ANALYSIS OF SOCIO-ECONOMIC FACTORS AFFECTING THE PRODUCTION OF BANANAS IN RWANDA: A CASE STUDY OF KANAMA DISTRICT

By

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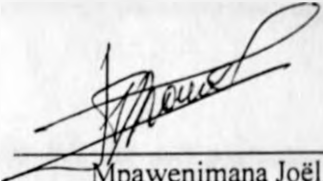
DECLARATION

This research paper is my original work and has not been presented for award of a degree in any other university.
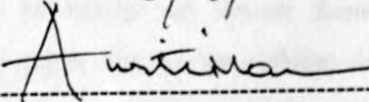
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DEDICATION

To my loving wife Mukangango Elizabeth and my beautiful three children: Ndayishimye Elise.
Nishimwe David Elie. Ndayisenga Dinah Mumbi.

In this work I remember my late parents. my father Bayema Zaché and
my mother Bakulikiza Elizabeth.

ABSTRACT

The economy of Rwanda depends on agriculture. It accounts for 41% of its GDP. Bananas are a major food crop and an essential source of income for households in the country. However, the production of bananas has been declining from 1990. To find out the reasons of this situation, this study has been conducted to investigate the socio-economic factors affecting the production of bananas in Rwanda, and a case studied was the District of Kanama. After estimating the relationship between the output of bananas and various factors, the findings shown that various socio-economic factors have to be reviewed in order to improve the production of bananas in the country. The results described that acreage (land), physical capital, fertilizer and price, have positive relationship with the output. These are factors on which, the government should give emphasis, in order to increase the production of bananas in Rwanda. Nevertheless, due to limited time and funds, this study has not covered all factors that are needed for the production of bananas. Further research has to be done in order to reverse the situation.

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ABBREVIATIONS AND ACRONYMS

ACP	Afrique Caraïbe et Pacifique
CES	Constant Elasticity of Substitution
C-D	Cobb-Douglas
COMB	Common Market Organization of Bananas
DRC	Democratic Republic of Congo
EC	European Community
EEC	Economic European Community
FAO	Food Agricultural Organization
Frw	Franc rwandais
GDP	Gross Domestic Product
GNI	Gross National Income
ISAR	Institut des Sciences Agronomiques du Rwanda
KIAKA	Koperative Ihuza Abanyabukorikori ba Kanama (Craftsmen micro- enterprise of Kanama District)
KOTAKIRWA	Leather-micro enterprise
LDC	Less Developed Countries.
MINAGRI	Minstère de l'Agriculture et de l'Elevage
MNIFIN	Ministère des finances
OLS	Ordinary Least Squares
PRSP	Poverty Reduction Strategy Paper

SEM   Single European Market

US$ United States Dollar

WTO   World Trade Organization

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CHAPTER ONE: INTRODUCTION

1.1 Background

Rwanda is a country situated in Central Africa. It covers an area of 26.338 square kilometers and shares boarders with four countries namely: The Democratic Republic of Congo in the West, Burundi in the South; Uganda in the North and Tanzania in the East. Rwanda has the highest population density in Africa with population of 8.5 millions, and is growing at a rate of about 3.6% per annum, one of the highest population growth rates in the world. The population density is estimated at 285 people per square kilometer with 16.7% of the population staying in urban areas, while 83.3% stays in the rural areas. Sixty percent (60%) of the population is below the poverty line (US Census Bureau, Population Division 2005)[1].

Rwandan economy is in a quasi-exclusive dependence on agriculture with about 90% of the population engaged in mainly subsistence agriculture. Like other countries in the region, which have suffered years of intense conflict, Rwanda's economy has been virtually destroyed. Ethnic conflicts have erupted several times since 1990 culminating in deaths of hundreds thousands of citizens in 1994. The country is almost entirely dependent on emergency grants and a post- conflict reconstruction plan financed by international donors. In 1998, the government agreed on an Enhanced Structural Adjustment Facility and, with the onset of relative peace, the economy has improved to some extent (Bingen et al; 2002).

The agricultural sector suffers output fluctuations due to periodic drought and the heavy dependence on coffee. In the cash crop sector, earnings have diminished as the international coffee price continues to fall. The country has few exploitable natural resources and suffers from high transport costs due to its landlocked position. The Inflation rate substantially increased to 2.1% in 2000 in response to external shocks that caused higher food and fuel prices, while the country's parallel market exchange rate stood at Rwandan franc (Frw) per 1 US dollar (1$ US) as follows: 333.942 Frw in (1999); 389.696 Frw in (2000); 442.801 Frw in (2001); 476.327 Frw in (2002); 537.658Frw in (2003); thereby making imports more expensive (Minifin 2003).

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1. http://infotut.com/geography/Rwanda/

Rwanda has minimal industry, and the primary foreign exchange earners are coffee and tea. The real growth rate of the GDP was at 3.5% in the year 2003; the inflation rate was estimated at 7.5%. Rwanda's per capita income is currently US$ 260 (Rwanda 2002).

Rwanda faces an unfavorable trade balance, relying on imports for most of her needs. The country continued to pursue trade liberalization, further reducing the maximum tariff rate from 40 to 25 percent. The coffee tax was eliminated in early 1999 and exchange regulations were further simplified and liberalized, as were import taxes on fertilizers (Rwanda 2002). The structure of Rwanda's economy is averaged as follows: agriculture 38.8%, Industry 21.5% and services 39.7%. The table 1.1 illustrates the structure of the Rwandan economy while table 1.2 illustrates other Rwandan economic indicators.

Table 1.1 Structure of Rwandan Economy

Contribution of the sectors in % of the GDP	1983	1993	2002	2003
Agriculture	38.2	33.7	41.9	41.6
Industry	24.1	18.3	21.6	21.9
Services	37.7	47.9	36.6	36.5

Source: World Development Indicators database, April 2005[2]

Table 1.2 Other Rwandan economic indicators

Indicator	1999	2002	2003
Population growth (annual %)	2.8	2.9	2.8
GNI (current US $)	2.0 billion	1.9 billion	1.8 billion
GNI per capita (in US $)	270	230	220
GDP (in US $)	1.9 billion	1.7 billion	1.6 billion
GDP growth (annual %)	7.6	9.4	3.2
Export of Goods and Services (% of GDP)	5.9	7.7	8.6
Imports of Goods and Services (% of GDP)	22.9	25.4	27.7
Gross Capital formation (% of GDP)	17.2	19.0	20.2

Source: World Development Indicators Database April 2005[4]

2 http://www.exxun.com/eznd/nd_dgp.html

More than 90% of the labor force by occupation, and 58% of the labor force by participation is engaged in agriculture. The industrial sector employs 2% of the population and contributes 20.3% of the GDP. The manufacturing industry whose 80% accounts for brewing industry contributes 12.6% of the secondary sector, followed by construction 6.5%. The tertiary sector contributes 39% of the GDP (Rwanda 2002) Attempts to diversify into modern agriculture exports such as flowers and vegetables are hampered by inadequate transportation infrastructure. Despite Rwanda's fertile ecosystem, food production often does not keep pace with population growth, requiring food to be imported.

1.1.1 Overview of Rwandan agricultural development policy.

For the purpose of this study, agricultural policy evolution in Rwanda can be divided into three periods: the period before 1970s, the period 1970-1994, and the period after the war of 1994.

