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## FINANCIAL FACTORS AFFECTING PRODUCTION EFFICIENCY OF SMALL SCALE COFFEE FARMS IN BURUNDI

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## FINANCIAL FACTORS AFFECTING PRODUCTION EFFICIENCY OF SMALL SCALE COFFEE FARMS IN BURUNDI

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### Abstract

**Purpose:** The study sought to evaluate financial factors affecting the production efficiency of small-scale coffee farms in Burundi.

**Methodology:** The research design used during the study was descriptive. The research targeted a population of 300 small-scale coffee farmers. The study had a sample population of 121 smallholder coffee farmers. The study conducted the research for a 6-year period between 2015-2020. The data was collected using a secondary data collection sheet. Secondary data was obtained from Coffee federations' annual reports, cooperatives reports, and coffee farmers' records. Analysis of the data was done using the Eviews student 11 version. The analyzed data was presented in form of tabulations, mean and standard deviation.

**Findings:** The study findings showed that the correlation analysis showed that the selling prices per kilogram of coffee beans had a negative and significant correlation to the production efficiency by  $R = 0.98$ . Production efficiency had a negative and significant correlation to capital availability by  $R = 0.260$ . Lastly, production efficiency had a positive and significant correlation to production costs at  $R = 0.500$ . The findings of the research obtained that selling prices per kilogram of coffee beans had a not significant negative effect on production efficiency, while capital availability and production costs had a positive effect on the production efficiency.

**A unique contribution to theory, practice, and policy:** The study recommended that government should review the policies relating to the selling prices per kilogram of coffee beans to improve small-scale coffee farmers' incomes. Government should also facilitate access to credit to small-scale coffee farmers. The study incorporated the Cobweb theory of price fluctuation, the theory of credit rationing also called adverse selection theory, and the high payoff inputs model.

**Keywords:** *Agricultural finance, small-scale farmer, production efficiency, price volatility*

## INTRODUCTION

Coffee is one of the agricultural products traded in global markets, in terms of both volume and value (Borrella, Mataix, & Carrasco-gallego, 2015). Around 80 percent of the globe's coffee is produced by 17.7 million small-scale coffee farmers (Vincent, Andrea, & Adrian de Groot, 2017). Coffee farming is globally dominated by small-scale farmers who depend directly on coffee for their incomes (Borrella et al., 2015). It is estimated that the coffee sector provides employment and income directly to 25 million farmers and over 100 million human beings across the world whose livelihoods depend on coffee farming (Clac, 2019). Coffee is a growth market and affords economic profits at each step of the worldwide value chain, from farmers to consumers (ITC, 2020). Additional economic benefits are accrued by actors along the global value chain, be they traders, roasters, retailers and their workforce or other stakeholders (ICO, 2019a). Coffee is grown in more than 70 countries then over 60% of the world coffee is produced in four countries such as Brazil, Colombia, Vietnam, and Indonesia.

A small-scale coffee farm is characteristically a family-owned enterprise that produces crops on two or less than one hectare (IFC, 2013). According to IFC (2013), an estimated 525 million smallholder farms exist worldwide with the majority are in Asia, with 44 million in Europe and the Russian Federation, 33 million in Africa, and five million in the Americas. They cultivate both food and non-food products including field and tree crops with less access to resources such as land ownership, capital, skills, and share of family labor (Jefferson, 2016). Productivity is measured in terms of yield, generally calculated as tons per hectare. The efficiency of coffee farming varies from country to country depending on factors that impact yield levels. Small-scale farmers live in farms that in various countries are considerably smaller than 2 hectares (IFC, 2013). In Asia, smallholdings are very small by the average size of a smallholder farm in Bangladesh and Vietnam of 0.24 and 0.32 hectares respectively (George, 2015). George shows that in Africa, smallholder farms can be comparatively larger, but only marginally. In Latin American countries, small-scale farms are over 2 hectares, as in Nicaragua where the average small farm size is 5 hectares.

