BARRIERS TO SMALLHOLDER FARMERS PRODUCTION AND MARKETING OF WHEAT IN KARATU DISTRICT, NORTHERN TANZANIA

AUDIFAS BONAVENTURA

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DECLARATION

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

Signature…… Date…….

Audifas Bonaventura- N50EA/38527/2017

This project has been submitted for appraisal with my approval as University Supervisor.

Signature: …… Date: …….

Dr. Christine Majale

Department of Spatial and Environmental Planning

Kenyatta University

DEDICATION

This work is dedicated to my beloved son Elvis Dalvin for his motivation and spirit towards accomplishing this project. To my family and colleagues, Dorrah Luoga, Caroline Reuben, and Lutengano George for their day-to-day encouragement and inspiration.

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I thank you God for the favor of health and knowledge, it is on his glory and blessing that I was able to accomplish this project.

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ACRONYMS AND ABREVIATIONS

AMCOS	Agriculture Marketing Cooperative Society
ASDP	Agriculture Sector Development Strategy
ASDS	Agriculture Sector Development Strategy
BRN	Big Results Now
CAN	Calcium Ammonium Nitrate
CDP	Cooperative Development Policy
CPB	Cereal and other Produce Board of Tanzania
DAP	Diammonium Phosphate
DED	District Executive Director
EU	European Union
FAO	Food Agriculture Organization
FGDs	Focussed Group Discussion
GIS	Geographic Information Systems
MOA	Ministry of Agriculture
NARS	National Agriculture Research Station
NBS	Tanzania National Bureau of Statistics
SAGCOT	Southern Agriculture Growth Corridor of Tanzania
TARI	Tanzania Agriculture Research Institute
TCT	Transactional Cost Theory
URT	United Republic of Tanzania
USA	United States of America
USDA	United States Department of Agriculture

ABSTRACT

The growth and distribution of the world population has led to an increase in demand for food which puts pressure on the expansion of agriculture production and marketing. Smallholder farmers are central to the development of the agriculture sector and they are crucial in contributing to the food security of the majority of the people. Wheat is the fourth most consumed crop in Tanzania. Wheat farming in Karatu district, Tanzania is dominated by smallholder farming. However, it faces many barriers to its contribution in development and poverty reduction. Hence the objectives of this study were; a) examine smallholder wheat production, b) examine factors that affect smallholder production, c) examine the marketing extent of wheat smallholder farmers, d) to determine the factors that influence smallholder market decision in Karatu district. A mixed research design was used for this study. Simple random sampling was used to select household respondents from the five villages, while purposive sampling method was used to select the necessary institutions such as Agriculture Marketing Cooperative Society and local government. Data was collected by use of interviews, questionnaires, observation checklist and Focus Group Discussions. The collected data was analyzed by using the Statistical Package for Social Sciences tool. Estimation of the average yields was done by considering the recorded harvest of farmers and weighing them to a randomly selected number of harvest units. Multinomial regression was used to determine the factors that influence marketing decisions of farmers. The study found wheat production in Karatu to be below the national average harvest with 67% of the farmers harvesting less than one tons per hectare which is below the average production value of 0.5 tones per hectares. Low yields were as a result of the intensity of production challenges and constraints. It was found that smallholder wheat production in Karatu is hindered by various challenges while capital and abiotic variables play the most roles. Wheat production level was the only significant variable found to influence market decision of farmers. Additionally, wheat price advantage, capital support, technical and market assurance emerge as the dominant influences to smallholder farmers market participation. This study derived a significant level of contribution of numerous variables to the farmers' production and marketing of wheat in the Karatu district. The results provide useful information for economic development, specifically information for making relevant decisions on the use of scarce agricultural resources in wheat production and reformulation of agricultural development policies through updated wheat production and marketing information. The results are also useful as an input for the country or regional evidence-based agricultural production and marketing strategies.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

World population growth and technological developments have led to an increase in demand for agricultural products. The 2017 Revision, published by the UN Department of Economic and Social Affairs, project that by 2050, world population will hit over nine billion people which mean the demand for food will also rise to more than 70 percent from the current needs. This implies that more agriculture output would be needed to meet the population's demand for food, therefore need to start measures to improve agriculture production (GPFI & IFC 2011; Tilman, *et al.,* 2011). Agriculture is the most critical factor in global environmental resource management concerning soil, biodiversity, water and environmental emissions. Global agricultural production varies depending on the intensive resource supply and the interfaces of the other socioeconomic sectors particularly transport, water, energy, labour, marketing processes and product distribution (Poole, 2017). A glance at the 2015 International Community Sustainable Development Goals, which are set as 2030 targets, confirms that agriculture is significantly linked to a variety of other sectors within the development agenda (Gupta & Vegelin, 2016).

There is a distribution of 2 billion people in the world, experiencing a moderate or severe lack of sufficient and nutritious food (FAO, *et al.,* 2019). Food insecurity is much higher in Africa than in other regions globally whereby almost 260 million people have been reported to be food insecure in 2018, with more than 90 percent living in sub-Saharan Africa (Maletta, 2018). Maletta (2018) also reported that the primary food source in the region is smallholder agriculture, which produces around 80 percent of the consumption. For the poor rural population comprising more than 65 percent of the sub-Sahara Africans, earning below 1.25 USD per day, smallholder farming is their main source of revenue supporting their livelihood (Arias *et al.,* 2013). Therefore, smallholder farmers hold a pivotal role in the region's food security and are essential to its economic growth.

Global wheat production plays a critical role in food security, serving as a staple crop for over 35% of the world’s population (FAO, 2024). In the 2023/24 season, worldwide

wheat output reached approximately 781 million metric tons, led by major producers like China, India, Russia, and the United States (USDA, 2024). Climate change poses growing challenges, with droughts and extreme weather disrupting yields in key regions such as Australia and the EU (IPCC, 2023). Meanwhile, innovations in drought-resistant varieties and precision farming aim to boost productivity (CGIAR, 2023). The crop remains highly traded, with Russia alone exporting 50 million tons in 2023 (ITC, 2024), though geopolitical conflicts and export restrictions continue to destabilize global markets (World Bank, 2024). Sustainable intensification and equitable distribution are now focal points to meet rising demand projected to grow 60% by 2050 (UN, 2022).

According to FAO (2023) findings, wheat is listed as the major food crop globally with 750 million tons of production in 2017 from around 220 million hectares. The increase in demand for wheat has stimulated the tension to promote its production and supply. FAO has projected that the consumption for wheat in Africa by 2025 will increase to 76.5 million tons and its 48.3 million tonnes is expected to be imported according to 63.3% of the wheat demand at the existing status quo.

Wheat has indeed grown into a vital nutritional and political stability asset in Africa. The wheat demand and supply chain is extremely unstable and can cause social unrest due to the growing global demand for wheat on the one side, and the difficulties challenging wheat production on the other, including climate rising cost of input, intensified biotic (pests and diseases) and abiotic (heat and drought) stresses (Tadesse et al., 2019). Given the global wheat condition, some countries in the region that are dependent highly on wheat imports are at an important economic juncture. The first level of research on wheat potential has found poor investment in the national expansion of wheat production in many countries where such an opportunity exists (Negassa *et al.*, 2013). Investment in commercialized wheat farming can also create significant weightings of national economic development that contribute to job opportunities, income earning and poverty reduction.

Wheat is among five most consumed crops in Tanzania together with maize, cassava and rice. Approximately 96,000 hectares are currently devoted to wheat production in the northern highlands of Kilimanjaro, Manyara and Arusha regions, and some southern

highlands in Mbeya, Rukwa and Iringa, regions, with the capacity of producing roughly 100,000 million tons per year (Mtaki, 2018). The total area used for wheat production in both the southern and northern highlands has been decreasing due to smallholder farmers withdrawing from the sector. According to Agflow 2023 Tanzania Agriculture market news, wheat production in all regions of Tanzania has fallen despite the increase in crop demand. ~~The~~ Increase in wheat demand may be the factor of population increase, urbanization and increase in wheat milling investments. Between production year 2022 and 2023, wheat farming land has decreased to 5000 hectares as indicated that most wheat farmers switched to attractive production of corn and beans (Agflow, 2023). Decision of farmers to engage in production of alternative crops has been potentially encouraged by barriers in wheat production.

Although wheat makes up a pitiful 4% of Tanzanians' daily caloric intake, crop production, demand and supply has a significance and incredible implication to the country economy (Townsend & Mtaki, 2020). This is based on two major factors. First off, Tanzania's foreign exchange reserves are susceptible to fluctuations in prices in wheat exporting countries, as a considerable almost 90 percent amount of the wheat consumed in Tanzania is imported. Second, as population is increasingly concentrating in urban areas and rapidly developing cities the wheat demand will probably rise and the government will require producing or importing more. In 2021 and prior, Tanzania government used to import wheat from mainly Russia and Ukraine where by 50.8 percent and 38.7 percent of the total imported wheat were from Russia and Ukraine respectively.

The rising of Russia-Ukraine conflict is a tragedy to Tanzania wheat sector and economy. This is because Tanzania is wheat dependency from the two countries. However, disruption of trade and transportation route has the adverse implication to the wheat price and supply in the country. As the result of the conflict, Tanzania cannot import wheat from Ukraine at this crisis moment but only Russia and other countries as displayed in Figure 1.1. By August 2023, the country imported 727,100 million tonnes of wheat from Russia, Poland, Latvia and Romania and the total import was expected to hit 1.35 million tonnes by the end of the year 2023 (Agflow, 2023 and Cowling, 2024). Tanzania is making efforts to boost-up local wheat production to ensure a sustainable and sufficient

wheat supply to meet market demand. This is not an easy task since the agriculture sector of the country is facing number of challenges (Mtaki, 2020).