1.1.1.1 The period before 1970s

According to Leurquin (1963), Rwanda adopted agricultural policy left by the Belgium colonialists: the agricultural production was organized so as to provide the total food needs of the family. By the reason of the country's relief and population density, cultivated land is rarely on slope of less than five percent, very large areas have a slope of 10 to 20 percent and particularly in the north of the country, where the slope of 40 to 50 percent is nothing extraordinary. For that reason, the battle against erosion was therefore urgent and was undertaken on a grand scale. Since coffee constitutes the most important single item in trade in Rwanda, the remaining agricultural output had no interior market worth mentioning. The ninety five percent of the total food production, was consumed by the producers themselves and others living near by. As measure against famine, an ordinance of November 7, 1924 gave District officers the power of convincing African cultivators, only for their own profit, to plant food crops; and to plant export crops (Leurquin 1963).

1.1.1.1 The period before 1970s

In the period 1983-84 Rwanda was among the few countries cited by Food and Agricultural Organization (FAO) where food production had outpaced population growth. The reasons were that the government policy was the increased focus on identifying and executing agricultural projects, and on programmes aimed at raising smallholder productivity. Another reason was that the government

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emphasized on accelerated agricultural and rural development, and spending has reflected a priority concern with economic development. The government has demonstrated a strong commitment to development and was concerned with fostering equity in economic opportunity. For instance, in 1977, the government raised coffee prices to the highest level in real terms in Africa during the years of the coffee boom; resisted overspending and borrowing, distinctly different from the behavior of other African countries, which experienced similar boom years. The government has avoided deficit financing by accumulating international reserves, and maintained a low debt service during the late 1970s and through 1982. Cash crops were Arabica coffee, the principal export crop and source of foreign exchange earnings. The tea as the second cash crop in the country was increased from 6,245tonnes in 1981 to 6976 tonnes in 1982 (Legum1984).

1.1.1.3 The period after the war of 1994

The Ministry of Agriculture, Animal Resources and Forestry (Minagri) outlined an agricultural policy calling for a radical change of approach to transform and modernize Rwandan agriculture. This policy is established on the following pillars:

a) To abandon traditional subsistence practices in adapting the agriculture to the markets.

The strategies identified to achieve on this transformation include the promotion of more intensive agricultural practices through the increased use of agricultural inputs, to promote high enterprise profitability, the promotion of soil fertility and protection, improved marketing initiatives and the reinforcement of agricultural research and advisory services, including a greater role for farmer cooperatives and associations.

b) The Poverty Reduction Strategy Paper (PRSP). This is one of the government policies which comes to reinforce the MINAGRI strategies, which calls for energetic public action in collaboration with private and non-governmental development partners to encourage greater input use and to assist in the provision of services and their monitoring.

c) The National Decentralization Policy. This comes as the second one of the government to reinforce the Minagri policy in its focus on the empowerment of local populations to fight poverty by participating in planning and management of their development process.

1.1.2 Bananas in Rwandan economy

According to Institut des Sciences agronomiques du Rwanda (ISAR[3] 2001) banana is the top crop in Rwanda. Exclusively small-scale farmers grow it and occupying 35% of the country cultivated land The perennial nature of the banana crop is important for food security and income generation in the peasant farming communities. The cash income from bananas is important as 60-80% as the remaining 20-40% for the rest of crops. The daily consumption of bananas in Rwanda is the highest in the world (250g per capita); with coffee they are the largest source of cash income for Rwandan agricultural households (Kangasniemi: 1998). The following table (1.2) arranges crops produced in the country for various years in descending order.

Table 1. 3 Agriculture & Food Production (crops & livestock products)

Major commodities produced		1969-71	1979-81	1989-91	1992	1993	1994	1995	1996
Banana plantain	1000 MT	1656	2136	2629	2316	2136	1489	2002	2105
Sweet potatoes	1000 MT	379	899	876	1063	1100	800	950	1100
Beans, dry	1000 MT	145	185	203	150	120	120	118	105
Indigenous cattle meat	1000 MT	8	12	14	13	12	10	10	10
Cow milk, whole, fresh	1000 MT	27	61	85	89	85	80	80	80

Source: FAO 1997 Food and agricultural Sector Profile Rwanda

In Rwanda, people attach considerable value to the banana crop beyond economic gain. It is associated with many cultural ceremonies and forms an important part of the diet. It also plays a crucial role in the country's farming system in terms of soil protection given the many steep slopes. Bananas will therefore remain important in the rural livelihoods for many years. The analysis done by Ministry of Agriculture (2002) indicates a drop in acreage under bananas by about 13% over the period 1997-2000 due to factors such as political turmoil and the current government policy of reducing the dominance of the crop. The following Charts show how the production of bananas has declined from 1990 to 2002(Chart1.1 and 1.2).

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3 http://www.isar.cgiar.org/about/aboutisar.html

Chart 1.1 Crop group Distribution in (ha) 1990   Chart 1.2 Crop group Distribution in (ha) 2002
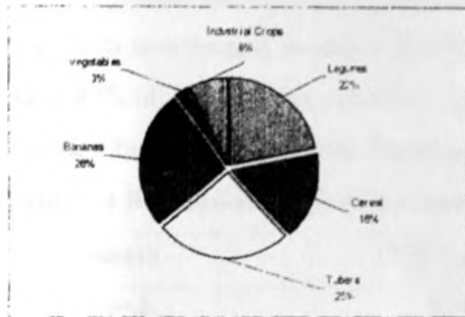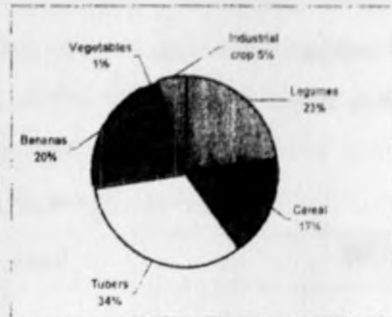
Source: MINAGRI 2002

The potential reasons attributed to this decline over the eleven-year interval can be divided into two causes: (i) Natural causes (or direct causes) (ii) Indirect causes.

(i) Natural causes (or direct causes): Poor soil conditions and pests infestations.

(ii) Indirect causes: These factors affect yields indirectly by influencing the farmers' behavior. These include policy, level of income and logistical factors, which can be termed in general as social–economic environment. Among them, we can state that the government has reduced investment in bananas production; political turmoil and lack of maintenance; high population density resulting in uneconomical subdivision of land; over-reliance on traditional methods of growing bananas, degraded soils and low soil fertility; the systems to process and deliver Rwandan agricultural outputs to the national and international market not improved.

Types of bananas under cultivation in Rwanda

Banana crop in Rwanda can be divided into three types: cooking bananas, dessert bananas and plantain, and beer bananas which at the moment predominated production, accounting for more than 70% of the acreage under bananas.

a) Cooking bananas

According to Ministry of Agriculture (2002), cooking banana has been experiencing market growth in recent years especially in urban areas and this growth is expected to continue increasing. Total market demand is estimated at about 70.000 tones per annum. The rural area, traded volume is estimated at 40,000 MT per annum having increased from about 17.000 MT in 1990 (DSA/Minagri 1990). This increase in market size is explained by the increasing rate of urbanization and the influx of communities from neighboring countries where banana is a major staple. Although the main producing

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areas within Rwanda are trying to increase the production of cooking bananas in response to growing market opportunities. Rwanda is also a major importer of cooking bananas. The import volume of the year 2000 is estimated at about 19,000 tonnes per annum with supplies from Uganda accounting for about 80% of total imports. Similarly, an estimated 80% of the market in Kigali (about 19,000 tones) is supplied through imports from Uganda (see table 1.4).