Africa has the biggest number of 25 coffees producers' countries as different to 11 in Asia & Oceania, 12 in Mexico & Central America, and 8 in South America (ICO, 2015b). Africa coffee sector estimates 33 million smallholdings of fewer than 1 hectare, counting around 80% of the whole farms (Ibrahim, 2013). Coffee provides livelihoods for five million households in East Africa, and the majority of whom live less than USD 1.25 per day. East Africa production produced 13.2 million bags in 2014/2015, just 9.3 percent of world production. Africa dropped from a yearly average of 1.25 million tons in the 1970s to 1.06 million tons in the 2000s and an average of 1.02 million tons in recent years, from

which 63% was accounted for by Ethiopia and Uganda(ICO, 2015a).

Burundi Coffee sector contributes to GDP, accounting for around 80% of the total export earnings(Kimonyo & Ntiranyibagira, 2007). In the world production system, Burundi coffee production covers 0.11% of the world's exports. It is estimated that four million Burundian depend indirectly on the coffee industry. Burundi has more than 600,000 smallholder farmers engaged in the production of coffee. The smallholder farms account for an estimated 70,000 hectares. Hence, Coffee plays a major role in the development of Burundi and its performance has far-reaching socioeconomic consequences(ICO, 2019a). According to International Coffee Organization (2019), Burundi coffee production decreased from 272,000 tonnes in 2015/2016 to 247,000 tonnes in 2016/2017 and to 174,000 tonnes in 2017/2018. The selling price of coffee varies with mean prices of 558 BIF/kg in 2014/2015, 473BIF/Kg in 2015/2016, and 409 BIF/Kg in 2016/2017(Clay & Emile, 2018). Burundi's coffee productivity breaks far after that of other coffee-producing countries in East Africa with the productivity of 244 Kg/hectare compared to more than double the yield at 625 Kg/hectare for the East African Countries(Gerard, Clay, & Lopez, 2017).

The variation in prices is observed during each season and from year to year. The study conducted by Gerard, Clay, & Lopez (2017) shows that selling prices vary with regions and even from seasonal year to year. According to the authors, during the coffee year 2016/2017, coffee farmers get in kayanza province 527 BIF/Kg of coffee bean, against Karusi 447 BIF/Kg, Ngozi 536 BIF/Kg, and Gitega 473 BIF/Kg (between \$ USD 0.17 and \$ USD 0.29 per kilo). The low prices of coffee beans by coffee farmers incite them to abandon their farms, associate coffee with other crops, or sell their products to the neighbours' markets(Bonaparte, 2018).

The African coffee-producing countries, except Ethiopia and Uganda, have presented an adverse production growth (ICO, 2018). The ICO report shows that an average annual production was over 20 million 60kg bags in the 1970s, compared to 15 million 60kg bags currently. Today, the total output of Africa represents 10.5% of world production, compared to 30% in 1970. The average yields are regularly poor and decreasing, ranging from 100kg to 800kg per hectare. The average productivity level in Central American countries is somewhere between 0.5 to 0.75 tonnes per hectare, while in Africa, yield levels range from 0.1 to 0.8 tonnes per hectare. In Asia, average yield figures are hard to calculate due to a lack of information, but beyond Vietnam, rates appear to be increasing. Indonesia and India yield 0.76 tonnes per hectare and 0.8 tonnes per hectare respectively(USAID, 2019). Despite the positive production developments, differences exist among actors in the coffee value chain in terms of risks, income, access to resources, and exposure to price volatility, which encumber the sustainability of coffee.

While global coffee production has been growing annually by 1.3% and 4.3% in Asia, production in Africa has been declining by an annual average of 0.1% (ICO, 2018). For the period 2017/2018, the total value of exports by African countries remained US\$1.9 billion compared to US\$5.4 billion for Asia, US\$4.1 billion for Central America & Mexico, and US\$8.4 billion for south America (Frederick, 2019). Even though smallholder farming plays an important role in worldwide agricultural production and supporting rural livings, they face many challenges in increasing agricultural yields and transitioning from subsistence to commercial farming.