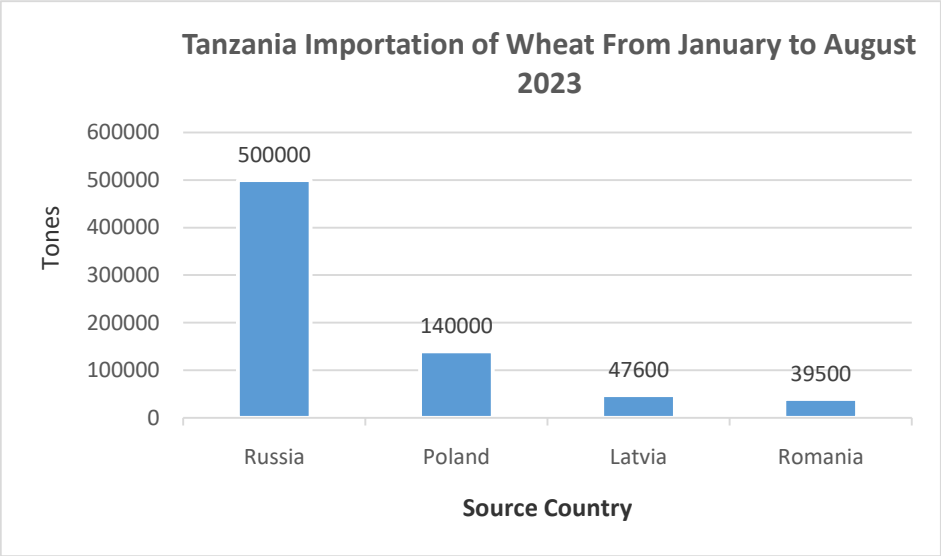

Figure 1.1: Tanzania wheat import record by origin country in January to August 2023

Source: Agflow 2023

This study aims to better understand the barriers to smallholder profitable wheat production as the driver in securing availability of food and economic improvement of livelihood in rural communities of Tanzania. More specifically, the study also explores the commitment of smallholder farmers in production of wheat through assessment of biophysical feasibility and economic profitability by determination of competitiveness of smallholder wheat marketing with the import market.

1.2 Problem Statement

Agriculture in Tanzania remains the backbone of the economy as it provides for 31% of the growth domestic product and it contributes 25% of the total annual earning on export (Leyaro, 2014). According to Ministry of Agriculture (2019), wheat production in 2019 fiscal year was estimated at 63,388 tonnes while the demand was 266,329 tonnes creating the deficit of 202,942 tonnes. Poor performance of wheat sector has put the burden to the government to set financial budget for foreign purchase that consequently affect the

national economy. Surprisingly, the country has a larger area with suitable agronomical requirements for wheat production and yet it is underutilized (MoA 2019). The situation reflects that the government past efforts to boost domestic production have not achieved the desired target.

Majority of Tanzania's farmers are smallholders practicing rain-fed production with inadequate equipment and operating under poor technology. (Munishi, *et al.*, 2017). Poor investment in rainwater farming, unsupportive infrastructure, unavailability and unaffordable fertilizer, and inadequate technical support are constraining farming system including wheat growers (Otieno, 2016). Wheat farming in Tanzania including Karatu district is dominated by smallholder farming which faces many barriers to its contribution in development and poverty reduction. Significant research is required to promote wheat farming investment and boost its production and marketing in the northern and southern regions of Tanzania to meet the consumption demand in the country.

The widening gap between declining wheat production and rising in wheat demand is the impact of farmers withdrawing from farming the crop and switching to alternative crops (Agflow, 2023). Among the factors influencing farmers' decision to stop or reduce efforts in wheat production are the barriers to the crop production, complicated marketing channels and lack of support from the government and external institutions. The government strategies in boosting wheat production and marketing have bounced due to lack of clear information on the challenges facing wheat producers (TARI, 2024). However, the government through TARI has initiated serious consideration on wheat sector, and since the year 2023 it has invited all stakeholder out and within the county to assist and support wheat research, information about wheat improved production technologies and training in order to strengthen wheat production and marketing industry in the country. This study addresses the knowledge gap by exploring the key barriers that limit smallholder farmers' participation in wheat production and marketing in Karatu District. It provides empirical evidence that can inform more targeted policy interventions. Furthermore, it contributes to the broader dialogue on food security, agricultural commercialization, and rural development in Tanzania by emphasizing the role of structural and institutional challenges that hinder the growth of the wheat sector.

1.3 Research Questions

The following question will guide this research to meet the objectives.

1. What is the level of wheat production and marketing by smallholder farmers in Karatu district?
2. What are the factors affecting smallholder farmers' production of wheat in Karatu district?
3. What is the marketing extent of wheat marketing among smallholder farmers in Karatu district?
4. How do determinant factors influence smallholder market decision in Karatu district?

1.4 Objectives of the Study

The main objective of this study is to investigate the barriers to smallholder farmers in wheat production and its marketing processes in Karatu district.

1.4.1 Specific objectives

1. To examine smallholder wheat production levels in Karatu district
2. To examined factors that affects smallholder wheat production
3. To examined the marketing extent of wheat smallholder farmers in Karatu
4. To determine factors that influence smallholder market decision in Karatu district

1.5 Research Hypothesis

1. Smallholder wheat production levels in Karatu District are significantly below national and regional benchmarks
2. Wheat production in Karatu District is significantly influenced by socio-economic factors
3. 3.Smallholder farmers in Karatu District predominantly engage in informal, low-value wheat markets

4. 4.Farmers' market decisions are significantly influenced by access to credit, proximity to markets, availability of extension services, and participation in farmer group

1.6 Significance of the Study

Majority of Tanzanians and rural population are vulnerable and derive their survival through subsistence farming (Townsend & Mtaki, 2020). Measuring the efficiency and performance of agricultural production and marketing is useful for economic development; also, it provides important information for making relevant decisions on the use of scarce agricultural resources and in reformulation of agricultural policies. Given the dynamic nature of social development, it is important to update information based on the contemporary production.

The basic contribution of smallholder farming to poverty alleviation and hunger reduction depends on sustainable market access (Poole, 2017). Research on the barriers to farmers' marketing of their wheat yield, and their inclusion to economic development will provide multiple and alternative ways and extent that smallholder farmer can improve their selling of yields to consumers or large-scale procurement system. This study focuses on the production and consumption of wheat commodity as well as on its trade strategies in Karatu District. The findings of the study analysis can be useful to the government and stakeholders in formulation of agriculture and food policies and plans. They can also be used as input for the country or regional evidence-based agricultural production and marketing policies

1.7 Conceptual Framework

This study sought to examine the constraints influencing smallholder farmers' decision-making processes regarding wheat production and marketing. The conceptual framework incorporated independent, intervening, and dependent variables, which were systematically analysed to elucidate their interrelationships. Figure 1.2 presents a schematic representation of these variables and their linkages. Wheat production, decision to market and marketing extent are dependent variables provided that the amount of yields and marketing are determined by smallholder decision to participate in

the production and marketing process. However, the extent of farmers' production and marketing of wheat is affected by the number of internal factors including employment, resource distribution, access to farming inputs and securing food availability. Also, external factors such as guiding policies, farming methods, weather suitability and availability of reliable market are determinants of wheat production and marketing. In addition, quality and quantity of yield, infrastructure and market incentives influence the decision and level of wheat marketing. Smallholder farmers may rather affect the amount of production and extent of marketing than be affected by production and marketing level.

