carrying out what has been planned. Among the major activities in project implementation are securing community participation, coordination of activities, monitoring and taking care of unforeseen events. A number of stakeholders from various institutions and individuals in the community were involved in implementing the project. Constant coordination is being done to prevent duplication of activities, to promote efficiency and to reduce costs. Monitoring will constantly be carried out for checking whether the work is proceeding according to plan, and in case of any apparent shortcomings to take stock of the situation and effect the necessary correction.

The implementation task participated and involved commercial production of maize grain of maize production for maize farmers, Rukoma village leaders, and extension officers with their expertise relevant to the project mainly from Ngoma District Council. The main activities under the implementation were coordination of activities, supervision as well as monitoring and evaluation. Project monitoring allowed the project flexibility on the undertaken activities to ensure smooth implementation of the project and that activities are done as per plan. Evaluation process has been ensuring whether or not the planned interventions are carried out under the right track.

In general the plan helped at large in realizing the set objectives and built the cohesion among the project implementers and other stakeholders. Resources for implementing the project were contributed by various institutions being: (1) IMPINDURAMATWARA by its funds allocation of initial 1,540,000 Rwf in offering project leadership, hiring land, office space and equipment, storage facility, transportation, and purchase of equipment, supplies, facilitating training; (2) Rukoma Local Government Authority contributed labor in planning and initial implementation; (3) FBSA and Caritas Rwanda who offered the training and provided further seedlings from its own nursery without fee. FBSA and Caritas Rwanda also helped with some spray chemicals. Plans are under way to follow up on some pledges from RAB to purchase some more project land. Other stakeholder was government itself that facilitated some training to IMPINDURAMATWARA maize farmers on planting and soil management. The CED student was responsible for support in facilitating trainings and advice in project management, planning, collaboration with various development partners, implementation, and monitoring of planned activities.

#### **4.3.2 Logical Framework**

Logical Framework is an analytical tool which is used to plan, monitor, and evaluate projects. Its name have been derived its logical linkages/relationship set by the planner in order to bring about connection between project means and its ends. The Logical Framework which has been used here is a logic Matrix. A logical Framework as a Matrix has a standard form in its representation. The format which has been used in this framework is sometimes known as a four by four Matrix. It

consist a vertical logic which show the hierarchy of objectives, sometimes it is known as Narrative summary. It describes arrangement of objectives logically. It starts with Goal followed by objective, then Outputs and activities. The matrix allow the planner to arrange objectives in logical order by asking simple questions such as; what objectives are needed to achieve this goal? What output are expected to realize objectives? And then what activities should be done to realize the outputs? After the question on output the last variable which not necessarily to be within the matrix is what inputs are needed to undergo the planned activities?

**Table 20: Project Logical Framework**

Hierarchy of Objectives	Objectively Verifiable Indicators (OVIs)	Means of verification (MOV)	Assumptions
Goal (Impact): Income poverty reduced and standard of living improved to maize farmers.	Increased income and improved standard of living of maize farmers.	Survey and auditing monthly and annual sales reports at beginning and end of project.	People are aware and are open and honest about their income-status
<b>Objective:</b> To create awareness of 80 maize farmers in Rukoma village on commercial maize production by June 2015.			
<b>Output 1:</b> One operation conducted.	Response of CBO and community members (suppliers and consumers)	Project progressive report	Community members became aware about the project.
<b>Activities</b>			
Disseminate adverts	75 Community members attended the meeting	Project progressive report	Readiness of community members to support the project.
Outsource experts	Pieces of flyers prepared and distributed	Project progressive report	Readiness of community members to support the project.
<b>Objective 2:</b> To pass on 40 maize producers with management skills of the maize grain processing project by July 2015.			
<b>Output 2.</b> At least one training on how to start processing project.	Number of CBO Staff, maize farmers and project staff attended	List of participants	Willingness and readiness of CBO Members to attend training
<b>Activities.</b>			
2.1 Organize Training on project management	20 CBO members attended the training.	Training report	Willingness and readiness of CBO Members to attend training
2.2 To organize stakeholders meeting	50 maize growers attended the training.	Training report	Willingness and readiness of maize producers to attend training and learn skills
2.3. Conduct training to project staff.	2 project staff trained	Training report	Willingness of staff to attend the training.
<b>Objective 3:</b> To link maize farmers with reliable markets for the maize production of maize grain by the year 2015.			

<b>Output 3:</b> Newspaper adverts reported.	Prepare adverts	Records of advertisement news paper distributed.	Willingness and readiness of CBO/NGO and development partners to support the project advertisement.
<b>Activities</b>			
3.1: Mention large scale maize buyers.	Three wholesale buyers contracted	List of buyers.	Development partners to support the project.
<b>Objective 4:</b> To conduct monitoring and evaluation of the project after harvesting of maize grain product by mid and annually 2015.			
<b>Output 4:</b> Maize production project inaugurated, and monitoring and evaluation participatory project report.	Monitoring and evaluation plan prepared.	Monitoring and evaluation report.	Selected members participate in monitoring and evaluation.
<b>Activities.</b>			
4.1 Selecting and appointing invitees	Government leaders and other stakeholders working with other community farmers with Rukoma village have been appointed as invitees.	Project inauguration report.	Invitees will attend the inauguration.
4.2 Arrangement to get business license	Business license acquired	Business license	Business License obtained
4.4 Inauguration of maize production project	Number of people who will attend	List people will attend	Readiness of people to attend and availability of fund
4.5 Conducting Mid and Annual evaluation (After six month of project take off)	4 People to participate	Evaluation report	Willingness of members of evaluation team

### **4.3.3 Inputs**

In the course of project implementation various inputs employed include human resources inputs, financial resources inputs and materials input. Human resources were IMPINDURAMATWARA select staff, members of Rukoma local government authorities a few other people from Rukoma community; Rwamagana Agricultural Training Institute consultation staff and few FBSA and Caritas Rwanda staff.

Financial resource is the major component in the implementation which were used for capacity building, purchase of project equipments and for payment of various expenses such as consultation cost, water and electrical bills, fares, rent and transportation. Considering the importance of the project IMPINDURAMATWARA supported the project with 3 million Rwf, whereas other stakeholders contributed 5 million Rwf. Material input includes tool, equipments donation, chemical supplies. Packaging boxes have been procured.

### **4.3.4 Staffing Pattern**

The project has three employed staff being a project manager, secretary and one attendant; with a support of three other members from IMPINDURAMATWARA. Also there are two watchmen who will be paid in terms of honoraria hence the project premise is within the local government authorities' area. However, the implementation to a great extent was and will be assisted by FBSA and Caritas Rwanda members. Group leadership comprises of the chairperson, vice chairperson Secretary and treasurer and Committee members.

#### **4.3.5 Project Budget**

The project annual budget was 3,040,000 Rwf. Out of the total budget 2,500,000 cash was a contribution from CBO members and FBSA as Host organization. The rest was donated in terms of equipments worthy 1,500,000 Rwf by Caritas Rwanda, and beneficiaries contributed work force. All resources and inputs are in place. Costing of items and for project equipments was done in collaboration with Ngoma Livelihood Initiative leaders, sector institutions and local government authorities professions. The procurement was done by Rukoma leaders and technical personnel from the Ngoma local government authorities. The project budget was developed as Table 21 indicates.