Table 1.4 Regional imports of bananas by origin (in Frw)

Country	1999 (2nd season)	2001 (1st season)
Burundi	6,000	0
DRC	2,436,000	1,848,000
Tanzania	0	5,000
Uganda	1,351,070	11,261,300
Grand Total	**3,793,070**	**13,114,300**

Source: MINAGRI 2002.

b) Dessert bananas and plantain

Production of dessert banana is small, accounting for about 10% of the entire banana production. However, this market is growing especially in the urban areas and also it is of a much higher value than that of cooking bananas. Dessert banana mainly consists of apple banana (Kamaramasenge). There is importation of both apple and Gros Michel. Apple banana is mainly imported from Uganda for the brewing industry while Gros Michel is imported from the DRC. Opportunities for exports to higher value markets in Europe exist and are currently being tapped (Minagri 2000).

c) Brewing bananas

From a nutritional income and food security angle, beer banana plays a very important role for the farmers in Rwanda, providing up to double, the nutritional requirement and income compared with cooking bananas. Brewing bananas have formed the largest share of production for many years, accounting for over 60% of banana production per annum over the period 1984-90. Beer banana is a high value beverage, which commands a large and stable rural and urban market. Although beer banana is the dominant type of banana in Rwanda, the country still imports beer banana from the DRC estimated at around 4,000 tonnes per annum, suggesting poor marketing infrastructures and organization (Minagri 2002).

In Rwanda, the production of bananas is considered as a staple food and provides cash income. There are species of cooking bananas including plantains, dessert or sweet bananas; and the brewing bananas (high land AAA-EA) and ABB (Pisang Awak), being a dominant banana type grown almost

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everywhere across the country, and plays an important role for food security by generating cash income to the small farmers from traditional bananas beer sale.

1.1.3 Banana Trade in Rwanda

Banana producers generally sell their fruit at the farm gate. Marketing therefore involves a few wholesales distributing bananas to consumers on a large scale. This has contributed to the development of complex marketing channels with middlemen playing an essential role in the coordination of purchases of banana, transport and sale, thus being able to pocket a larger proportion of the value added along the chain (Figure 1).

Figure 1. The Marketing Channel in Rwanda
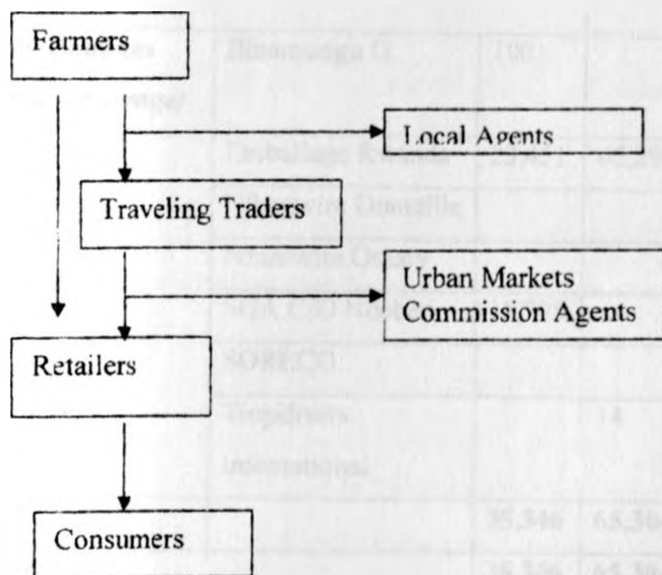
1.1.4 Export of bananas in Rwanda

At the moment, with the efforts of the government to promote private sector efficiency the modern banana beer factory in the country COVIBAR with capacity of over 2 million liters per annum has already been privatized. The Company is planning to enter the regional market of COMESA, which offers more opportunities than the much smaller domestic markets.

There are also opportunities for the export of apple bananas, which need to be exploited to the full to realize the potentials of the export market. In the recent past, the country has exported apple banana to the EU market. Also, findings reveal that exports have not been consistent mainly due to transport constraints, the low level of private sector-growth and efforts to improve production structures and penetrate the high value organic market for this commodity (Rwanda 2002). As can be seen from (Table 1.5), apple bananas seem to offer viable opportunities for export.

Table 1.5 Exports of bananas from Rwanda (Kgs), 1998-2000

Type of banana	Exporter	1998	1999	2000	2001	2002	Grand Total
Green bananas	Nibagwire Donatille				200		200
	Nzamwita Omary				400		400
	SORECO				1.970		1.970
TOTAL					2,570		2,570
Apple Bananas (Kamaramasenge)	Binamungu G.	100					100
	Emballage Rwanda	23,451	65,290	66,301	23,149		178191
	Nibagwire Donatille				13,815	21.593	35,408
	Nzamwita Omary				100		100
	SGA C/O Ndeberi	11,795					11,795
	SORECO				170		170
	Tropifruits International		14				14
Total		35,346	65,304		37,593	21593	225778
Grand Total		35,346	65,304		39,804	21593	228348

Source MINAGRI 2002.

1.1.4 Export of bananas in Rwanda

Bananas are grown in all tropical regions and play a key role in the economies of many developing countries. FAO (2002)[4] states that in terms of gross value of production bananas are the world's fourth most important food crops after rice, wheat and maize. Bananas are staple food and an export commodity. As staple food, bananas (including plantains and other types of cooking bananas) contribute to the food security of millions of people in much of developing world, and when traded in local markets they provide income and employment to rural populations. Banana production may be classified as local or trade production, according to whether the fruit is consumed locally or is sold

4http://r0.unctad.org/infoconim/anglais/banana/#descript

after being transported to a more or less distant market (Stover et al; 1959). Banana being the world's most popular fruit, its world trade value, estimated at more than US$ 3bn each year, is higher than all other tropical fruit combined. World import demand is estimated at around 12millions tones representing about 14% of banana and plantain production. The rest estimated at about 65 million tones is eaten locally, implying that only a small proportion of production is being traded and the global trade is in fresh bananas.

According to FAOSTAT 2003, since 1960s banana production in Africa has increased at about 2.2% per annum. But in East Africa countries, (Uganda, Rwanda and Burundi), where bananas are produced as staple or for domestic consumption, productivity has fallen from 30-40tons per hectare in 1970s to about 15 tons per hectare in year 2000 due to combined effects of pests, declining soil fertility and reduced input use.

According to Arias et. al, (2002), the period 1985-2002 witnessed many developments in trade policy that affected the world banana economy. Perhaps the most important were the launching of the Uruguay Round of trade negotiations to liberalize international trade in 1986. The opening up to world trade of socialist economies in the early 1990s and the creation of the single European Market in 1992. Moreover, many changes in EC trade policies were brought about by WTO rules and regulations, which occurred at the time when socialist economies were opening up to world trade (FAO 2002). Banana imports are concentrated in two main markets:

The United States (free market) and the European Union. In the period 1985-2000 the US and EC captured an average of 32% of all world banana imports, Japan 9%, Eastern Europe 6%, South America and Canada 8%, Near East 5%, Asian countries and Oceania 5%.

However, the birth of the Single European Market (SEM) in 1993, and under Council Regulation (EEC) Nr 404/93 of 13February 1993, the EC put in place the Common Market Organization for Bananas (COMB-EC Banana Regime concerning the importation, sale and distribution of bananas) COMB honored the Lomé Convention of 1975 by extending to all member states those protectionist policies that existed before the SEM was created, which included preferential access to 48 of its ex-colonies (Borrell 1999). The regime established a tariff rate banana quota import system as follows:

A quota of 857700 tonnes for the duty free access of traditional ACP bananas (from Ivory Coast, Cameroon, Somalia, Cape Verde, St Lucia, Jamaica, Belize, St Vincent and the Grenadines, Dominica, Suriname and Grenada). The quota was allocated to each country on a historical basis (Word Banana Economy 1985-2002).

