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Examining the Profitability of Soya Beans Production in Agri-business: A Case Study of Mumbwa District in Farm Block A

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Abstract

This study investigates the profitability of soya bean production in Mumbwa District, Central Province, Zambia, by examining demographic factors, input prices, and market prices as key determinants. Data from 70 respondents reveal that age and farming experience positively influence profitability, with each additional year of experience increasing profitability by 856 units. Older, experienced farmers achieve better financial outcomes due to efficient resource use and market access, while younger farmers show potential for adopting inpnovative practices if provided with training and support.

Input prices, particularly for fertilizers and transportation, were found to negatively affect profitability. Fertilizer prices showed a strong negative correlation of -0.572, while transportation costs exhibited the strongest impact with a correlation of -0.637. Rising input costs disproportionately affect subsistence farmers, who often lack economies of scale and face higher production costs relative to their output. The study highlights the need for interventions to reduce these costs through subsidies and infrastructure improvements. The findings emphasize the importance of addressing demographic disparities, input price challenges, and market accessibility to improve profitability in soya bean farming. Policy recommendations include targeted training for younger farmers, subsidies to offset input costs, and strategies to stabilize market prices. These measures can enhance the economic sustainability of soya bean production, benefiting farmers and stakeholders in Zambia's agricultural sector.

Keywords: Agri-Business, Soya Bean, Zambia

1. Introduction

1.1 Overview

The overview of this chapter presents the general introduction of the study. In addition, the chapter provides the statement of the problem, the objective of the study and highlights the significance of the study. Furthermore, it also involves the hypothesis and explores other key features that will help in the study.

1.2 Background

The global demand for Soya Beans as a protein source has significantly increased production, expanding from 74 million hectares in 2000 to 129 million hectares in 2021, with South Africa and Zambia becoming key producers (Voora *et al*., 2020). Soya Beans are often termed a "miracle crop" due to their high yields of both vegetable oil and protein, thriving in diverse climatic conditions and soil types. In early 2022, global demand estimates for soybeans in the 2021/22 season were around 374 million metric tons (MMT). The largest producers of soybeans in 2021 included Nigeria, South Africa, and Tunisia, with Zambia, Benin, Togo, Ghana, Malawi, Ethiopia, Uganda, and Mozambique following closely. Cornelius and Goldsmith note that Africa's production growth is primarily due to an expansion in the area planted with soybeans rather than increases in yield (FAO statistics, 2022). Production trends show that small holder soya bean production increased in 2015 to 2016 due to increases demand from local processing facilities. In 2020, smallholder farmers produced more than large scale farmers and remained dominant since 2020 to 2022 according to Peter Setimela (Soybean rust threatens soyabean production in Malawi and Zambia, 25 January 2024).

Access to high-quality seeds is crucial for increasing soya bean production. Despite recognizing the benefits of certified seeds, adoption remains low at 25-30% (Harnowo, 2019), hindering national self-sufficiency efforts. Furthermore, small- scale farmers face pricing exploitation due to external market pressures, exacerbated by poor soil conditions and inadequate agricultural support. To improve market competitiveness, particularly in the Mumbwa district, there is a pressing need for better grain quality understanding, enhanced seed selection practices, and effective production strategies.

Soya bean cultivation is becoming a significant cash crop in Zambia, embraced by small, medium, and commercial farmers, contributing to the country's food security and agribusiness sector. The Zambian government actively promotes the cultivation of soya beans to enhance small-scale farmers, particularly in rural areas like the Eastern Province and Luapula. As the fourth most important crop after maize, groundnuts, and sunflower, soya beans are increasingly in demand due to their economic benefits and role in improving soil fertility (Murithi *et al*., 2016). With a high protein content of around 40%, soya beans also serve as a crucial nutritional source, allowing farmers to diversify their incomes and enhance food security (Meyer *et al*., 2018).

However, despite the advantages of soya bean production, smallholder farmers face challenges in the Agri-business landscape, particularly due to perceptions of unreliable markets. According to National Agricultural Information Service journalist, Happy Mulolani; the lack of an organised market and processing plant for farmers has led to low production in previous years in Zambia. Recently released crop forecast survey for the 2021/2022 agricultural season and the food security status for 2022/2023 shows a 15% annual rise in the soya bean, of which smallholder farmers produce 96%. This development indicates that soya bean processing equipment is critical to enhancing the production capacity of smallholder farmers. Interviews with market actors indicate a significant unmet demand for soya beans in Zambia, revealing a disconnect between farmers' perceptions and actual market needs. This paradox affects the smallholder soya bean value chain, limiting the potential for increased production and commercialization among small- scale farmers.

1.3 Problem Statement

Soya bean production faces significant challenges, including limited processing capabilities and small- scale farmers' issues, such as high equipment costs, lack of technology access, and market distrust. Adoption of high-quality seeds remains low (25- 30%), worsened by inferior seed reuse. Farmers encounter poor soil, low fertilizer use, and inadequate advisory services, with marginal prices near breakeven making soya less appealing than maize. As argued by (Brivery Siamabele 2019) challenges faced in soybean by small-scale farmers range from inputs accessibility, rainfall dependence, production to market. There is also insufficient research on how grain quality affects market prices, emphasizing the need for improved seed selection practices.

