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PRODUCTIVITY AND PROFITABILITY OF RICE PRODUCERS OF KIRIMBI MARSHLAND IN NYAMASHEKE DISTRICT, RWANDA: A GENDER WISE ANALYSIS

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Abstract:
The topic of gender in agriculture sector has had an increasing interest for many researchers. Authors of this paper assess the productivity and profitability levels of rice producers of Kirimbi marchland in Nyamasheke district using an indicative gender approach. To achieve the objective, data were collected from 333 farmers whereas 198 were male farmers while 135 were female farmers using an interview schedule. This study employs a mixed approach of research viz qualitative and quantitative to analyze the study. Descriptive statistics method was used to describe the data with continuous variables while inferential statistics method was used to ascertain whether there is difference significant between productivity levels of male and female farmers, profitability levels of male and female farmers and benefit cost ratio levels of male and female farmers in Kirimbi marshland. Findings of the study revealed that land productivity for female farmers is high compared to that of males though there is a meager difference between productivity levels. With regards to benefit cost ratio, it is high for male farmers than that of female farmers. It was also found that rice farm business for female farmers was not profitable as the BCR equals to 0.45 therefore female farmers were advised to revisit their expenditures patterns because it was observed that the higher amount of variable costs led to the rice business to be a non-profitable business. For both categories, the average cost of field protection was the highest among others. It is also seen through the differences in total costs where the total cost for males was found to be 609,841Rwf and 979,073Rwf for females which indicates that females spent more

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money on various agricultural practices and inputs than male. This might lead to loss and affected negatively the BCR of female farmers found to be less than one.

Keywords: productivity, profitability, gender, rice, Kirimbi marshland, Nyamasheke district

1. Introduction

The topic of gender in agriculture sector has had an increasing interest for many researchers across the world because of the ongoing discussions on the role of women in the agriculture sector of their countries and the challenges that they faced in all the aspects of their lives. The World Bank, through various researches concluded that countries can directly increase their gross domestic product by acknowledging the role of women in the economic development (Kathleen, Carin, & Speller, 2017).

In Rwanda, agriculture sector is the mainstay activity of the majority of rural people on which they depend on for their livelihoods and contributes 31 % to the GDP (NISR, 2018). The Government of Rwanda (GoR) is committed to achieve gender equality and women empowerment, the sustainable development goal number 5 as defined in the economic development for poverty reduction strategy (MINAGRI, 2010). In this regard, Rwanda has established several policies and government bodies that will implement the initiated policies including Gender National Policy, Ministry of Gender and Family Promotion, Gender Monitoring Office and Women's National Council and specifically in agriculture sector; agriculture gender strategy. These initiatives made Rwanda to be ranked as the second country in the world in promoting gender equality after Sweden. Rwanda was the first country in the world to have more than 50% female members in the parliament (COL, 2015).

To deal with the problems faced by the farmers and recognize women role in the decision making in rural development agriculture gender strategy has been initiated. This strategy is in line with the constitution of Rwanda, economic development and poverty reduction (EDPRS), national gender policy (NGP) and the main purpose of this strategy is to mainstreamed equality between men and women and boys and girls in all the domains of socio-economic development (MIGEPROF, 2010).

Despite the efforts made by the GoR, women are still facing continuous challenges in rural areas especially inequality in the decision making in the use of resources, household income and so forth while women's contribution in the income generating activities is of a great importance. Hence the objective of this study is to understand gender differences in technical efficiency among smallholders' maize farmers. However, modeling gender differences in technical efficiency implies estimating the production functions that yield the maximum output produced by the vector of inputs for a given technology (Mohammed & Ibrahim, 2016).

Literatures show that there are differences in the decision making between males and females in which males have powers over females especially in rural areas (Sexsmith, 2017). Differences reside on how the factors like land rights, credit market, access to extension services, production inputs (seed, fertilizers, labour, etc.) are benefited between male and female farmers and the powers of each group in the decision on how the resources will be allocated. The unbalanced power in decision making especially on the resources use leads to the differences in output between male and female and thereby create difference in frontier line. As the result of these inequalities, the frontier line for female production lies down to that of males indicating that females are less productive and less technically efficient than males.

Therefore, the study of gender differences in technical efficiency will add knowledge to the existing studies and the findings from it will help policy makers to develop policies that will focus on the reduction of gender inequalities in agricultural system.

Women were found to comprise a large proportion of the agricultural labor force in Sub-Saharan. Africa, ranging from 30 to 80 percent. In Malawi, Uganda and Tanzania, female farm managers were found to have lower levels of education and a smaller average family size and were less wealthy compared to all other plot managers. In Malawi, women farmers were found to be older by over five years, on average, and also have lower levels of education as compared to male managers. Only 25 percent of sole female managers were found to be married monogamously, as compared to 87 percent of male managers. Seventy percent of them were found to be widowed, divorced, or separated, compared to only 3 percent among male managers. This study of World Bank asserts that closing the gender gap in agricultural productivity could potentially lift as many as 238,000 people out of poverty in Malawi, 80,000 people in Tanzania, and 119,000 people in Uganda (World Bank, 2015).

In agriculture sector, gender aspect can't be ignored specifically in the productivity and profitability analysis as it provides insights on the differences between male farmers and female farmers in decision making, conducting the activities during and after farming, farm ownership proportions, productive resources' control, access to the: land, credit facilities, extension services and improved tools as well as membership in cooperatives. Therefore, this paper aims to assess differences between male and female farmers in the productivity and profitability levels of rice production in Kirimbi marshland, Nyamasheke district, Rwanda.

1.1.Description on cultivation under wet agriculture

Worldwide, wetlands are most important in producing ecosystems' resources towards the living of huge varieties of natural vegetation. They are also adequate not only for food production for human livings but also for products' crop yield for trading of different farming activities. The development of marshland in Asia is in advanced level than in Africa since there are large wetlands that are unexploited even if most of sub-Saharan African countries have implemented the promotion of wetlands for production of agricultural activities. Although other production activities can be implemented on wetlands with some soil water management, but most of wetlands in the world was designed for rice production systems. The marshland rice related areas in Africa have increased during the time period of 1975 to 1995 and this production of rice yielded food for than 3 billion people in the developing countries and provides different job opportunities and incomes for several hundreds of millions in the world (http://www.fao.org).

In Africa, marshland rice related areas constitute a huge part of commodities' production and direct food production. In a survey conducted by FAO (Food and Agriculture Organization) in 1986, the estimated irrigated land in a traditional way was about 2.38 million hectares out of a total of 5.02 million hectares, 47 percent (Alexis, 2016). In Rwanda where the agriculture provides 84% of livelihood of the population and 33% of the gross domestic production (GDP), wetlands of rice have been implemented to reinforce the agriculture sector in providing job opportunities and incomes in rural area (NISR, 2013).

Rice was introduced in Rwanda in 1960s by various missionaries from South Korea, Taiwan and PRC in lowland where accessibility to irrigation water is relatively better compared with hilly areas and since then, rice has become one of the major food crops grown in Rwanda (MINAGRI, 2013).

