Profitability of coffee production among smallholder farmers in Mbozi District, Songwe Region, Tanzania

Luhuvilo Lupondo[1]
Baltazar Namwata[2]
Fadhili Ngalawa[3]
Hebron Nyamboga[4]

[1]llupondo@ irdp.ac.tz/llupondo@gmail.com

[1,3,4]Institute of Rural Development Planning, Dodoma, [2]Moshi Co-operative University, [1,2,3]Tanzania

Recommended Reference: Lupondo, L., Namwata, B., Ngalawa, F., & Nyamboga, H. (2025). Profitability of coffee production among smallholder farmers in Mbozi District, Songwe Region, Tanzania. *African Quarterly Social Science Review*, *2*(3), 104–113. https://doi.org/10.51867/AQSSR.2.3.9

ABSTRACT

The study was conducted in Mbozi District, which is located in Songwe Region of the southern highlands of Tanzania. The district is among the key producers of Arabica coffee due to its favourable agro-ecological zone, such as favourable rainfall, fertile soil, and suitable altitude. The district has a population of 510,599 people, among whom the majority are living in rural areas, depending on agriculture as their main source of income. The main cash crop produced is coffee. The coffee industry contributes around USD 100 million annually to the national economy. Coffee production accounts for over 70% of the district's economy and over 85% of its internal council revenue. In addition, coffee contributes approximately five percent of Tanzania's total export. Despite its contribution, the profitability of coffee production among smallholder farmers remains largely undocumented. This study aimed at addressing the knowledge gap by assessing the profitability of coffee among smallholder farmers at Mlowo Ward in Mbozi District. The profitability study is guided by the Production Function theory, which states that "a profit maximization farmer selects the best inputs to get the best output levels and achieve the best profit." A cross-sectional design was used to collect data from a sample size of 228 smallholder farmers. The sample size was determined by Cochran's formula, and multistage sampling techniques were applied to reach all respondents effectively. Descriptive statistical analysis was used to analyze demographic characteristics of respondents, and the gross margin approach was used to determine the profitability of coffee production. The results indicated that the Profitability Index (PI) was 3.1, meaning coffee production is profitable; however, the level of profit attained is relatively low due to inefficiency in production. Based on these findings, the study recommends that smallholder farmers adopt modern and improved production practices for efficient production and to improve the profitability of coffee. Finally, the government should create an enabling environment to ensure farmers have access to improved agricultural inputs and enhanced extension services.

Keywords: Coffee, Production, Profitability, Smallholder Farmers, Tanzania

I. INTRODUCTION

Agriculture is the foundation of Tanzania's economy, heavily reliant on smallholder farmers and encompassing both food and cash crops. While it employs a significant, portion of the population and contributes substantially to Gross Domestic Product [GDP] and exports. Agriculture supports the livelihood of millions of smallholder farmers. In the year 2023, the sector contributed approximately 23.7% to the country's Gross Domestic Product (GDP) and provided employment to 65% of national workforce (Yang et al., 2022). Moreover the sector also is the major source of income, food, and foreign exchange earnings.

Tanzania is a significant coffee producer, and coffee is one of its major agricultural exports, though it is not among the top global producers. It is the fourth largest coffee producer in Africa, behind Ethiopia, Uganda, and Côte d'Ivoire. In Tanzania, Kagera region remains the leading in producing robusta coffee, following by Mbeya, Kilimanjaro Arusha, Ruvuma producing arabica coffee Key Arabica growing areas include Kilimanjaro, Arusha, Mbeya, Mbinga (Ruvuma), and Mbozi (Songwe), whereas Robusta is predominantly cultivated in the Kagera region. Other coffee-producing regions include Tanga, Iringa, Morogoro, Kigoma, Manyara, Mwanza, Rukwa, and Mara (Rweyemamu et al., 2024).