### **Statement of the problem**

The importance of coffee in the global economy is clear because it is one of the greatest value products in international trade. Coffee is the primary source of export revenue. Burundi coffee production over the latest several years has been standing at less than half of what it was in the early 1990s, diminishing from a 5-year average of 34,000 MT to a 5-year average of 16,000 MT today (Thiruchelvam, Alexandre, Maryam, & Bamiah, 2018). According to International Coffee Organisation (ICO, 2019b), from 2016/2017 to 2017/2018, the total production of coffee has decreased from 247,000 tons to 174,000 tons. This source showed that 70,000 hectares are covered by coffee during the season year 2015/2016 land at the national level.

Thiruchelvam, Alexandre, Maryam, & Bamiah (2018) show the reasons for the decline of coffee production. In their paper, they state factors of decline like the capacity to invest, which includes land, labour, and capital. Many coffee farmers in Burundi hold sufficient capacity, in varying degrees, to produce high-quality coffee on their farms.

The other factor is that farmers must also have the incentive to invest in their plantations. There are many smaller incentives, such as keeping up with family tradition, social benefits of participating in coffee cooperatives, and the prestige often associated with owning coffee trees and producing coffee. However, the most important factor of all, the one that motivates coffee farmers to invest in their plantations, is the compensation they receive for their coffee beans. For many, it comes down only to coffee bean prices and whether they are high enough for farmers to invest their scarce resources into coffee versus other crops or livestock or non-farm activities. And we bear in mind that the coffee bean price incentive is discounted by farmers to account for the level of risk they associate with coffee production, including the risk of poor rains, plant pests/diseases, and, especially, the risk of a drop in world coffee selling prices (Thiruchelvam et al., 2018). In their paper, other reasons cited for the decline in coffee production included: decline in application of inputs; poor farming practices; and farmers' loss of confidence in the management of coffee affairs. There are many other research studies that have been

carried out to find the challenges and opportunities of Burundi coffee farming (Kimonyo & Ntiranyibagira, 2007, USAID, 2010 , (Thiruchelvam et al., 2018). However, many studies already carried have investigated the combined effect of all the factors of production on coffee.

### **Objectives**

1. To analyze the effect of selling prices on the production efficiency of small-scale coffee farms in Burundi
2. To examine the effect of credit availability on the production efficiency of small-scale coffee farms in Burundi
3. To evaluate the effect of production costs on the production efficiency of small-scale coffee farms in Burundi.

## **LITERATURE REVIEW**

### **Theoretical review**

The basis of the study was based on the Cobweb theory of price fluctuation, the theory of credit rationing also called adverse selection theory, and the high payoff inputs model.

### **The Cobweb theory of price fluctuation**

The Cobweb theory of price fluctuation was proposed by Mordecai Ezekiel (1938). The price fluctuation theory identified as Cobweb theory is the indication that price fluctuations can lead to fluctuations in supply which cause a cycle of increasing and decreasing price(Ezekiel, 1938). The Cobweb model states that producers are very shortsighted. Assuming that farmers look back at the most current prices in order to estimate future prices might appear very rational, but this retrospective forecasting turns out to be critical for the model's fluctuations. When farmers expect high prices to continue, they produce too much and therefore end up with low prices, and vice versa(Samson, 2016). The determined fluctuations of prices in selected agricultural markets have concerned the attention of economists from time to time, and the theory of the cobweb was developed to explain them(Samson, 2016) .