1.4 Objectives

1.4.1 General Objective

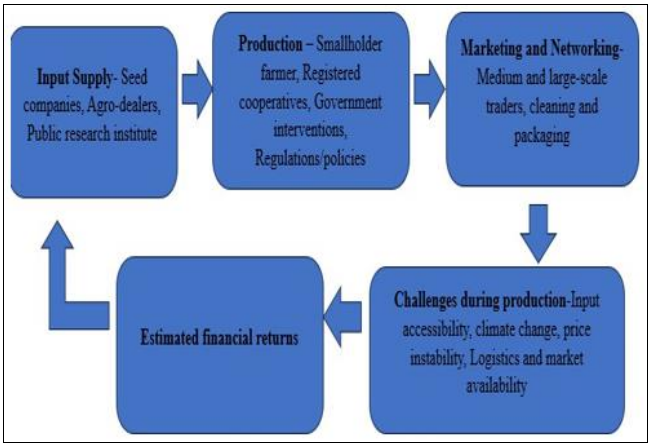
Main Objective

Examining the profitability of Soya Beans Production on Agri-business in central province, Mumbwa District Farm block A.

Specific Objectives

1. To analyze the relationship between demographic factors of soya bean farmers and their profitability.
2. To analyze how the input prices, affect profitability of Soya Beans Production in Mumbwa.
3. To examine how market prices for Soya Beans influence the profitability of production for smallholder farmers in Mumbwa.

1.5 Conceptual framework



The diagram illustrates the processes and challenges small-scale farmers face in soya bean production, highlighting the journey from acquiring inputs to marketing their produce. The process begins with input supply, where seed companies, agro-dealers, and public research institutes provide high-quality seeds, fertilizers, and agricultural innovations. However, farmers often struggle with accessibility and affordability due to supply chain disruptions and high costs. Many farmers form cooperatives to pool resources and gain bargaining power, but this involves navigating government regulations and policies, which can introduce bureaucratic hurdles. After production, farmers face challenges in marketing their produce, including establishing networks with traders who clean and package soya beans for larger markets. Limited resources, inadequate infrastructure, and poor logistics further complicate market access. Additionally, farmers must contend with climate change, price instability, and uncertainty about financial returns, all of which hinder productivity and discourage investments in new practices. These interconnected challenges create an environment of uncertainty, making it crucial for policymakers and stakeholders to support small-scale farmers with strategies that enhance resilience and profitability. In this context, the study identifies soya bean production as the independent variable and its profitability in agri-business as the dependent variable**.**

1.6 Significance of the Study

This study provides valuable insights for soya bean farmers in Mumbwa District and Zambia, offering empirical data on factors influencing profitability, including input costs, production prices, and market conditions. Farmers can leverage these insights to optimize operations, while policymakers and agricultural organizations can design interventions to boost sustainability and profitability.

Through data collection, analysis, and academic writing, the student develops essential research skills like critical thinking and systematic problem-solving, crucial for both academic and professional success.

1.7 Scope of the study

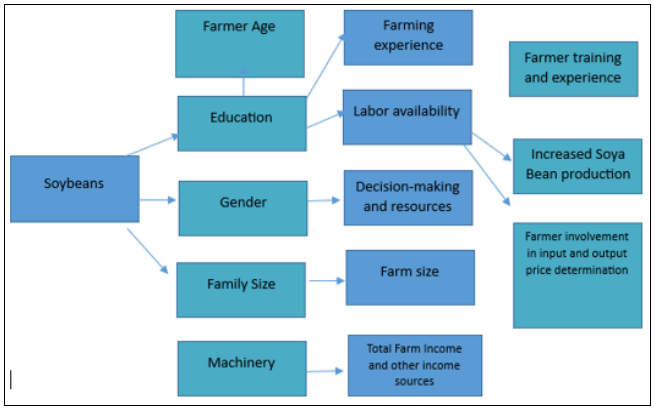
This study aims to comprehensively examine the agribusiness dynamics of Soya Beans Production in Mumbwa District, targeting at least 70 farmers and selected Ministry of Agriculture staff for diverse representation. It focuses on two key groups in the soya beans value chain: smallholder farmers and soya traders. Smallholder farmers, as essential stakeholders, will provide insights into their cultivation practices, challenges, and resource access. In contrast, traders will share information on market trends and logistics. Covering the farming seasons from 2021 to 2024, this study seeks to provide a holistic view of the local soya beans agribusiness landscape.

2. Literature Review

2.0 Overview

This chapter gives an account on the literature and studies on foundational component of the research, highlighting key themes, gaps, and insights that inform the current understanding of the significant impact of soya beans production on agribusiness in Mumbwa district. It starts by exploring the theories surrounding the significant impact of soya beans production on agribusiness and ends by reviewing empirical methods used across the vast array of literature to study the impact of the crop in the agricultural sector.