1.2.Description of the Rice sub-sector in Rwanda

The period of cultivation can be divided into three agricultural seasons: the first cultivable season or a season start from September to January, the second cultivable season or B agricultural season start from February to June. In marshland, where water is abundant, there is also a third agricultural season or C agricultural season which the farmers mainly cultivate vegetable (NISR, 2013). According to MINAGRI report (2020), Rice is cultivated in A and B season.

In Rwanda, rice is a major cereal crop and considered as a cash crop, providing income generation and livelihoods for an estimated half a million of individuals. It is one of the sectors that received the biggest investment and support by the Government of Rwanda and development partners such as the World Bank, AfDB, IFAD and JICA among others. The investments focused majorly on reclaiming marshlands to increase area under rice production, building drying and storage facilities, putting-up systems to ensure sustainable access to water for irrigating in paddy fields, quality seed production and research, setting-up rice factories to attract private investors in rice milling business, and capacity building of farmers to modern rice farming. In Rwanda, rice growing conditions are favorable and are now dominated by smallholder farmers grouped in cooperatives. It grown over 12,400 Ha of marshlands in two seasons with an average productivity of 5.8 t/Ha of marshland outperforming those of neighboring countries such as Burundi, Uganda, Tanzania (2.5 tonnes per hectare) and Kenya (4.2 tonnes per hectares) (FAO, 2018).

In 2009, smallholder farmers engaged in rice cultivation were 44,907 (MINAGRI, 2021). In Rwanda rice farmers belong to 60 cooperatives, distributed within 29 rice schemes country-wide western (2) southern (12) Eastern (13) and Kigali (2) whereby each cooperative cover rice farmers in a watershed (MINAGRI, 2012).

The total population in Rwanda was estimated at 12.6 million people in 2019, according to the latest census figures compare to 10,04 million people in 2010 (https://worldpopulationreview.com/countries/rwanda-population). The increasing population has put the pressure on available land and water resources which led to their degradation and loss of productivity of arable lands and increase food insecurity (Bidogeza et al., 2015). The respond of Rwanda's farmers to the pressure on land and associated decline in productivity has been to expend their agricultural activities into the fragile marshland.

The total area of marshland in Rwanda is approximately 165000 hectares (ha) of which 19,754 hectares has been cultivated (MINAGRI, 2010). In Nyamasheke district (in 2019) had 807 hectares where the rice is intensely cultivated totally in marshland and the average yields of consolidated land was 6.2 tonnes per hectares.

According to Rwanda Agriculture Board (RAB), there are different rice types on 12,400 ha of all marshlands in Rwanda with an average productivity of 5.8 tonnes per hectare (https://www.newtimes.co.rw/news/farmers-count-losses-poor-quality-affects-demand-local-rice).

Rice production increased to 113,880 tonnes in 2018 from 83,338 tonnes in 2017.This led to the increase in rice production in Rwanda from 46,191 tonnes of paddy in 2004 to 115,315 tonnes in 2018 and the increase in area under rice production from 3000 ha in 2000 to 14000 ha in 2015. Farmers were organized in cooperatives and almost 40 improved varieties yielding more than 7t/ha were availed to rice producers. Rice is sold locally and aboard. The market of rice locally is monitored by the different stakeholders under the umbrella of government policies precisely in setting price and linking the cooperatives with potential market. Kirimbi sector is one sector from fifteen sectors composed Nyamasheke district with an area of 43,4km2 and a population density of 516,7/km2.10,521 population are males (45,9%) and 11,913 population are females (53,1%).

The rice sector is organized in such around 90% of farmers are in cooperatives therefore the utilization of agriculture inputs such as land, fertilizers, pesticides, and water are high in comparison with other crops. The accessibility of technical assistance is done by the different entities therefore the production is raising. The utilization of mechanization in farming is still low; the farmers use the hand toolkits in different activities.

In agriculture sector, gender aspect can't be ignored specifically in the productivity and profitability analysis as it provides insights on the differences between men farmers and women farmers in decision making, conducting the activities during and after farming, farm ownership proportions, productive resources' control, access to the: land, credit facilities, extension services and improved tools as well as membership in cooperatives. Despite of the high yield of some rice's variety such as Kigori (short grain) be cultivated in Kirimbi marshlands and its resistance to disease caused mostly by

Fungal and viral diseases, namely the rice blast caused by Magnaportheoryzae, and the rice yellow mottle virus, on the market is considered as a low quality in competition with other varieties from abroad and or within the country.

On the other hand, smallholder farmers in Rwanda are getting lower profits (profitability) up today, 60 per cent of rice grown in Rwanda is Kigori which is short grain rice, but consumers do not like it due to its poor quality and therefore it fails to compete with imported rice from Pakistan, Tanzania and India. In addition, with long grain rice, the price is a bit high compared to the one imported but almost the same quality. If Pakistan rice is costs Rwf18,000 per sack, locally produced long rice goes for Rwf20,000 and its quality is similar to that of the imported rice.

2. Literature review

2.1 Definitions of key terms

2.1.1 Productivity

Measure of the amount of crops produced compared to the amount of time, effort, and money put into growing the crops. While economically productivity is defined as the ratio of agriculture inputs to agricultural outputs, incl. labor and land, capital and materials, most often measured in yield (weight) and market value (profit).

2.1.2 Profitability

David Kahan (2013) differs two type of farming, in the first type "The decisions on the farm are closely interlinked with decisions of the farm household, similarly the objectives of the farm are mostly driven by the objectives and goals of the farm household, governed by the phase in which the household finds itself prior to having children, while children are growing up or post-children, The second type called Market-oriented farming is driven by making profits through selling farmer products in the market on a regular basis. The Agriculture profitability is the degree to which a business or activity yields profit or financial gain.

2.1.3 Gender

Refers to the social roles of men and women and boys and girls as well as relationship between and among them in a particular society at a specific time and places. It is a key determining factor of who does what, who has what, who decides and who has the power (Rogert Le Moyne, 2010).

2.2 Empirical studies relating to the present study

Abdulallem, et al. (2017) conducted the study on the analysis of costs and returns on maize production among small scale farmers in Osun state Nigeria. To select the sample size of 180 farmers, the multistage sampling technique was employed using structured questionnaires. Descriptive statistics were employed to study the socio-economic status while the gross margin analysis was used to estimate the profitability of maize enterprise.