Tanzanian coffee industry plays a vital role in the nation's economy, providing livelihoods for hundreds of thousands of families and contributing significantly to export earnings however Coffee farming in Tanzania is largely practiced by smallholder farmers operating on an average farm size of 1.5 hectares (Tanzania Coffee Board, 2024). Despite the small scale farmers, coffee remains a crucial source of income, supporting about 400,000 smallholder farmers who contribute approximately 90% of the country's coffee output. In 2023/2024 marketing year, Tanzania

produced an estimated 1.35 million 60-kilogram bags of coffee; this represents a 21% increase compared to the previous years due to a recovery from drought conditions. However, production is projected to grow by 7% to 1.5 million bags in 2024/2025 attributed to improved agronomic practices, distribution of climate-resilient seedlings, and rehabilitation of plantations in additional exports are also expected to increase by 13% to 1.27 million bags due to higher exportable supplies (TCB, 2024). Apart from these expected progress , Tanzania government through Ministry of Agriculture have made several initiatives including the distribution of approximately 17.8 million coffee seedlings during the 2022/2023 season and an ambitious target to reach 25 million seedlings and improve accessibility of extension services by 2025. The focus is improving productivity and quality by 2025 (The Citizen, 2023).

The marketing of coffee is centralized through an auction system based in Moshi, Kilimanjaro region, Pre-auction coffee marketing in Tanzania is conducted mainly through farm gate sales where producers sell wet processed parchment or dried cherry coffee to licensed buyers, cooperatives, or farmer groups. These buyers then process the coffee further before it is sold at weekly auctions organized by the Tanzania Coffee Board (TCB) in Moshi during the main season. Prices at these auctions are linked to international markets such as the New York Arabica and London (Tanzania Coffee Board, 2024). Producers with premium quality coffee may bypass the auction system by directly contracting with exporters, subject to TCB approval to ensure competitive pricing.

Coffee sales statistics for the year 2022/2023 trade season in Songwe Region as indicated in Table 1 reveals that, a total of US$ 26,381,0852 was earned and out of the total amount earned US$,26,897,656 equivalent to 98% was earned from sales of Mbozi coffee (TCB, 2024).

Table 1

Coffee Sales in Songwe Region (Mbozi & Ileje) Statistics for the year 2022/2023

	AUCTION			DIRECT EXPORTS			LOCAL ROAST			TOTAL	
District	**Auc Kgs**	**Auc Kgs**	**Auc usd/5**	**DE kg**	**DE usd/50**	**LR usd**	**LR kg**	**LR Usd**	**LR usd/50 kg**	**Total kg**	**Total usd**
Ileje	180,157	516,571	143.3	0	0	0	0	0	0	180,157	516,571
Mbozi	7,181,411	19,404,832	135.1	2,452,024	6,976,252	142	0	0	0	9,633,435	26,381,085
Total	7,361,568	19,921,403	278.4	2,452,024	6,976,252	142	0	0	0	9,813,592	26,897,656

In cognizance of the contribution of coffee production to forex and employment, the government of Tanzania has designed and implemented policies and programs supportive of its development. These policies and programs include the coffee industry development strategy (CIDS). The CIDS goal is to enhance and improve income across the entire value chain by increasing coffee production and quality.

Despite of the increase in coffee production compared to previous years, the actual impact on smallholder farmers' profitability remains unclear. This situation may be attributed to the complex pricing structure, whereby the prices received by farmers are diminished by deductions from primary societies, cooperative unions, and the warehouse receipt system. Additionally, thin markets with few buyers limit competition and depress farm-gate prices (Rweyemamu et al., 2024). Therefore the study of profitability of coffee production among smallholder farmers in Mlowo Ward, Mbozi District, Tanzania, is very important to assess small holders' efforts in relating to profitability.

1.1 Research Objective

In line with the overall aim of understanding the economic performance of coffee farming, this study was designed to assess the profitability of coffee production among smallholder farmers in Mbozi District. To achieve this, one a specific objective supported the general objective as follows...

i. General Objective: To assess Profitability of coffee production among smallholder farmers in Mbozi District.
ii. Specific Objective: To determine the level of profitability of coffee production among smallholder farmers.