2.1 Diagram depicting the demographics factors in relation to Soya beans production



The diagram in 2.1(a) shows how farmer demographics affect Soya Beans production. Key factors include:

1. **Age:** Older farmers possess traditional knowledge but may lack access to new technologies, while younger farmers are more adaptable and informed.
2. **Gender:** Female farmers face challenges in accessing resources, impacting production, whereas male farmers often control resources and decisions.
3. **Education level:** Higher education correlates with the adoption of new technologies and efficient farm management.
4. **Farm size:** Smaller farms have fewer resources, hindering profitable production; larger farms can negotiate better prices.
5. **Occupation:** Full-time farmers dedicate more resources than part-timers.

Farming experience significantly enhances the likelihood of smallholders adopting Soya beans production, as increased experience correlates with improved skills and technology understanding. Access to agricultural input resources also encourages larger-scale farming. In Zambia, where smallholders are numerous, commercial farmers dominate Soya production, contributing to 85% of the output. Challenges faced include low productivity due to limited education and resources, resulting in reduced income and hindered investment potential. Additionally, insufficient adoption of modern technologies leaves farmers vulnerable to climate and market risks, jeopardizing food security and limiting economic growth. To improve Soya beans production, strategies must focus on training, access to credit, and promoting resilience through better risk management and supportive agricultural policies. (Philogene, B.J.R., Regnault-Roger, C. & Vincent, C. (2005).

2.2 Policies on how input prices affect Soya beans profitability

The production and value addition of Soya Beans Production in Zambia has primarily been shaped by two significant policy drivers: addressing nutrition and promoting crop diversification. The government's focus on combating malnutrition, particularly among children, has been a central force behind the push to increase both the production and consumption of Soya Beans. Given its high nutritional value, Soya Beans have been recognized as an important food source to address deficiencies in the diets of vulnerable populations, and they became a cornerstone of Zambia's national nutrition strategy.

Despite these challenges, the Ministry of Agriculture and Livestock (MAL 2016) has remained committed to promoting Soya Bean value addition, particularly among smallholder farmers. This is being done through targeted training programs, especially for women and youth, who are taught how to process soybeans at small-scale levels. These training programs aim to empower smallholder farmers to produce a variety of Soya Bean -based food products, such as soybean flour, snacks, relishes, fritters, and other traditional foods. The initiative is part of a broader effort to improve food security and nutrition at the community level, as soybeans offer a high-protein alternative to more traditional staple foods. To support these efforts, educational materials like books and booklets have been produced, providing instructions on how to incorporate soybeans into traditional dishes, thereby making them more accessible and appealing to local households.

The current policy driving the development of the soybean value chain from the agricultural sector's perspective is centered around crop diversification. The Zambian government recognizes the importance of diversifying the agricultural base to reduce the nation's dependence on Maize

and to promote greater food and nutrition security. By encouraging the cultivation and processing of soybeans, the government aims to create new income-generating opportunities for both small- and large-scale farmers. Soya Beans, as part of this diversification strategy, are seen not only as a means to improve household nutrition but also as a valuable cash crop that can contribute to rural development and poverty reduction. This dual focus on food security and income generation reflects the broader goals of Zambia's agricultural policy, which seeks to create a more resilient and diversified agricultural sector capable of sustaining both smallholder and commercial farming operations. (Shea Z, M. Singer W and Zhang B (2020)

2.3 Effect of the input prices on profitability of Soya Beans Production

The latest insights on Zambia Soya Beans are that prices are projected to go down in coming months within the country. This will not go well with farmers who seek to tap the lucrative Asian market later in the year. Furthermore, the country expects an increase in harvests and this may find the prices at a lower scale than they are now, especially since farmers have stocked up current unsold har vests. In a story published April 28 2023, Yotam Mkandawire of the Grain Traders Association of Zambia cited the low regional prices as a major factor causing the stagnation of prices of Zambia Soya Beans. Coupled to this is the fact that not only Zambia is experiencing the low asking prices but the rest of the export market. The only saving grace, Mkandawire avers, is the opening of the Chinese and Indian markets, currently also plagued by weak prices. (Mtisunge B.M. (2023).

Addressing these issues requires a multi-faceted approach. Improving access to inputs such as high- quality seeds, fertilizers, and crop protection products could help increase yields and profitability. (Regnault-Roger, C. & Vincent, C. (2005). Additionally, providing financial support through affordable credit schemes could enable farmers to invest in better equipment and technology, reducing the risks associated with late planting and poor crop management. Expanding training programs to teach farmers best practices for soybean cultivation and disease management could also go a long way in improving productivity and profitability in the sector.

2.4 Personal critique on literature review

The literature review provided a detailed and well-structured analysis of the state of soya beans production in Zambia, focusing on agribusiness perspectives. It effectively addressed the study's objectives by utilizing reputable local sources to discuss policies, economic aspects, production practices, market trends, and profitability. The review highlighted key challenges faced by producers, including limited access to inputs, inadequate infrastructure, and financial constraints, while also identifying opportunities such as growing domestic demand and potential for value addition. This comprehensive approach offers valuable insights for developing targeted interventions to enhance Zambia's soya beans agribusiness sector.

2.5 Establishment of research gaps

It is evident that there has been a good number of studies conducted throughout the world on Soya beans production. However, very little research has been done on the role smallholder farmer farmers play in the intensity of Soya beans production. While many authors have argued that smallholder farmers lack skill and resources to effectively contribute towards the production of Soya beans. This research study focuses on adding this knowledge gap in the hope to examine how profitable Soya bean production has contributed to Agri-business in Mumbwa district- Farm block.