**Table 21: Project Budget**

Objective	Output	Activities	Resources needed	Quantity	Unit price	Total Rwf
1. To create awareness of 80 maize farmers in Rukoma village on commercial maize production by June 2015.	One operation conducted	Disseminate adverts	Stationery papers Ream	2	4,000	8,000
			Mobilization	10	1,000	10,000
			Hall of meeting	1	75,000	75,000
			Facilitators Stipends	3	20,000	60,000
	75 community members attended the meeting	Outsource experts	Per diem	3 days	30,000	90,000
2. To pass on 40 maize producers with management skills of the maize grain processing project by July 2015.	At least one training on how to start processing project.	Organize training.	Stationery Flip chart	6	15,000	90,000
			Mark Pens	30	1,000	30,000
			Facilitators Stipends	30	20,000	120,000
			Soft drinks and Snacks	150	400	60,000
	Meeting for stakeholders conducted.	To organize stakeholders meeting.	Papers Ream	1	10,000	10,000
			Flip chart	2	10,000	20,000
			Mark Pens	10	600	60,000
			Facilitators Stipends	3	20,000	60,000
			Soft drinks and Snacks	27	1,000	27,000
	Maize producers attend the meeting.	Conduct training	Participants Stipends	10	20,000	80,000
			Travelling van hire	1	70,000	70,000
		Outsource experts.	Stationery	3	15,000	45,000
	A sum of 2,500,000 Rwf acquired	To prepare project budget	Time	-	-	-
		Consult different stakeholders to supply.	Fuel	30 litters	2,500	75,000
3. To link maize farmers with reliable markets for the	Newspaper adverts reported.	Prepare advert	Advert fee	30	20,000	60,000
			Fuel	20 liters	2,500	50,000
	At least three wholesale buyers	Mention large scale maize buyers	Participant Stipends	2participants	120,000	240,000



#### **4.4 Project Implementation**

##### **4.4.1 Project Implementation Report**

The project implementation was the responsibility of CED student, target group and other stakeholders to ensure that project activities are efficiently implemented. The implementation is slated to start by early March, 2015 as it can be seen in the project plan which followed the sequential order of activities that resulted into project objectives achievement. The project implementation was done in a participatory way involving various stakeholders. The implementation can be divided into four dimensions objectives as being illustrated in the Table 22.

**Table 22: Implementation of the Project**

<b>Objective</b>	<b>Output</b>	<b>Activity</b>	<b>Implementation status</b>	<b>Reasons</b>
1. To create awareness of 80 maize farmers in Rukoma village on commercial maize production by June 2015.	One operation conducted	Disseminate adverts	Advert were disseminate well to the concerned people.	
	75 community members attended the meeting	Outsource experts	Meeting were participated by experts from district.	
2. To pass on 40 maize producers with management skills of the maize grain processing project by July 2015. \\	At least one training on how to start processing project.	Organize training	Training organized	
	Meeting for stakeholders conducted.	To organize stakeholders meeting.	Meeting organized and conducted by stakeholders.	
	Maize producers attend the meeting.	Conduct training	Ten participants attended the training.	
		Outsource experts.	Meeting were participated by experts from district.	
	A sum of 2,500,000 Rwf acquired.	To prepare project budget	A sum of 2,500,000 Rwf prepared	
		Consult different stakeholders to supply.	Ngoma district, stakeholders and maize producers contributed the project.	
3. To link maize farmers with reliable markets for the maize production of maize grain by the year 2015.	Newspaper adverts reported.	Prepare advert	Launching the processing activities, stakeholders' contribution and usefulness of the project.	
	At least three wholesale buyers contracted.	Mention large scale maize buyers	Three maize buyers identified	
		Signing contract with buyers	Signing contracts with buyers is under construction.	
4. To conduct monitoring and evaluation of the project after harvesting of maize grain product by mid and annually 2015.	Maize production project inaugurated.	Selecting and appointing invitees	District executive officer, expected three products buyers have been selected and appointed.	Letters of invitation has not yet disseminated.
	Monitoring and evaluation participatory project report.	Prepare monitoring and evaluation	Monitoring and evaluation plan has been prepared	
		Conduct monitoring and evaluation	Pre MandE have been done.	Annual MandE will be conducted after the project take off.

The CED student in collaboration with CBO leaders, and other stakeholders participated fully in all arrangement of project take off. Monitoring of day to day activities was conducted under the supervision of CBO committee member on duty. The CED student, CBO leaders and Horticultural officer will conduct monitoring on weekly basis for the first three months. Evaluation of the progress of project implementation will be done later as the project is at initial stage, therefore CBO and sector professionals and various stakeholders will conduct mid and annual evaluation after the takeoff.

The objectives and planned activities were done accordingly except evaluation of project implementation that will take place on mid and annual basis. Unexpectedly, the project won the interest of various development partners. It was planned to start with few resources depending on CBO's capital, but interestingly, various stakeholders who were approached happened to respond positively. This has motivated the CBO members and maize farmers to work hard in order to achieve the project goal.

Training to CBO members and project staff on entrepreneurial skills will contribute a lot to the success of the project. The CED student managed to get in touch with various stakeholders who played big role in training CBO members; no wonder, now members are readily destined to skills that will enable them to run the project and take care of their other maize grain related plans. The maize farmers and Marketing will be established; harvesting will start off around November 2015 with few grains of harvest per day; and this will progress into pick by December 2015. The number of grains of harvest will be increase and so will the demand in line with the

marketing of the crops and expected people's awareness of the value of maize eating and maize grain flavor. The CED student in collaboration with IMPINDURAMATWARA leaders succeeded to solicit project tools and equipments from various stakeholders.



**Figure 4: Members Discussing on Improvement of Maize**



**Figure 5: CBO Leader Advice the Members**



**Figure 6: Maize Now in Plantation**

After realization that all required project equipment the CED student mobilized a study visit is planned to Nyagatare Maize Farm which is run by a Ugandan farmer. This trip is meant to provide some firsthand information of process and highlights on experience with maize grain business. Ten participants are expected to be involved in this, namely: 3 persons from IMPINDURAMATWARA including the project manager, one Horticultural officer, CED student, and four members of FBSA and Caritas Rwanda. Participants will first be debrief on specific areas of interest to look for; namely: how that project was established, the challenges and promises the farmer is going through, source of fund, staff pattern, soil management, maize grain collection/storage/marketing; achievement; etc.



The farm proprietor, who is an experienced Horticulturalist; having excelled in Uganda and has long found some secret with the soil and marketing situation in Rwanda which he has expressed interest in unveiling to a team of people with similar interest in Rwanda. Lesson expected to be learnt from this visit includes among other things, how they started with small amount of capital, few of equipment and yet they are making a good profit. After the return of the team, we expect to stay in touch with this Nyagatare farm and be able tap into available market outside of Rwanda for better returns.

## **CHAPTER FIVE**

### **PROJECT PARTICIPATORY MONITORING, EVALUATION AND SUSTAINABILITY**

#### **5.1 Introduction**

This chapter discusses project participatory monitoring, evaluation and sustainability. Monitoring, on which evaluation depends, is the process of observing the implementation of day-to-day activities of a project with the intent to enhance progress in order to realize a desired goal. Evaluation, on the other hand, is a systematic investigation of the worth, value, or merits of an object or process. Monitoring and evaluation are linked together since monitoring sets preference for evaluation. Thus monitoring and evaluation help to collect information required to keep the project on schedule and predict challenges and then make provision for remedy, measure progress and evaluate the success of the program.

It is through this part that one can understand the health of the project whether it will die or be sustained regardless of changes in external support (funding sources) or internal resources (change in staff). Thus participatory monitoring and evaluation is an action of involving all stakeholders of the project from the beginning to an end. In so doing participants become aware of proceedings and once they overcome challenges they discuss and come with solutions and ultimately create sense of ownership, hence, contribute to project sustainability. The chapter is divided into the following parts; monitoring information system, participatory monitoring methods, participatory monitoring plan, participatory evaluation plan, performance indicator, participatory evaluation methods, project evaluation summary and project sustainability.