### **Theory of credit rationing**

The theory of credit rationing also called adverse selection theory at the market is attributed to Stiglitz & Weiss (1981). The term credit rationing can be defined as a situation in which among loan applicants who seems to be identical some receive loans and others do not. The rejected applicants would not get the loan although they accepted to pay a high interest rate. There is also another group of individuals in the community who cannot obtain a loan even if the supply of loan in credit market has increased

significantly (Stieglitz and Weiss, 1981). As shown by Stiglitz and Weiss (1981) equilibrium quantity rationing arises from lender unwillingness to increase the interest rate to clear excess demand because doing so would result in adverse selection of the borrower groups. This is due to unseen information which indicates that lenders do not have complete information of the borrower's capacity to service a confident amount of loan. It is on this premise that the theory posits that lending institutions demand collateral to be put up as a mitigating measure against loan defaults.

### **The high payoff inputs model**

The high payoff inputs model was proposed by Schultz (1965). Schultz's theory states that farmers are rational allocators of available resources, but they have remained poor because they are provided with limited technical and economic opportunities to which they can respond. Schultz's model neither explains how economic conditions induce an efficient path of technical change for agriculture in an area nor how economic conditions induce the development of institutions such as agricultural testing and research locations which become the suppliers of the location-specific information. The model focuses on how to create and provide to farmers' new high pay off technology embodied in capital equipment and other inputs, and how to create the productivity of labor. It assumes that economic growth from agricultural sector of poor country depends predominantly upon the availability and price modern high pay off inputs. When they succeed in producing and distributing these factors, agricultural factors such as fertilizers, high yielding seeds cheaply, investment in agriculture becomes profitable. In order to counter to this situation, Schultz presented three types of high-payoff investments for agricultural development such as agricultural research institutions to produce new location-specific technical knowledge; technology source industries to develop, produce, and market new technical inputs; and schooling and extension of rural people to facilitate them to use the new knowledge and technology successfully.

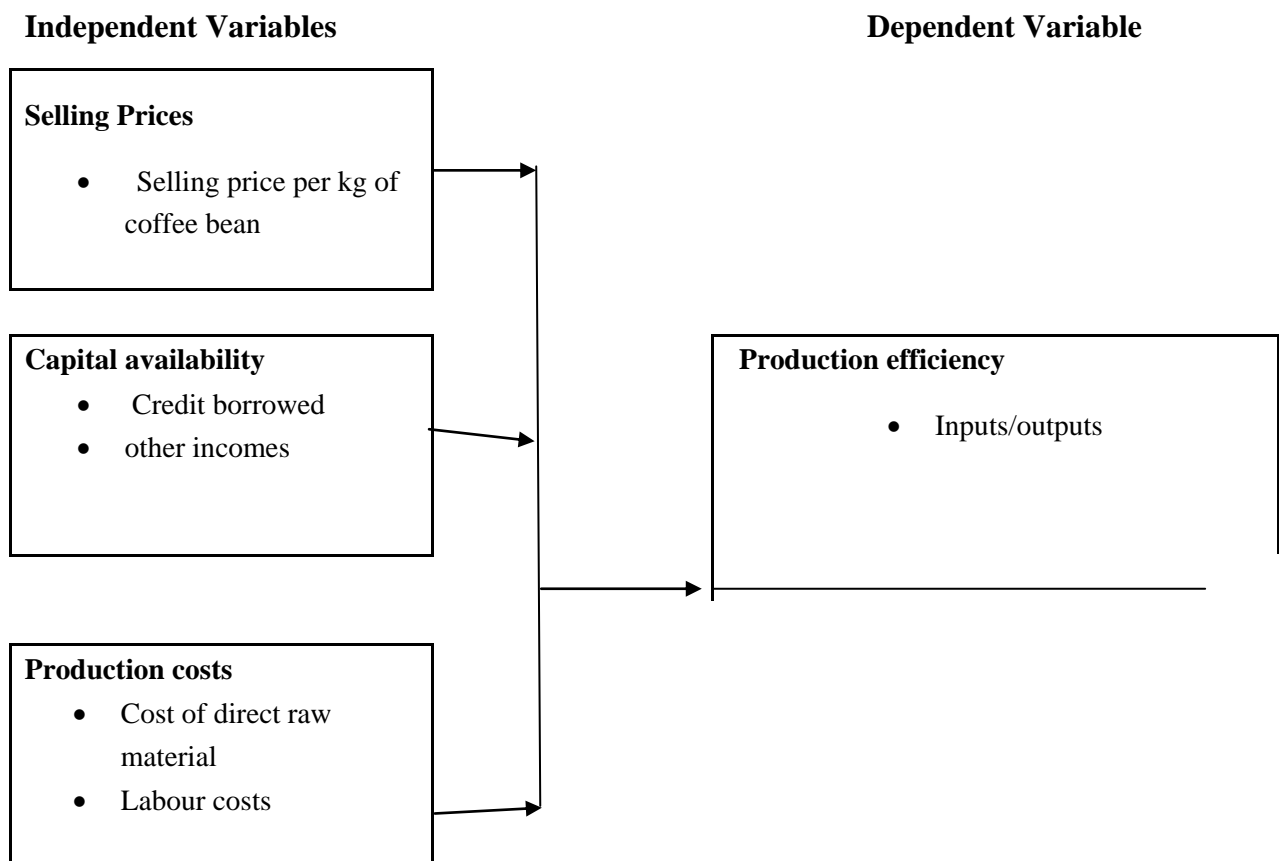
Ruttan(1988) criticized the high-payoff input model by arguing that the high payoff input model remains incomplete as a theory of agricultural development. Typically, learning and research are public things not traded through the marketplace. The mechanism by which resources are allocated among education, research, and other public and private sector economic activities was not fully incorporated into the model. It This theory was enthusiastically accepted, and arguably led to much agricultural advancement in rural areas as education specific to each location was provided to farmers. This theory headed to much technical improvement in agriculture across the world. Nevertheless of this critique, the high-payoff input model made the development of agriculture, mostly in rural areas such as the high country beginning in the 1960s(Ruttan, 1988). The high degree of services delivered to farmers in this region was due to the conviction that