II. LITERATURE REVIEW

2.1 Theoretical Review

This study based its assumptions on production theory. The production function stipulates a mixture of factor inputs to produce a desired output. A rational producer will continuously need to maximize profit with the partial combination of factor inputs (Doll & Orazem, 1984). A profit-maximizing farmer selects both its inputs and outputs levels with the single goal of attaining maximum profits. Given a production function as:

$$Q = f(x_i, \dots \dots, x_n)$$

Where Q is the quantity of output and $x_{i,\dots\dots}x_i$ are the amounts of input variables such as seed. With prices of inputs r for x_1 then the smallholder farmers profit is given by:

$$\pi = pq(.)rx$$

Where p and q are the prices and amount of output correspondingly. The top set of the production actions on inputs and output is characterized by the condition such that:

$$p\frac{dq(.)}{\partial x} - r = 0$$

For pq = revenue of the firm with its associated cost (C), then:

$$p\frac{\partial R(.)}{\partial X} = \frac{\partial C(.)}{\partial r}$$

With the condition that MR=MC

Where R represents Revenue

Equation above postulates the profit maximization point in production where the marginal revenue is equal to the marginal cost. If MR > MC, there occur an ideal condition for the producer to rise production whereas if MR < MC, then the producer should decline production since the extra cost acquired in producing the added unit of output is greater than the added revenue gained from the extra output. In the small holders 'farmers profit maximization tactics there exists technological constraint which concerns the feasibility of the production plan and market constraint which concerns the effect of actions of other agents in the market. Therefore, in a perfect competitive market, a smallholder farmer will take into consideration the prices of factor inputs to maximise its output. Assume that P is a vector of prices for inputs, and then the profit maximization of the firm is expressed as:

$$\pi(p) = max\ pq(.)$$

If the firm produces only one output, the profit function can be written as:

$$\pi(p,r) = \max pf(x) - rX$$

Where p is the (scalar) price of the output, r is the vector of the factor prices and the inputs are measured by the (non-negative) vectors:

$$X = (x_i, \ldots \ldots, x_n)$$

Therefore, the first-order condition which states that the production function with respect to a single input must be non-negative for an efficient production function is expressed as:

$$p\frac{af(x^*)}{\partial x} = ri\ for\ i = 1, \ldots \ldots n$$

The condition expressed in above depicts that the marginal product of each factor input must be equal to its price. Thus, the value addition to the product must be equal to the price of the factor input. In the long run production, both the first-order condition and the second-order condition must be satisfied for an efficient production where the second-order condition states that the second derivative of the production function with respect to a single input must be non-positive such that:

$$\frac{\partial^2 f(x^*) < 0}{\partial x^2}$$

Therefore, in order for a rational farmer to maximize profit, the condition is that the extra revenue derived from adding production by a unit of input should equal the amount incurred on the input variable to increase production. This infers that a rational smallholder farmer will not increase production if the cost of such increase is more than its corresponding gain. This theory attempts to lead the farmer in making rational decision on the volumes of yield it produces.

From the context of the study, it is assumed that the smallholder farmers are rational and therefore want to maximise their profits through efficient consumption of the input available to them (Tocco et al., 2015). Therefore, to maximize their profits, the farmers need to increase their gross margins, net margins and return on investment by either reducing their overall cost of production or increasing output efficiently. When the inputs are utilized efficiently, the farmer is likely to increase his or her gross margin, net margin, and return on investment.

2.2 Empirical Literature Review

In conducting the study of profitability of coffee production among smallholder's farmers in Mbozi District, several studies was reviewed. For example Kiyingi and Gwali (2012) who examined Productivity and profitability of robusta coffee in central Uganda. found that the production of coffee was profitable, the study revealed that shaded coffee yielded substantial returns from shade tree products, amounting to 53.3 and 42.5 % of the gross annual income in traditional and compost coffee options respectively. Although the mean coffee productivity per acre from coffee fields with compost manure (748 kg acre) and traditional low input. However profitability of the coffee can be significantly improved by increasing coffee stocking density from the current average (340 coffee trees acre) to the recommended stocking density of 450 coffee trees acre^{-1} in addition farmers providing own manure instead of buying.

Bamenga et al. (2025) did a study on Profitability Analysis of the Robusta Coffee Value Chain in Democratic Republic of Congo, Their results showed that the production was profitable, optimizing better coffee processing practices to increase value of coffee for efficiency. Another study was done by Yang et al (2022) on profitability of coffee in African countries. The study found that the coffee production was profitable although coffee originated in Africa, the average coffee production efficiency of African countries (0.6167) lags behind non-African countries (1.1563). However, the average coffee productivity of African countries (1.1766) is better than that of non-African countries (1.1007). At present, coffee production efficiency in coffee-producing countries in Africa is low, and technological improvements are being used to improve efficiency.