## **5.2 Participatory Monitoring**

Participatory monitoring is the process of routinely collecting information on all aspects of the project activities that involves the members of the group/community in project implementation. Participatory monitoring is carried out using various techniques and different methods. It is a system of collecting information and making use of the information to determine the progress of the planned work/activities.

Participatory monitoring was intended to monitor the implementation of all activities, that include advocacy meeting to community members, preparing and distributing flyers, training to CBO members, maize farmers and IMPINDURAMATWARA staff, conducting lobbying and advocacy meeting to other stakeholders, conducting study tour, collecting funds and project equipments, facilitate acknowledgement of received support. Other activities are facilitating the purchase of project tools and equipments, identification of maize seeds suppliers, recruiting full time working staff and arrangement of business license. The involvement of CBO members and maize farmers in field visits and in all stages of project implementation enabled them to be aware of the activity process and progress, hence, creating room for comprehensive decision making.

### **5.2.1 Monitoring Information System**

Monitoring and information system is a system designed to collect and report information on a project and project activities that enable a project manager to plan, monitor and evaluate the operations and performance of the project. For commercial of maize for maize farmers, the Monitoring and Information System (MIS) designed

to establish a data base by recording relevant information to activities that were planned in a specified period. Information required include project facilities required and available, Staff required and available, number of maize farmers (suppliers of maize seeds), actual demand and supply, project customers, project stakeholders, training required and actual implementation, number of people who participated in project activities, information on fund received and list of tools/equipment (Inventory of project equipment).

Monitoring will also cover utilization of funds, items purchased as authorized by relevant authorities, bought items and their respective receipts. Obtaining all these information help the project manager plan, monitor, evaluate and report project operations much more easily. The CED student together with CBO committee members and representative of maize farmers prepared a daily recording sheet that allows any one (project staff, CBO members, maize farmers and other stakeholders) to see daily proceedings. It was done so because the CBO committee member is responsible to check daily records which will enable him/her to prepare a week report to be presented in a monthly meeting.

### **5.2.2 Participatory Monitoring Methods**

Various methods and techniques were used to involve CBO members, maize farmers in monitoring of project activities. The PRA key principles and techniques were used to gather information which includes key informants interview, observation, and documentation. The analysis done on the system of maize grain collecting and processing in the field visits and at the project center helped to make some improvement on daily recoding sheet.

#### **5.2.2.1 Key Informants Interview**

The researcher gathered information through key informants that includes extension staff, CBO committee members and district officials and agreed to measure to what extent the project is going to operate. Through discussion they agreed that maize grain suppliers should be those who have been trained on maize grain handling so as to determine the quality of maize grain supplied. Also they insisted and set time for those who haven't attended the training to attend the training so that they benefit from the project.

#### **5.2.2.2 Observation**

The researcher in collaboration with CBO members and Horticultural Experts observed if all activities are implemented as planned. Thus observed training and advocacy meeting carried out, number of participants attended, purchased project equipments and arrangements for project take off. That includes recruitment of project full time staff and their performance to their daily routine, identification of maize farmers who will manage to supply quality maize grain. Necessary information to observe is about customer care to both maize grain suppliers and maize grain consumers.

#### **5.2.2.3 Documentation**

Documentation involves minutes of monthly meetings whereby CBO members will get feedback on project progress. The CBO secretary was required to take note on each agenda during the meeting especially on discussion about achievements, challenges, solutions and the way forward. The CED student, extension staff and other invited stakeholders attend meetings and respond to any technical issues and

challenges as experienced by members as well as reviewing the group's plan. In case there are problems encountered, this forum creates room for discussion and agrees on measures to improve the situation.

Furthermore, information about all transactions in relation to maize grain business is documented in relevant books. For example financial record books including receipt books, payment vouchers, cashbooks, ledger and journals. Also The CED student together with Horticultural expert from FBSA and Caritas Rwanda, CBO committee members prepared the daily recoding sheet that will enable the project manager to check records of the salesmen on boxes of maize grain collected, sorted, amount damaged, and amount sold, and income generated.

### 5.2.3 Participatory Monitoring Plan

**Table 24: Participatory Monitoring Plan**

Objective	Output	Activity	Indicators	Data source	Method/tools	Personnel responsible	Time frame
To create awareness of 80 maize farmers in Rukoma village on commercial maize production by June 2015.	One operation conducted	Disseminate adverts	List of adverts	CBO progressive report	Meeting	CED student CBO members Extension officer	February 2015
	75 community members attended the meeting	Outsource experts	Experts accessed and attended the meeting.	CBO progressive report	Group discussion	CBO members Extension officer	February 2015
To pass on 40 maize producers with management skills of the maize grain processing project by July 2015. \\	At least one training on how to start processing project.	Organize training	List of participant Training report	CBO progressive report	Group discussion	CBO members Extension officer	February 2015
	Meeting for stakeholders conducted.	To organize stakeholders meeting.	Funds or items received	CBO progressive reports	Direct contact, mobile phones	CBO members, Project staff	March 2015
	Maize producers attend the meeting.	Conduct training	List of participants	Progressive report	Discussion Observation	CBO members, Extension officer	March 2015
		Outsource experts.	List of experts outsourced	CBO progressive report	Group discussion	Extension officer, CED students	March 2015
	A sum of 2,500,000 Rwf acquired.	To prepare project budget	A sum of 2,500,000 Rwf prepared	CBO progressive report	Transports	Extension officer, CED students CBO members	April 2015
		Consult different stakeholders to supply.	Maize producers consult and contribute the	CBO progressive report	E-mail letters	Extension officer, CBO secretary	May 2015

			project				
To link maize farmers with reliable markets for the maize production of maize grain by the year 2015.	Newspaper adverts reported.	Prepare advert	List of adverts prepared	CBO progressive report	Discussion	CBO leaders Project officer Maize farmers	May 2015
	At least three wholesale buyers contracted.	Mention large scale maize buyers	List of maize buyers, Event pictures	CBO progressive report	Product promotion advertisements	CBO leaders Project officer Maize farmers	July 2015
		Signing contract with buyers	Signing contract with buyers under construction	CBO progressive report	Product promotion advertisements	CBO leaders Project officer Maize farmers	July 2015
To conduct monitoring and evaluation of the project after harvesting of maize grain product by mid and annually 2015.	Maize production project inaugurated.	Selecting and appointing invitees	Written invitation letters	CBO progressive report	Product promotion advertisements	CBO leaders Project officer Maize farmers	August 2015
	Monitoring and evaluation participatory project report.	Prepare monitoring and evaluation	Number of evaluation conducted	CBO progressive report	Participatory evaluation	CBO leaders Sector experts	December 2015
		Conduct monitoring and evaluation	Report of Monitoring and Evaluation	CBO progressive report	Participatory monitoring and evaluation	CBO leaders Sector experts	October to December 2015

### **5.3 Participatory Evaluation**

Is the process of gathering and analyzing information to determine whether the project is carrying out its planned activities and it investigate if the project is achieving its stated objectives. Participatory monitoring and evaluation can define as a process of collaborative-problem solving through the generation and use of knowledge. It is a process that leads to collective action by involving all level of stakeholders in shared decision making. The key concept of the definition, therefore, is involvement of stakeholders and collective actions towards problem solving or improving the situation. That evaluation to be termed as a participatory evaluation should involve stakeholders at different levels who will work together to assess the project so as to take corrective action required.