Findings from the descriptive statistics showed that majority (80%) of the farmers' respondents were male with the mean age of 42.3 years old. About marital status variable, results revealed that 84.5% of maize farmers were married and most of respondents knew how read and write. The mean household size was about 7 persons per house. The computed BCR was 1.74 implying that maize farming in the area of the study was profitable. The also investigated the problems that farmers encountered throughout the value chain of maize production where lack of control measures against pests and diseases, poor social infrastructures, high transportation cost and low market price of maize. In the perspective of increasing more returns to the farmers, recommendations were made where the government was advised to provide farm inputs at affordable rate. Islam, et al. (2017) studied the profitability and the productivity of rice production in the selected coastal area of Satkhira district in Bangladesh. To achieve the objective of the study, the employed the Cobb-Douglas production function model in order to estimate the contribution of each agricultural input to the production processes of rice. Concerning the estimation of the profitability level of rice, authors used the net returns from rice production where gross costs such as variable and fixed costs were computed. The study findings showed that smallholder farmers got higher net returns than the medium and large ones. This led to the same conclusion as the BCR for the smallholder farmers, medium and large were 1.38, 1.23 and 1.15 respectively. It was also found that the coefficient of seed, fertilizer, power tiller, irrigation cost and human labor had significantly affected the gross return. Lack of saline tolerable good quality seeds, high price of inputs, low price of outputs and natural calamity were the major problems encountered by rice farmers in the study area. Ogunniyi, et al., (2012) conducted a study on the gender comparison in production and productivity of cocoa farmers in the Ile Oluji Local Government area of Ondo State, Nigeria. Findings revealed that male farmers made 5.79 tonnes while females made 3.79 tones, farm size of male 13.1ha as against 11.78ha. Hence, male farmers cultivate more farm size compared to females. The male farmers recorded 164 man-days while the female recorded 287 man-days, with regards to fertilizers use, the average use of 92kg was used by females while the male farmers used an average of 123.5kg. In terms of pesticides and insecticides, male farmers used 4.47 liters and 5.8 liters of pesticides and insecticides respectively and against 1.74 liters and 4.35 liters used by females.

Sanaullah, et al. (2016) analyzed the rice profitability and marketing chain with a reference case of Taluka Pano Akil district Sukkur Sindh Pakistan. The study used the primary data collected from the sample size of 60 rice growers. Results showed that marketing average cost for various agricultural activities such as fixed cost, land preparation, seed and sowing, farm inputs, harvesting and threshing were Rs.41910, Rs.15200, Rs.2350, Rs.2900, Rs.7460, Rs.7400 and Rs.6600. The study found also that on an average per acre gross income was Rs.108,400 with total expenditure of Rs.68,310 in the study area, from here it was concluded that rice farming business was profitable as the net farm income was Rs.40,090. Farmers were advised a proper combination of inputs, facilitating farmers to easily access financial related services, providing subsidies on fertilizers, pesticides to farmers, establishing a research center focusing on developing the guidelines for improving rice productivity in the area of study.

2.3 Research gap

Many studies aimed to estimate the productivity and profitability levels of different agricultural crops were done in the world as shown above in the review of empirical studies. However, according to the best of our knowledge there are no or few studies which tried to assess the productivity and profitability by taking into consideration gender parameter. Here we mean studying the differences in productivity and profitability levels between female and male farmers. In Rwanda, specifically in the district of Nyamasheke no study related to the analysis of productivity and profitability for both female and male rice farmers in Kirimbi marshland. With these few statements, authors wished to close this gap by conducting a study on the productivity and profitability of rice producers of Kirimbi marshland in Nyamasheke district taking into consideration gender wise approach. Hence, the present study will inform the policy makers in agricultural sector on the existing productivity and profitability differences to ensure equality in the sector in Rwanda.

3. Methods and Materials

3.1 The study area

Kirimbi marshland is located in the Kirimbi and Macuba sectors of Nyamasheke district in Western province, Rwanda. Nyamasheke district borders in East with Nyamagabe District, Lake Kivu in the West, Rusizi District in South and Karongi District in North. Due to its agro-ecological conditions, the soil is more fertile and productive. These farmers are mainly smallholders as they operate at small scale. All the farmers operating in Kirimbi marshland cultivate rice under the area of 127 hectares.

The district location is shown in Figure 1 below:

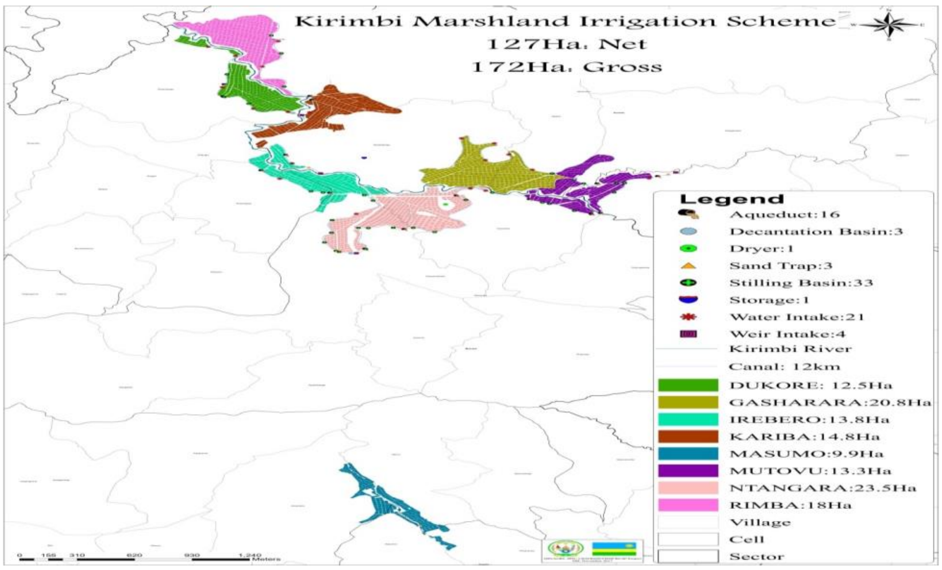


Figure 1: Kirimbi marshland irrigation scheme (**source:** Kirimbi Rice Cooperative)

3.2 Data sources

Both primary and secondary data were used for this study. Primary data was collected through a survey. They were used to answer most of the research questions under investigation such as questions related to the socio-economic status of the rice producers, costs of cultivation, price at which the produce was sold, quantity of rice harvested among others. Secondary data were used to get seasonal information on the rice production in Rwanda and to back up some results of the research. Furthermore, they were found on the National Institute of Statistics of Rwanda (NISR) website (www.nisr.gov.rw).

3.3 Study population

Study population comprises of the total number eligible for the selection of the sample size. In this study we had 2006 smallholder rice farmers under Kirimbi rice cooperative. However, the study selected a small sample of smallholder farmers from the district to represent smallholders in the entire cooperative members.

3.4 Sampling methods and sample size

A sample of 333 randomly selected smallholder rice farmers was gathered from the rice cooperative of Kirimbi. Kirimbi cooperative leaders assisted in providing list of farmers in the study area from which 333 farmers were randomly selected. We used simple random sampling because of its merits in giving each and every smallholder maize producer to have an equal chance of being selected to represent the population.