3. Research Methodology

3.0 Overview

Research methodology refers to the organized process employed for designing, conducting, and analyzing research. It encompasses the various steps and techniques utilized to gather and interpret information effectively (Kuecker, Elliot. 2021). In the context of this study, a mixed method approach will be adopted to ensure that the research objectives are met and that reliable and valid data are collected. The following sections outline the specific methodological steps that will be implemented to conduct this study successfully:

3.1 Research Designs

The study shall use descriptive survey research design with both qualitative and quantitative approaches. Descriptive survey design was selected because it is a method of collecting information by interviewing or administering questionnaires to a sample of individuals hence suitable for extensive research. It is an excellent vehicle for the measurement of characteristics of large population. It maintains a high level of confidentiality, it is convenient and enables data to be collected faster, enables questions to be asked personally in an interview or Impersonal through a questionnaire about things which cannot be observed easily. It also gives the study an opportunity to get accurate view of response to issues as well as test theories on social relationship at both the individual and group level. (K. Asante 2017).

3.2 Target Population

The target population for this study will comprise soya bean farmers in Mumbwa district and some selected Ministry of Agriculture officials. This population is selected due to their direct involvement in soya been production and trade, which are crucial to understanding the agricultural dynamics within the region. A minimum total of 70 individual farmers will be targeted, ensuring a representative sample that allows for meaningful analysis and insights. Targeting this specific group of participants will facilitate the exploration of the challenges and opportunities they face, thus providing valuable data relevant to the research objectives.

3.3 Study Population

Mumbwa District, situated 140km from Lusaka, has a population of 328,020, growing annually at 3.2%. The district spans 23,800km² and supports large-scale agriculture with crops such as maize, cotton, soya beans, and sunflower. Livestock farming thrives due to the grazing grounds provided by the Kafue Basin. Recent investments in agro-production and processing position Mumbwa as a significant contributor to local and regional markets (Mumbwa District Report, 2023).

3.4 Sampling Design

The research employs both probability and non- probability

sampling techniques. Probability sampling will use simple random sampling, ensuring equal and independent chances of selection for each population element, particularly individual soya bean farmers. Non-probability sampling involves the purposive method, targeting small-scale soya bean farmers to gather specific, relevant information. This dual approach ensures a representative and focused sample for the study (Kumar, 2022).

3.5 Data Collection Methods

Primary and secondary data collection methods will be utilized. Primary data will include face-to- face interviews with respondents using questionnaires, while secondary data will involve reviewing peer-reviewed articles, books, conference papers, government publications, and other accessible online resources. These methods ensure a comprehensive approach to gathering relevant information (Creswell, 2018).

3.6 Data Analysis

Data will be analyzed using qualitative methods, comparing and contrasting primary and secondary sources. Quantitative data will be processed using SPSS software for statistical analysis. Descriptive methods will summarize the findings, which will be discussed before conclusions and recommendations are presented. This mixed-methods approach enhances data interpretation and research insights (Miles *et al*., 2014).

3.7 Triangulation

The study employs data triangulation to improve validity and reliability. Multiple data sources, including responses from 70 smallholder farmers, are used to validate findings on soya bean production in Mumbwa. Triangulation ensures robust and credible results (Patton, 2002).

3.8 Limitation of the Study

The study acknowledges several challenges, including time constraints due to the impending rainy season, limited financial resources as it is self- funded, and difficulties in accessing information from certain respondents due to confidentiality concerns. These limitations may impact the comprehensiveness of the research, but efforts will be made to mitigate their effects (Bryman, 2016).

3.9 Ethical Considerations

Ethical principles will guide the study, ensuring participants' informed consent and the protection of their anonymity and confidentiality. This ethical commitment safeguards participants' rights, fosters trust, and upholds the integrity of the research process while generating valuable insights into soya bean agribusiness in Mumbwa (Belmont Report, 1979).

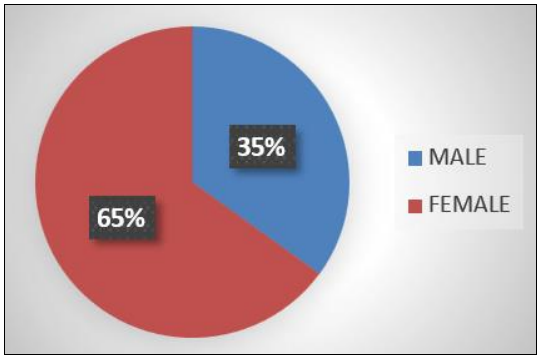
4. Presentation of Findings

4.0 Overview

This chapter presents the research findings derived from the analysis of data collected regarding the profitability of soya bean farming in Mumbwa District, Zambia. It aims to systematically showcase the key results obtained from various statistical analyses, including regression models, correlation studies, and descriptive statistics.

4.1 Presentation of results on background characteristics of the respondents

The table below presents the gender distribution of the respondents involved in the study. The sample consists of a total of 70 respondents, with an equal representation of both male and female participants.