In the course of action while implementing the maize farmers and Marketing project, the community members, i.e. maize farmers, CBO members, and other stakeholders were involved in the community needs assessment exercise. They found that establishment of commercial maize production was worthwhile for sustainable economic development of maize farmers. After they agreed on the project, they discussed and set project goals, objectives and activities that need to be implemented. Also they discussed when to conduct evaluation, how, when and who will be responsible. With the assistance of CED student they prepared an action plan, agreed to evaluate the project after six months and twelve month mid and Annual evaluation.

### **5.3.1 Performance Indicators**

Performance indicators of the maize grain collecting and processing project fall into two categories; qualitative and quantitative based on project objective and project goal. To measure the input-indicator, members were to examine resources that were utilized in project implementation that include number of hours, money spent; while for output-indicators involved number of CBO members, maize farmers and project staff trained; and then for impact indicators, this will be measured by examining actual change to maize farmers. Maize farmers are expected to improve their standard of living by fulfilling their basic needs such as ability to have three meals, quality housing and improved health. Project goal and project objectives performance indicators were developed as shown in Table below.

**Table 25: Project Performance Indicators**

<b>Objective</b>	<b>Output</b>	<b>Activity</b>	<b>Resources needed</b>	<b>Performance indicators</b>
To create awareness of 80 maize farmers in Rukoma village on commercial maize production by June 2015.	One operation conducted	Disseminate adverts	Stationery, Facilitators Stipends	List of adverts
	75 community members attended the meeting	Outsource experts	Stationery, Facilitators	Two experts accessed and attended the meeting.
To pass on 40 maize producers with management skills of the maize grain processing project by July 2015. \\	At least one training on how to start processing project.	Organize training	Stationery, Facilitators Stipends	3 day training
	Meeting for stakeholders conducted.	To organize stakeholders meeting.	Stationery, Facilitators Stipends, Soft drinks	3 stakeholders identified
	Maize producers attend the meeting.	Conduct training	Stationery, Facilitators, Soft drink and Snacks	25 participants attended the training
		Outsource experts	Stationery, Facilitators Stipends, Travelling fare	3 experts outsourced
	A sum of 2,500,000 Rwf acquired.	To prepare project budget	Stationery, Facilitators fund	2,500,000 Rwf budget prepared
		Consult different stakeholders to supply.	Stationery, Facilitators Stipends	Ngoma district council, and maize producers consulted and contributed the project
To link maize farmers with reliable markets for the maize production of maize grain by the year 2015.	Newspaper adverts reported.	Prepare advert	Stationery, Facilitators Stipends	25 adverts prepared
	At least three wholesale buyers contracted.	Mention large scale maize buyers	Stationery, Facilitators Stipends	Two large buyers identified
		Signing contract with buyers	Facilitation fund	Signing contracts with buyers is under construction
To conduct monitoring and evaluation of the project after harvesting of maize grain product by mid and annually 2015.	Maize production project inaugurated.	Selecting and appointing invitees	Stationery, Facilitators Stipends	Invitation letters are written
	Monitoring and evaluation participatory project report.	Prepare monitoring and evaluation	Consultation and supervision fees	Monitoring and evaluation plan
		Conduct monitoring and evaluation	Facilitation fund	Monitoring and evaluation report.

### **5.3.2 Participatory Evaluation Methods**

Participatory evaluation method used two methods being Participatory Rural Appraisal (PRA) and Participatory Learning Action. Both methods were in use depending on available resources, environment, and required information. The PRA techniques used are Key informant Interview, Focus Group Discussion, Direct Observation and Workshop.

Main issues to be evaluated were agreed through democratic way during the Focus Group Discussion, Planning meeting and monthly meetings. The participatory evaluation will focus on progress in work plan, Implementation of planned activities, Achievement of Objectives, Project success, Impact of the project and Project sustainability. In order to have a clear understanding and flow of in formations, a checklist were prepared to guide the discussion during the Workshop, Key Informant Interview and Focus Group Discussion.

For the case of maize farmers and Marketing Project Key informants were CBO committee members, Project Manager, maize farmers Suppliers and maize farmers Customers. Observation was used to examine the information collected during the Workshop, Focus Group Discussion, and Key Informant Interview. The collected data and information involved investigating project performance in line with participatory evaluation objectives. That is to check whether planned activities were accomplished according to plan then project outcome were evaluated. Based on participatory evaluation exercise the following results were observed. During the advocacy meeting, discussions issued among participants on the theme of “maize flavor culture”. Participants were convinced grain eating or maize grain eating add to

our natural health. The participants were in the position to give examples of their own people or themselves who are of poor health and of how troublesome their circumstance is to their family members. They realized they all could have by themselves been much healthier with a glass of maize grain a day.

Capacity building to CBO members, maize farmers and Project staff has a trickle-down effect of development all areas of intervention. The CBO members are part and parcel with the Community Development Officer and District Horticultural experts since they mobilized community members and maize farmers about the project output or outcome. The implementation of second objective (capacity building) was done as planned by 100%. Unexpectedly, objective of collaborating with other stakeholders to seek advice and support were met as stakeholders showed immediate positive response.

A number of up to four stakeholders namely Rukoma local government authorities, Rwamagana Agricultural Institute, FBSA and Caritas Rwanda, as well as IMPINDURAMATWARA played a great role in the implementation of the project and achievement of project objective. The procedure (modus operandi) used to establish the project from CNA, project planning, budgeting, project implementation and evaluation plan are methodologies that contributed to getting support from the stakeholders.

Although it is too early to evaluate achievements of objective four - Ensuring maize farmers access to reliable market, still maize farmers found that the project is promising and can survive to a good extent even within the local market.

### **5.3.3 Project Evaluation Summary**

Table below indicates the project evaluation summary based on the project goal, objectives, performance indicators, expected outcomes and actual outcome. Based on the project goal, objectives and activities planned have been met with exception of mid and annual evaluation that will be done after six months of project implementation. Generally the evaluation shows that there are strong commitments of various stakeholders from the planning stage to the implementation activities. This indicates that the project has a felt-need nature to the direct beneficiaries and community at large.

**Table 26: Project Evaluation Summary**

Objective	Output	Activity	Performance indicators	Expected output	Actual output
To create awareness of 80 maize farmers in Rukoma village on commercial maize production by June 2015.	One operation conducted	Disseminate adverts	List of adverts	Community members access adverts	Adverts disseminated to the community members
	75 community members attended the meeting	Outsource experts	Two experts accessed and attended the meeting.	Sensitization conducted	A sensitization meeting successively conducted
To pass on 40 maize producers with management skills of the maize grain processing project by July 2015. \\	At least one training on how to start processing project.	Organize training	3 day training	2 days training preparation completed	A 2 days training conducted
	Meeting for stakeholders conducted.	To organize stakeholders meeting.	3 stakeholders identified	3 Stakeholders to be identifies	3 Stakeholders identified and attended the stakeholders meeting
	Maize producers attend the meeting.	Conduct training	25 participants attended the training	25 maize producers imparted knowledge and skills on how to operate and manage the project	25 host organization members trained on how to operate and manage the project
		Outsource experts	3 experts outsourced	2 experts obtained and conducted the training	2 expert from Kayonza District conducted the training
	A sum of 2,500,000 Rwf acquired.	To prepare project budget	2,500,000 Rwf budget prepared	A budget of 2,500,000 Rwf prepared	A budget of 2,500,000 Rwf prepared
		Consult different stakeholders to supply.	Ngoma district council, and maize producers consulted and contributed the project	Stakeholders contribute worth 1,000,000 Rwf	1,000,000 Rwf collected from different stakeholders
To link maize farmers with reliable markets for the maize production of maize grain by the year 2015.	Newspaper adverts reported.	Prepare advert	25 adverts prepared	Adverts from maize promotion broadcasted	Adverts prepared and broadcasted the project
	At least three wholesale buyers contracted.	Mention large scale maize buyers	Two large buyers identified	Two large scale buyers identified	Two large scale buyers have been identified
		Signing contract with buyers	Signing contracts with buyers is under	Contract with large scale buyers signed	Signing contracts with buyers is under construction

			construction		
To conduct monitoring and evaluation of the project after harvesting of maize grain product by mid and annually 2015.	Maize production project inaugurated.	Selecting and appointing invitees	Invitation letters are written	The district mayor, district Executive officer, the expected 2 products large scale buyers have been invited.	Not yet implemented because inauguration is expected to be done on December 2015
	Monitoring and evaluation participatory project report.	Prepare monitoring and evaluation	Monitoring and evaluation plan	Monitoring and evaluation plan prepared	Evaluation plan prepared
		Conduct monitoring and evaluation	Monitoring and evaluation report.	Project activities executed successful.	Annual evaluation has not been done