Having the total number of rice farmers in Kirimbi cooperative, the sample size is calculated using the formula of Yamane as shown here under:

$$\text{n} = \frac{N}{1+Ne^2}$$

Where:
n: sample size for a finite population
N: Size of population
e: Margin of error considered is 5% for this study

$$n = \frac{2006}{(1+2006\times(0.05\times0.05)}=333$$

After getting the sample size it is therefore required to use probability proportional to sample size method to have both samples size for male and female rice farmers. For instance, the population size for male (N1) is 1194while that of female (N2) is 812 (Cooperative Book, 2020). Knowing the population sizes for male and female stratums it is evident to apply the following formulas to derive samples sizes:

$$n_{1(Male)} = \frac{N_1\times n}{N} = \frac{1194\times333}{2006} = 198\text{(Rice Male farmers)}$$

$$n_{1(Female)} = \frac{N_2 \times n}{N} = \frac{812 \times 333}{2006} = 135(\text{Rice Female farmers})$$

3.5 Data collection methods

Every study relies on the data collected. Thus, to collect the needed data, authors developed a questionnaire that was pre-tested, adjusted and used to collect data. Information on rice input cost and production consisted the bulk of the questionnaire. However, farmer characteristics (resources" endowment and demographic characteristics etc.), costs and benefits incurred by farmers in the value chain were received. Face to face interviews were used to gather the data as the method was regarded as the one with a higher possibility of getting high rate of responses and to take less time than other interviewing methods.

3.6 Data analysis tools

The main objective of this study is to measure productivity and profitability between women and men rice producers to have insight on the differences of performance levels and allow comparison of both productivity and profitability levels between them.

3.7 Productivity analysis: Land versus labour

Productivity is an economic indicator of measurement that measure farm-level productivity. For instance, it indicates measurement for one commodity and one input (for example, labour productivity of maize farms) may only require basic information on output quantities and labour use. For example, a productivity measure for agriculture that is often cited is crop output per land area (commonly referred to as crop yield), with a higher yield corresponding to higher productivity.

3.7.1 Land productivity

$$\text{Land productivity} = \text{Volume of output} / \text{Planted Area}$$

Where:
Volume of output is measured in Kilogram
The planted area is expressed in an area unit (acres)
Land productivity corresponds to crop yields

3.7.2 Labour productivity

Labor productivity is applied to measure the productivity of the worker and is calculated as the value of output produced by a worker per unit of time, such as an hour. By comparing the individual productivity with average, it can be identified whether a particular worker is under-performing or not (https://www.wallstreetmojo.com/labor-productivity/).

$$\text{Labour productivity} = \text{Volume of output} / \text{Units of labour used}$$

The units of labour used are the total number of hours taken by the farmer to produce rice.

Many ways are adopted to assess the quantity of labour input: the number of workers active on the holding; the number of time units (such as hours, days and months). This study used the number of time units measured in hours.

3.8 Profitability analysis

To assess whether rice farm business is profitable or not for men and women producers an economic indicator named as Benefit Cost Ratio (BCR) was computed. Since it indicates compares the economic benefits of an activity (farm business) with the economic costs of the same activity.

3.9 Economic indicators for profitability analysis

3.9.1 Total cost (TC)

$$\text{TC} = \text{TFC} + \text{TVC}$$

Where:
TC: Total cost
TFC: Total fixed cost
TVC: Total variable cost

It is important to compute both total fixed and total variable costs in regard to rice production since our study focuses on gender analysis; it is evident that each indicator was analyzed to both male and female rice farmers. Hence, for the case of this study TC, BCR for male and female are generated for the sake of comparison purposes.

$$TFC = Ttax$$

Where:
TFC: Total fixed cost
$Ttax$: Total amount of tax

$$TVC = CTill + Cnurs + CHar_1 + CHar_2 + CSow + CFert + CSpr + CWeed1 + CWeed_2 + CWeed_3 + CWeed_4 + CFP + CHarv + CDr + CWin + CBa + CSh + CWat$$

Where:
TVC = Total variable cost
$CTill$ = Cost of tillage
$Cnurs$ = Cost of nursery
$CHar_1$= Cost of harrowing for the first time
$CHar_2$= Cost of harrowing for the second time

$CSow$ = Cost of sowing
$CFert$ = Cost of fertilization
$CSpr$ = Cost of spraying
$CWeed_1$= Cost of weeding for the fisrt time
$CWeed_2$= Cost of weeding for the second time
$CWeed_3$= Cost of weeding for the third time
$CWeed_4$= Cost of weeding for the fourth time
CFp = Cost of field protection
$CHarv$ = Cost of harvesting
CDr = Cost of drying
$CWin$ = Cost of winnowing
CBa = Cost of bags
CSh = Cost of sheeting
$CWat$ = Cost of watering

3.9.2 Gross Margin (GM)

$$\text{Gross Margin} = \text{Gross Return} - \text{total variable cost}$$

3.9.3 Benefit Cost Ratio (BCR)

$$\text{BCR} = \text{Gross Margin}/\ \text{Total cost}$$

If the BCR exceeds one, then the business is profitable and when it is less, the business is not profitable. However, if it equals to one, it means that the business needs to be reassessed for further adjustment.

3.10 Inferential statistics

To test whether there is /or no significance difference in means of productivity among male and female farmers in the area under study, researchers set up the hypotheses governing the test as follows:

H_N: There is no significance difference in means of productivity among male and female farmers of Kirimbi Rice-Marshland versus

H_A: There is a significance difference in means of productivity among male and female farmers of Kirimbi Rice-Marshland.

Where the notations H_N and H_A stand for the null and alternative hypothesis respectively.

4. Results and Discussion

4.1 Socio-economic status of the sample distribution

Table 1: Gender distribution in the sample

Variable	Frequency	Percent	Valid Percent	Cumulative Percent
Female	135	40.5	40.5	40.5
Male	198	59.5	59.5	100
Total	333	100	100	

Source: Own constructed.

Table 1 depicts information on the distribution of gender in the sample whereby 59.5 percent and 40.5 percent comprise males and females respectively. This information is very important because it guides throughout the analytical process of this study. Gender parameter is also considered as the pillar under which this study lies upon.

Table 2: Training status among male and female rice farmers

Variable		**Gender distribution**		**Total**
		Female	**Male**	
Training status	**No**	76	139	215
	Yes	59	59	118
Total		135	198	333

Source: Own constructed.

Table 2 provides details about the training differences between male and female rice farmers. Results show that out of 198 male farmers, only 59 were trained which means that a large part of males did not received any training for this season and hence it can negatively affect the labor productivity and then technical efficiency among rice farmers. Similarly, to female farmers, less portion of females only 59 were trained out of 135 farmers.

Table 3: Educational status among male and female rice farmers

Variable		**Gender of the respondents**		**Total**
		Female	**Male**	
Education status	**Illiterate**	11	10	21
	Literate	124	188	312
Total		135	198	333

Source: Own constructed.

Table 3 gives details on the educational status viz illiterate and literate sub categories between male and females rice farmers. As it is observed from the table, out of 198 male farmers 188 are literate (know how to read and write) whereas out of 135 female farmers; 124 were literate. This factor is very important in the production process as it enables farmers to easily cope with agricultural extensionists whenever necessary and therefore improve farm productivity.