Ssekitooleko (2019) on his study of Profitability of Coffee Production among the Youth in Kirumba Sub County, Kyotera District in Uganda, his result indicated that, the coffee production was not profitable due low access to extension services, distance from the market and herbicide use greatly.

Additionally, Mohammed et al, (2013) conducted a study focusing Profitability of coffee production in Kebab/Bunu local government area of Kogi State Nigeria. The results indicated that, coffee production is profitable in the study area; age, family size, farming experience and farm size play vital roles in increasing coffee production, level of profit was affected by the high cost of labour, processing method, low yield and the unavailability of accessible market.

Andrew and Philipp (2014) conducted study on Coffee Production, profitability and constrains in Kigoma Region, Tanzania, the result revealed that Kigoma. The results show that farmers in Kigoma Region earned a gross margin of Tanzanian shilling 730 per tree per annum. Farmers processed at CPU gained about TZS 1350/kg as coffee improvement gain. Therefore, this indicating that farmers are operating underprofit however Coffee production contributed about 39% of the total household income in Kigoma region. Input prices, taxes, research contribution and Central Pulpery Unit tax, shortage of extension services, unreliable markets and low coffee price, low quality of coffee, transportation and delayed payment constituted the major problems that faced coffee producers.

Research done by Mhando and Mdoe (2018) assessed the reason smallholder famers districts continue with coffee production despite fluctuating price, The study found out that despite of the production and marketing challenges, coffee farming has remained a source of reliable income, a traditional crop and cultural symbol.

Overall, the reviewed literature highlights that profitability in coffee farming is not solely determined by yield levels but also depends on market access, price transparency, and institutional support. These findings justify the need for integrated strategies that enhance both on-farm practices and broader market systems to improve the financial outcomes for smallholder coffee producers. Moreover most have focused on either the technical aspects (like input use and improved varieties) or market-based strategies (such as value chain integration) that enhance coffee profitability. Therefore, this study aims to fill that gap by assessing the profitability of coffee production specifically among smallholder farmers in Mbozi District.

III. METHODOLOGY

3.1. Study Area

The study was conducted in Mbozi District located in Songwe Region- Tanzania, the area was selected because Mbozi district Mbozi District is a major coffee producer within Songwe Region, contributing significantly to the region's overall coffee output. It's estimated that coffee accounts for over 70% of the Mbozi district's economy, and over 85% of its internal council revenue. Additionally, the district is a suitable area for studying because coffee as a main cash crop. Moreover, Mbozi District plays a significant role in the national coffee economy. It contributes a notable share to which ranks among the top regions in Tanzania for Arabica production. The district contributes 8963.83 metric tons per year, equivalent to 13% of the total coffee produced in Tanzania (Tanzania Coffee Board [TCB], 2023).

3.2 Data Collection and Sampling

Data for this study were collected using a cross-sectional research design. This design allows for the collection of data at a single point in time and is useful for descriptive purposes as well as for determining relationships between variables. It is considered favorable when resources are limited in terms of finances, personnel, and time (Kesmodel, 2018). Purposive sampling was employed to select the region, district, and villages for the study.

The region (Songwe), district (Mbozi), and villages (Mbimba and Mlowo) were purposively selected because they are among the major coffee-growing areas and account for 13% of Tanzania's marketed coffee (Tanzania Coffee Board [TCB], 2023). Data were collected from both primary and secondary sources through interviews, focus group discussions, and documentary reviews. These methods were administered using questionnaires and checklists, respectively.

Furthermore, purposive sampling was used to select key informants, such as officers from the Tanzania Coffee Research Institute (TACRI), management staff from the Coffee Curing Factory, agricultural officers from

Mbozi District Council (MDC), leading coffee growers, and major coffee buyers. A multistage sampling method was applied to select smallholder farmers. Multi-stage stratified sampling was utilized, as reliable information can be obtained from a stratified sample of the same size more effectively than from a simple random sample of the entire population.

In the first stage, two villages (Mlowo and Mbimba) were purposively selected from Mlowo Ward. In the second stage, hamlets within each village were randomly selected using lists provided by the Village Executive Offices (VEO). In the third stage, smallholder farmers within the selected hamlets were systematically selected based on VEO household and farmer lists. The first household was randomly selected within the sampling area, and subsequent households were chosen by selecting every 10th household.