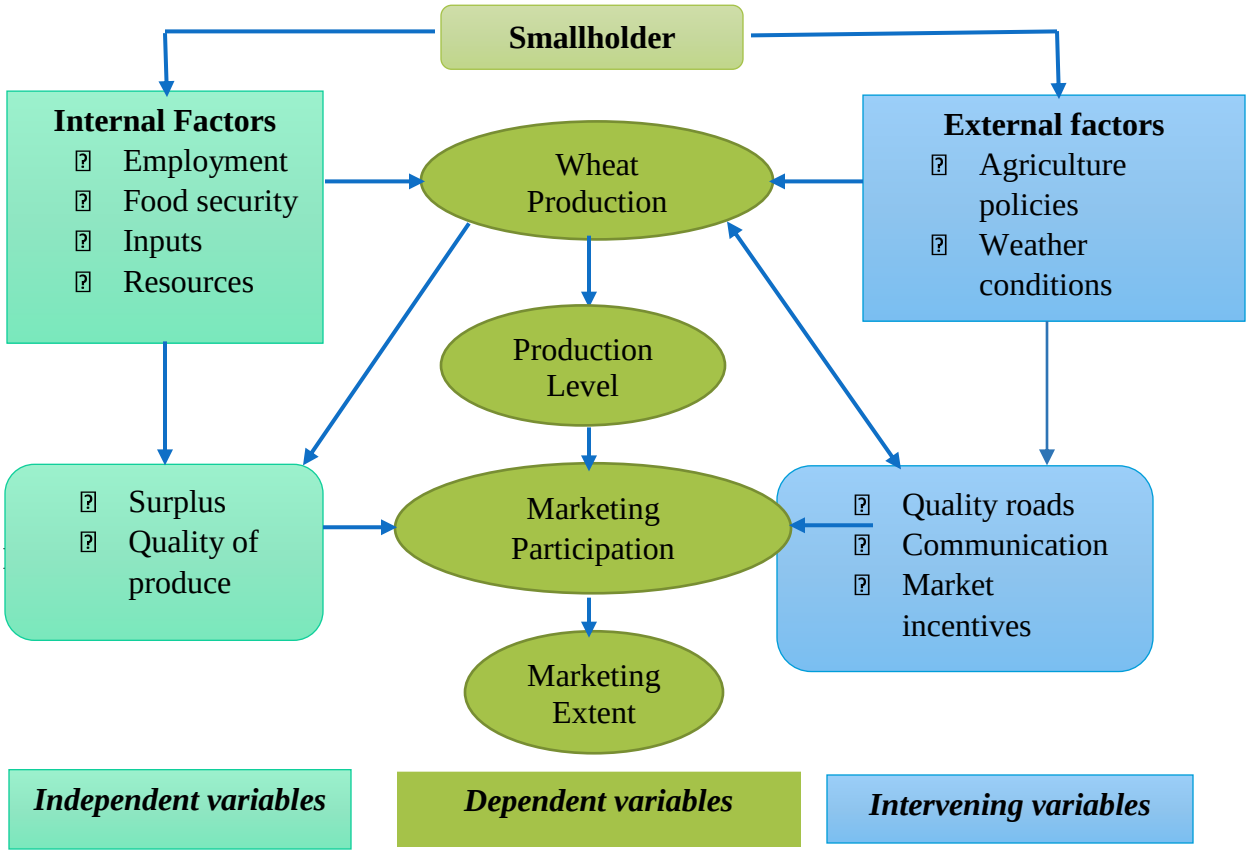

Figure 1.2: A Conceptual Framework

Source: Researcher, (2023)

1.8 Definition of Key Operational Terms

Smallholder Farmer - Farmer who own and cultivate on small portions of land (0.2 – 2 ha), and mostly depending on family labor with poor technology, they produce low yield and use part of the yield for their consumption (Abdalla, Stellmacher, & Becker, 2023).

Barriers – Obstacles or restrictions to a set standard goal. (Thornsbury *et al.*, 1997).

Production - In other word termed as 'farming' which means the process of obtaining food, feed, fibre and other kinds of products by cultivating plants and the raising of consumed domesticated livestock (Mutayoba & Ngaruko, 2015).

Marketing - Covers all the processes involved in exchanging the ownership of the agricultural product from the producers to the consumers or manufactures (Suhaimee *et al.,* 2014). These activities involve the planning, coordinating, and handling of agricultural yields to meet the satisfaction of farmers, traders and consumers.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This section explains thoroughly the information that has been provided by various literatures in relation to the objectives of the study. In particular, this chapter discusses the concepts and previous findings on wheat farming, barriers to farmers in production and marketing of wheat; level and extent of wheat production and marketing respectively, in Karatu district. It also presents the analysis of policies, legal and regulatory guides in production and marketing of the crop under concern in Tanzania. Finally, the gap in literature and prioritized areas for further studies are presented.

2.2 Production Levels of Wheat Amongst Smallholder Farmers

Wheat plays a key role in contribution of the diet to the world population. Wheat is scientifically called *Titicum aestevum*, and belongs to family *Poaceae* and is self-pollinated cereal crop (Khan, 2019). Wheat provides food and a living for more than one billion human population in many poor and developing regions, and it is a major staple food crop highly consumed by the majority. Wheat is also an essential source of nutrition, accounting for 40% of per capita calorie intake. Wheat is the basic staple food and daily consumed in several sub-Saharan countries. Africa is the world's biggest wheat importer with more than 45 metric tons per year (Gezachew, 2018).

According to FAO 2023 statistical data, by 2022/2023 China was the largest wheat producer in the world with the annual average of 134 million tonnes production in every year from 2018/2019 season. China development in wheat production is remarkable by its expanded cultivation area which account to 23 million hectors. As shown in **figure** 2.1, the other major wheat producer countries are India, Russia, U.S.A, France Canada, Australia, Ukraine, Pakistan and Germany (FAO 2023).

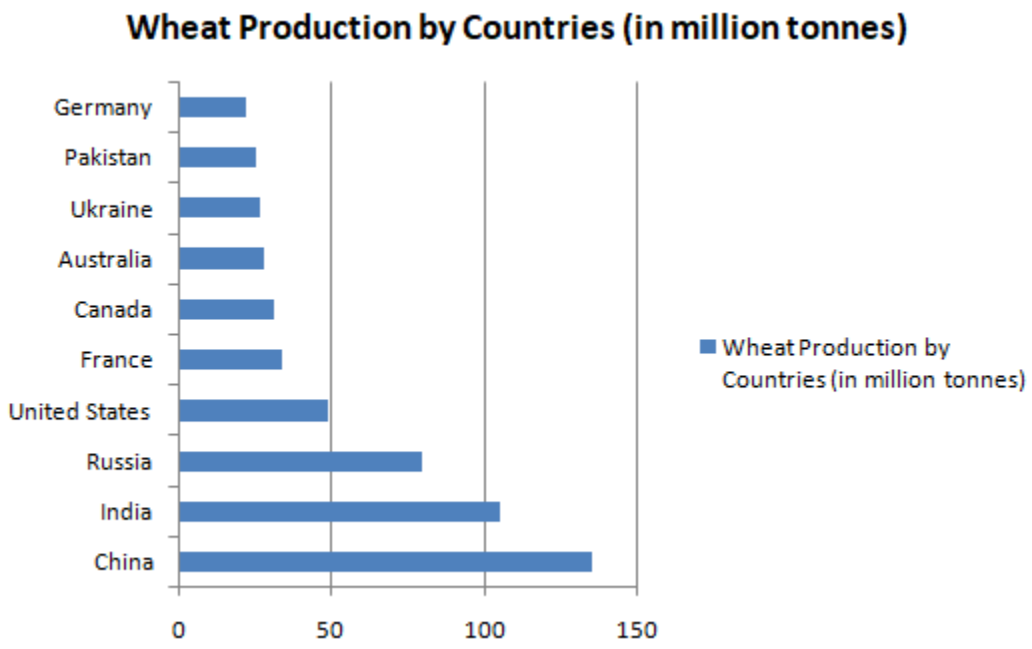

Figure 2.1: Major Wheat Producers Globally
Source: FAO, (2023)

According to Shahbandeh (2024), China is the top among global wheat consumer countries ahead of EU and India. China consumes over 153 million metrics tonnes per year which implies that its demand is around 20 million metrics tonnes over the country production. This is in congruent with the USDA reports that China in 2023 has overtaken Egypt in dominating international wheat trade where it spent more than 3.8billion US dollars to import more than 12 million metrics tonnes of wheat to cover their domestic demand (Shahbandeh 2024).

In Africa, consumption for wheat is increasing whereby the region spends over 12.75 billion US dollars annually for wheat import which is 15 percent of the total spends for total food imports (FAO, 2021). Over the past 20 years, the bill for wheat import have risen to about 9 percent influenced by increasing consumption as the result of population growth, urbanization, and insufficient production of the crop (Noort *et al.*, 2022). In sub-Sahara Africa wheat production is dominated by smallholder farming system with majority of the production basically for household consumption and little surplus is set for market (Tadesse *et al.*, 2019; Dube, 2020; Reardon *et al.*, 2021; Noort *et al.*, 2022)

Ethiopia, Africa 3rd largest wheat-producing country, produces 5.7 million tons (Getahun & Muleta, 2022). Soil preparation, the use of pure seeds, the amount of irrigation, fertilizer, and pesticide applications are well-known elements that increase wheat yield (Khan, 2019). Increased input utilization, combined with sound agronomic practices and better varieties, is critical to closing wheat production gaps in smallholder farming systems in Eastern Africa. Markets, useful seed systems, and technological adoption are all essential for fostering an environment where farmers may increase wheat yield. The key to closing the gaps in the wheat yield among the smallholder farming systems in Eastern Africa is increasing input use in conjunction with improved varieties and sound agronomic techniques. In order to establish an environment where farmers may expand wheat production, it is equally vital to adopt technologies, effective seed systems, and markets (Silva *et al*., 2023).

FAO (2023) has reported that Tanzania is potentially capable of producing sufficient wheat to meet its consumption demand and export. However, smallholder wheat farming in Tanzania has been performing poorly, mainly because of insufficient rainfall, labour shortages, poor implement and the decrease in soil fertility caused by improper use of fertilizer, soil erosion, and hardpan caused by improper soil tillage (Triomphe *et al*., 2012). It was reported by Townsend and Mtaki, (2020) that there was no increase in smallholder wheat production for the past two years because of unfavourable weather condition in the growing areas of northern highland Tanzania. Wheat production by smallholder farmers in Northern Tanzania is carried out under either mixed farming of demarcated small plots of farms. Wheat farming can be mixed with other appropriate crops such as maize, rice, millet and sunflower.

2.3 Factors that affect Smallholder Wheat Production

Smallholder agriculture is the primary driver to improvement of rural community livelihood as it is the main source of food and income and basic economic activities to the rural majority (Jengka, 2020). Rural social well beings and economic condition is reflected by performance in smallholder agriculture sector. From number of studies, (Weatherspoon, *et al.,* 2021; Khoza, *et al.,* 2019; Mayekiso, Taruvinga, & Mushunje, 2017; Muzekenyi, *et al.,* 2023)

the factors that influence smallholder farming productivity can be categorized into three groups, first demographic characteristics such as gender, age, level of education, and household size. Second, institutional factors including land tenure system, training, information and access to market; and thirdly, environmental factors such as climate change, environmental degradation and soil productivity. However, despite this clear categorization, the interactions among these factors remain underexplored**.** For example, how education enables farmers to better utilize extension services or how farmers adapt to changing weather patterns is rarely discussed in an integrated manner.