4.2 Productivity analysis between male and female rice farmers

4.2.1 Land productivity

a) $\boldsymbol{LPM} = \frac{Output\ by\ Males}{Planted\ area\ by\ Males} = \frac{75{,}462}{14.19} = 5{,}317$

b) $\boldsymbol{LPF} = \frac{Outputby\ Females}{Planted\ area\ by\ Females} = \frac{45{,}490}{8.05} = 5{,}650$

4.2.2 Labor productivity

a) $\boldsymbol{LPM} = \frac{Output\ by\ Males}{Unit\ of\ labour\ used\ by\ Males} = \frac{75{,}462}{119{,}573}$ =0.63

b) $\boldsymbol{LPF} = \frac{Output\ by\ Females}{Unit\ of\ labour\ used\ by\ Females} = \frac{45{,}490}{67{,}749} = 0{,}67$

Results on the land productivity analysis showed that land productivity between male and female farmers is almost similar because there is a meager difference indicates 5,317 and 5,650 respectively. Results indicate that male farmers harvested on average 5,317Kg of rice on 1acre of land while females harvested 5,650Kg of rice on 1acre of land. In regard to labour productivity, findings report that labour productivity for male farmers equals to 0.63Kg implying that male farmers produce on average 0.63kg of rice in an hour while females produce on average 0.67Kg of rice in an hour. Similarly, to the land productivity findings the difference between male and female farmers is also small for the labor productivity.

4.2 Profitability analysis between male and female rice farmers

4.2.1 Cost of production (males and females)

Generally, in economics total cost is composed by total fixed cost and total variable cost and particularly in agricultural production economics specifically to rice crop production total cost comprises total fixed cost which is constituted by tax on land and total variable cost which is in turn cost of tillage, cost of nursery, cost of harrowing 1 & 2, cost of sowing, cost of fertilization, cost of spraying, cost of weeding 1, 2, 3, & 4, cost of field protection, cost of harvesting, cost of drying, cost of winnowing, cost of padding, cost of bags, cost of shifting and cost of watering. Therefore, descriptive data of the variable cost for male and female farmers' sub-categories are shown in Table 4 & 5 respectively. Note that data of fixed cost is given as amount of tax paid seasonally on agricultural land which is constant.

1st step: Cost structure for male farmers

Table 4: Descriptive statistics for cost of various activities in rice production among male farmers

Cost per activity	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Cost of tillage	198	600	32000	861400	4350.505	3425.62377
Cost of nursery	198	0	9000	289400	1461.616	1550.41878
Cost of harrowing-1	198	400	24000	759400	3835.354	2551.19413
Cost of harrowing-2	198	200	16000	747500	3775.253	2277.13055
Cost of sowing	198	500	30000	812000	4101.01	3337.20741
Cost of fertilization	198	0	55000	542000	2737.374	4928.47493
Cost of spraying	198	0	9000	313280	1582.222	1568.61966
Cost of weeding-1	198	500	70000	761900	3847.98	5211.0066
Cost of weeding-2	198	1000	24000	855000	4318.182	2961.21678
Cost of weeding-3	198	0	28000	780700	3942.929	2957.46934
Cost of weeding-4	198	500	40000	781100	3944.95	4081.23722
Cost of Field protection	198	1000	40000	1207400	6097.98	4009.12613
Cost of harvesting	198	500	38000	754380	3810	3854.7147
Cost of drying	198	200	30000	578200	2920.202	3213.61254
Cost of winnowing	198	0	34000	333200	1682.828	2602.73345
Cost of padding	198	0	6000	196700	993.4343	759.04517
Tax on land	198	300	6900	315970	1595.808	919.76995
Cost of bags	198	300	9000	313000	1580.808	1005.18218
Cost of shitting	198	100	10000	413060	2086.162	1372.43657
Cost of watering	198	200	10000	429300	2168.182	1434.22549

Source: Own constructed.

Table 4 reports the descriptive statistics results for cost of various activities in rice production performed by male farmers in Kirimbi rice marshland. The calculated statistical indices were minimum, maximum, summation, mean and standard deviation.

As it is seen through the results, among the costs of various activities in rice production for males the average cost of field protection is the highest compared to others as it is 6097Rwf followed by the cost of tillage which is 4350Rwf and cost of weeding-2 which is 4318Rwf. The lowest cost is for padding on average it costs 993Rwf preceded by cost of nursery i.e. 1461Rwf. The findings reflect the reality of the field because the majority of rice farmers reported that they usually faced the problem of having many birds in the area as they eat rice in its germination phase. They requested that if there is any possibility of dealing with this issue would of great importance to them as they could expect more yield and reduce the amount that they are spending field protection in the purpose of stopping birds and others external parasites to enter in the field. They also stated that during tillage activity, many farmers need extra casual workers meaning that workers are on high demand which caused the increase in price and therefore the cost of tillage. Due to this, farmers suggested to maintain stable the amount to be paid for a worker per day which is known as 500Rwf and they said that to follow this rule, sectoral agronomists, cooperative agronomist and RAB staff and other staff from the ministry of agriculture and animal resources must be there during the period of heavy tillage to make sure that the amount paid for workers is given as it is known. Finally, they argued that once these two issues are tackled for sure they will enjoy high economic return and be able to have money to invest for the next season while also covering household expenses.

2nd step: Cost structure for female farmers

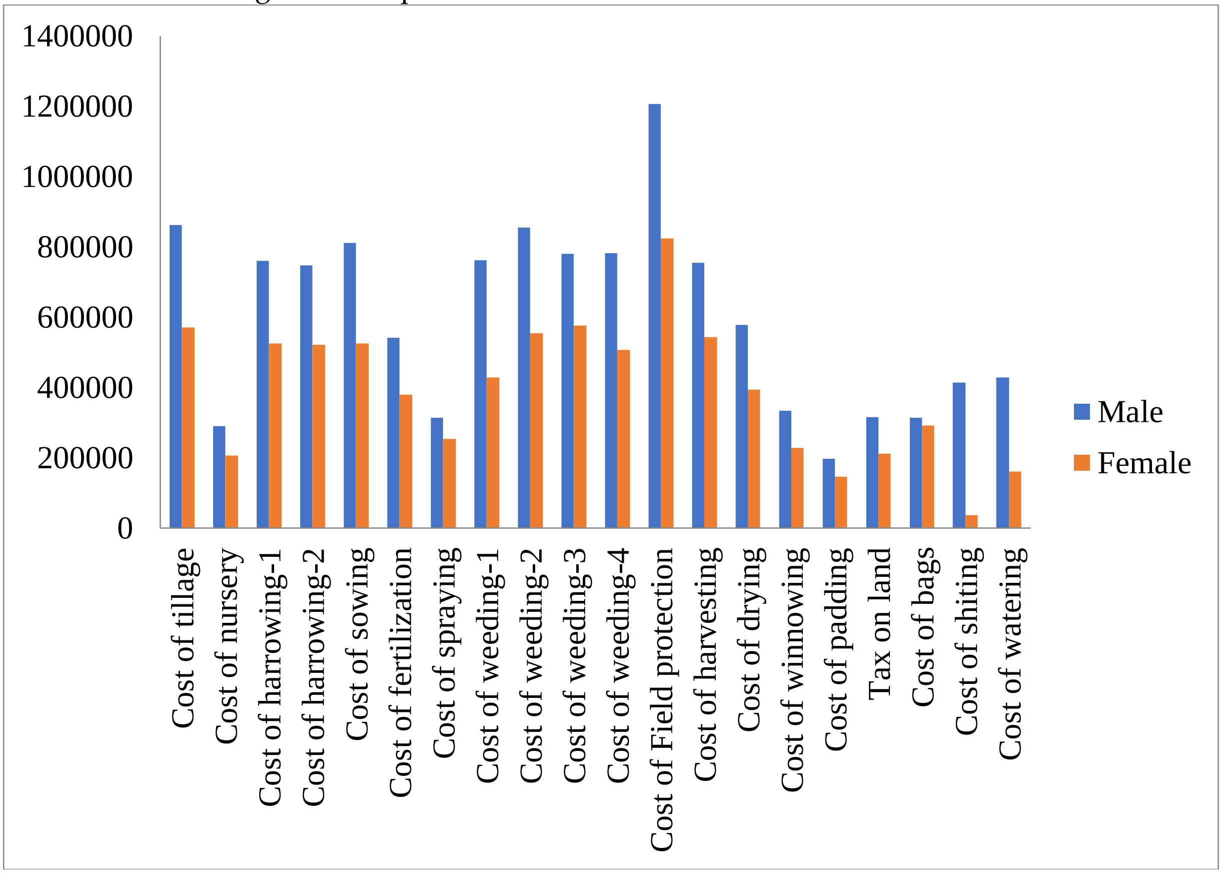
Table 5: Descriptive statistics for cost of various activities in rice production for female farmers