In the fourth stage, individual respondents within each household were purposively selected, targeting members responsible for coffee production and who had been actively engaged in farming for at least the past five years. The sample size was determined using Cochran's formula, which is typically used when the population size is unknown.

$$n = \frac{z^2 pq}{e^2}$$

Where,

n =Sample size,

z = Value of standard variety at a given confidence level under normal curve 95%. =1.96.

e = Desired level of precision (i.e. the margin of error) = 0.065

p = Probability of getting a coffee farmer with needed characteristics =0.5

q = 1 – p = 1-0.5=0.5

$$n = \frac{(1.96)^2 x0.5x0.5}{(0.065)^2} = 228 \; for \; both \; villages$$

Since there are two villages which are main producer of coffee in Mlowo ward the above sample size was equally distributed in the two villages 114 each. The study utilized both primary and secondary data, the primary data were collected from smallholder farmers through questionnaires and Key informant interviews with some selected respondents such as the coffee curing factory management team and Agricultural officers from Mbozi District Council (MDC). Primary data were preferred because they are current and original and can better give a realistic view to the researcher about the topic under consideration. Secondary data were collected from small holder farmer's revenue and expenditure book, published manuscripts and other records from TACRI officers. Secondary data were preferred because they save time, efforts and money and add to the value of the research. It was necessary to use a combination of data in order to complement each other and to obtain sufficient and insightful information for the study.

3.3 Analytical Model

Qualitative data from Key Informant Interviews will be analyzed using Content Analysis (CA) method. First interviews will be transcribed into word document. Then from these transcriptions' key themes, concepts, or phrases related to performance appraisal and organizational performance will be identified. This will be done in order to organize the information into common themes that emerged in response to dealing with specific items. These themes will be organized into coherent a category which summarised key results. Qualitative information then will be integrated with the quantitative information to provide a meaningful study conclusion

Quantitative data from the questionnaire and reviewed documents related to socio-economic characteristics of respondents and information related to coffee farming were analysed by descriptive statistics, particularly to obtain means, percentages, frequencies, and distribution tables. This analysis provides preliminary information on socio-economic characteristics. Gross margin and average gross margin were computed using Microsoft excel to determine coffee production profitability index (PI). Since Gross Margin (GM) is the difference between the Gross Return (GR) and the Total Variable Cost (TVC) (Acharya & Dhakal, 2014). Gross Margin analysis was employed to establish the amount that coffee farmers earn from the sale of their clean coffee before the deduction of any expenses and fixed costs. The gross output was calculated as a product of output multiplied by the selling price (Andrew & Philip, 2014). Gross Margin was calculated as:

$$GM = \Sigma TR - \Sigma TVC \quad \ldots\ldots 1$$

Where:

GM = Gross margin Tsh/tree

ΣTR= Total Revenue gained Tsh/tree (Gross Return)

ΣTVC= Total variable Cost Tsh/tree

GM) = Gross return (GR) - Total variable cost (TVC)

$$NP = GM - FC \quad \ldots\ldots 2$$

Where:

NP = Net profit, GM = Gross margin, FC = Fixed cost

Description

Total Revenue or Gross return (GR.) = Price of fresh cherry per Kg × total quantity sold

Total variable cost (TVC) = Summation of cost on all variable inputs.

$$PI = \frac{NFI}{TVC} \qquad (3)$$

Where:

PI= Profitability index

NFI = Net farm Income

TVC= Total variable cost

The guiding rule to know whether production is profitable or not is when, PI>1 = profitable and when PI<1 not profitable.