1.2 The problem statement

The economy of Rwanda dependents on agriculture which accounts for 41% of its GDP, with banana being a major food crop as well as an essential source of income for over 90% of the population (FAO 1997). Banana farming system plays an important role in the economy of Rwanda. This role can be furthered if strategies are pursued to increase production and earnings to farming households. Banana crop covers 35% of the land under cultivation. Rwanda needs to guarantee sustainable banana production systems in order to contain the declining productivity levels. However production of bananas declined during the recent past (from 1990), and it has dropped by 69% in output (Donavan et al; 2002). This trend has continued to date, and the information on the factor responsive for this decline is scanty. There is therefore need to conduct an assessment of the socio-economic factors influencing production of bananas in order to come up with mitigating measures to reverse the trend. Different analyses on production have been conducted. Most of the studies on production looked at in the literature review, are almost similar, others are applicable in the countries where the studies have been done, but there is need to fit the information provided in Rwandan case.

1.3 Objectives of the study

The overall aim of this study is to investigate the socio-economic factors that affect production of bananas in Kanama district.

Specific objectives

1. Identify the socio-economic factors that affect banana production.
2. Analyze the impact of various socio-economic factors on banana production
3. Provide information and recommendations that will be useful for agriculture decision makers, to increase the production of bananas in Rwanda.

1.4 Significance of the study

Bananas are primary food staple as well as essential cash crop for smallholder farmers in Rwanda. From 1990, Rwanda has been experiencing low productivity of bananas. Since the agricultural sector is the key to development in Rwanda, and a major factor in poverty reduction, given the prevailing

situation of food scarcity the country is facing in general, there is need to carry out study that will gather and analyze, various relevant socio-economic factors that affect banana production. The focus of the study will be Kanama District. However it is expected that the results of this study will be used by agriculture decision makers to increasing the production of bananas in Rwanda.

CHAPTER TWO: LITERATURE REVIEW

2.1 Theoretical literature.

According to Schultz (1965), population growth is probably the best-known problem of economic development and provides the most publicized argument for expanding agricultural production. Schultz ranks agriculture throughout the world in accordance with the contribution it is making to economic growth. For this purpose, economic growth means simply increases in national income. Agriculture is then one of the sources of national income. There are countries which practice traditional agriculture, and others modern agriculture. Traditional agricultures occur in a wide variety of institutional forms, ranging from highly communalized systems to small farms organized around their family unit. Generally peasant farms produce in excess of what the farm family chooses to consume and sell that surplus in the market, in order to purchase non-farm goods and services. This surplus varies among farms, regions, and nations. There is also variety in size of farm, state of technology and the degree of specialization in production.

Schultz (1964) says that agriculture is treated as a source of economic growth, which can act as an engine of development, but the form of investment is important for the realization of this goal. Incentives to guide and reward farmers are seen as an important component of the investment to increase agricultural production. Transforming traditional agriculture into a highly productive sector depends on the investment made on agriculture and the form it takes, makes it profitable. Schultz continues to say that once traditional agriculture is established, the equilibrium is not readily changeable. He further hypothesizes that there are comparatively few inefficiencies in the allocation of factors of production in traditional agriculture.

Lloyd (1975), like Schultz affirms that agriculture plays a role of resource reservoir, which can be drawn on for supplies of food, labor, and finance to fuel the growth of urban activities. In many LDC's such as Kenya for instance, in the study done by Southworth and Johnston (1974), they found that

agriculture is by large margin the largest single sector of production. The contribution of agriculture and other rural work to total employment is greater. The share of agriculture is almost two third while non-rural employment makes up seventeen percent of the national total. Agriculture has contributed significantly to the country's success during the first fifteen years of independence in achieving rapid economic growth without running into major balance of payments crises

Labor is the primary instrument for increasing production within the framework of traditional agriculture. The analysis done by Mellor (1974) states that families with small farms (a small resource base) will maximize utility by providing greater labor input per acre and achieving higher yield per acre than families with larger farms (a large resource base). It is quite possible that in low-income societies the marginal productivity of labor is so low that it will, even under the most favorable circumstances in regard to the supply and displays of consumer goods, still not equal the slope of the utility curves once the traditional subsistence level has been reached

The analysis done by Hayami and Vernon (1971) confirm that the relative availability of labor and land in the agricultural sector is a result of original resource endowments and the resource accumulation associated with historical growth processes of each economy. For instance, in Asia, land has been the major factor limiting the increase in output while in the new continents; a relatively inelastic supply of labor has represented the most significant constraint on growth of output. In order to ease the limitation set either by land or by labor; farmers try to economize in the use of the limiting factor or to substitute man–made inputs for it, e.g., fertilizer for land and tractors for labor. The growth path followed by the countries in the new continents seems to reflect a process of easing the limitation set by labor, and the one suggested by Asian countries reflects a process of easing the limitation by land.

Clayton (1964) noted that it is important to know the problem facing peasant agriculture if they are related to raising agricultural productivity. Schultz (1965) says that the technological possibilities have become increasingly more favourable but the economic opportunities that are required for farmers in the low-income countries to realize their potential are far from favourable. He suggests that government intervention is the primary cause of lack of optimum incentives. It therefore becomes important to determine the conditions that are both necessary and sufficient to attain the optimum increase in agricultural productivity.

Hayami and Vernon (1971) hypothesized that the agricultural productivity gap among countries is based on differences in the prices of modern technical inputs in agriculture and differences in the stock of human capital capable of generating a sequence of innovations which enables agriculture to move along the metaproduction function in response to changes in factor and product price relationships. Technological change will have an income effect and a substitution effect: the first one occurs through a real increase in efficiency so that output is increased with no increase in labor input. Technological change may have important interaction with labor input.

Land in traditional mode of production is the main inputs and farmers believe that any person without access to arable land is poor and destitute (Kuamar 1996). So they rely on traditional cultivation, as the only way of living, and even those without or with little land make no other efforts than struggling hard in order to have access to at least a small piece of land through various tenant farming arrangements. Mellor (1974) continue to say that in low-income countries, the land measures the economic and social position. Although most farmers in low –income countries have opportunity to increase their incomes through increased labor input, that is by working harder, the resulting increase in income is normally very low. The pressure of population on the existing land resource may have driven the marginal productivity of labor and other inputs to a level, which favors expanding cultivation outside the extensive margin to successively poorer quality land. Such expansion of the land area is, of course, an indication of declining levels of living may be small.

According to Clayton (1964), the importance of land tenure arrangements in peasant agriculture is a factor impeding progress in agriculture. Labour difficulties due to the seasonal nature of peasant farm organization are also important in determining output. Unsatisfactory marketing arrangements for farm produce and long distance or poor communication resulting in high transport cost hamper the peasant farmer as these may make the sale of surplus unnecessary and not worth while, thus hindering agricultural growth. Poor farming practices are further difficulty in peasant agriculture. In Rwanda land becomes a serious problem because of the high population density. Land is inherited and subdivided according to the number of members of family. This means that the labor is abundant resource. The total supply of rural labor is too high (US Census Bureau, population Division 2005). As states Mellor (ibid) that there is little relation to the level of factor returns until the population becomes so large that the average product of labor drops close to subsistence level.

According to Hayami and Vernon (1971) divide the sources (or capital) of productivity growth into three broad categories: (i) Resource endowments which include not only the original land resource endowments but also internal capital accumulation in the form of land reclamation and development, livestock, inventories, and so forth. (ii) Technical inputs which include the mechanical devices and the biological and chemical materials purchased from the industrial sector. (ii) Human capital which is broadly conceived to include the education, skill, knowledge, and capacity embodied in country's population.