agricultural education should be open to all and definite to each location. This theory marks a change from existence agriculture and multiple-livelihood approaches into the international dominion. The earlier two theories concentrated on a much limited view of how societies operate the societies grew most of their own food or relied on their family and friends in economic and social dealings.

### Conceptual Framework

This conceptual framework describes the relationship between independent variables and the dependent variable.

**Figure 1: Conceptual Framework**



### RESEARCH METHODOLOGY

The study used descriptive research design. The research targeted a population of 300 small-scale coffee farmers. The study had a sample population of 121 smallholder coffee farmers. The study conducted the research for a 6-year period between 2015-2020. The data was collected using a secondary data collection sheet. Secondary data was obtained



from Coffee federations' annual reports, cooperatives reports, and coffee farmers' records. Analysis of the data was done using the Eviews student 11 version. The analyzed data was presented in form of tabulations, mean and standard deviation.

## RESULTS AND DISCUSSIONS

### Descriptive analysis

**Table 1: Descriptive analysis**

	PRODUCTI...	SELLING_P...	CAPITAL_A..	PRODUCTI...
Mean	0.142004	480.0000	114850.0	167064.7
Median	0.138764	500.0000	124500.0	168140.0
Maximum	0.183474	550.0000	153000.0	178000.0
Minimum	0.106643	380.0000	52000.00	150740.0
Std. Dev.	0.023183	53.26576	37489.76	8291.282
Skewness	0.362202	-0.729367	-0.482567	-0.863624
Kurtosis	2.630135	2.601384	1.747381	3.031542

Results in the table indicate that production efficiency range between 0.1066 and 0.1834. The mean score for efficiency is 0.1420. The variability as depicted by the standard deviation is 0.0231 indicating that variations in production efficiency were within the mean. The natural log of selling price had a mean score of 480 and a standard deviation of 53.265 indicating that the coefficients were not widely dispersed from the mean. The maximum and minimum prices were 550 and 380 respectively. The results further indicate that capital availability had a mean rate of 114850 a minimum of 52000 and a maximum of 153000. The standard deviation of 37489 indicates low variability implying that data was clustered around the mean. The variable of log of total production costs had a mean value of 167064, a maximum value of 178000 and a minimum value of 150740. The variable had a regular standard deviation of 8291.