IV. FINDINGS & DISCUSSION

4.1 Demographic Sample Characteristics

Table 2 presents sample characteristics in terms of characteristics of respondents and information related coffee production. Understanding of this information is crucial because they influence farmers' actions allocating and utilizing resources effectively so as to obtain profit. On the aspect of characteristics of respondents, the results indicated most of the respondents (81.1%) were aged between 30 – 60 years. Which means that the production of coffee is done by middle ages people, may be due to their capacity in terms of capital and energy for working, simply they are still strong and able in farm management. Thus, age high age of the farmer may affect the profitability potential. This reflects findings provided by village extension officers during key informant interview that:

> "*People above 60 years are not strong enough in proper management of coffee farms and thus they engagement in coffee farming and production is low, as these activities are labour intensive.*"

Table 2

Sample Characteristics

Characteristics of respondents			**Information related to coffee farming**		
Variable	**Frequency**	**Percent**	**Variable**	**Frequency**	**Percent**
Age			**Farming experience**		
Less than 30 years	35	15.4	1 year	42	18
30-60 years	185	81.1	2 years	53	24
60+ years	8	3.5	3 year and above	133	58
Total	**228**	**100.0**	**Total**	**228**	**100**
Sex respondent			**Current land Size**		
Male	175	76.8	Bellow 4 Acres	167	73
Female	53	23.2	4 Acres and above	61	27
Total	**228**	**100.0**	**Total**	228	100
Marital status			**Average yield**		
Married	153	67	1200 kg/acre and above	61	27
Single	37	16	Less than 1200kg/acre	167	73
divorced	38	17	**Total**	228	100
Total	**228**	**100.0**	**Age of Tree**		
Education level			Bellow 10 years	65	29
None	19	8.3	10 +years	163	71
Primary	151	66.3	**Total**	228	100
Secondary+	58	25.4	**improved variety** variety)		
Total	**228**	**100.0**	Tall variety	163	71
Household size			Short variety	65	29
Bellow 5 member in	143	62.7	**Total**	228	100
Above 5 members in	85	37.3	**Extension services**		
Total	**228**	**100.0**	Frequent access	65	29
Main Sauces of household			Less frequent	163	71
Farming and livestock	185	81	**Total**	228	100
Off farm activities	34	15	**Financial capacity**		
Employment	9	4	Access to credit	163	71
Total	**228**	**100.0**	Inaccess to credit	65	29
			Total	228	100

The result in Table 2 further revealed that, three quarter of respondents were males almost seventy-six percent (76.8%) and the rest were female, indicating male predominance in coffee farming in the area. On other hand the study revealed that males are predominance in ownership of coffee farms compared female, this situation may affect profitability because women who are major source of labour in coffee farming may be discouraged to work hard and this may affect the yield and hence profitability. This is similar to what was revealed by key informants from TaCRI and Agricultural officials who asserted that

> "*Women have been struggling for access to land for a long time and have constantly been met with resistance due to the perception that land is a symbol of male dominance".*

Concerning marital status results indicates that, 37 (16%) out of 228 surveyed respondents were not married (Single), 38 (17%) of respondents were widowed and separated while majority 153(67%) of the respondents were married. This result was also revealed by FGDs and Key informants that, "*most of married people are using most of efforts in farming so as to make sure they increase household income and improve food security"*. Overwhelming majority of famers engaging in coffee production are married person. Therefore, it can be argued that married person is highly tied with family responsibilities that require enough time to deal with income generating activities. The analysis of Education level revealed that low level of education is predominant in most of coffee farmers. The result revealed that majority 151 (66%) out 228 surveyed farmers, had primary education which is the minimum required to complete a basic education. In addition, 58 (25%) had secondary education, 14 (14%) had Diploma level of Education and 19 (8%) never attended any formal education (illiterate), this implies that a low level of education (primary education) is predominant in coffee farming and that coffee farmers need basic education to perform their work. In other words, it does not need special skills or high education to engage in coffee farming it rather requires creativity and experience or learning by doing. However, the results contradict that of Kiyigi and Gwali (2012) who found that people with secondary education and above level can make sound farm management, efficient in resources allocation and technological innovation. Moreover, similar the results was revealed by agricultural extension officers and participants in focus group discussions (FGDs). One participant explained:

> *"Educated respondents seem to be more efficient in coffee farming because their level of education enables them to understand markets, management, and business trends. This knowledge allows them to operate more effectively and manage resources strategically by applying creativity and innovation, which in turn creates a competitive advantage that leads to increased profitability"* (May ,2024).