2.2 Empirical literature

Several studies have been done on agricultural production using the production function model, and supply response model to estimate the impact of various factors on output changes. The combination of both allows estimating total impacts of institutional reforms, price realignments and technological factors on agricultural production. Macours and Swinnen (1997), in their paper they quantify the relative importance of the different causal factors of the changes in agricultural production in Central and Eastern Europe since 1989 using a production function and supply response approach. The analyses show that the deterioration of the agricultural terms of trade explains a considerable part of the production change. The shift of the production to family farms caused a productivity increase due to improved labor effort but the process of disruption of the production structures caused a (temporary) negative effect. The net effect of the restructuring was slightly positive.

Macours and Swinnen (ibid) used the same approach as Lin[5] (1992) who analyzed the impact of Chinese reform on agricultural output and productivity. As Lin, they applied a production function model and a supply response function model to aggregate (sector-level) data. The different causal factors can influence production by inducing changes in input use, or by causing changes in productivity. With the production function model, the factors that influence productivity can be identified. The supply response function model allows indicating all causal factors, the ones that have an impact on productivity as well as the ones that influence the use of production factors. This idea is supported by Mbithi (2000) when says that the supply response has an impact on economics as well as on agricultural development, poverty, equity and the environment at large; so, policy makers need supply response information on both individual activities and on the sector aggregates. By comparing the two models, we cannot only determine which factors caused the output changes, but also how this occurred. Their study used the Cobb-Douglas specification of the agricultural production function, which is the most commonly used function in these studies and the results obtained was good. Two additional arguments were their limited number of observations and it allowed them to compare their

estimates of input-output elasticities with respect to each input with the other studies. The amount of output generated with a certain amount of inputs depends on the intensity and quality of input use. For example, workers react on incentives, created by the institutional and economic environment, by changing their labor effort and thus the intensity of the production factors (Leibenstein, 1966; Carter, 1984)[6]. To account for the different factors that affect productivity, different production function shifters are included in the model. The specification of the production function is

$\ln(OUTPUT_{it}) = \alpha 0 + \alpha 1 \ln(CAPITAL_{it}) + \alpha 2 \ln(LABOR_{it}) + \alpha 3 \ln(FERT_{it}) + \alpha 4 \ln(LAND_{it}) +$

$\alpha 5 \ IND_{it} + \alpha 6 \ DISR_{it} + (\alpha 7 + \beta \ CSH_i) \ PR_{it} + \alpha 8 \ UNC_{it} + \varepsilon_{it}$ (1)

where **i** refers to country, **t** to year. The α's and β are the coefficients to estimate, and ε_{it} is the error term. The production function has four conventional inputs: capital, labor, fertilizer and land. In addition, four other variables are included to capture the effect of farm restructuring (IND), disruption (DISR), privatization (PR) and uncertainty (UNC). The impact of the weather on crop output is captured by the conventional inputs, due to the way these were defined in the model. Therefore, a weather variable is explicitly included in the supply response model but not in the production function model. The individual farm variable *(IND)* is measured as the change in the share of total agricultural land used by individual farms (family farms). This is used as a proxy for the increase in the agricultural working force in individual or family farms and reflects the impact of labor effort on output. With the production function, they indicate the effect of factors that affect output through a change in technical efficiency. However, also the causal factors for the change in inputs, accounted for in the production function, can be identified. The estimation of a supply function allows quantifying the impact of producer price and input price changes on output changes.

Furthermore the importance of factors that affect allocative efficiency as well as technical efficiency can be quantified. The specification of the supply function model is:

$\ln(OUTPUT_{it}) = \alpha 0 + \alpha 1 \ln((PP/IP)_{it-1}) + \alpha 2 \ln(WEATHER_{it}) + \alpha 3 \ IND_{it} + \alpha 4 \ DISR_{it}$

$+ (\alpha 5 + \beta CSH_i) \ PR_{it} + \alpha 6 \ UNC_{it} + \varepsilon_{it}.$ (2)

The specification for IND, DISR, PR and UNC is the same as in the production function model.

where **i** refers to country, **t** to year, the α's and β are the coefficients to estimate and ε_{it} is the error term in the model.

5&6: see Macours and Swinnen work of June 1997

As in the production function model, the dependent variable is normalized around the 1989 value, as well as the price and the weather variables (PP, IP and WEATHER). The relative price index, PP/IP is the ratio of producer prices to input prices and measures the agricultural terms of trade faced by the farmers. PP measures the evolution of the commodity prices. IP measures the evolution of the input prices.

Theoretically, the relevant price variables should be the expected prices. WEATHER measures the rainfall in year t rainfall during the crucial months for crop production (as in Herdt, 1970) and is expected to be positively related to output.

In the discussed paper of McKay et. al. (1997) entitled "Aggregate export and food crop supply response in Tanzania", they used the Nerlove's model devised for single commodities, and the model involves a one stage procedure and directly regresses production on prices and other relevant variables. This study describes the dynamics of agricultural supply by incorporating price expectations and/or adjustment costs. The general form of this supply function is:

$$X_t^* = a + bP_x^e \tag{3}$$

where X_t^* is desired or equilibrium output X at time t and P_x^e is the expectation of price P_x at time t formed at time t-1. First there is assumption that the dynamics of supply is driven by price expectation only so that $Xt^* = Xt$. The Nerlove's model price expectations are generally assumed to be adaptative:

$$P_{xt}^e - P_{x,t-1}^e = (P_{x,t-1} - P_{x,t-1}^e)$$

or

$$P_{xt}^e = P_{x,t-1} + (1-)P_{x,t-1}^e \tag{4}$$

hence

$$P_{xt}^e = \sum_{t=1}^{T} (1-)^{t-1} P_{x,t-t}$$

Substituting (4) into (3) and writing gives:

$$X_t = a + bP_{x,t-1} + (1-)X_{t-1} \tag{5}$$

where $(0< <1)$ is the price expectation coefficient. b is the long-term elasticity of X with respect to P_x (long-run supply response), and b short term elasticity (immediate response).

Peter and Falcon[6]. estimate in the model of the Southeast Asian rice economy a cross-section production function for rice for the year 1962 to 1970. A standard Cobb-Douglas production function containing rice area harvested and total fertilizer nutrients applied. with separate intercepts for each country. adequately explains the widely different levels of rice production in the nine countries examined (i.e.. Japan, Burma, Thailand, Indonesia. Philippines. Malaysia. Taiwan. Ceylon. and South Korea). The area devoted to rice culture in any country is a long run policy variable. especially in terms of irrigation investment. but it has limited flexibility in the short-run. Thus for a given area, the emphasis must be on the factors that affect output in the short-run. such as fertilizer. Holding other things constant, the level of fertilizer application determines yields. The empirical estimate of the aggregate fertilizer-yield relationship for the sample of countries using the Cobb-Douglas. log-linear form usually assumed for this type of analyses. the critical parameter is the elasticity of output with respect to fertilizer:

$$Q = A H^{\alpha} F^{\beta} \tag{6}$$

where Q represents rice production. H is the area harvested. and F is the fertilizer application, the relationship between output (Q) and the ratio of rice price to fertilizer price to the farmer (P) is of the form:

$$Q = (A \beta H^{\alpha} P^{\beta})^{\frac{1}{1-\beta}} \tag{7}$$

The elasticity of Q with respect to P is $\frac{\beta}{(1-\beta)}$. The result of several alternatives was of estimating the value of β (the coefficient attached to F or $\frac{F}{H}$). The major criticism levied against the data used was that, no attempt was made to determine amounts of fertilizer actually used on rice.