**Table 27: Project output**

<b>Expected outcome before project</b>	<b>Season one after project</b>	<b>Outcome</b>	<b>Season two</b>
Before project, the expected outcome was 1 ton per one acre of maize crops harvested.	After implementation of the project harvest was increased up to 1500kg per acre.	Maize farmers are required to continue up to 1800kg per acre for the second season.	Not yet harvested.

The amount of maize product harvested for the first season was thirty thousand kilograms (30 tons) where all amount was sold, and it was give hope for maize farmers to continue producing their product, where the second season of harvesting is waiting in early 2017 with increase of 36 tons for 20 acres where for acre there will improvement of 1800kg from 1500kg per acres. The maize farmers are required to increase their product once it seems that in the market maize produced is inadequate compared to the demand needed by customers.

### **5.3 Project Sustainability**

Project sustainability is the capacity of a project to continue functioning, supported by its own resource (human, material and financial) even when external source of funding have ended. It is commonly known as a state whereby the project functions will totally depend on its own resources. However, it is very important to the Organization /CBO/NGO to develop its own definition of sustainability, the links between organization's own contexts, focus, and the state of affairs.

#### **5.3.1 Institutional Sustainability**

The sustainability of maize farmers and Marketing project for commercial maize in Rukoma village is most likely to be sustainable since human resource (CBO members, community members, maize farmers, project staff, and extension staff and other stakeholders) are readily available towards project implementation. Essentially the materials required as inputs are produced by the beneficiaries themselves (maize grain). Other material input are in place that once depreciate replacement is within the project's capacity.

Capacity building done to maize farmers on maize grain diseases prevention and cure as well as cross breed will contribute to increased maize grain production in future. Referring to the information gathered from key informants and focus group discussion during the CNA exercise, it was revealed that despite small market and low price of maize grain still they appreciated that they gains money to access basic needs.

Thus established commercial maize production is a liberty since it will enable maize farmers to be engaged in other socio-economic activities due to time saved from going around house to house looking for customers. Also training to CBO members and project staff on business management will contribute to project sustainability since they are sure of profit making and employment. The community participation in identifying, designing, planning, implementation, monitoring and evaluation of the project is the key issue that creates sense of ownership that leads to sustainability of the project.

### **5.3.2 Financial Sustainability**

The maize farmers and marketing project has started readily with a total sum of 1.5 million Rwf as the starting capital for land hire, and vital preliminaries to establish a viable maize grain farm. Additional funds will be collected as per agreement with maize grain suppliers by charging a certain percentage per kilogram. As it was proposed by maize farmers during the training that maize grain suppliers will form an organization whereby money will be raised from entering fee and monthly contributions for capital investment, Organization members will get as loan that capital investment and pay a reasonable interest that will be used for development of

members and the project. Since the project is located at the centre of the Rukoma Town, nearby the bus stand and town market, and being the only maize farmers' project of this nature in the district, it all seems obvious to win the market. Based on the plans the project is expected to expand the maize grain supply apart from Ngoma Township to other nearby business/institution centers after acquiring packing materials.

Through collaboration with other development partners such as IMPINDURAMATWARA Staff, CED Student, Sake Local Leaders, FBSA and Caritas Rwanda, the project of commercial maize production is in place to acquire trade permit that will allow the product to win the National and International market. Therefore having such qualifications the project will be financially sustainable since it will be in business with local market, National and International levels. Support from Rukoma LGA particularly extension staff from key departments will continue to support the project even after completion of the project of which reduce project expenses

### **5.3.3 Political Sustainability**

The maize farmers and Marketing project is directly supporting the Rwanda Agricultural Horticultural Policy, the Nation Strategy for growth and Reduction of Poverty II. That being a case, the local leaders at village level, Councilors, Executive Experts at sector levels and District Council level are in favors of the project. Efforts done by various stakeholders, development partners to support the maize grain processing project has created good environment between local government and community members.

## **CHAPTER SIX**

### **CONCLUSION AND RECOMMENDATIONS**

#### **6.1 Introduction**

This chapter gives a summary of the Rukoma maize farmers and marketing project for sustainable economic development of commercial maize farmers in Rukoma Village. Briefly it analyzes on the processes that were carried out from project identification up to the project implementation result. The information within the chapter includes Community Needs Assessments, Problem identification, Literature review, Project implementation, Participatory Monitoring, Evaluation and sustainability of the project. However, the chapter will carry a conclusion which will enable researchers, decision makers, policy makers and other developments partners in the Horticultural sector get the necessary information about the project and come up with concrete suggestions and improvement.

#### **6.2 Conclusion**

The Rukoma maize farmers and marketing project is a venture in direct vision for Rwanda Agricultural Horticultural Policy, the National Strategy for growth and Reduction of Poverty II. Community dwellers in Rukoma village with the assistance of CED student conducted CNA exercise which showed that there are many opportunities and possibilities to support maize farmers, hence bringing sustainable economic development. Findings by participatory assessment showed that although maize farmers own patches of land, they still have to find strategic agricultural or other economic ventures that can turn their story towards economic self-reliance.

Otherwise, the rate of poverty is still high. Findings showed that about 60% of Rukoma village residents live below 1 USD (about 720 Rwf) per day; hence they cannot meet human basic needs. During the interview, only 6% of residents stated that food was adequate. Findings from key informants, focus group discussion show that there are many contributing factors to maize farmers' poverty. These include lack of capital, knowledge and skills, poor technology, inadequate support from government and private sectors dealing with extension services and reliable market for maize grain products.

The chosen CBO "IMPINDURAMATWARA" expressed commitment to providing both men and women's capacity building, the farm's build-up, strengthening IMPINDURAMATWARA leadership capacity, facilitating farm's technical consultancy and requirements thereof, soliciting for more financial channels and opportunities to enhance performance, facilitating the planning and funding of irrigation system to fight drought, and advocating for fair pricing of grain and seedlings. They are committed to starting the arrangements of business by July 2015; and project takes off by December 2015. Agricultural Training Institute of Rwamagana has offered to support the IMPINDURAMATWARA with as much technical advice as can be possible. Being the stakeholder that Agricultural Training Institute is the institute promised to support the CBO with what tools/equipment could be necessary.

The participatory needs assessment conducted in Rukoma Village revealed that income poverty is the major concern in the community. From this study the community members came to agree that maize farmers and marketing project would

contribute to the improvement of socio-economic status. As they responded through questionnaires, experiences during the Focus Group Discussion, in-depth interviews and general observations, the maize farmers and market has been supported by significant stakeholders like District Community development Officer, District Agricultural and Horticultural Development Officer, District Planning Officer, District Health Officer, Sector Executive Officer, Cell Executive Officer and professionals from Agricultural Training Institute. Thus the researcher has to make sure that the community members expectations were met, building on the existing team spirit.