With regard to household size it is indicated that, 143 respondent are living with less than 5 members, and 85 respondents reported they were living with more than 5 members however most of members were below 18 years age. Therefore it is indicated most of household were composed by wife and husband, children bellow 18 years and grandchildren, Most of children are in either primary or secondary school and most of children above 18 years have migrated to town to do off farms activities, therefore most of household lack family labour. A village leaders revealed the same result and key informants' reported that:

> *"Most of household are composed by father, mother and children bellow 18 years old."* June 2024

Kamuzora and Mkanta (2000) were of the view that reflection of underlying complexities of life realities that a lot of families and individuals are experiencing for the patriarchal power relationships within families also play part whereby the women and children labour while the male head appropriates the product.

Information about sources of income is very crucial towards profitability of coffee production. From Table 2, the result indicates that out of 228 of all respondents interviewed, 185 (81%) attained their income from farming and livestock keeping, 35 (15%) obtained their income from off farming activities such as petty business activities such as small shops, also transport activities such as *Bodaboda and Bajaji* also some were food vendors, Carpenters. While as 9 (4%) earned their source of income from employment, due to that fact most of the farmers do depend on farming activities and that mostly plays a big role to the household, s needs. Therefore, the results revealed that, majority of respondents are dealing with coffee farming and livestock keeping as their source of income. Therefore production inputs such as manure will play a role on reduction on the cost of using artificial fertilizers and hence may increase profit to small holder's farmers, this complies with the information brought by key informants and reports from FGDs.

On the aspect of farming experience results in Table 2 indicate that more than half of sample size 58% (133) out of 228 respondents had been engaged in coffee farming for at least 3 years, and therefore it reveals that most of farmers have much experience in farming and therefore they can deal with farm management effectively. This collaborates findings of Bacsi et al. (2022) who found that farming experience enable farmer to have greater contacts allowing trading opportunities to be discovered at lower cost and enhance profitability. Also, the information from key informants and focus group discussions (FGDs) reported that three-quarters of the respondents are experienced in coffee farming. One participant noted:

> *"We have been engaging in coffee farming for more than ten years now. At the beginning, production and income earned were not this big, but with time, we learned from previous mistakes and we have managed to reach this far"* (FGD participant, personal communication" June , 2024.

This implies that most of coffee farmers in Mbozi District have much experience in coffee farming and therefore they have prior knowledge and skills in farming. The analysis further indicates that, most of the respondents owned small farms for Coffees nearly three quarters (73%) having less than two acres as shown in Table 2, however the quantity of yield harvested do not relate with size of land used. Coffee productivity was low nearly three -thirds (73%) harvested less than 1,200 kg per acre in a year, given the farm sizes and the recorded level of production. It is clear that the production potential of coffee has not been fully realized. This result was sup[ported by to results brought by key informants specifically TaCRI Officials and DAICO both reported that, the quantity of yield harvested do not match with size of land (standard yield is above 1200 kg per acre).

Most of farmers harvest less. On the side of age of tree as indicated in Table 2, the result showed that 73% of respondent's trees are old, (above 10 years) and therefore there is high chance of producing low yield. In the aspect of the use of improved variety, the study reveals that 71% of farmers are still using tall variety which is not resistant to diseases. Therefore, there is low possibility of improving efficiency and increasing production, this was revealed by TaCRI Officials, Extension officers and members from FGDs. Therefore, the result revealed that as a farmer use old tree and tall variety, the efficiency in production decreases.

On the accessibility of extension services, the study reveals that, only 29% farmers are frequently visited by Extension Officers. Therefore, majority of farmers approximately 70% are not and frequently accessing extension services, the same result was revealed by FGDs and TaCRI representative, Therefore there is possibility harvesting low quality and quantity and hence affect profitability to coffee farmers.

The determination of profitability analyzed using the gross margin approach as indicated in Table 3. The results show that farmers in Mbozi District earned a gross margin of Tanzanian shilling (TZS) 14,000 per tree per annum. After deduction of fixed and variable costs, farmers who processed coffee gained about TZS 4,000/kg as coffee improvement gain. Respondents reported that coffee farming is very beneficial; their livelihoods are highly dependent on the crop.

Income from coffee enables them to pay school fees, hospital bills, and construct modern houses. This finding is consistent with Andrew and Philip (2014), who noted that despite challenges facing coffee production in the Kigoma region, smallholder farmers earned a gross margin of TZS 730 per tree per annum. The profitability index (PI) was 1.04, indicating that coffee production is profitable (PI $\geq$ 1 denotes profitability).