Most smallholder farmers in Sub-Saharan Africa faces complex obstacles. These issues limit their ability to participate in marketplaces due to a variety of limits and barriers. These obstacles include exorbitant transaction fees, inadequate market and transit infrastructure, and a dearth of reliable data regarding exchange partners and markets (Barzola Iza, 2020). This finding highlights the structural inequality embedded in agricultural market systems in Sub-Saharan Africa. Yet, the literature largely does not evaluate how policy interventions such as subsidies, guaranteed minimum prices, or cooperatives can mitigate these barriers. This leaves a policy gap in the discussion.

For the most of smallholder farmers, transaction expenses are the most significant obstacle to market participation. The hidden expenses that prevent access to input and product markets mostly reflect this (Martey *et al.*, 2014). These problems call for a range of actions, including as expanding the market, institutional changes that encourages agriculture service supply and delivery, building physical agricultural infrastructures to farming and marketing centres and enacting laws that guarantee a stable and favourable environment. Systems that are attentive to their needs are necessary for these farmers. Markets access, market intelligence, market knowledge, and strong farmer organizations are essential in ensuring performance of smallholder agricultural sector production and commercialization (Muzekenyi, *et al.*, 2023).

Low technology adoption, limited land size and fertility, frequent variability in climatic variation (such as rainfall and temperature), moisture stress, lack of efficient market prospects and poor agriculture technology are the key factors that lead to low wheat

productivity (Kebede *et al*., 2017). However, the role of digital technology and mobile services in bridging this information gap remains underexplored in the reviewed studies, despite their growing relevance in rural areas. In Oromia, the factors that were found to influence wheat production were land size, rainfall, pesticide, fertilizer and temperature (Khan, 2019). While the effects of agro-climatic conditions are acknowledged, there is limited analysis of long-term climate change scenarios and adaptation strategies among smallholder wheat farmers. For instance, how farmers respond to unpredictable rainfall, or what indigenous knowledge systems are used to manage soil erosion or fertility, is not discussed. Another study showed that determinants of wheat productivity were weather and soil quality in France; while in Hungary it was climate change and seasonal weather. In Hungary, wheat production were positively corresponding to higher agro-chemicals use while in France additional days of labour positively correlates the amount of produce (Vigani *et al.*, 2015). In Zarai, Pakistan main issues that led to low wheat output were low rainfall, high price of chemical fertilizer, and the lack of availability of high yielding types seed (Khan, 2019). In Balochistan, Province of Pakistan, the major challenges to wheat production level was climate change and high price of the technological inputs (Bajkani *et al*., 2019).

In Sheka, West-Omo, Bench-Sheko, Kaffa Zones of Southwest Ethiopia, the main issues that have been found to affect crop productivity and production are: inadequate extension services; low availability and usage of enhanced fertilizers and types; the knowledge and expertise gap among farmers; soil acidic; disease; insect pests; and other associated concerns including security and human illness (Tadesse *et al.,* 2021). The key factors that have a significant impact on wheat yield are the application of moder n

inputs like pesticides, chemical fertilizers, herbicides; the implement of improved wheat s eeds; traditional farming practices; broadcasting techniques for sowing; and lack of training to smallholder farmers. (Guye & Uppal, 2018). In Northwestern Ethiopia, the number of oxen, amount of urea fertilizer, and seed had a positive and statistically significant effect on the level of wheat output, except wheat farm size (Endalew *et al.*, 2023). Oxen are basically used in farm preparation and yield transportation. As a result,

smallholder farmers who have healthier oxen can easily cultivate their plots on time and in proper tillage frequency and this can led to a better yield under low inputs (Endalew *et al.*, 2023).

Mmbando, *et al.*, (2015); Kimaro and Towo (2015) and Boniphace, *et al.*, (2015), carried their research on Tanzania smallholder farming including Karatu wheat growers and maintained that the status of the production is poor and mostly done by women for subsistence purposes. They also found that the poor production level is affected by less concern of the farmers influenced by unpredictable rainy season, cost of inputs, poor government support, predominant poor farming technology and lack of information and market assurance. The reviewed literature does not sufficiently examine the link between extension services and technology uptake, and how farmers perceive risk in adopting new inputs. the literature also does not sufficiently analyse how production and market challenges reinforce each other. Moreover, there's insufficient engagement with gendered barriers to market access, such as women's limited control over productive resources, mobility constraints, or exclusion from market information and networks.

2.4 Marketing Extent of Wheat Marketing Among Smallholder Farmers

Market participation refers to a farmers' ability to participate in market processes efficiently and successfully (Andaregie *et al.*, 2021). Farmers must participate in markets to provide food security, alleviate poverty, and sustain economic progress. Smallholders with a high level of market participation enjoy higher welfare standards because successful market engagement lifts farmers out of economic poverty by boosting their food security and income (Ahmed *et al.*, 2016). Smallholder engagement in modern contract based supply chains is limited, accounting for fewer than 5% of all small farmers worldwide (Diwakar *et al.*, 2022). In Zimbabwe's Masvingo and Manicaland provinces, market participation was only 19% (Dube, 2020). However, while the benefits of market engagement are well-articulated, the complexities involved in market access and integration are underexplored.

Market-oriented production by smallholder farmers is essential for the expansion of the agriculture production and a way to enhance smallholder farmers' livelihoods. However,

because of various marketing constraints, most smallholder's farmers in developing nations find it difficult to fully utilize the markets' potential. To address these issues, modernizing and market-orienting smallholder agriculture is essential (Dube, 2020; Getahun & Muleta, 2022). Formal and informal are the two routes available for marketing wheat. Due to worries about transaction costs, smallholder's farmers in rural areas typically sell their goods to local agents who collect wheat from rural producers and transport it to urban areas where they resell to wholesalers. These smallholder's farmers prefer the informal channel. The rural wholesalers, primary cooperatives, commercial farmers, unions and millers make up the formal sector (Getahun & Muleta, 2022). A critical gap here is the lack of investigation into how informal and formal systems can be integrated or transformed gradually rather than replaced. There is also limited analysis on how cooperatives or farmer associations could serve as a bridge between these two systems to reduce transaction costs while still maintaining farmer agency.

Farmers' market involvement is critical to supporting economic growth, food security, and poverty alleviation. Smallholder farmers' market participation has led to the improvement of rural infrastructures, power supply, industrialization, population growth and other developments. Due to their ability to purchase food items with the money they earned from selling their wheat produce, majority of farmers who engage in the wheat marketing appear to be most food secured (Przekota, 2020). Smallholder farmers' access to market outlets improves productivity and profitability and their participation is subject to the availability of the markets that farmers can choose (Mauki *et al*., 2023). Commercialization of agriculture production and market participation sector in rural communities in developing countries like Tanzania has the potential to promote economic development and livelihood wellbeing of smallholder (Mauki *et al*., 2023).

Smallholder farmers must become market-oriented producers who sell a significant amount of their produce on the open market as a result of the commercial transformation of smallholder agriculture, which requires them to base their production decisions on market signals. It is believed that increasing commercialization to the smallholder farmers who are mostly semi-subsistence with poor input and low production in developing countries including in Sub-Saharan Africa is crucial to reducing poverty in

rural community and boosting national income. Commercializing smallholder agriculture will assist these group as well as market-based exchange economies, which is essential for equitable growth. Enhancing the involvement of smallholders in the market could potentially reduce poverty more effectively than supporting a few large-scale projects (Gezachew, 2018).

There are two types of agriculture restrictions: marketing and production. Numerous abiotic and biotic factors, such like low capital, pests, diseases, restricted access to improved and quality seeds, low labour supply, unpredictable weather patterns, low market prices, inadequate marketing infrastructure, and low market integration, affect smallholder farmers, especially those in developing nations. These factors have led to low agricultural performance and a low or lack of marketing produce. One of the main obstacles to combating poverty is the limited market involvement experienced by many rural households (Gezachew, 2018). The literature tends to assume that all smallholders can and should become commercialized. What's missing is a typology of smallholder farmers that accounts for differences in land size, labor availability, risk tolerance, gender, and location. Commercialization strategies must be tailored rather than blanket approaches, which is not adequately addressed in the current review. Additionally, there's little interrogation of what kind of commercialization is sustainable whether export-oriented, contract-based, or domestic food markets and what trade-offs exist, such as food versus cash crops.

2.5 Barriers to Smallholder Marketing of Wheat

Wheat farming in Tanzania is increasingly significant due to rising urban demand. As FEWS Net (2018) observes, wheat grown on rural farms is predominantly consumed in urban centers, especially by wealthier households. Urban preferences for wheat-based foods such as chapati and bread have created a strong demand for wheat, driven further by rapid population growth. However, the flow of wheat from rural production zones to urban consumption hubs remains inefficient, largely due to barriers faced by smallholder farmers in marketing their produce. Tamako, (2022); Dube, (2020); Morton, & Martey, (2021); and Anthony, *et al.* (2021), have explored some barriers of smallholder farmers'

marketing of their produce in rural areas of developing countries. These factors can be categorized into three major groups namely; access to market and information; surplus and quality of produce; and policy-related and institutional factors. However, the literature tends to list barriers without analysing how these constraints interact or reinforce one another.