### Regression analysis

The regression analysis among dependent and independent variables was carried out. The coefficient of determination was denoted by adjusted r-squared which provides explanations to the total variations independent variables due to changes in the value of the dependent variables. Regression analysis was performed to empirically determine the effects of financial factors on the production efficiency of the small-scale farms in Burundi. The results are presented in the table below:

### Regression model summary

Dependent Variable: PRODUCTION\_EFFICIENCY

Method: Pooled Least Squares

R-squared	0.829811	Mean dependent var	0.142004
Adjusted R-squared	0.829752	S.D. dependent var	0.023169
S.E. of regression	0.009560	Akaike info criterion	-6.462019
Sum squared resid	0.530499	Schwarz criterion	-6.458575
Log likelihood	18768.70	Hannan-Quinn criter.	-6.460821
Durbin-Watson stat	1.292321		

The coefficient of determination R-squared value was 0.8298 which indicates that 82.98% of variations in production efficiency could be explained by financial factors. The remaining 17.02% was explained by other factors not considered by the study. The study selling price had a negative but statistically not significant effect on production efficiency. Similarly, credit availability had a positive, though the statistically significant influence on production efficiency. On the other hand, total production costs had a positive and statistically significant effect on efficiency.

### Regression coefficients

The regression coefficient shows the statistically significant test of the predictor variables in the study model. It shows the estimation of the independent variables, standard error, and t-statistics. It was used for the case of multiple regression.

Dependent Variable: PRODUCTION\_EFFICIENCY

Method: Panel Least Squares

Cross-sections included: 121

Total panel (balanced) observations: 726

PRODUCTION\_EFFICIENCY=C(1)+ C(2)\*LNSELLING\_PRICE\_PER\_KG\_\_  
 \_BIF\_KG\_ + C(3)\*LNCAPITAL\_AVAILABILITY + C(4)  
 \*LNPRODUCTION\_COSTS

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	0.254985	0.001081	235.9295	0.0000
C(2)	-0.000410	8.73E-07	-470.2700	0.0000
C(3)	3.47E-08	1.16E-09	29.80990	0.0000
C(4)	4.79E-07	5.27E-09	90.85481	0.0000

The results in table 3 were represented by the following equation:

**Production efficiency = 0.2549 – 0.0004\*Selling prices per kg of coffee beans + 3.4747\*capital availability + 4.7878\*production costs**

Where:

C (1) represents the constant

C (2) represents the coefficient of selling price per kilogram of coffee beans;

C (3) represents the coefficient of capital availability,

C (4) represents the coefficient of production costs.

According to the regression models shown above, selling prices negatively influenced production efficiency while capital availability and production costs had positive and effects on efficiency.

The regression model has shown that the production efficiency of small-scale coffee farms is 0.2549 provided all the other independent variables are held constant at zero value. A unit increase in the selling price per kilogram of coffee beans will result in a 0.00041 decrease in the production efficiency of small-scale coffee farms. Similarly, a unit change in the capital availability will result in a 3.4693 increase in the production efficiency of small-scale coffee farms. Also, a unit change in production costs will result in 4.7878 increases in the production efficiency of small-scale coffee farms. Accordingly, capital availability and production costs had positive and statistically significant effects on the production efficiency of small-scale coffee farms.

## **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

### **Summary**

The general objective of the study was to evaluate the financial factors affecting the production efficiency of small-scale coffee farms for a sample of 121 coffee farmers in Burundi. The specific objectives were to analyze the effect of selling prices on the production efficiency of small-scale coffee farms, examine the effect of the availability of capital on the production efficiency of small-scale coffee farms, and assess the effect of production costs on the production efficiency of small-scale coffee farms in Burundi. The study findings on the financial factors affecting the production efficiency of small-scale coffee farms were established and presented. The findings of the research obtained that selling prices per kilogram of coffee beans had a not significant negative effect on production efficiency, while capital availability and production costs had a positive effect on the production efficiency.