Source: Author (2024) generated using Stata

Fig 1: Render distribution of respondents

With 35 male and 35 female respondents, the survey offers a fair range of viewpoints on the cultivation of soy beans in the Mumbwa district. A thorough examination of gender-based variations in farming, input costs, and profitability is made possible by this equitable distribution of genders. Equal representation of both genders is ensured when the entire sample reaches 100%. Five age groups are used to categorize the respondents: 18–25, 26–35, 36–45, 46–55, and 56 and older.

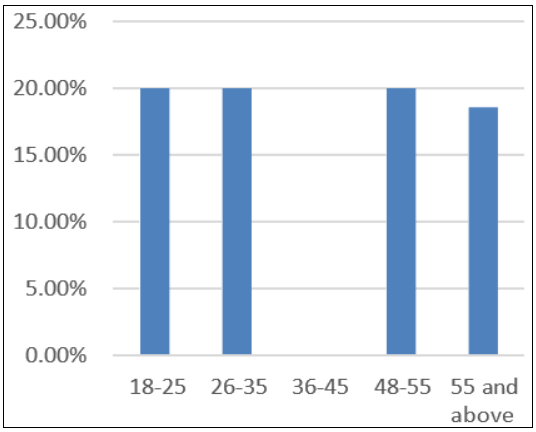


Fig 2: Age distribution of respondents

The study consisted of 70 respondents aged 18- 25, 26-35, 36-45, 46-55, and 56 and above in Mumbwa, Kenya. The majority are young adults, with a significant proportion of participants being young adults. The majority are in their prime working years, with experience in managing operations or resources. The oldest age group, aged 56 and above, represents more established farmers with long-term farming experiences. The sample covers over 80% of the population, with 18.57% from the 56 and above group. This balanced perspective ensures the study captures insights from both younger and older farmers.

Table 2: Education Profile of respondents

Education	Percentage
School certificate	25.71
Bachelor's degree	25.71
Master's degree	24.29
Doctorate	24.29

Source: Author (2024) generated using Stata

The table presents the educational backgrounds of 70 study participants categorized into four levels: School Certificate (18 respondents, 25.71%), indicating basiceducation and reliance on practical experience; Bachelor's Degree (18 respondents, 25.71%), suggesting access to modern farming techniques; Master's Degree (17 respondents, 24.29%), reflecting advanced education that enhances skills in agriculture and business; and Doctorate (17 respondents, 24.29%), which implies a significant academic perspective in farming practices. Over 70% possess a bachelor's degree or higher, indicating strong potential for adopting innovative agricultural strategies in soya bean production.

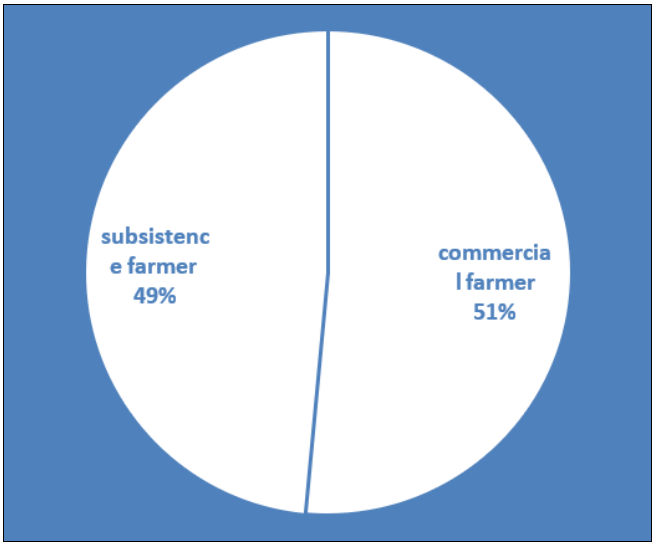
Table 3: Occupation of respondents

Occupation	Percentage
Farmer	24.29
Trader	24.29
Processor	22.86
Other	18.57

Source: Author (2024) generated using Stata

The table outlines the occupational distribution of 70 respondents, categorized into Farmers (24, 34.29%), Traders (17, 24.29%), Processors (16, 22.86%), and Others (13, 18.57%). Farmers constitute the largest group, providing insights into soya bean cultivation challenges. Traders facilitate market access, while processors add economic value through post-harvest activities. The "Other" category includes those in supporting roles. Overall, the distribution reflects the diverse contributions to the soya bean value chain, essential for understanding the dynamics of production, pricing, and profitability in Mumbwa's agricultural landscape.

Figure Type of farmers



Source: Author (2024) generated using Stata

Fig 3: Type of farmers

The chart depicts the distribution of 70 respondents based on their farming type: 36 commercial farmers (51.43%) who focus on larger-scale soya bean production for market sale and 34 subsistence farmers (48.57%) who grow soya beans primarily for personal consumption with potential surplus sales. This near-equal representation provides a balanced analysis of farming practices, their challenges, and impacts on profitability, input usage, and sustainability, highlighting the experiences of both commercial and subsistence farmers in the Mumbwa district.