Age, gender, education, household education and household population size are among of the socioeconomic elements that determine farmers' decisions to participate in marketing processes. The age of the head and leader of the household might have a detrimental or impact on household involvement in the market. Older farmers have a positive impact because they are believed to decide more wisely and positively than younger farmer and also, they usually may know and have a knowledge and long-term relationship with potential clients, additional capital, or preferential credit access due to their age, experience, family size, or land ownership. Young farmers may have a negative impact since they have many alternative plans than agriculture and sometimes, they may be unwilling to risks their capital and time in agriculture (Przekota, 2020). The gender of the household leader influences involvement in market decisions. Male head or leader of the households has a higher level of participating in marketing than female head or leader of the households due to their resources, ability company and community traits (Gezachew, 2018).

Households headed by a female are usually challenged by the transaction costs of searching for buyers, contract selling, and to enforcing a sale transaction, in contrast to a households headed by a male (Sigei, 2014). Similarly, female leader or head of the households are most likely to be confined by resources, which affects market production (Jagwe *et al*., 2010). Education level factor has a favourable effect on market involvement because an educated household head has the expertise and skills to make profitable market decisions, which led to lower marketing expenses and a higher profit margin. Household size factor implies labour supply to farming practices and level of consumption. When the household size is big then there might be cheap and available labour for production but also high rate of consumption hence high production but low marketing (Przekota, 2020). Education level is may have a favourable impact on

willingness of the farmer to involve themselves in the production and marketing platforms. According to Gezachew, (2018), education factor empowers an individual to independently decide on production and marketing choices, implementation strategies and act upon as well as boost the desire to collaborate with others and participate himself to the group or community activities.

A variety of factors influence farmers' marketing channel choices. In Walmara, Central Ethiopia, total livestock owned, the level of education of household heads, access to credit and total land ownership, all have a significant influence on the likelihood of participation in wheat marketing, while size of household has a significant and negative impact (Getahun & Muleta, 2022). In Ethiopia, quantity of harvested crops, level of education, access to market information and market price positively affect farmers' decision to participate in marketing processes (Ahmed *et al*., 2016). In Zimbabwe, it was discovered that a farmer's age, household size, gender, and level of education, as well as their farming experience, extension services, agricultural income, and degree of farm specialization, as well as their access to irrigation, power, and quality of extension support, as well as their tenure, all had an impact on how much they participated in the market (Dube, 2020).

The commitment of smallholder farmers to participate in the market is heavily impacted by some of factors among their level of education, the amount of money they made from nonfarm work, the number of extension they had, their gender, usage of quality seeds, application of fertilizers, and their impression of land degradation (Andaregie *et al*., 2021). In Zambia, factors that determine traditional marketing channel participation are among the gender, off-farm income, distance to markets and milk yield. For the modern marketing channel, education and gender of the head of the household, distance to markets, access to market information and amount of yield were the key determining factors found to influence livestock farmers to sell their products in various marketing channels (Cheelo & Merwe, 2021). In the Mao Komo district - Ethiopia, the intensity of market performance of wheat yield was significantly determined by the level of education household heads, land size, access to the main road, and the market price, while the sex of the household head and access to the market were negatively and significantly

determined by the intensity of the market supply (Dibaba & Goshu, 2018). Farmers' choices for marketing channels are affected by a variety of exogenous variables, including market prices, infrastructure services, demographic and socioeconomic indicators, and household characteristics. Using the available data, the farmers will choose a marketing avenue that minimizes transaction costs and enhances utility (Cheelo & Merwe, 2021).

Mpombo, (2022) study has listed Tanzania among five East African countries whose smallholder farmers are facing long-standing and chronic similar market constraints. According to FEWS Net, (2018), marketing of wheat by smallholder farmers in Tanzania is complicated by the fact that the farmers sell their produce at the harvest period to local collector at negotiated low prices. This is facilitated by lack of in-farm storage facilities that would assure farmers later sales at a better price. The purchase of import wheat is mostly from Australia, Argentina and Russia while the export of wheat flour is mainly to Burundi, Zambia and Congo (FAO, 2023).

2.6 Agriculture Policies, Legal and Regulatory Framework Related to Wheat Production

The National Development Vision 2025 strategy puts significant focus on the agrarian sector and contemplates the transition of the sector from a low-productivity agriculture system to a semi-industrialized agrarian economy by 2025, driven by modern and high technological agriculture production with industrial and market activities in all production, marketing, processing and manufacturing areas (Lerrayo, 2013). The envisioned agriculture revolution is set on the basis policies and framed strategies. The Agricultural Sector Development Strategy (ASDS) formulated in 2002, Cooperative Development Policy (CDP) of 2002 and the Agricultural Sector Development Program (ASDP) of 2005 are among the policies that has previously formulated to guide and support the sector development (Collavizza, *et al.,* 2017). In 2008, the Ministry of Industry, trade and marketing developed the Agricultural Marketing Policy aimed on the basis of a sustainable, efficient and balanced marketing mechanism to promote strategic markets for agricultural products while maintaining equal returns for all stakeholders (URT, 2008).

The popular *Kilimo Kwanza* initiative formulated in 2009, provide for the commitment and efforts of government and private sector partnership and involvement of all citizens in agriculture development (Mauki, *et al.,* 2023). This policy sets spirit for the achievement of mid-term achievement of vision 2025 through addressing the need to enhance the input and to boost product marketing performance, enhance access to credit, expand the accessibility to extension support and encourage investment in smallholder farming in rural areas. Vision 2025 is objectively implemented in 5 years' interval phases named 'The Five Years Development plan (Mkonda & He, 2016).

The government was collaboration with potential development partners and developed a number of initiatives, such like Agricultural Sector Development Programme (ASDP), Big Results Now (BRN) and The Southern Agricultural Growth Corridor of Tanzania (SAGCOT), all with the priority of promoting agriculture modernization and marketing towards the improvement of productivity and improving rural smallholders' livelihoods and ensuring food security (Collavizza *et al*., 2017).

The policy and institutional context play a significant role. Despite Tanzania's high potential to increase wheat output and reduce import dependency, the promotion of wheat farming has not been matched by strong policies supporting smallholder commercialization or enhancing rural-urban market linkages.

2.7 Tanzania Wheat Production and Marketing Strategy

Markets have an essential role in rural economic development, creating job, generating income, securing food availability, technological dissemination, natural resources management, and the establishment of rural-urban market links (Dube, 2020). Enhancing the accessibility of markets and expanding the network of market links for smallholder and resource-constrained rural farmers are crucial preconditions for augmenting agriculture-driven economic growth and augmenting rural incomes. Since the majority of rural smallholder farming produce for subsistence, only little surplus for set for marketing, and therefore smallholder farmers in the majority of developing countries have minimal participation in formal output markets (Dube, 2020). Even when smallholder farmers have a surplus, they face a number of barriers to participating in

official output markets. These difficulties include, among other things, the absence of markets, a deficient marketing infrastructure, insufficient excess production to pay for marketing-related expenses, a lack of business and negotiation experience and collective bargaining abilities, shoddy produce packaging, and restricted access to marketing data and market intelligence (Dube, 2020).

The barriers facing smallholder farmers in wheat production and marketing can be considered an opportunities if the government decide to put efforts to potentially promote to production by investment in advanced technological practices in crop management, application of policies that favor accessibility and availability of inputs as well as to regulate and foster marketing services (Tadesse *et al.*, 2019). However, the availability of fertile land and inputs are the key indicators of successful wheat production and marketing. The Ministry of Agriculture in Tanzania has recorded a production of only 7% of the demand for wheat in the country. The government has outlined strategies to improve wheat production to 1 million tons by 2025 to overcome wheat demand in the country. A total of 400,000 hectares of fertile land have been earmarked for wheat cultivation from currently 100,000 hectares which is an increase of 300 percent.

The strategy aims to meet the crop demand by 2025, and this program started in 2022 in northern highland, central, and southern highland wheat growing zones. Tanzania Cereal and Other Produce Board – CPB has ordered a total of 210 tons of wheat seeds from Zambia that will be distributed to local farmers to motivate and boost production. TARI (2022) has confirmed that Tsh 151.8 billion will be used to research wheat production and marketing and over 55,000 tons of improved seeds will be distributed to farmers for three years from 2022. As a result, Tsh. 750 million was already allocated for training and research in wheat and TARI collected 11 samples of wheat to research on their suitability, and extension officers and 1,085 farmers in Monduli, Siha, Karatu, and Hanang districts have been trained on wheat production. CPB also entered a contract with farmers and promised to purchase wheat produce at a minimum of Tsh. 800 per kilogram.

Various research projects were carried out for an effort to boost wheat production through innovation and research. Different programs from the government, research funders, and donors support the execution of these initiatives. The aforementioned

projects sought to conduct research, provide training, and provide advanced technologies to all parties involved in wheat production, marketing and consumption.