From the information gathered during the CNA exercise and literature review was the pouring force to the CED student to establish the project in Rukoma village. These pouring forces include readiness of community members towards economic development, huge maize grain population in the village, and presence of opportunities to facilitate the operation of the project.

The fact that the establishments of commercial maize for maize grain production and marketing project for sustainable development does require any form of land and minimum weeding, and no much labor on spraying mean limited resources can work miracles, and maize farmers would soon be touching people's life and desire. The progress of the implementation project will be covered by all four objectives and all activities will be implemented except the inauguration of the project to promote sales permits together with mid and annual evaluation that will be conducted after the project take off.

Ensuring that the project will bring sustainable economic development the CED student involved the community members, CBO members and other stakeholders from the project identification, project planning, implementation and monitoring and evaluation of ongoing activities. In the process of project implementation the CED student is expected to see the community through to lead themselves and CBO members capable enough to run the project in absence of CED student. For project sustainability maize farmers proposed to establish a revolving fund that will be used to meet unpredicted expenses and other project cost. For example during the budget exercise it was not taken in considerations that the maize grain box for harvest and sales would require one whole month for delivery. Therefore CBO members have to look into the matter to engage a Ugandan company to design and manufacture the boxes in the name of IMPINDURAMATWARA maize grain farm Produce Sellers.

It is expected that after the project take off all maize farmers in Rukoma village will be able to sell all maize grain produced. Income of Horticultural producers will be increased as the result standard of life improved as they will afford to access basic needs. The success of this project will encourage maize farmers in other villages and sector-experts, as well as other stakeholders to establish such a project. In this way, per capita income and the GDP will be increased.

### **6.3 Recommendations**

Based on experiences from the implementation of commercial maize production it was realized that when participatory community needs assessment is done accordingly community members or beneficiaries are always ready to devote their time, work force and material resources. Thus, authentic participation, transparency

and sense of ownership can easily be determined and are the roots of project sustainability. For a person/group/ interested in establishing maize commercial production of maize farmers and marketing project, I recommend that: Participatory Rural Appraisal (PRA) as it allows for shared learning between local people and outsiders (development practitioners, government officials) to plan together on appropriate interventions;

The participatory assessment should involve the representative of community residents in clusters being residents, maize farmers, business people, and stakeholders from government, private institution and sector experts. This helps to share knowledge and experiences that minimize wastage of resource especially during the planning, designing, budgeting exercise; For project design and implementation for projects that are bounded to follow regulations of sector policies e.g. food growing and marketing, as well as time for seeking working permit should be considered hence it requires cross follow-ups.

Also I would like to recommend the government should give special attention to the maize farming and marketing industry in Rwanda; since is promising investments that save the country from having to import from outside fruit which locals can easily produce and make considerable amount and become reliable tax-payers. One such area where maize farmers need some patience about with government is the challenge of getting packaging materials. The government through sector ministries should play part making sure that they are responsible to produce packaging materials rather than thinking of banning of plastic materials used for maize grain packaging. It should look for, or provide, alternatives before deciding to ban.

From available Literature review, challenges and suggestions on development of maize grain industry are well analyzed. What is required is to take action if at all the government really means to improve the standard of living of maize grain farmers includes: Promoting of investment on maize farming and marketing; Strengthening the technical support services to enable comprehensive and speedy fruit grafting; Eliminating Bureaucracy, inefficiency and conflict of interests between and within Government and Private Institutions and Decentralizing all its activities by empowering all public institutions/agencies that operate in a centralized system in order that all local services required by locals, be local or village levels. All stakeholders in the maize grain industry including government should take measures to facilitate technical advancement, this include training on maize grain processing techniques, exposure to the developed technology in order to acquire knowledge on how to overcome the challenges.

## REFERENCES

- Abel, C. A, Berhow, M. A, Wilson, R. L., Binder, B. F., and Hibbard, B. E. (2000). Evaluation of conventional resistance to European corn borer (Lepidoptera: Crambidae) and western corn rootworm (Coleoptera: Chrysomelidae) in experimental maize lines developed from a backcross breeding program. *Journal of Economic Entomology*, 93(6), 1814–21.
- Agu, R., Bringhurst, T., and Brosnan, J. (2006). Production of grain whisky and ethanol from wheat, maize and other cereals. *J. Inst. Brew.*, 112(4), 314–323.
- Backwell, L., Pickering, R., Brothwell, D., Berger, L., Witcomb, M., Martill, D., ... Wilson, A. (2009). Probable human hair found in a fossil hyaena coprolite from Gladysvale cave, South Africa. *Journal of Archaeological Science*, 36(6), 1269–1276.
- Barry, D., and Alfaro, I. D. (1994). Relation of European Corn Borer ( Lepidoptera : Pyralidae) Leaf- Feeding Resistance and DIMBOA Content in Maize. *Environmental Entomology*, 93(6), 104 - 128.
- Berdica, K. (2002). An introduction to road vulnerability: What has been done, is done and should be done. *Transport Policy*, 9(2), 117–127.
- Bergvinson, D. J., Hamilton, R. I., and Arnason, J. T. (1995). Leaf profile of maize resistance factors to European corn borer, *Ostrinia nubilalis*. *Journal of Chemical Ecology*, 21(3), 343–354.
- Boomsma, C. R., Santini, J. B., West, T. D., Brewer, J. C., McIntyre, L. M., and Vyn, T. J. (2010). Maize grain yield responses to plant height variability resulting from crop rotation and tillage system in a long-term experiment. *Soil*

*and Tillage Research*, 106(2), 227–240.

Bosch-Rekvelde, M., Jongkind, Y., Mooi, H., Bakker, H., and Verbraeck, A. (2011).

Grasping project complexity in large engineering projects: The TOE (Technical, Organizational and Environmental) framework. *International Journal of Project Management*, 29(6), 728–739.

Butrón, A., Chen, Y. C., Rottinghaus, G. E., and McMullen, M. D. (2010). Genetic variation at bx1 controls DIMBOA content in maize. *Theoretical and Applied Genetics*, 120(4), 721–734.

De Leon, N., and Coors, J. G. (2002). Twenty-four cycles of mass selection for prolificacy in the Golden Glow maize population. *Crop Science*, 42(2), 325–333.

de Vendômois, J. S., Roullier, F., Cellier, D., and Séralini, G. E. (2009). A comparison of the effects of three GM corn varieties on mammalian health. *International Journal of Biological Sciences*, 5(7), 706–726.

Devereux, S. (2001). Livelihood insecurity and social protection: A re-emerging issue in rural development. *Development Policy Review*, 19(4), 507–19.

Dittus, K. L., Hillers, V. N., and Beerman, K. A. (1995). Benefits and barriers to fruit and vegetable intake: relationship between attitudes and consumption. *Journal of Nutrition Education*, 27(3), 120–126.

Ellis, F. (1998). Household strategies and rural livelihood diversification. *Journal of Development Studies*, 35(1), 1–38.

García-Berthou, E. (2007). The characteristics of invasive fishes: What has been learned so far? *Journal of Fish Biology*, 71(SUPPL. D), 33–55.