Cost per activity	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Cost of Tillage (Rwf)	135	600	20000	571200	4231.111	2393.94344
Cost of nursery (Rwf)	135	200	6000	206600	1530.37	1150.74759
Cost of harrowing-1 (Rwf)	135	500	20000	525700	3894.074	2642.18823
Cost of harrowing-2 (Rwf)	135	500	25000	520800	3857.778	2724.14485
Cost of nursery (Rwf)	135	500	30000	525500	3892.593	3332.64338
Cost of fertilization (Rwf)	135	500	12000	379500	2811.111	2524.37865
Cost of spraying (Rwf)	135	200	15000	253460	1877.482	2238.64489
Cost of weeding-1 (Rwf)	135	500	13000	428700	3175.556	2258.39947
Cost of weeding-2 (Rwf)	135	500	25000	554100	4104.444	2874.14794
Cost of weeding-3 (Rwf)	135	300	25000	576600	4271.111	3053.20645
Cost of weeding-4 (Rwf)	135	500	20000	506700	3753.333	2823.35145
Cost of field protection (Rwf)	135	500	54000	823180	6097.63	6519.70014
Cost of Harvesting (Rwf)	135	500	40000	543180	4023.556	4425.9087
Cost of drying (Rwf)	135	500	12000	393500	2914.815	2119.50848
Cost of winnowing (Rwf)	135	200	6000	228300	1691.111	1233.63718
Cost of padding (Rwf)	135	100	5000	145300	1076.296	875.98196
Cost of bags (Rwf)	135	300	12000	211350	1565.556	1379.33126
Cost of shitting (Rwf)	135	0	8000	291110	2156.37	1608.43653
Tax on land	135	80	2000	36520	270.5185	253.36929
Cost of water	135	240	4000	160240	1186.963	649.79133

Source: Survey, 2020.

Table 5 indicates the descriptive statistics results for cost of various activities in rice production performed by female farmers in Kirimbi rice marshland. Findings revealed that among the costs of various activities in rice production for females the average cost of field protection is the highest compared to others as it has an average of 6097.62Rwf almost similar to that of males. This means that the activity of protecting rice farms against birds and other external agents that can damage rice through its developmental value chain. Another activity which was found to be costly was the third weeding followed by the tillage as they cost averages of 4271Rwf and 4231Rwf respectively. Thus, about field protection cost, they strongly requested the same as for males however on the cost of the third weeding they said that the third weeding is costly due to the reason that this activity is usually costly among all the weeding activities as it requires more time in regard to others. Generally, for 2 workers the first weeding takes two days to weed one acre of land while the third weeding needs 4 workers to complete one acre. With regard to cost of land, it is the lowest among all the costs as it is having a mean value of 270.5Rwf because the GoR has reduced the amount of tax on land whereas previously it was 40,000Rwf per hectare for year but currently it is 4000Rwf per hectare for one year.

Figure 2: A comparison in terms of costs of various agricultural practices between male and female rice farmers



Source: Own constructed.

Figure 2 informs the total costs of various agricultural practices involved in rice value chain production between male and female farmers. Results show that cost of field protection is high for both categories. The second practice which costs a lot of money male farmers is ***tillage*** while for female is the ***third weeding***. The third practice for males is the second weeding while it is the tillage females.

Table 6: Benefit Cost Ratio analysis of rice production in Kirimbi marshland

S.No	**Economic Indicators**	**Male**	**Female**
		Mean	**Mean**
1	Rice production per hectare	5,317	5,650
2	Price of rice per Kg	250	250
3	**Total Revenue**	**1,329,250**	**1,412,500**
4	**Variable costs**		
	Cost of Tillage	40253.7	70956.52
	Cost of nursery (Rwf)	14559.55	25664.6
	Cost of harrowing-1 (Rwf)	37047.22	65304.35
	Cost of harrowing-2 (Rwf)	36701.9	64695.65

	Cost of nursery (Rwf)	37033.12	65279.5
	Cost of fertilization (Rwf)	26744.19	47142.86
	Cost of spraying (Rwf)	17861.87	31485.71
	Cost of weeding-1 (Rwf)	30211.42	53254.66
	Cost of weeding-2 (Rwf)	39048.63	68832.3
	Cost of weeding-3 (Rwf)	40634.25	71627.33
	Cost of weeding-4 (Rwf)	35708.25	62944.1
	Cost of field protection (Rwf)	58011.28	102258.4
	Cost of Harvesting (Rwf)	38279.07	67475.78
	Cost of drying (Rwf)	27730.8	48881.99
	Cost of winnowing (Rwf)	16088.79	28360.25
	Cost of padding (Rwf)	10239.61	18049.69
	Cost of bags (Rwf)	22057.79	26254.66
	Cost of shitting (Rwf)	29109.23	36162.73
	Cost of watering/irrigation	30253.7	19905.59
	Total Variable Cost(TVC)	**587,574**	**974,536.6**
5	**Total Fixed Cost**		
	Tax on land	22,267	4,536.65
	Total Fixed Cost (TFC)	**22,267**	**4,536.65**
6	$TC = TVC + TFC$	**609841**	**979,073.25**
7	$GM = TR - TVC$	**741,676**	**437,963.4**
8	$NFI = GM - FC$	**719,409**	**433,426.75**
9	$BCR = GM/TC$	**1.21**	**0.45**

Source: Own constructed

Table 6 shows the average costs and returns of rice production in Nyamasheke district with a reference case of Kirimbi marshland. Return was calculated based on the production per hectare (yield) of rice and the unitary price. Results revealed that the average revenue and the unitary price were for male and female were 1,329,250Rwf and 1,412,500Rwf respectively.