2.8 Theoretical Framework

Transactional Cost Theory (TCT) is a concept from economics that examines the costs associated with making an economic exchange Libecap, (2024). Transaction costs which at intervals is referred to hidden costs, are the both unobservable and observable costs related with marketing of goods and services Akrong, *et al*. (2021). In the theory of the transaction cost, transaction costs in the agribusiness supply chain are affected by various factors including governance structures and marketing channels Libecap, (2024). According to the theory, the costs may be influenced by exchanging products and services, including those associated with locating a market or trading partner, negotiating and haggling, carrying out contracts, choosing and keeping an eye on reliable purchasers, and mitigating hazards (Akrong, *et al*.,2021). A fuller understanding of the decisions involved is crucial for policy, as participation in agricultural markets is hindered by transaction costs and other socioeconomic variables. Transaction costs are factors that contribute to market failures in developing countries and act as barriers to market participation for smallholders with limited resources (Haile, *et al.,* 2022). Hence this study is underpinned by transaction cost theory. The theory emphasizes that a number of factors influence farmers' market involvement and these transaction costs. These variables include the frequency of exchanges, the quantity and quality of crops, the uncertainty brought on by flaws in the input and output markets, the shrewd actions of market participants and farmers, and the absence of proper institutional framework that support formal marketing exchange channels (Diwakar *et al*., 2022).

2.9 Summary of Gaps in Literature

According to Maro, and Barreiro-Hurlé, (2012), research and literature in National Agriculture Research Stations (NARS) about the status and development of wheat in the country is very limited leading to drawbacks in production to smallholder farmers. However, FAO (2023) has confirmed that the country has the potential to produce more

than 164,000 tonnes annually if the purposive policies, research, and efforts on lifting up wheat production, trading and marketing will be seriously considered.

A review of empirical studies reveals that while there has been some attention to production, the linkage between production and marketing factors remains underexplored. For example, Arias *et al.,* (2013), found that the country strategies to maximize wheat production does not meet the consumption demand if marketing factor will still be neglected. Mtaki, 2018 ranked wheat consumption in Tanzania fourth after maize; rice and cassava, while its production from previous years accounted for less than 20 percent of the consumption. This mismatch between production and consumption highlights the critical need to assess both production efficiency and market participation. Yet, literature on smallholder engagement in wheat production especially from a market-linked perspective remains minimal.

To bridge this gap, it is crucial to understand not only the barriers to smallholder wheat production but also how these farmers access and engage with markets. As World Bank (2017) argues, enhancing productivity, strengthening supply chains, and ensuring environmental sustainability require supportive policies and well-functioning markets. This will help to meet the wheat consumption requirement, and ensure wheat farming has high productivity and efficiency. Negassa *et al.,* (2013) further suggest the need to understand the pressures that reduce the smallholder farming of wheat such as crop biophysical conditions, market conditions, labour, resources, institutional and policy restrictions that can influence the productivity and commitment of farmers to grow wheat. This study, therefore, seeks to fill the gap by examining both the production levels and the extent of market participation of smallholder wheat farmers in Karatu District. It also identifies the barriers to production, investigates marketing behaviour, and explores the influence of various socio-economic and institutional factors on market decisions. Yield estimation, particularly in smallholder mixed farming systems, is a known challenge. However, Carly and Kumar (1988) recommend the use of harvest unit sampling method as an appropriate way to estimate average yields.

Numerous econometric models have been used to measure factors that influence marketing decision of farmers and their extent of participation. Tobit model has been

used by different researchers to determine factors that influencing market participation of smallholder farmers. The Tobit model was developed by James Tobin (1958), and has been used due to its suitability for continuous outcomes with censored values. This model has been successfully applied in similar studies, such as in Myanmar (Kyaw, *et al.*, 2018) to test significant factors that influence wheat marketing. The probit model has also been used to predict the probability of farmer participation in wheat marketing, extent of market in relation to the number of sales (Martey, *et al.*, 2014). While Tobit and Probit models are commonly used to explore the influence of internal and external factors on agricultural production and market participation, few studies have applied both models simultaneously to analyse the linkage between wheat production levels and marketing behaviours among smallholder farmers in Tanzania. This is the core knowledge gap that this study seeks to address.

CHAPTER THREE: METHODOLOGY

3.1 Study Area

Karatu is an administrative district located within the latitude $3^0$0'S to $3^0$40'S and longitude $34^0$40'E to $36^0$0'E. It is one among five districts of Arusha region in northern Tanzania, established in 1997. Karatu district measures about 3300km^2 combining the agriculturally suitable land of 102573ha; 155808ha for pastures, 61218ha covered with bushes, forests and trees, and 1060ha of water body (Lake Eyasi) (URT, 2016). The town of the district has been used as an important tourist' stopover heading to Serengeti and Ngorongoro national parks.

According to the 2022 government census, the Karatu district population was 256,838 people: 131,417 men and 125,422 women, with the annual growth rate of 3.1% and living into 48,345 households. The population density is of the average 73.4 person/km^2 with high densities (100 person/km^2) in Mbulumbulu and Karatu divisions and low densities in the western zone and along Lake Eyasi (7 to 10 person/km^2) and (NBS, 2023).

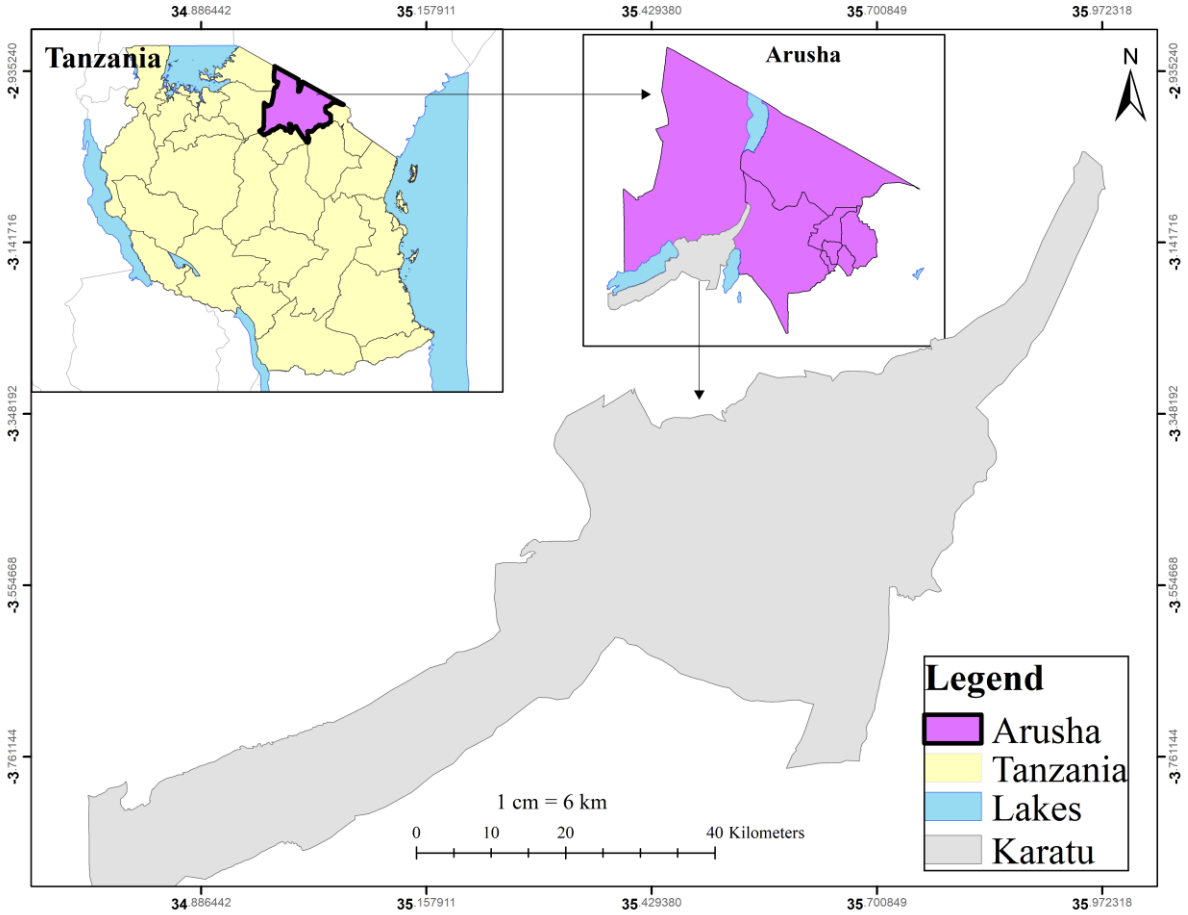

Figure 3.1: Map of Karatu district

Source: Researcher, (2023)

3.1.1 Climatic and Soil Characteristics in Karatu

Karatu district has a normal rainfall distribution of rainfall which ranges from 300mm in lowland plains to 1200mm in highland areas. Short rains season is around October to December and the long rains (‘masika’) season is between March to June, with the wettest period in April and unpredictable storms. The mean annual temperature lies around 15^{o}C to 24^{o}C with the increase from lowland plains of lake Eyasi to highland. June to August is the coldest period with no frost and October to April is the warmest (URT, 2016).

The type of soils in Karatu district varies with location and origin while shallow and infertile soils dominating summits areas and slopes. On valleys and gently sloping land are occupied by clay volcanic fertile soils. Karatu district has three agro-ecological zones,

highland zone in northern part to Ngorongoro conservation area, midland zone bordering Marang Forest and lowland along Lake Eyasi basin (Triomphe *et al*., 2012).