## **Conclusions**

Based on the results of the analyzed data, the study concluded that the selling price per kilogram of coffee influence the efficiency of small-scale coffee farms. The lowest selling prices of coffee influence their income compared to production costs. The availability of capital and production costs have had a positive impact on the production efficiency of coffee farms. Capital has a significant effect on the efficiency of small-scale coffee production. This shows that production efficiency can be increased by facilitating access to credit to small-scale coffee farmers. The study showed that production costs have a positive effect on the production efficiency of small-scale coffee -farms. The positive coefficient indicated that compared to coffee growers who did not use direct raw materials, farmers who used direct raw materials were more productive and efficient, everything else being constant. By lowering the costs of direct raw material, small-scale coffee farmers can get the latter at affordable prices and become productive and efficient. Labour used in coffee production affect positively the production efficiency of small-scale coffee farms. The inability of farmers to be productive and efficient has been verified by the low selling prices. The results of this study show that productive efficiency is more associated with maximizing the volumes produced of coffee. The study also found that the production efficiency of farmers increases with the use of labor as well as the use of direct raw materials. In this study, the factors that influence the production efficiency that was found to be statistically significant were capital availability and production costs. An analysis of the financial factors of production efficiency was carried out and it showed that production efficiency in coffee production could be created by increasing the selling prices per kilogram of coffee beans.

The conclusion of this study then is that when capital and production costs lead to production efficiency, then coffee farmers can expect a positive relationship between production efficiency and production costs.

## **Recommendations**

Based on the observed results of the study, recommendations were recommended. The selling prices of coffee have an effect on the production efficiency of small-scale coffee farms and influence their income in relation to production costs. It is important that the prices of a kilogram of coffee must be fixed taking into account the related production costs. The government should therefore develop policies that favor farmer groups and protect their synergies from exploitation. The dominant market prices were found to be independent of variations in market diversity between different channels. This is associated with weak market links and an increase in the number of participants between farmers and potential markets, which reduces the incomes of small farmers. This study

recommends the need for government to develop and implement policies that promote contract markets that have the potential to directly link farmers and buyers. This will reduce the influence of intermediaries and ensure the efficiency of marketing and therefore the improvement of coffee prices. In addition, smallholder farmers should familiarize themselves with the basics of contract marketing as this will enrich their negotiation efforts and mitigate the effects of constraints that qualify them as price takers.

Cooperatives of coffee farmers can make approaches to the banks and microfinance to enable farmers to get direct access to credit and get their direct requirements. Co-operatives must be refined as a means of investments and credit and build a connection where they can invest a huge amount of money. As a consequence, coffee producers can benefit reciprocally. Diverse commercial banks and micro finances have to create associations to facilitate credit to small coffee producers. The purchase of fertilizers requires a lot of means. The price of these is high and this affects the production efficiency of coffee growers. The results from the study exposed that to increase the production efficiency of coffee farms, it is necessary to reduce the cost of fertilizers. Farmers want to obtain necessary inputs for farming at low prices and consequently increase their production. Coffee growers through their cooperatives need to know how to benefit from these fertilizers at a lower cost. The use of labor and application of fertilizers in coffee production was found to positively influence production efficiency. This would increase coffee yield and enable farmers to benefit from the economies of scale. The study, therefore, recommends that farmers should embrace production costs and possess high yielding potential. Lower production costs will ensure better yields. while the government should ensure affordability and equitable supply among smallholders. The government and other stakeholders should develop strategies that secure fertilizer subsidies, as this will reduce input costs and ensure higher yields. The government should support coffee production by further research into the analysis of the production costs used in coffee farming to improve coffee production since coffee farming has benefits such as the economic development of the country and that of small producers.

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