Table 4: Cross tabulation of types and occupation of farmer

Occupation	Types of famers		total
	commercial	Subsistence	
Farmer	19	5	24
Trader	17	0	17
professor	0	16	16
other	0	13	13

Source: Author (2024) generated using Stata

This table illustrates the variation of farming types (commercial vs. subsistence) across different occupations. Among 24 farmers, 79.17% are commercial farmers, indicating a market-oriented focus for profitability. All 17 traders are also engaged in commercial farming, leveraging their market expertise. Conversely, all 16 processors are subsistence farmers, prioritizing self-sufficiency by transforming crops for small-scale production. Similarly, the 13 respondents in "Other" occupations are exclusively subsistence farmers. Overall, traders and farmers lean towards commercial farming, while processors and others emphasize subsistence practices, highlighting the influence of occupation on farming type.

Table 5: Acres Cultivated by Respondents

acres_cultivated	Freq.	Percent	Cum.
1-2 acres	16	22.86	22.86
3-5 acres	15	21.43	44.29
6-10 acres	20	28.57	72.86
More than 10 acres	19	27.14	100.00
Total	70	100.00	

Source: Author (2024) generated using Stata

The study reveals diverse land sizes for soya bean cultivation, categorized as: 1-2 acres (22.86%), 3-5 acres (21.43%), 6-10 acres (28.57%), and over 10 acres (27.14%), indicating various farming approaches from subsistence to commercial operations.

Table 6: Main Inputs for Soya Bean Production

Variable	Mean	Std. dev
fertilizer	708.9	19.14651
Seed cost	59.34286	4.94
Pesticide	637.971	93.8015
machinery	15292.63	4827.741

Source: Author (2024) generated using Stata

In Mumbwa District, soya bean farmers experience minimal fertilizer price variation, averaging ZMK 708.93. This

consistency suggests established supply chains and efficient local market dynamics among suppliers.

4.2 The relationship between demographic factors of soya bean farmers and their profitability

This section examines the relationship between demographic factors of soya bean farmers, specifically age and farming experience, and their profitability in Mumbwa District, Farm Block A. The study aims to provide a foundational understanding of how these demographic characteristics influence profitability within the context of soya bean production.

Table 7: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Profitability	70	2.457	1.045	1	4
Age	70	43.3	15.179	21	78
Farming Experience	70	11.271	4.8	5	22

Source: Author (2024) generated using Stata

The results reveal that the average profitability score among farmers is 2.457 on a scale of 1 to 4, where higher values indicate greater profitability. The standard deviation of 1.045 indicates moderate variability in profitability levels among farmers. This variability suggests that while some farmers are achieving high profitability, others are facing significant challenges in realizing similar outcomes. The range of profitability scores, spanning from 1 to 4, highlights the diverse financial performance of soya bean farming in the region**.**

The average soya bean farmer is 43.3 years old with 11.271 years of experience, showing diversity in age and expertise. Age and experience significantly affect decision-making, resource access, management efficiency, and profitability in farming.

Table 8: Correlation matrix of demographic factors

Variables	(1)	(2)	(3)
Age	1.000		
Profitability	0.451	1.000	
Farming Experience	0.628	0.312	1.000

Source: Author (2024) generated using Stata

Table 10 reveals a positive correlation between age (0.451) and farming experience (0.312) with profitability in soya bean farming, suggesting older farmers are more profitable due to knowledge and stability, while their combined effects are significant.

Table 9: Regression results-influence of demographic factors of farmer

Mean dependent var	2.457	*SD dependent var*	*1.045*
R-squared	0.65	*Number of obs*	*70*
F-test	1.594	*Prob > F*	*0.011*
Akaike crit.	206.57	*Bayesian*	*213.31*
(AIC)	3	*crit. (BIC)*	*8*
*** p<.01, ** p<.05, * p<.1			

Source: Author (2024) generated using Stata

The analysis indicates that farming experience significantly boosts profitability by 856 units per additional year (p = 0.048), while age contributes a smaller increase of 2 units per additional year (p = 0.033). The model explains 65% of profitability variation, confirming the importance of demographic factors for soya bean farmers' financial success.

4.3 The effects of input prices on profitability of Soya Beans Production in Mumbwa

This section examines the impact of input accessibility on the profitability of soya bean farming in Mumbwa District, focusing specifically on how the availability and cost of agricultural inputs influence farm outcomes. Access to inputs such as seeds, fertilizers, and machinery can directly affect the productivity and profitability of soya bean farms. The following analysis presents the distribution of input accessibility among the surveyed farmers.

Table 10: Tabulation of input accessibility

	Freq.	Percent	Cum.
Very accessible	18	25.71	25.71
Accessible	18	25.71	51.43
Somewhat accessible	17	24.29	75.71
Not accessible	17	24.29	100.00
Total	70	100.0	

Source: Author (2024) generated using Stata

Table 12 illustrates input accessibility among 70 surveyed farmers: 51.43% found inputs accessible, while 48.57% experienced difficulties obtaining them, indicating potential barriers.

Table 11: Tabulation of price change

	Freq.	Percent	Cum.
Increased significantly	24	34.29	34.29
Increased moderately	34	48.57	82.86
Remained the same	10	14.29	97.14
Decreased	2	2.86	100.00
Total	70	100.00	

Source: Author (2024) generated using Stata

Table 13 reveals that 48.57% of farmers noted moderate input price increases, while 34.29% reported significant hikes. Only 14.29% experienced stable prices, and 2.86% saw decreases. These trends could impact farmers' profitability in Mumbwa.