However, input prices, taxes, shortage of extension services, unreliable markets, low coffee prices, low coffee quality, and delayed payments remain major challenges for coffee producers. These results align with Andrew and Philip (2014). Moreover, the issue of capital was observed in detail as displayed in Table 2, the analysis revealed that 71% of farmers has low access to credit the same result was brought by Key informant members (DAICO).

Therefore, it can be argued that almost three third of respondents are having low financial capacity which hindered a coffee farmer in using required farm inputs, a good example is in last year 2019/20 where majority failed to purchase farm inputs due to low purchasing power this in turn affects yield and so profitability.

4.2 Profitability of Coffee Production among Coffee Farmers

In order to determine the profitability of coffee crop farming, gross margin analysis was used (Evmenchik et al., 2021) and Kanyua et al. (2015). The model used for the estimation of the gross margin for each farm is the model

Table 3

Gross Margin Approach for Profitability of Coffee

Variables	**Cost (TZS)**
A. Fixed Cost	
Hired pulping machine	2,000
Total Fixed Cost (FC)	**2000**
B. Variable Cost	
Labour	1000
Organic fertilizer	500
Inorganic fertilizer	500
Pesticides	500
Total Variable Cost (VC)	**4,500**
Total Cost (FC + VC = A + B)	**6500**
Price @kg 3500	
C. Return	
Income from fresh cherry generated per tree 4 kg @3500 *4000	14,000
Net Income = TR - TC (14,000 - 6500)	4000
Profitability Index = NI / VC = 14,000 / 4,500	**3.1**

4.2.1 Gross Margin Results

The results from Table 3 show that the profitability index of (PI) of 3.1 indicating that the production of coffee is profitable, under the standard of profitability rule where PI> 1 indicate profit, and when PI<1 indicating loss, this implies that for every unit of investment in coffee, is expected to generate 3.1 units profit by a significant margin. This study is similar to study conducted by Rweyemamu et al. (2024), who determined PI of 1 in a study conducted in Mbinga District, reflecting the viability of improved Arabica coffee varieties under smallholder conditions. The same result was done by Turco et al. (2017) on their study of economic profitability in conventional and irrigated coffee production systems in Brazil, he reported profitability index of the conventional coffee production system in 2015 was 44.8%, and that of the drip irrigated production system was 49.7%. In 2014, profitability rates were negative for both the conventional (-13.9%) and irrigated coffee production systems (-8.6%). The most preferable choice was found to be the irrigated production system, as it allows reducing the risk of loss in production during prolonged periods of water shortage as well as greater yields due to a larger production of grains.

Despite this profitability, a significant proportion of farmers in Mbozi operate below optimal efficiency. This inefficiency has been also in study done by Cremaschi et al. (2018) who noted that although coffee farming can be profitable, many smallholders face persistent challenges including limited access to improved inputs, inadequate technical knowledge, and restricted market linkages which hinder their ability to maximize returns.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

The results from a study of, indicate that, the Profitability Index (PI) of 3.1 which confirms that coffee production in Mbozi District is profitable, however, farmers have yet to fully capitalize on potential cost advantages due to constraints in scale efficiency, technology adoption, resource access, and financing, as highlighted by production theory and Porter's competitive strategy framework.

5.2 Recommendations

There are diverse practical implications for policy makers and smallholder farmer who are keen to enhance profitability to set laws and regulations that will encourage competitions but again protect smallholder farmers from too much cost of productions but again from unfair competitive practices. The following recommendations should be taken into consideration

The government through Tanzania coffee board should facilitate small holder farmers to access soft loans that can be used in acquisition of processing machine for value addition and thus attract higher prices. On the other hand, a smallholder farmer should take into consideration the prices of factor inputs in order to maximise its output and profit as stated in the production theory. It is recommended that, local government Authorities such as District Councils should focus on promoting education in the rural areas through training and workshops. This will improve the farmers' managerial skills, thus resulting increasing profitability with efficiency. Furthermore, smallholder farmers need to adopt modern production practices and improve their performance so that they can make adequate profits. This will be achieved if the government provide adequate environment for small holder farmers to access modern equipment and farm implement but again be able to improve their knowledge.

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