In relation to the cost of production, the variable cost was high for females (974,536 Rwf) compared to their counterpart males (587,574 Rwf) with a difference of 386,962 Rwf which seems to be high. In addition to variable costs, the fixed cost was related to the amount spent on land renting whereas 22,267Rwf was spent by male farmers while 4,536 Rwf was spent by females**.** After having details on variable and fixed costs**,** the total cost was calculated as to be 609,841Rwf for males and 979,073Rwf for females. This indicates that females spent more money on various agricultural practices and inputs than males which leads to the loss and this affected negatively the benefit cost ratio for female farmers which are less than one. This can be due to the fact that females don't pay much attention on the ways of spending money and also not taking time to record the expenditures as it was observed that most of them don't carefully verify the expenditures patterns throughout the process of cultivating rice as men do.

The gross margin from rice production was 741,676Rwf for males and 437,963Rwf for females respectively which implies that males benefit more economics returns than females. Thus, is observed through the benefit cost ratio indicator as for male it is greater than one while for females is less than one. Simply this means that the rice farm business is profitable for males while it is not for females. Though it is profitable for males we see that it is close to one which means that if they don't pay attention on how they are applying agriculture practices and the amount allocated to each one of them since they will fall in loss if don't pay much attention, they are advised to keep always eyes on them. Concerning females, they simply advised to revisit their expenditures patterns because it was observed that the higher amount of variable costs led to the rice business to be a non-profitable business.

4.2 Inferential statistics results

4.2.1 Comparison of levels of productivity

To determine which hypotheses are to be retained or rejected, an independent samples t-test was performed in SPPS and the following outputs revealed useful information:

Table 7: Group statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Productivity	Male	198	381.12	216.298	15.372
	Female	135	336.96	456.591	39.297

Source: Computed.

In the above table, the number of female farmers was 198 versus on 135 female farmers with the corresponding means of quantity produced of 381.12 kg and 336.96kg respectively and standard deviations of 216.298 and 456.591 for male farmers and female farmers respectively in the area under study.

Table 8: Test statistic for Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Land Productivity	Equal variances assumed	0.903	0.343	1.181	331	0.238	44.158	37.394	-29.401	117.718
	Equal variances not assumed			1.046	175.351	0.297	44.158	42.197	-39.12	127.437

Source: Computed.

Since we do not know population variances from which we extracted the samples (male and female population) but we assume they are not equal, we used the non-pooled t – test, that is equal variances not assumed, in the table 8, the test statistic is T=1.046 with 175.351 degrees of freedom with a corresponding p-value=sig.(2-tailed)=.297> .05 (at 5% cutoff), we conclude that there is no significance difference in means of productivity among male and female farmers of Kirimbi Rice-Marshland. That is, the null hypothesis is retained and thus there is not enough evidence to conclude that the means of productivity are the same for the two categories of farmers in the area under study. To support this conclusion, we can also refer to the 95 % Confidence interval (95 % CI) of the test and notice that it includes zero, that is$(-39.118, 127.438)$.The summary statistical metrics of the performed test can be summarized in the in the table 9 below:

Table 9 (a): Summary of statistical metrics from t-test

	N	Mean	Std. Deviation	Std. Error Mean
Male	198	381.12	216.298	15.372
Female	135	336.96	456.591	39.297

Table 9 (b): Independent Samples Test's statistical metrics

	Mean Difference	Std. Error Difference	t	df	Sig. (2-tailed)
Equal variances assumed	44.16	37.394	1.181	331	0.238
Equal variances not assumed	44.16	42.197	1.047	175.351	0.297

Table 9 (c): 95.0% Confidence Intervals for Difference

	Lower Limit	Upper Limit
Asymptotic (equal variance)	-29.131	117.451
Asymptotic (unequal variance)	-38.544	126.864
Exact (equal variance)	-29.4	117.72
Exact (unequal variance)	-39.118	127.438

4.3 Comparison of Land productivity

The land productivity of each and every member in the sample was computed using the formula:

$$\text{LandPro} = \text{Quantity/farm size} = \text{Qty/F.S}$$

Similarly, to test whether there is /or no significance difference in means of land productivity among male and female farmers in the area under study, researchers set up the hypotheses governing the test as follows:

H_N: There is no significance difference in means of productivity among male and female farmers of Kirimbi Rice-Marshland versus

H_A: There is a significance difference in means of productivity among male and female farmers of Kirimbi Rice-Marshland.

Where, the notations H_N and H_A stand for the null and alternative hypothesis respectively.

To determine which among the hypotheses is to be retained or rejected, an independent samples t-test was performed in SPPS and the following outputs revealed useful information:

Table 10: Group statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
LandPro	Male	198	5779.6456	2264.304607	160.9171214
	Female	135	5417.8171	4666.104296	401.5943163

Source: Computed.

In the table 10, the number of female farmers was 198 versus on 135 female farmers with the corresponding means of land productivity of 5779.650 kg/farm size and 5417.820 kg/farm size respectively and standard deviations of 2264.300 and 4666.100for male farmers and female farmers respectively in the area under study.

Table 11: Test Statistic for Independent samples/Land productivity

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
LandPro	Equal variances assumed	0.294	0.588	0.941	331	0.347	361.8284	384.4764	-394.497	1118.154
	Equal variances not assumed			0.836	177.373	0.404	361.8284	432.6342	-491.944	1215.601

Source: Computed.

Since we do not know population variances from which we extracted the samples (male and female population) but we think they are not equal, we used the non-pooled t –test, that is equal variances not assumed, in the table 11above, the test statistic is T=.836 with 177.373 degrees of freedom with a corresponding p-value=sig.(2-tailed)=.404> .05 (at 5% cutoff), we conclude that there is no significance difference in means of land productivity among male and female farmers of Kirimbi Rice-Marshland meaning that the we retained the null hypothesis. It implies that means of land productivity are the same for two categories of farmers in the area under study. Furthermore, to support this conclusion, we can also refer to the 95 % confidence interval of the test and we noticed that it includes zero, that is$(-491.942, 1215.602)$.The summary statistical metrics of the performed test can be summarized in the in the table 12 (a)-(c) below:

Table 12 (a): Summary Data of t-independent samples for land productivity

	N	Mean	Std. Deviation	Std. Error Mean
Male	198	5779.65	2264.3	160.917
Female	135	5417.82	4666.1	401.594

Table 12 (b): Independent Samples Test's statistical metrics for comparison

	Mean Difference	Std. Error Difference	t	df	Sig. (2-tailed)
Equal variances assumed	361.83	384.476	0.941	331	0.347
Equal variances not assumed	361.83	432.634	0.836	177.373	0.404

Table 12 (c): 95.0% Confidence Intervals for Difference

	Lower Limit	Upper Limit
Asymptotic (equal variance)	-391.729	1115.389
Asymptotic (unequal variance)	-486.116	1209.776
Exact (equal variance)	-394.494	1118.154
Exact (unequal variance)	-491.942	1215.602

Source: Computed.