Table 12 correlation matrix of Profitability and inputs
Source: Author (2024) generated using Stata

A strong negative correlation exists between labour prices (-0.540), fertilizer expenses (- 0.572), and transportation prices (-0.637) with profitability in soya bean farming, indicating that rising costs of these inputs significantly reduce profits. Pesticide expenses (-0.256) and machinery maintenance prices (-0.467) also negatively impact profitability, though to a lesser extent.

The study examined variables affecting production prices, revealing that farmers experiencing increased input prices had production costs approximately 3096.94 units higher, though this was not statistically significant (p = 0.531). Similarly, farmers with decreased prices saw costs lower by about 3687.40 units, also insignificant (p = 0.732). Acreage cultivated had no significant effect on production prices (p = 0.814). However, type of farmer significantly influenced prices; commercial farmers had costs about 17213.83 units

lower than subsistence farmers (p = 0.000). These findings highlight the complexities of soya bean production costs and suggest the need for tailored support for subsistence farmers, considering additional influential factors in future research.

Table 13: Test for multicollinearity

Variable	VIF	1/VIF
type_of_fa~r	2.00	0.499035
acres_cult~d	1.86	0.539020
pri~ncreased	1.26	0.791933
pri~ecreased	1.17	0.853854
Mean VIF	1.57	

Source: Author (2024) generated using Stata

This study examined multicollinearity's impact on a regression model analyzing how input price changes, cultivated acreage, and farmer type affect soya bean production prices in Mumbwa District, Zambia. Variance Inflation Factor (VIF) analysis showed all values below concern thresholds, indicating acceptable multicollinearity levels. Descriptive statistics informed on yield and profitability.

Table 14: Summary statistics of the yield cost per acre

V	Mea n	St Dv	Minimum	Ma x
3875	909.9882	B N R	-	-

Source: Author (2024) generated using Stata

An analysis of 70 observations in Mumbwa District revealed that the average yield cost for soya bean farmers was ZMK 3787.5, with a standard deviation of ZMK 899.96, indicating moderate variability. Costs ranged from ZMK 2322 to ZMK 5391, reflecting differences in farming practices, resource access, and market conditions. Farmers with better seeds and fertilizers incurred lower costs, while resource constraints increased expenses. Yield-price fluctuations impact profitability and decision- making. Understanding these dynamics helps stakeholders identify interventions to enhance profitability and productivity in soya bean farming.

Table 15: Correlation Analysis Between Yield Prices Per Acre and Profit

Yield cost	1.00
profit	-0.0696 -1.000

Source: Author (2024) generated using Stata

A correlation analysis of soya bean farming in Mumbwa District, Zambia, revealed a weak negative relationship (-0.0696) between yield prices per acre and profit, suggesting that higher yield prices slightly decrease profitability. However, the correlation is minimal, indicating yield prices are not a primary profit determinant. Factors like market conditions, efficiency, and input quality may have greater impact. Strategies should focus on improving production efficiency and market access to enhance profitability.

Table 16: Regression Analysis of Yield Prices Per Acre on Profit

Source	SS	df	MS	Number of obs = 70
Model	94973580.3	1	94973580.3	**F(1, 68)** = 0.33
Residual	1.9496e+10	68	286709765	**Prob > F** = 0.5668
Total	1.9591e+10	69	283939080	**R-squared** = 0.76
				Adj R- squared = - 0.871
				Root MSE = 16933

Source: Author (2024) generated using Stata

Linear regression analysis in Mumbwa District shows yield prices per acre do not significantly impact soya bean farming profit.

4.4 Influence of Market prices for soya beans on the profitability of a production for smallholder farmers in Mumbwa

A regression analysis examined the relationship between market prices and profitability among subsistence farmers engaged in soya bean farming in Mumbwa District, Zambia. The model was statistically significant (F = 4.21, p = 0.0485), with an R-squared value of 0.1162, indicating that 11.62% of profitability variation is explained by market price fluctuations. The coefficient for market prices (0.0000629) suggests a positive and significant relationship (p = 0.049), where increases in market prices lead to higher profitability. The constant (_cons) was 3.077172, predicting profitability when market prices are zero, though this scenario is impractical. The findings underscore the importance of favorable market conditions for enhancing economic outcomes, as higher market prices are associated with increased financial gains for subsistence farmers. Despite the modest explanatory power, the analysis highlights market prices as a critical factor in improving the profitability of soya bean farming at the subsistence level.

4.5 How market prices for Soya Beans influence the profitability of production for smallholder farmers in Mumbwa

This section explores the relationship between market prices for soya beans and the profitability of their production for smallholder farmers in Mumbwa District. Understanding how market prices impact profitability is critical for assessing the financial sustainability of smallholder farming in the region.

Table 17 Descriptive Statistics for price of soya beans per kgSource: Author (2024) generated using Stata

The average price of soya beans is 59.343 ZMW per kilogram, with a standard deviation of 4.943, indicating moderate price variability ranging from 47 ZMW to 73 ZMW, impacting farmers' profitability.