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6. Check in Lloyd G. Reynolds 1975

A test done by Hayami et al (1971), the production function was specified as being of the Cobb-Douglas type, assuming unitary elasticity of substitution among inputs. The attempt to test the assumption by estimating the parameters of the CES production function developed by Arrow et al. The models used for estimation are:

$$\text{Log}(Y/L) = a + b \log W + c \log Z \tag{8}$$

and

$$\log(V/L) = a^{\cdot} + b^{\cdot} \log W + c^{\cdot} \log Z \tag{9}$$

Where Y and V are respectively gross output and value added in agriculture; L is labor; W is the wage rate (measured by output); Z is the shorthand notation for nonconventional variables, which shift production function (general and technical education, in this study). Under competitive factor markets b and $b^{\cdot}$ measure the elasticity of substitution (between labor and the aggregate of other conventional inputs, including current inputs in case of b and between labor and capital in the case of $b^{\cdot}$). In order to be consistent with the C-D production function, the estimated parameters of b and $b^{\cdot}$ should not be significantly different from one, and the estimated parameters of c and $c^{\cdot}$ should not be significantly different from zero. After regressing different equations from the above models, the results of estimation based on data of twenty-two countries, two alternative sets of wage data were employed for estimation: current wage rate (W_t: 1957-62 averages) and lagged wage rate (W_{t-1}: 1957-62 averages). The lagged wage rate was tried to determine whether the adjustment might not be instantaneous. The results are quite similar, because there is a high correlation between current wage and lagged wage. The Koyck-Nerlove type of distributed lag model was also tried, and the results were implausible, however probably because of inter-correlation between the wage rate and the lagged dependant variables.

Assessing the social and economic impact of improved banana varieties in East Africa. Lusty and Smale (2002), analyzed the household model under perfect market conditions and found that production and consumption decisions are assumed to be made separately. On the production side, which is subject of our study, the household chooses the levels of labor and other variables inputs that maximize farm profits given the current configuration of capital and land and the expenditure constraint. Optimal input choices depend on input prices, output prices, and wage rates, as well as the physical characteristics of the farm technology. In this household model, they prove that soil quality and technologies are considered exogenous factors, which do not change with time. The soil quality is also affected by farmer decisions, since quality declines in terms of soil nutrients and soil organic matter during the production process. Soil quality is affected by two types inputs: yield increasing

inputs (such as new banana varieties) and soil conserving inputs. Based on this analysis, it has practical application to the Rwandan case. However, we note that Lusty and Smale conducted their analysis under the assumption of perfect market information in the East African countries of Uganda and Tanzania. These two countries have almost a similar culture of banana planting with that of Rwanda. This study will however assume the condition of imperfect markets in the case of Rwanda when analyzing the data.

2.3 Overview of literature

This chapter summarizes both theoretical and empirical literature related to the socio- economic factors of production in agricultural development. As can be seen from both theoretical and empirical literature, land, labor and capital are the basic factors of production. Different models and recommendations have been suggested.

The rate at which an economy becomes transformed from a primarily agriculture economy to mixed economy depends mostly on the proportion of the labor force, the technique of farming, the capital used, and the way the land is maintained. It has been hypothesized that the differences in technical inputs and human capital do account for every substantial share of the agricultural productivity gap among countries and even within the resource endowments category internal accumulation appears to be relatively important as compared to the original endowments of land (Hayami et al: 1971).

In the context of Rwanda, little emphasis has been accorded to analysis of the economic factors affecting the production in agriculture. Thus this study seeks to fill this inadequacy since the majority of the studies looked are applicable in developed countries where the information provided does not fit very well the situation of Rwanda. In this study an attempt will be made to use production function model to analyze the relationship between the output and the different socio-economic factors affecting banana production in Kanama District.

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CHAPTER THREE: METHODOLOGY

3.1 Conceptual framework.

The economic model commonly used to determine the relationship between the various factors and the output in agriculture is production function model. The production function of any farmer is determined by resource availability of the farmer. In agriculture, the production inputs consist of land, labor and capital as the basic factors of production. The expected relationship between output and land is that as more land is brought under production, output is increased (Malassis 1975). The simplified form of production function is given by:

$$Q = f(Ld, K, L) \hspace{3cm} (1)$$

Where Q is the production output, which is function of land (Ld); the capital (K) and the labor force (L) used for the production of the same output. A production function may be defined as a mathematical equation showing the maximum amount of output that can be realized from a given set of inputs. The mathematical form of the Cobb-Douglas production function is given by:

$$Q = AL^{\alpha} K^{\beta} \hspace{3cm} (2)$$

Where Q is the output; A is the technology used in the production of output; labor (L); capital (K); α and β are elasticity. Alternatively, a production function can show the minimum amount of inputs that can be utilized to achieve a given level of output (Malassis 1975). To find out the impact of these factors on farm level production of bananas on small-scale farmers in Kanama District, the functional relationship is specified.

3.1.1. Specifications of the study model

$$Q = f(N, Kp, L, F, P, Ed) \hspace{2cm} (3)$$

Where,

Q = total output of bananas in terms of quantity of bananas (in tonnes) produced.

N = acreage in terms of acres under bananas crop.

Kp = physical capital in terms of Rwandan Franc (Frw) spent on equipment.

L = labor in terms of man-hours spent on the farm.

F = fertilizer use in terms of Rwandan Franc (Frw) spent on fertilizer.

P = price of bananas.

Ed = level of education attained by the respondent (it is a dummy variable

where 0=Primary, 1=secondary and above).

α = is the coefficient to estimate the relationship between the output and the different variables.

U= error term.

The econometric model is specified as follows

$$LnQ = ln\alpha_0 + a_1lnN + a_2lnKp + a_3lnL + a_4Fert - a_5lnP + a_6Ed + U \quad (4)$$

3.1.2 Expected signs of explanatory variables

Table3.1: Expected signs

Dependent variables	Explanatory Variables	Expected signs	Explanations of the relationship
Output (Q)	Acreage (N)	+	Output is positively related to acreage. As more land is brought under banana production, output is increased
	Physical Capital (Kp)	+	Output is positively related to Physical capital. The more households invest in banana production, the more the output increases.
	Labor (L)	+	Output is positively related to labor. The more households use hired labor, the more they increase output.
	Fertilizer (Fert)	+	Output is positively related to fertilize. The more households use fertilizer, the more they increase the output.
	Price	+	Expected high price of bananas will make its output to increase. When the households expect an increase in price of bananas, they will be motivated to increase the output
	Education level (Ed)	+	Output is related to education. This means that the more the households are educated, the more output will increase.

3. 1.3 Estimation techniques

Using OLS technique. the coefficients of the above variables were estimated. For the study to estimate with OLS. the Cobb-Douglas production function has to be a transformed model. to satisfy the Classical Linear Regression Model (CLRM), so that to come up with the usual assumption of Best Linear Unbiased estimator (BLUE).

3.1.4 Data types and Sampling procedures.

Taking household unit of sample. the study used primary data collected on farm output of banana crop for the period of one year. Due to different characteristics of respondents. the sampling followed this technique:

The first step involved the stratification of the district into administrative divisions.

The next step was to classify all the sub-locations in the district. which cultivate banana crop according to their respective locations (this classification was obtained from the Kanama district field agronomist). Out of eleven sub-locations of Kanama District. bananas are cultivated in eight sub-locations where households were selected. The averaged population in every sub-location is around 254 households.

The following step was to select farmers for interview from each of sampled sub-locations. To get this sample. twelve households were chosen in every sub-location. Responding farmers were drawn from each sub-location using a systematic sampling procedure. The sampling frame was obtained with the assistant counselor in the particular sub-locations who helped in giving the names of the farmers. It should be noted here that not individual households were considered. but rather homestead were considered. And the name listed was that by which the home is known administratively to assistant counselor.