3.1.2 Crop Production and Marketing in Karatu

The basic crops produced in Karatu are maize, beans, wheat and paddy mostly in highland of eastern and central part of the district with high rainfall. However, there are permanent springs located along Lake Eyasi within Mang'ola flood plain making the potential 3600 ha of land for irrigation. Despite, only 1081 ha are under irrigation farming producing mainly vegetables. Karatu has a land-holding size of 0-5 ha per households with poor holding the less, and most of their cultivation is by hand, done by women and children (URT, 2016). The marketing of agricultural products is done under free-market system dominated by brokers who collect and negotiate the prices directly from farmers and sell them to major urban centres such as Arusha and Nairobi.

3.2 Research Design

The study used descriptive research designed by employing a mixed method approach as it combined the elements of quantitative and qualitative data collection, analysis and presentation. The use of descriptive research design has been effective in answering the research questions with validity and strengthening the conclusion of the study (Schoonenboom & Johnson, 2017). Both quantitative and qualitative data was assembled about the internal and external factors to wheat production and marketing in Karatu, and an analysis of the interrelationship between the variables was undertaken to meet the study objectives.

3.3 Target population and Sampling Procedure

Karatu district population growth rate of 3.1% as per Tanzania National Bureau of Statistics Census 2023, gives a projected population of 49843 households by 2020. The sample size was determined using the formula recommended by Daniel (1999).

The formula states as:

$n = N*X / (X + N - 1)$,

where by,

$X = Z_{\alpha/2}^2 * p*(1-p) / MOE^2$

$Z_{\alpha/2}$ is the critical value of the Normal distribution at α/2, P is the sample proportion, N is the population size and 'a' is coefficient of variation (0.05).

With the margin of error (MoE) of 5 and a confidence level of 90%, the sample size is calculated from 48,345 households. The calculated sample size, in this case, was 270 respondents. The distribution of the questionnaires, interview schedule and FDG is shown in table 1 below. Secondary data was also gathered from AMCOS offices, Karatu DED office and Ministry of Agriculture.

Table 3. 1: Distribution of respondents and other sources of data in Karatu study area

Rhotia Village	Farmers - 27
	Rhotia AMCOS
	FGD - 2
Silahamo Village	Farmers - 64
	Wheat Scheme AMCOS
	FGD - 3
Kambi ya Simba Village	Farmers - 59
	Diragw AMCOS
	FGD - 1
Kilimatembo Village	Farmers - 104
	Gilala AMCOS
	FGD - 3
Bonde la Faru Village	Farmers - 16
	Upper Kitete AMCOS
	FGD - 1

Source: Researcher, (2023)

3.3.1 Sampling Techniques

Respondents were selected from five villages which were Rhotia, Kilimatembo, Mtego wa Simba, Bonde la Faru and Silahamo in the study area. These villages were selected since there are the ones with the highest number of smallholder farmers. Households and wheat farms were scattered distributed with almost the same climatic and accessibility characteristics. However, farmers and households who were not practicing wheat was also contacted from the same location in the five selected villages. All selected villages have active cooperative societies giving the equal opportunity to all respondents to join. Purposive sampling method was used to reach all the institutions relevant to the study based on the information gathered from the literature review.

3.4 Data Collection

3.4.1 Primary Sources of Data

Primary data is first-hand information obtained from field study, for this study, data was derived from interviews, questionnaire administration to households, observation, measurement and focus group discussion. Questionnaire was administered to farmers in household and local and cooperative leaders and business brokers to obtain primary data.

FGD was conducted for the purpose of obtaining a deep integrated perception from leaders, wheat farmers and non-wheat farmers. FGD was aimed at bringing up understanding on the strength and weakness of wheat farming and marketing strategies and to obtain free opinion of respondents toward wheat production and marketing. At least one FGD was carried in every village and each FGD comprised one or more members of the local/cooperative leaders, wheat farmer, non-wheat farmer and wheat broker. FGD was done in every village centre particularly where all respondents were found. In Rhotia and Silahamo villages, where farmers were scattered, two and three FGDs was carried respectively.

Field trips were used to observe and capture the information from the offices, farms, stores and market. Key informant’s relevant departments in Karatu district council,

AMCOS officials and Boda-bodas who played a key role in transporting inputs and outputs from the farms were interviewed.

3.4.2 Secondary Sources of Data

Secondary data was derived from the district council documentation, GIS and remote sensing data, Karatu development and investment plans, agriculture production and marketing reports, books and journals.

3.4.3 Data Collection Tools

The questionnaires were designed and developed to capture the information required for this study. They were then administered to randomly selected households from the population. Key informant interviews schedules were used on Key informants and at institutions, based on their technical involvement and knowledge about the barriers to the production and marketing of wheat in the Karatu district, while a Focus Group Discussion guide was used for the Focus Group Discussions

3.5 Pretesting of Research Instruments

A pilot study was performed to assess the feasibility, time, cost, adverse event and the extend of the impact with an attempt of predicting the appropriateness of sample size. In addition, it aimed at improving the sample size upon the study's design before the performance of the full-scale research project. Prior to the study, pretesting of questionnaires and interviews schedules was performed which ensured that the issues sought in the study was sufficiently addressed. Members from the target population were used in conducting the pretest. Members who took part in pretest were not involved in the final sample of the study, and this was crucial to avoid influencing the behaviour of the research subjects, who had participated already in the research. The researcher utilised 27 respondents in this pilot study, representing 10 % of the study's sample size, in accordance to the recommendation by Lang,(2021). Piloting was useful to the researcher in identification of unclear questions and correction of directions that were not clear, space for writing responses that were not sufficient or questions that were wrongly phrased in the research instruments.

3.6 Validity and reliability of instruments

3.6.1 Validity

The validity of instruments of research is through accurate measurement of what they are intended and achievement of purpose they are design. Research instruments cannot be perfect and despite this, the researcher is supposed to be assured of its effectiveness. Determination of validity therefore, is according to appropriateness of the research instrument that are chosen (Lang, 2021).

The validity of the tools used were achieved through pilot testing which provide a chance to critique and to give recommendations on ways of improving on the design of the questions.

3.6.2 Reliability

Research instruments are supposed to be reliable in order to produce results which are consistent when single phenomena which does not change is measured. Inconsistencies of any nature such as even inconsistencies in wording can alter responses(Chatterjee *et al*., 2018). Attaining reliability in research requires research instrument to contain several questions and similar themes, touching on various aspects of that particular theme and these ensured that the responses that were obtained were reliable. Reviewing and restructuring of questions which could not fit the associated theme was done which resulted in associated data.

The reliability and internal consistency were measured using Cronbach Alpha calculated as:

$$\alpha = \frac{n}{n-1}\left(1 - \frac{\sum s^2(Xi)}{s^2(y)}\right)$$ ……. equation 1

where; n= number of items s^2 (X_i)=variance of item and $s^2(y)$=Variance of the observed total scores. If the result was closer to 1 it implies the reliability of the instrument is greater but if close to 0 it is weaker. Reliability of this study was conducted by Cronbach's coefficient alpha. A value of 0.67 was found which indicates the data had great reliability.

3.7 Data Analysis

The collected data from the field, households and institutions was cleaned, coded and analysed using the Statistical Package for Social Sciences (SPSS) tool. Level of wheat production, factors that affect wheat production and wheat marketing extent were analysed by descriptive statistics.

Various research have used multinomial regression to determine factors that affect participation in marketing channels since multinomial regression assumes normality, linearity, and homoscedasticity (Cheelo & Merwe, 2021; Geoffrey *et al.*, 2015). This method is appropriate because the dependent variable can be categorical or nominal. To identify the factors influencing these marketing decisions, multinomial logistic regression was applied, given its suitability for modelling relationships between a nominal dependent variable and multiple independent predictors. The dependent variable for this study was smallholder farmer marketing decision which was measured in a nominal scale of measurement (1=AMCOS, 0=non-AMCOS market outlets). While independent variables include Price variation (No, Yes), Wheat production (hectare/kg), Farm distance (km), and Membership of Cooperative society (Yes, No). The equation of the model for this study specified as shown below:

$$Y^{*} = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_n X_n + \mu_i \quad \ldots\ldots\ldots\ldots$$

equation 2

Where **Y*** is the latent variable (Market outlets),

β is estimated parameter or coefficient,

X *is* the explanatory variables and

μ is the error term (ε).

Therefore, the equation was applicable to all variables (determinants) as expressed in the equation below.

$$Y(0,1) = \beta_0 + \beta_1 * \text{Price variation} + \beta_2 * \text{Wheat production} + \beta_3 * \text{Farm distance} + \beta_3 * \text{Membership} + \varepsilon_i \ldots\ldots\ldots$$

equation 3

The AMCOS category was set as the reference group, so the model estimates the log-odds of selecting the non-AMCOS outlet relative to AMCOS. The model assessed the

level and significance of influence of each independent variable on the likelihood of a farmer choosing a particular marketing outlet. Assumptions underlying the model, such as normality, linearity, and homoscedasticity, were considered to ensure the validity and reliability of the results. Marginal effect was computed to interpret the effect of each independent variable on the probability of choosing a particular marketing outlet, holding other factors constant. A positive marginal effect of price variation on choosing non-AMCOS markets suggests that farmers facing price volatility are more likely to avoid AMCOS channels. A negative marginal effect of farm distance implies that increased distance reduces the likelihood of selecting non-AMCOS outlets, likely due to transport costs.

Data was presented in form of Mean (M), frequency (F), Percentage (%). Additionally, chats and figures were generated to support the presentation of the results.

3.8 Logistical and Ethical consideration

Logistical consideration was ensured by obtaining permission to conduct research from the Department of Spatial and Environmental Planning and the School of Graduate Studies at Kenyatta University.