4.4 Labor productivity

To test whether there is a significant difference in labour productivity among farmers (male and female) in area under study, two hypotheses were set as follows:

H_0: There is no significant difference in mean labour productivity among male and female farmers versus

H_1: There is a significant difference in mean labour productivity among male and female farmers

To decide which hypothesis to be accepted or rejected among the above two hypotheses, an independent samples t-test was applied and yielded the following statistical metrics

Table 13: Group Statistics of labour productivity among farmers

	Groups	N	Mean	Std. Deviation	Std. Error Mean
Labor pro	Female	135	501.8498	272.15310	23.42321
	Male	198	603.9060	430.65932	30.60563

Source: Computed.

In the above table, the number of female farmers was 198 versus on 135 female farmers with the corresponding means of quantity produced of 603.9060 outputs per hour and 501.8498 outputs per hour respectively and standard deviations of 430.65932 and 272.15310 for male farmers and female farmers respectively in the area under study.

Table 14: Statistical metrics of Independent Samples Test among male and female farmers

		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Labor production	Equal variances assumed	3.814	0.052	-2.44	331	0.015	-102.06	41.8175	-184.318	-19.7946
	Equal variances not assumed			-2.65	329.28	0.008	-102.06	38.5403	-177.872	-26.24

Source: Computed.

Since we do not know population variances from which we extracted the samples (male and female population) but we assume they are not equal, we used the non-pooled t – test, that is equal variances not assumed, in the table 8, the test statistic is T=-2.65 with 329.28 degrees of freedom with a corresponding p-value=sig.(2-tailed)=.008< .05 (at 5% cutoff), we conclude that there is significance difference in means of labour productivity among male and female farmers of Kirimbi Rice-Marshland. That is, the null hypothesis is rejected and thus there is enough evidence to conclude that the means of labour productivity are different for the two categories of farmers in the area under study. To support this conclusion, we can also refer to the 95 % Confidence interval (95 % CI) of the test and notice that it does not includes zero, that is $(-177.872, 26.24)$.The summary statistical metrics of the performed test can be summarized in the in the table 15 (a)-(c) below:

Table 15 (a): Statistical metrics of the Summary Data

Groups	**N**	**Mean**	**Std. Deviation**	**Std. Error Mean**
Female	135.000	501.850	272.153	23.423
Male	198.000	603.906	430.659	30.606

Source: Computed.

Table 15 (b): Independent Samples t-Test

	Mean Difference	**Std. Error Difference**	**t**	**df**	**Sig. (2-tailed)**
Equal variances assumed	-102.056	41.817	-2.441	331.000	.015
Equal variances not assumed	-102.056	38.540	-2.648	329.281	.008

Source: Computed.

Table 15 (c): 95.0% Confidence Intervals for Difference

	Lower Limit	Upper Limit
Asymptotic (equal variance)	-184.017	-20.095
Asymptotic (unequal variance)	-177.593	-26.519
Exact (equal variance)	-184.318	-19.794
Exact (unequal variance)	-177.872	-26.240

Source: Computed

4.5 Comparison of profitability among male and female farmers of KIRIMBI Rice Marshland

The output of the comparison of the profitability levels of the farmers by gender in the area under study can be summarized in the tables below:

Table 16: Group statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
BCR	Male	198	0.7445	0.82857	0.05888
	Female	135	0.6395	2.15605	0.18556

Source: Computed.

The average value of profitability of male farmers was .7445 with a standard deviation of .82857 while the average value of same variable for female farmers was .6395 with a corresponding standard deviation of 2.15605.

To test if there is significance difference or not in means of profitability of the female and male farmers in KIRIMBI rice marshland, we use the statistical metrics extracted in the output of the test illustrated in the table below:

Table 17: Statistical Metrics from Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig.(2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
BCR	Equal variances assumed	1.79	0.182	0.622	331	0.535	0.10501	0.16892	-0.22728	0.43731
	Equal variances not assumed			0.539	161.233	0.59	0.10501	0.19468	-0.27944	0.48947

Source: Computed.

The non-pooled t-test used (equal variances not assumed**)** reveals that the test statistic T = .539 with 161.233 degrees of freedom corresponding to a p-value=Sig. (2-tailed) = .590 > 0.05(at5%level of significance), we say there is no significance difference in means of profitability among male and female farmers in the area under study. Again, the computed 95% CI of the test $(.-27944,.48947)$ includes zero, this yields further evidence that there is not enough evidence to say that the mean of profitability of female farmers in Kirimbi rice marshland is statistically different from the mean of profitability of male farmers in the area under study.

Table 18 (a): Summary statistics from the t-test

	N	Mean	Std. Deviation	Std. Error Mean
Male	198	0.745	0.829	0.059
Female	135	0.64	2.156	0.186

Source: Computed.

Table 18 (b): Independent Samples Test

	Mean Difference	Std. Error Difference	t	df	Sig. (2-tailed)
Equal variances assumed	0.105	0.169	0.622	331	0.535
Equal variances not assumed	0.105	0.195	0.539	161.233	0.59

Source: Computed.

Table 18 (c): 95.0% Confidence Intervals for Difference

	Lower Limit	Upper Limit
Asymptotic (equal variance)	-0.226	0.436
Asymptotic (unequal variance)	-0.277	0.487
Exact (equal variance)	-0.227	0.437
Exact (unequal variance)	-0.279	0.489

Source: Computed.

5. Conclusion and Recommendations

This study aimed at evaluating the productivity and the profitability indices/levels for rice production in Kirimbi rice marshland, Nyamasheke district. It is in nature a comparative study whereas productivity and profitability levels of male rice farmers were compared to those of their counterpart females with the respect to the various agricultural practices involved in rice production. To achieve the objectives of this study, authors collected primary data on the needed demographic and economic variables using the interview schedule technique. With regard to productivity levels, it is found that male farmers produce on average worth of Rwf160 for 1Kg of rice in one hour while a female farmer produces on average worth of Rwf184 for 1Kg of rice in one hour. Furthermore, profitability level is high for male farmers compare to female farmers as it was found to be 1.21 and 0.45 for both males and females respectively. This concludes that rice farm business is a profitable business to male farmers while it is not profitable to female farmers. From this conclusion, authors like to report key recommendations that would be important to trigger/ tackle the observed problems which led to low level of productivity for females and also proposes recommendations that will be applied to male farmers in the perspective of improving the level of profitability for their farm businesses as it was found to be close to one though it was a profitable business. Hence, female farmers are advised to keep much attention when allocating expenses to various agricultural inputs as it was found that they the total cost is very high which affect negatively the BCR because when the total cost is high the BCR tends to be less than one. Another finding shows that the cost of field protection was high as it has the highest pick in all the total variable costs therefore farmers requested to the MINAGRI and RAB to support with field protection tools, if they exist or provide agricultural extension services in order to be aware of how to fight against external agents (birds) to improve profitability levels of their farm businesses. It was also noticed that farmers spend more days in the fields to protect them against birds indicating that once this problem is tackled farmers will be relieved and doing some other beneficial activities instead of spending more days in fields while expecting high returns.

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Conflict of Interest Statement
The authors declare no conflicts of interests.

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