From the list of farmers, a random start was obtained using a table of random number. then after the random interval was used to sample out farmers. As a result. the district was covered by the study. The size of the sample selected was determined by the available resources and time allocated to the study. A size sample of 106 was considered adequate for the study given the constraints. In this way. the different agricultural practices as determined by the natural conditions in the district were captured. The results are therefore expected to demonstrate what exist in Kanama district agriculturally.

The data was collected using a designed questionnaire (see annex1). which was administered to sampled farmers taking households as unit of the study.

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3.1.5 Source of data

The data has been collected in Kanama District, which is located in Gisenyi Province in Rwanda. It has a land area of 192 square kilometers, with population of 70080. Almost 90% of the population is engaged in agriculture with 365 persons per square kilometer. It is situated between the districts of Cyanzarwe, Gisenyi and Nyamyumba in the West, Mutura in the North, Gasiza and Gaseke in East, Kayove in the South. Due to its fertile ecosystem, Kanama district offers a potential to grow bananas, beans, peas, sorghum, sweet potatoes, and Irish potatoes. Tea and coffee are the main cash crop produced in Kanama. Banana is the most produced and consumed crop, it generates cash income that the population uses to satisfy their domestic needs. Every family has a size of land averaged 0.5 to 1 ha. Tea plantation industry employs a quite number of populations. Almost 10% are craftsmen and are grouped in two cooperatives called KIAKA and KOTAGIRWA. Mahoko is the only market where farmers sell their products.

3.2 Limitations of the study

Due to limitations on time and funds, the whole of Kanama District population cannot be studied but the sample of one hundred and six households chosen randomly in the whole district can give information on the impact of the economic factors that affect the production of bananas in the whole district. The study is also likely to encounter difficulties during interview, due to low awareness level of the farmers who do not keep record of agricultural information that is needed in this study. To overcome the above problem, it is expected to spend much time with the respondents in discussing the various economic factors affecting production of bananas in the area.

CHAPTER FOUR: DATA ANALYSIS

4.1 Introduction

This chapter presents the empirical findings on the analysis of socio-economic factors affecting banana production in Kanama District of Rwanda. The empirical findings revealed that 76% households grow brewing bananas, and 73% of the households sell their produce after transforming them into beer. 56% of the households grow cooking banana, which mostly are consumed at home. In this analysis, it has also been revealed that 46% of the households surveyed sell their banana production at the gate of the farm, while 54% sell in Mahoko market. In terms of banana production activities, only 23% of the households surveyed had gotten credit during the period of June 2004 to June 2005, from either Banque populaire or financial associations, while 22% face a problem of collaterals. The extension services officer has visited only 4% of the households surveyed. 54% of the households use fertilizer.

4.2 Descriptive Statistical Analysis

Table 4.1: Statistical analysis of the study variables.

Variables	Observations	Mean	Std. Dev.	Min	Max
Output	106	1.5061	3.654	0.118	8.247
Acreage	106	3.320755	2.497798	1	10
Physical Capital	106	5635.566	7494.54	14000	61500
Labor	106	60.26	22.41	38	250
Fertilizer	106	2809.906	4499.15	4500	45000
Price	106	300	290	200	1200
Education	106	0.226415	0.3514155	0	1

Interpretation from table 4.1

Output of bananas produced by households surveyed was estimated at an average of 1.5061 tonnes per year. The highest output per household was 8.247 tonnes, while the minimum quantity was 0.118.

Acreage per household is at an average of 3.32 acres. The household with the highest property of land under bananas had 10 acres and the one of a minimum property of land under bananas had an acre.

Physical Capital (Kp). which is defined in terms of Rwandan Franc (Frw) used in the banana farm per year. was at an average of Frw 5.635.566. while the lowest amount was Frw 14.000. The highest amount of money was Frw 61,500 per households.

The average labor hired by households was estimated at 60.26 hours, while the minimum hired was 18 hours. The maximum hours spent during the period of one year, was estimated at 250 hours.

The money spent on fertilizer was at an average of Frw 2,809.906: with a minimum amount of money spent was Frw4.500. The maximum spent on fertilizer was Frw 45,000 per household per year.

Price of bananas (bunch of banana) was at an average of Frw 300per bunch of bananas. The household who sold his bananas at the minimum price was selling at Frw200. and the maximum price was at Frw 1200.

The descriptive statistics show that 22% of the households have attained at least primary level of education.

4.3 Results of regression analysis

Table 4.2: Model results

Source	SS	df	MS			
Model	3.94677101	5	.789354201	Number of obs =	106	
Residual	19.6345908	100	.196345908	F(5, 100) =	4.02	
				Prob > F =	0.0023	
				R-squared =	0.5874	
Total	23.5813618	105	.224584398	Adj R-squared =	0.5557	
				Root MSE =	.44311	

ln Output	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
ln acre	.3264352	.1535284	2.13	0.036	.0218391	.6310312
ln kp	.1885627	.0603694	3.12	0.002	.0687916	.3083338
ln labor	-.0862735	.1013528	-0.85	0.397	-.2873546	.1148076
ln fert	.2302143	.1168601	1.97	0.039	.0191856	.6845085
ln price	.2991738	.1466538	2.04	0.007	.0265771	.6562984
Edn	.085181	.0910028	0.94	0.352	-.0953882	.2657502
_cons	9.72082	1.482364	6.56	0.000	6.779852	12.66179

The log of variables is estimated using Ordinary Least squares (OLS) as specified in the model in chapter three.

From the results R^2 =0.5874, imply that 58.74% of the variation in banana output is explained by the explanatory variables.

a) Acreage

From the findings output from banana production is positively related to acreage as shown by the coefficient of 0.326. Implying that as households expand acreage under bananas production by 1%, the output will increase by 0.32%. This is significant at 5% level. This confirms what Malassis (1975) said in the literature, that the expected relationship between output and land is that, as more land is brought under production, output is increased.

b) Physical Capital

Output from bananas production is positively related to physical capital as reported by the coefficient 0.188 and is significant at all levels. This means that when households increase the money spent in equipments by 1%, the output from banana production increases by 0.188%.

c) Fertilizer

Output from banana production is positively related to fertilizer as shown from the findings, where the coefficient is positive 0.23. This implies that a 1% increase in fertilizer results into a 0.23% increase in output, and it is significant at 5% level. This is true, because where there is limitation set by land, farmers have to economize in use of the limiting factor or substitute man-made inputs for it, as analyzed Hayami and Vernon (1971) in the literature, e.g., fertilizer for land.

d) Price

The output from banana production is positively related to price of bananas as shown by the positive coefficient of 0.299. This means that a 1% increase in price of bananas: the output is expected to increase by 0.299%. The results are significant at all levels. Price was varying because farmers sell the bunch of bananas according to its size.

f) Labor

From the results. labor as a factor does not have influence on output from bananas as reported the coefficient (-0. 086). This implies that as household increases hired labor by 1%. the output decreases by 0.086%. In this study, majority of households surveyed hired laborers in different activities of banana production. A positive sign was expected. but the results illustrate a 0.86% decrease This happens. because households have difficulties to organize themselves in hiring labor. as stated Clayton (1964) that peasant farm organization is important in determining output.

e) Education

From the results. education as a dummy variable shows a positive relationship to a output as reported the coefficient of 0.085. but insignificant as reported by the t-statistics of (0.94). which is less than t-critical (1.96). Meaning that education in this study does not have significant influence on the output of bananas in Kanama District.