Gáspár, M., Kálmán, G., and Réczey, K. (2007). Corn fiber as a raw material for

- hemicellulose and ethanol production. *Process Biochemistry*, 42(7), 1135–1139.
- Gassmann, A. J., Petzold-Maxwell, J. L., Keweshan, R. S., and Dunbar, M. W. (2011). Field-evolved resistance to Bt maize by Western corn rootworm. *PLoS ONE*, 6(7).
- Gerhart, G. M. (1999). We Wish to Inform You That Tomorrow We Will Be Killed With Our Families: Stories from Rwanda. *Foreign Affairs*.
- Government of Rwanda. (2012). EICV - 3 and DHS4 (2010/11) Preliminary Results, 4.
- Hay, R. K. M. (1995). Harvest index: a review of its use in plant breeding and crop physiology. *Annals of Applied Biology*, 126, 197–216.
- Heim, S., Stang, J., and Ireland, M. (2009). A Garden Pilot Project Enhances Fruit and Vegetable Consumption among Children. *Journal of the American Dietetic Association*, 109(7), 1220–1226.
- Ifejika Speranza, C., Wiesmann, U., and Rist, S. (2014). An indicator framework for assessing livelihood resilience in the context of social-ecological dynamics. *Global Environmental Change*, 28(1), 109–119.
- January, L. G. (2011). National Social Protection Strategy, (January).
- Kempton, J. H. (1924). Jala Maize. A Giant Variety from Mexico. *J Hered* 15 (8): 337–344
- Kgasago, H. (2006). Effect of planting dates and densities on yield and yield components of short and ultra-short growth period maize (*Zea*. *Plant Production and Soil Science*, (October).
- Khoury, C. K., Bjorkman, A. D., Dempewolf, H., Ramirez-Villegas, J., Guarino, L., Jarvis, A., ... Struik, P. C. (2014). Increasing homogeneity in global food

- supplies and the implications for food security. *Proceedings of the National Academy of Sciences*, 111(11), 4001–4006. <https://doi.org/10.1073/pnas.1101000111>
- Koch, G. W., Sillett, S. C., Jennings, G. M., and Davis, S. D. (2004). The limits to tree height. *Nature*, 428(6985), 851–854.
- Kruger, M., Van Rensburg, J. B. J., and Van den Berg, J. (2012). Transgenic Bt maize: Farmers' perceptions, refuge compliance and reports of stem borer resistance in South Africa. *Journal of Applied Entomology*, 136(1–2), 38–50.
- Kucharik, C. J. (2008). Contribution of planting date trends to increased maize yields in the central United States. *Agronomy Journal*, 100(2), 328–336.
- Latour, B. (1993). *We Have Never Been Modern*. *Noûs* (Vol. 12). Retrieved on 1<sup>st</sup> March, 2016 from: [https://doi.org/10.1016/0956-5221\(96\)88504-6](https://doi.org/10.1016/0956-5221(96)88504-6)
- MINAGRI. (2013). Strategic Plan for the Transformation of Agriculture in Rwanda Phase III, (July), 76.
- Matsuoka, Y.; Vigouroux, Y; Goodman, MM; Sanchez G, J; Buckler, E; Doebley, J (2002). A single domestication for maize shown by multilocus microsatellite genotyping. *Proceedings of the National Academy of Sciences* 99 (9): 6080–4.
- Ministry of agriculture and animal resources (MINAGRI) (September 2006); *horticulture strategy for Rwanda, preparing for growth*.
- Monsanto Image, October 2, (2008). *Corn Stalk Lodging*. Retrieved February 23, (2009).
- Natarajan, E., Nordin, A., and Rao, A. . (1998). Overview of combustion and gasification of rice husk in fluidized bed reactors. *Biomass and Bioenergy*, 14(5–6), 533–546.

- . Narayan-Parker, D. (2000). *Voices of the Poor; can Anyone Hear Us?* New York: Oxford University Press
- NISR (National Institute of Statistics of Rwanda)/ EICV3 (Enquête Intégrale sur les Conditions de Vie des ménages (*Integrated Household Living Conditions Survey*)) (2010 – 2011) District Profile, EAST – Ngoma
- NISR. (2012). Fourth Population and Housing Census, Rwanda, 2012. *Rwanda*, 226(4676), 782.
- Ordish, George; Hyams, Edward (1996). *The last of the Incas: the rise and fall of an American empire*. New York: Barnes and Noble.
- Paliwal, R. L (2000). *Tropical maize: Improvement and production*. New York: Barnes and Noble.
- Parker, L., and Blodgett, J. (2010). Greenhouse Gas Emissions: Perspectives on the Top 20 Emitters and Developed Versus Developing Nations. *International Journal of Energy, Environment and Economics*, 18(3–4), 323–341.
- Peiffer, J. A., Roday, M. C., Gore, M. A., Flint-Garcia, S. A., Zhang, Z., Millard, M. J., ... Buckler, E. S. (2014). The genetic architecture of maize height. *Genetics*, 196(4), 1337–1356.
- Pingali, P., Alinovi, L., and Sutton, J. (2005). Food security in complex emergencies: Enhancing food system resilience. *Disasters*. <https://doi.org/10.1111/j.0361-3666.2005.00282.x>
- Piperno, D. R., and Flannery, K. V. (2001). The earliest archaeological maize (*Zea mays* L.) from highland Mexico: new accelerator mass spectrometry dates and their implications. *Proceedings of the National Academy of Sciences of the United States of America*, 98(4), 2101–3.

- Piperno, D. R., Ranere, A. J., Holst, I., Iriarte, J., and Dickau, R. (2009). Starch grain and phytolith evidence for early ninth millennium B.P. maize from the Central Balsas River Valley, Mexico. *Proceedings of the National Academy of Sciences of the United States of America*, 106(13), 5019–5024.
- Ranum, P., Peña-Rosas, J. P., and Garcia-Casal, M. N. (2014). Global maize production, utilization, and consumption. *Annals of the New York Academy of Sciences*, 1312(1), 105–112.
- Ranere, Anthony J., Dolores R. Piperno, Irene Holst, Ruth Dickau, José Iriarte (2009). *The cultural and chronological context of early Holocene maize and squash domestication in central Balsas River Valley, Mexico*. *Proceedings of the National Academy of Sciences* 106 (13): 5014–5018.
- Ridley, W. P., Sidhu, R. S., Pyla, P. D., Nemeth, M. A., Breeze, M. L., and Astwood, J. D. (2002). Comparison of the nutritional profile of glyphosate-tolerant corn event NK603 with that of conventional corn (*Zea Mays* L.). *Journal of Agricultural and Food Chemistry*, 50(25), 7235–7243.
- Roberts, T. L. (2009). The role of fertilizer in growing the world's food. *Better Crops*, 93(2), 12–15.
- Roney, John (Winter 2009). *The Beginnings of Maize Agriculture*. *Archaeology Southwest* 23 (1): 4.
- Sacks, W. J., Deryng, D., Foley, J. A., and Ramankutty, N. (2010). Crop planting dates: An analysis of global patterns. *Global Ecology and Biogeography*, 19(5), 607–620.
- Sangoi, L. (2001). Understanding Plant Density Effects on Maize Growth and Development: an Important Issue To Maximize Grain Yield. *Ciência Rural*,

31(1), 159–168.

Schober, T. J., and Bean, S. R. (2008). Sorghum and maize. In *Gluten-Free Cereal Products and Beverages* (pp. 101–118).

Shephard, G. S., Thiel, P. G., Stockenström, S., and Sydenham, E. W. (1996). Worldwide Survey of Fumonisin Contamination of Corn and Corn-Based Products. *Journal of AOAC International*, 79(3), 671–687.

Smith, B. D. (1997). The Initial Domestication of *Cucurbita pepo* in the Americas 10,000 Years Ago. *Science*, 276(5314), 932–934.

Solon Robinson, (1853). *Hot Corn: Life Scenes in New York Illustrated* (Series app

Spielvogel, Jackson J. (2006). *Medieval and early modern times*. USA: National Geographic. p. 452.

Stanley Gajanayake and Jaya Gajanayake, (1993). Community Empowerment: A *Participatory Training Manual on Community Project Development*.