Table 18: Matrix of correlations profitability and price of soya beans per kg

Variables	(1)	(2)
Profitability	1.000	
Price_of_soya_~g	0.538	1.000

Source: Author (2024) generated using Stata

A correlation of 0.538 between soya bean prices per kilogram and profitability indicates a moderate positive relationship, suggesting higher prices enhance farmers' returns in Mumbwa. While market prices influence profitability, factors like production costs and management also matter. Further regression analysis could clarify these dynamics. Findings highlight price stability's importance, as volatility risks farmers' income, emphasizing the need for strategies to mitigate price fluctuations.

Table 19: Linear regression profitability against price change

Mean (dependent Var)	0.788	SD (dependen t var)	0.502
R-squared	0.418	Number of obs	70
F-test	1.217	Prob > F	0.044
Akaike crit. (AIC)	103.998	Bayesian crit. (BIC)	108.495
*** *p<.01*, ** *p<.05*, * *p<.1*			

Source: Author (2024) generated using Stata

A linear regression analysis assessed the impact of soya bean prices on farming profitability in Mumbwa. The price coefficient of 63 indicates a significant positive effect on profitability. The model explains 42% of profitability variation, suggesting other important factors are at play. Further research is needed to explore additional determinants.

5. Discussion

This study examined factors influencing the profitability of soya bean farming in Mumbwa District, focusing on demographic variables like age and farming experience. A positive correlation (0.451) between age and profitability showed older farmers perform better due to established operations, financial resources, and market knowledge, aligning with Kariuki *et al*. (2017). Younger farmers, while less profitable, bring innovation and adaptability through modern technologies. Farming experience significantly influenced profitability, with experienced farmers achieving higher yields and efficiency, as supported by Alene and Manyong (2007). Challenges for older farmers include physical limitations and resistance to innovation, while younger farmers face resource constraints.

Recommendations include capacity-building for young farmers, access to credit, mentorship, and support for older farmers via labor-saving technologies. Multi-generational collaboration and joint ventures are proposed to integrate modern techniques with traditional practices. These findings emphasize leveraging demographic strengths to sustain and enhance soya bean profitability across generations.

The study indicates that input prices significantly affect soya bean production profitability in Mumbwa District. Negative correlations were found between fertilizer (-0.572), labor (-0.540), transportation (-0.637), and machinery maintenance (-0.467) costs and profitability, demonstrating the financial strain on farmers. Rising input prices also emerged, affecting smallholders more than commercial farmers. High transportation and labor costs, exacerbated by inadequate infrastructure, hinder market participation. The analysis underscores the critical role of input affordability in determining smallholder profitability in Sub-Saharan Africa. The study reveals that high input prices significantly hinder profitability for smallholder soya bean farmers in Mumbwa District, aligning with past research on agricultural profitability challenges. It emphasizes the urgent need for interventions in input affordability, infrastructure, and mechanization. Furthermore, a moderate positive correlation (0.538) between market prices and profitability indicates that increasing soya bean prices enhance farmers' financial returns, especially for subsistence farmers. Overall, integrating smallholders into stable markets is crucial for their financial sustainability beyond just market price influences.

6. Conclusion and Recommendations

6.0 Overview

The chapter summarizes findings on the profitability of soya bean farming in Mumbwa District, focusing on challenges and opportunities. Conclusions are drawn based on demographic, market, and input cost factors, forming the basis for recommendations to improve economic outcomes.

6.1 Conclusions

The profitability of soya bean farming is significantly influenced by demographic factors, with older and more experienced farmers showing better financial outcomes due to their established farming practices, resource management skills, and market connections. These farmers often have better access to financial resources and long-standing relationships with buyers and suppliers, enabling them to navigate challenges effectively. In contrast, younger farmers demonstrate a high potential for innovation and technology adoption but require targeted support and intergenerational knowledge transfer to realize their potential.

The study identified high input costs, particularly for fertilizers and transportation, as a significant barrier to profitability. Smallholder farmers, who lack the scale to mitigate these costs, are especially vulnerable, while commercial farmers offset expenses through economies of scale. This disparity highlights structural inequalities in resource access that need to be addressed. Market price variability also emerged as a critical factor affecting profitability. Farmers with stable market access benefited from predictable income, while those without such access struggled to cover production costs, exacerbating financial insecurity for remote farmers with limited infrastructure.

6.2 Recommendations:

To address soya bean farming challenges in Mumbwa, interventions include strengthening cooperatives, local marketplaces, subsidies, training, rural infrastructure investments, robust policies for resource access, and promoting diversification and export market access for sustainable income and equity.

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Finally, I dedicate this work to the pursuit of knowledge a lifelong endeavor that has enriched my understanding of the world. May this thesis contribute, in its own way, to the ongoing dialogue within the academic community.

8. Dedication

This research paper is dedicated to the almighty God, the source of strength, grace and wisdom during conducting the research. I also dedicate this work to my children; Tasheni Kabaso, Mwewa Kabaso, Chimwemwe Kabaso and Anthony Banda for their unwavering support and encouragement through this journey**.**

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