4.3.1 Other results from the study

a) Credit facilities

In this study, only 23 households out of 106 surveyed have acknowledged having had credit from the local bank (Banque populaire) or from financial associations. This credit was to enable them purchase chemical or organic fertilizers. Majority were facing the problem of collaterals. while others said that they couldn't afford the payments due to the high rates of interest.

b) Extension services

The availability of extension services to farmers was taken from the number of times a households received visits by extension officers during the period. Since the study was focusing only on banana production. what was interesting here was to know whether these services are offered to farmers in terms of developing bananas production in Kanama District.   But the information given by the respondent-farmers was that extension officers have not visited them. This is the reason that the extension services as a variable in the model has been removed. because no data has been recorded it.

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CHAPTER FIVE: CONCLUSION, POLICY RECOMMENDATIONS AND AREAS OF RESEARCH

5.1 CONCLUSION

The main objective of this study was to investigate the socio-economic factors influencing the production of bananas in Kanama District in Rwanda. After estimating the relationship between the output of bananas and various socio-economic factors, the findings shown that various socio-economic factors have to be reviewed in order to improve the production of bananas in Rwanda. The results described that acreage (land), physical capital, fertilizer and price, are the socio-economic factors that have positive relationship with the bananas output. These are factors on which, the government should give emphasis, in order to increase the production of bananas. There are other factors such as education, which in this study has shown a positive coefficient, but explained an insignificant relationship to the banana output. One of the reasons is that educated people run away from rural areas to towns, this has a negative impact to the agricultural productivity. Labour was another factor, which in this study has shown negative effect; one of the reasons of this is that households spent much on hired labor than what they gain from bananas output.

However, based on these findings, we can conclude that land, physical capital, fertilizer, and price are the important socio-economic factors that have effect on the production of bananas in Rwanda

5.2 POLICY RECOMMENDATIONS

Based on the above findings, it is recommended that:

1. Since the land is fixed, the government should encourage the use of fertilizer, and it can do this by providing incentives for the setting up of cooperative shops in order to provide fertilizers to households at an affordable price, so as to increase the level of production.

2. Government should improve its method of gathering and dissemination of information that is vital for households; this also requires government to increase its current level of extension services.

3. The current scenario surrounding the low banana production in Rwanda requires the government to provide credit facilities that will enable households to access such credit at a reasonable cost.

4. The government should encourage private sector to invest in credit facilities like small scale banks to offer credit to farmers at affordable rates. This should be through legislation to facilitate credit creation.

5.3 AREA OF FURTHER RESEARCH

This study aimed to investigate the socio-economic factors affecting banana production in Kanama District. in Rwanda. Future research should extent the areas of study. to capture the socio- economic factors the information was not available due to the small sample studied in this model. For example. credit facilities and the availability of the extension services. These are essential in enhancing banana production in Kanama District.

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Multicolliniarity test

	edn	Output	acre	kp	laboryr	fertyr
Education	1.0000					
Output	0.1225	1.0000				
Acreage(land)	0.0691	-0.0384	1.0000			
Phys. Capital	0.0790	0.2883	-0.0052	1.0000		
Labor	-0.0790	0.1216	-0.0435	0.0110	1.0000	
Fertilizer	0.0724	0.0054	0.1828	0.0146	0.1609	1.0000

It shows that the variables have correlation matrix, above 0.5. Multicolliniarity is not a serious problem.

Hello, my name is **MPAWENIMANA JOEL**, we are conducting a research on "**Analysis of SOCIO-ECONOMIC FACTORS AFFECTING THE PRODUCTION OF BANANAS IN RWANDA: A CASE OF KANAMA DISTRICT**" for the fulfillment of Masters Degree in University of Nairobi-Kenya. We would very much appreciate your participation in this research. Now I would like to confirm you that the information you will give us will be treated with utmost confidentiality. May I begin the interview now?

Respondent agrees to be interviewed.

Name of Enumerator...................
District of KANAMA
Sector: ----------------------
Cellule: ---------------------------

To be administered to persons of age 18 years and above

Area

S/No.	A	B	C	D	E	F	G	H
	Sex of respondent	Age (Years)	Marital status	Relationship to HH	Size of HH	Education Level	Main occupation	Bananas harvested (/kgs)/Month Jun-Dec 2004
	1-male [ ] 0-female [ ]		0=single [ ] 1=married [ ] 2=separated [ ] 3=divorced [ ] 4=other (specify)	0=son [ ] 1=daughter [ ] 2=spouse [ ] 3=other (specify)	No of children in school [ ] No of children out of school [ ] No of other people living with HH [ ]	0 No education[ ] 1 primary [ ] 2 secondary [ ] 3 College [ ] 4 university [ ]	1=Farmer [ ] 2=Shopkeeper [ ] 3=Teacher [ ] 4=Gvnt employee [ ] 5=Mechanic [ ] 6=Driver [ ] 7=Other (specify)	Jan-Jun 2005

J	K	L	M	N	O	P
Acreage under banana cultivation Size of land (acre)	Capital How much do you use?	Source of Credit	If credit inadequate, Reasons	Collateral Required	Extension services Per years	Labor
Owner [ ] Rented [ ]	1 In weeding[ ] 2 in harvesting[ ] 3. Land preparation [ ] 4 in trsportation [ ] 5 Farm Implements [ ] 5 Other (specify	1=Bank populaire [ ] 2=Micro-finance[ ] 3=Co-operative society [ ] 4=Other (specify)	1=collateral [ ] 2=high interest rate [ ] 3=lending ceiling [ ] 4=other (specify)…	0= none [ ] 1=land/plot [ ] 2=livestock [ ] 3=HH assets [ ] 4=building [ ] 5=members [ ] 6=future harvest [ ] 6=future harvest [ ] 7=shares [ ]	1=Access to visit [ ] 2= No visit [ ]	1 How many workers are engaged in your farm? [ ] 2= How many hours do they work in a day [ ] 3=How many days in a week [ ] 4= How much do you pay /day/Month?

Q	R	S	T	U	
Fertilizer	**Price of Bananas**	**Technology used**	**Market information**	**What type of bananas do you cultivate?**	**Infrastructure**
Do you use fertilizer in your farm? Yes [ ] No [ ]	1 What is the average price of the whole fruit of bananas? [ ]	Which farm implements you use?	1 Do you get market for your produce? [ ]	1 Brewing bananas----[ ] 2 Cooking bananas---[ ] 3 Dessert bananas ---[ ]	1 Very far from the road----Yes[ ] No [ ]
Which quantity do use in your banana plantation(bags/kgs)		1 Hoes [ ] 2 Wheelbarrow [ ] 3 Vehicle [ ]	2. Why do you grow bananas?		2 Roads Not good [ ] 3 Means of transportation is poor [ ]
1 How much did you spend on fertilizer in year? [ ] Where do buy it? [ ]		4 Indicate whether grown in pure or mixed stands	2-1 Have high yield [ ] 2-2 A source of income( ) 2-3 Mature faster [ ] 2-4 For cash income [ ] 2-5 For food [ ] 2-6 Other (specify)------	4 Do you sell bananas transformed into: Not --------- [ ] Juice --------------[ ] Beer ------------[ ] Other(specify)----	4 What improvements do you suggest?------
				5 Who do you sell to/Where?	
			Crop / Pure / Mixed Bananas Maize Sorghum Beans	3 Where do you sell your bananas? [ ]	Locally ---- [ ] In all the country---[ ]
		5 How do you store your harvested bananas?------		6 Do you find pblms in selling your bananas? Yes( ) No [ ]	

Crop table (within column S):

Crop	Pure	Mixed
Bananas		
Maize		
Sorghum		
Beans		

DEMOCRATIC REPUBLIC OF CONGO (DRC)

Carte Administrative du Rwanda

UGANDA

BURUNDI

TANZANIA

Légende:
- Forêt Naturelle
- Ville
- Limite de district
- Limite de province
- Limite d'Etat
- Lac