Stevenson, J. C.; Goodman, M. M. (1972). Ecology of Exotic of Maize. I. Leaf Number and Tillering of 16 Races Under four Temperatures and two Photoperiods<sup>1</sup>. *Crop Science* 12 (6): 864.

*The New York Times*. February 11, (2011). *US Approves Corn Modified for Ethanol*.

Wellhausen, Edwin John (1952). *Races of maize in Mexico*

Valadabadi, S. A., and Farahani, H. A. (2010). Effects of planting density and pattern on physiological growth indices in maize (*Zea mays* L.) under nitrogenous fertilizer application. *Journal of Agricultural Extension and Rural Development*, 2(3), 40–47.

Van Inghelandt, D., Melchinger, A. E., Martinant, J.-P., and Stich, B. (2012). Genome-wide association mapping of flowering time and northern corn leaf

- blight (*Setosphaeria turcica*) resistance in a vast commercial maize germplasm set. *BMC Plant Biology*, 12(1), 56.
- Wallace, J. G., Larsson, S. J., and Buckler, E. S. (2014). Entering the second century of maize quantitative genetics. *Heredity*, 112(1), 30–38. h
- Weber, A., Clark, R. M., Vaughn, L., Sánchez-Gonzalez, J. D. J., Yu, J., Yandell, B. S., ... Doebley, J. (2007). Major regulatory genes in maize contribute to standing variation in teosinte (*Zea mays* ssp. *parviglumis*). *Genetics*, 177(4), 2349–2359.
- Wilkes, Garrison (2004). Chapter 1.1 Corn, strange and marvelous: but is a definitive origin known?. In Smith, C. Wayne; Betrán, Javier; Runge, E.C.A. *Corn: Origin, History, Technology, and Production*. Wiley. pp. 3–63
- Wrigley, C. W. (2009). Wheat: A Unique Grain for the World. *WHEAT: Chemistry and Technology*, 1–17.
- Wyse, R., Campbell, E., Nathan, N., and Wolfenden, L. (2011). Associations between characteristics of the home food environment and fruit and vegetable intake in preschool children: a cross-sectional study. *BMC Public Health*, 11, 938.
- Zárate, S. (2000). The archaeological remains of *Leucaena* (Fabaceae) revised. *Economic Botany*, 54(4), 477–499.
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## APPENDICES

### Appendix 1: Structure Questionnaire to Key Informants Rukoma Community

**Dear Respondent,**

The questionnaire below intends to get your views on economic development of our community. I request that you provide your opinion; and they will be of great importance toward community development. Be assured that the information you contribute will be kept confidential.

Thank you for your kind cooperation.

**Ernestina**

#### **Respondent's Personal Information**

##### 1. Sex

- |   |        |                          |
|---|--------|--------------------------|
| A | Male   | <input type="checkbox"/> |
| B | Female | <input type="checkbox"/> |

##### 2. Age category

- |   |                   |                          |
|---|-------------------|--------------------------|
| A | Below 18          | <input type="checkbox"/> |
| B | Between 19 and 29 | <input type="checkbox"/> |
| C | Between 30 and 40 | <input type="checkbox"/> |
| D | Between 41 and 51 | <input type="checkbox"/> |
| E | Above 51          | <input type="checkbox"/> |

##### 3. Your level of education

- |   |                     |                          |
|---|---------------------|--------------------------|
| A | No Formal Education | <input type="checkbox"/> |
| B | Adult Education     | <input type="checkbox"/> |
| C | Primary             | <input type="checkbox"/> |

D Secondary ☐

E Higher Education ☐

4. Number of persons living under your care

A None ☐

B Between 1 and 3 ☐

C Between 4 and 6 ☐

D Between 7 and 9 ☐

E Ten or Above ☐

5. Your occupation

A Market vendor ☐

B Food crop grower ☐

C School teacher ☐

D Government employee ☐

E Taylor ☐

F Cultural artist ☐

G Construction worker ☐

H Other ☐

6. Your monthly income

A Below 80,000 Rwf ☐

B Between 80,000 and 160,000 Rwf ☐

C Between 161,000 and 240,000 Rwf ☐

D Between 241,000 and 320,000 Rwf ☐

E 321,000 Rwf or Above ☐

7. Your situation to meet the following basic needs:

ITEM	VERY ADEQUATE	ADEQUATE	NOT ADEQUATE
A. Food	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Quality housing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
C. Security	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
D. Clothing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Economic Assessment**

8. People's major economic activities in the community

- |                              |                          |                          |                          |                      |                          |
|------------------------------|--------------------------|--------------------------|--------------------------|----------------------|--------------------------|
| A. Fruit selling             | <input type="checkbox"/> | D. Construction work     | <input type="checkbox"/> | G. Cultural art work | <input type="checkbox"/> |
| B. Second-hand cloth selling | <input type="checkbox"/> | E. Crops growing/selling | <input type="checkbox"/> | H. Fish farming      | <input type="checkbox"/> |
| C. Government employees      | <input type="checkbox"/> | F. Maize crops selling   | <input type="checkbox"/> | I. Other             | <input type="checkbox"/> |

9. What business is potential needs and economically viable in your view?

- |                              |                          |                          |                          |                      |                          |
|------------------------------|--------------------------|--------------------------|--------------------------|----------------------|--------------------------|
| A. Fruit selling             | <input type="checkbox"/> | D. Construction work     | <input type="checkbox"/> | G. Cultural art work | <input type="checkbox"/> |
| B. Second-hand cloth selling | <input type="checkbox"/> | E. Crops growing/selling | <input type="checkbox"/> | H. Fish farming      | <input type="checkbox"/> |
| C. Government employees      | <input type="checkbox"/> | F. Maize crops selling   | <input type="checkbox"/> | I. Other             | <input type="checkbox"/> |

10. Does your business choice (No. 9 above) have production/supply throughout the year?

- |   |     |                          |
|---|-----|--------------------------|
| A | Yes | <input type="checkbox"/> |
| B | No  | <input type="checkbox"/> |

11. How will your business choice (No. 9 above) give impact to the community?

1 = Very strongly; 2 = Strongly; 3 = Not strongly

A.	Increase of individual income	1	2	3
B.	Decrease of dependence	1	2	3
C.	Providing employment opportunities	1	2	3

12. What challenge is most likely to show up in implementing your business choice (No. 9 above)?

- A Inadequate capital ☐
- B Unreliable market ☐
- C Lack of technical skills ☐

13. Are you likely to get support to meet your challenges (from government or NGO's)?

- A Yes ☐
- B No ☐
- C I am not sure ☐

14. If your answer to Question 13 above is 'Yes', what kind of support do you expect?

- A Financial ☐
- B Capacity building ☐
- C Tools and equipment ☐

## **Appendix 2: Interview Guide to Focus Group Discussion (FGD)**

DATE OF INTERVIEW \_\_\_\_/\_\_\_\_/2015

PLACE OF INTERVIEW \_\_\_\_\_

1. Is there any program which supports the Micro Enterprises in the District of Ngoma?
2. If yes, for № 1 above, what kind of support do Micro Enterprises get in the District?
3. How many CBO's are dealing with income generating activities around the District?
4. What is the percentage of CBO poorly performing in income generating activities?
5. If 'any' for № 4, what are the reasons for poor performing?
6. What measures do the Rukoma Local Government Authority and other Stakeholders take to support the CBO's entrepreneurial operations.
7. What measures have been taken to improve the commercial maize production farm?
8. What other economically viable and sustainable activities are there, which are likely to be beneficial to the community of Rukoma Village?
9. Suggest measures to improve the performance of entrepreneurial operations for CBO's.