In each scientific research project, ethical considerations are crucial. The following research ethics were taken into account in this study. First, the respondents' voluntary and consenting participation in the study served as the only basis for its conduct. Respect for the dignity of research participants was also given top priority. Furthermore, a high degree of confidentiality was taken into consideration because the respondents' privacy protection was highly valued in a professional manner without endangering their integrity. Furthermore, the study's emphasis on the anonymity of participants and organizations was crucial, and it was strictly forbidden to provide biased or inaccurate information.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

This chapter begins by giving data on social demographic information of the Karatu population under study. Based on the objectives of this study, it identifies farmers' wheat production levels and marketing extent. It also presents findings on the barriers to smallholder farmers in wheat production in the Karatu district. Finally, the chapter contains the determining factors that influence smallholder marketing decisions in Karatu district.

4.2 General Information

In Karatu study area, Smallholder wheat farmers use- both modern and traditional practices in cultivation. During farm preparation, 64 percent of the respondents use oxen and hand hoe to till the land and these are mainly the ones who cultivate- small pieces of land. Tractors are used by 36 percent of respondents in preparation of their land and these are farmers who invested in large pieces of land and can afford cost of tractors. The production depends on the available natural climatic conditions such as rainfall and temperature. However, in most farms soil fertility and nutrients are inadequate and unbalanced for wheat performance and hence farmers have to add chemical fertilizers to boosts soil productivity. Weeds, pests and diseases are common in Karatu; therefore, farmers spray ant-weed chemicals before sowing seeds and apply chemicals and fertilizers in their production. The commonly used agro-chemicals are 2-4-D, CAN, DAP and UREA.

At the harvesting stage, most of the farmers use- combined harvester and only 4 percent use knife and sickles. The cost of a combined harvester usually ranges from around 25 US Dollars to 50 US Dollars depending on the cost of fuel at present and the distance of the farm from the village centre. Farmers who at the time have no money to pay for the harvester tend to provide one to two bags of the produce as for compensation. 89 percent of farmers tend to sell their produce direct from the farm and only 11 percent store their produce for later sell. the reason for selling the produce soon after harvest is that buyers

are limited and tend to disappear after harvesting period, escaping the cost of storage and to get money for the payment of harvesting costs. Additionally, 73 percent of Karatu smallholder farmers are members of AMCOS and they have pre-signed a contract to be supplied with seeds, fertilizers and agro-chemicals on the post-payment basis and therefore they have to submit their produce to AMCOS to cater to the debt and at a pre-agreed price.

4.3 Social Demographic Information

An uneven population distribution in the Karatu district presents a nuanced picture of the social demographic characteristics, offering key insights that can inform various aspects of agricultural research and policymaking. As shown in Table 2, the majority of the respondents have either secondary education (33.7%) or post-secondary education (33.3%), with smaller proportions having no education (15.6%) or primary education (17.4%). The educational landscape reveals a relatively balanced distribution, with a significant portion of respondents having either secondary or post-secondary education. This pattern suggests a potential inclination towards a more educated farming community, which may have implications for the adoption of advanced agricultural practices or engagement with modern technologies.

The age distribution of farmers is noteworthy, with a substantial proportion falling within the 45-80 age range. The age distribution of farmers indicates that the highest percentage falls within the 45-80 age range (47.4%), followed by 25-45 (40.4%) and 18-24 (12.2%). This demographic trend raises concerns about the aging of the agricultural workforce and underscores the need for strategies to attract and support younger individuals in farming. Understanding the dynamics of this age distribution is crucial for developing targeted interventions to sustain and rejuvenate the agricultural sector.

Household size emerges as another critical factor, with a clear majority of respondents having larger households (6-10 persons). Regarding household size, a larger proportion of respondents have 6-10 persons in their households (67.0%), while 1-5 persons constitute 33.0%. This finding can inform resource allocation and support systems,

acknowledging the potential impact of household dynamics on agricultural practices, decision-making, and overall resilience.

Farming experience and land size demonstrate a parallel distribution, highlighting that a significant portion of the surveyed farmers possesses substantial expertise and manages relatively larger land holdings. In terms of farming experience, a similar pattern is observed, with 67.0% having 6-15 years of experience, and 33.0% having 1-5 years. The land size distribution is also evenly split, with 33.0% owning 1-5 acres and 67.0% having 6-10 acres. This insight is crucial for tailoring extension services, as experienced farmers may benefit from more advanced guidance, while those with limited experience may require additional support and training.

The distribution of farm distance from home is indicative of the geographical spread of agricultural activities. Farm distance from home indicates that the majority of farms are located within 1-5 kilometres (84.4%), with a smaller proportion situated 6-10 kilometres away (15.6%). The preponderance of farms located within 1-5 kilometres suggests a concentration of agricultural practices in proximity to residential areas. This spatial insight can guide infrastructure development, such as transportation networks and market access, to optimize agricultural efficiency and economic returns.

Therefore, **Table 4.1** provides a foundation for targeted and effective agricultural policies. Understanding the education levels, age distribution, household dynamics, farming experience, land size, and spatial considerations allows stakeholders to craft interventions that address the specific needs and challenges faced by the diverse Wheat smallholder farmers.

Table 4.1: Descriptive statistics results for social demographic information

Variables	Frequency	Percentage
Education level		
No education	42	15.6
Primary	47	17.4
Secondary	91	33.7
Post secondary	90	33.3
Age of a farmer		
18-24	33	12.2
25-45	109	40.4
45-80	128	47.4
Household size		
1-5 persons	89	33.0
6-10 persons	181	67.0
Farming experience		
1-5 years	89	33.0
6-15 years	181	67.0
Land size		
1-5 Acre	89	33.0
6-10 Acre	181	67.0
Farm distance from home		
1-5 Km	228	84.4
6-10 Km	42	15.6

Source: **Field data, (2023)**

4.4 Smallholder Wheat Production Level in Karatu District.

Table 4.2 provides a valuable overview of smallholder wheat production levels in Karatu district, highlighting the distribution of farmers across different production categories. The majority of respondents, constituting 66.3%, fall within the 0-999kg production range, indicating below-average wheat production. This finding suggests a substantial portion of smallholder farmers in the district may face challenges or constraints that limit their wheat yield, as reflected in the lower end of the production spectrum. Several variables play a significant consequence to quantity and quality of agricultural productivity. the factors can be basically categorized into environmental, biological and technological. According to researches, initiatives aimed at reducing the negative effects of variables on agricultural produce, both in terms of quantity and quality, should take

into account the crop type grown, farming land and the local climate and geographical characteristics of the location (Ngoune & Shelton 2020).

Despite non-climatic challenges, these smallholder and subsistence wheat growers are among the most vulnerable to climate change, which has already led to decreasing crop yields in the region (Rowhani, *et al.,* 2011). 86% of farmers declared that variation in precipitation and temperature influenced their yields consequently. This was also supported by Townsend and Mtaki, (2020) who also found wheat production over the years has been decreasing in Northern Tanzania due to unfavourable weather condition.

It is evidenced that the gap between the actual harvest and expected harvest is continuously widening seasonally ranging from 26 to 29 percent at the global level according to 2019 statistics (Tadesse, *et al.*, 2019). In Karatu it was found that smallholder farmers harvest up to 0.5 tonnes per hector while the national average harvest per hector 2 tones. This implies that wheat production is poorly performing and it can be associated with various challenges.

Conversely, 33.7% of respondents fall within the 1000-1500kg production range, representing an above-average wheat production category. This subset of farmers demonstrates a more robust wheat production capacity, potentially influenced by factors such as efficient farming practices, access to resources, or effective management strategies. Understanding the characteristics and practices of this group could provide valuable insights for disseminating best practices and improving overall wheat production in the district.

The data presented in **Table 4.2** underscores the heterogeneity in smallholder wheat production within Karatu district, emphasizing the need for targeted interventions to support farmers operating below the average production threshold. Identifying and addressing the specific challenges faced by this group, such as limited access to resources, knowledge gaps, or environmental factors, can contribute to overall improvements in wheat production at the community level.

Furthermore, exploring the factors that contribute to above-average production among the 33.7% of farmers can inform the development of extension services, training programs, and policy initiatives to replicate successful practices and enhance the resilience and productivity of smallholder wheat farmers across the district.

Therefore, **Table 4.2** serves as a crucial tool for stakeholders and policymakers to understand the distribution of wheat production levels among smallholder farmers in Karatu district. By tailoring interventions based on the distinct needs of different production categories, efforts can be directed towards promoting sustainable agricultural practices, improving resource access, and ultimately fostering a more equitable and productive smallholder farming community.

Table 4.2: Smallholder wheat production level in Karatu district

Level of wheat production	Frequency	Percentage
0-999 (Below average)	179	66.3
1000-1500 (Above average)	91	33.7
Total	**270**	**100**

Source: Field data, (2023)

4.5 Barriers of Smallholder Farmers in Wheat Production

Table 4.3 identifies the significant barriers faced by smallholder farmers in wheat production, providing a clear snapshot of the challenges encountered within this agricultural context. The most prevalent barrier, as indicated by 46.3% of respondents, is the lack of capital. Respondents term capital as a means of purchasing or renting farming land, purchasing seeds chemicals, and fertilizers, and affording farming machinery and labour services. Farmers' lack of capital has led to a paucity of modern agricultural skills, an inability to find appropriate financing solutions, and restricted access to modern technology for the development and manufacturing of seeds, fertilizer, insecticides, and pesticides. The cost of improved seeds, pesticides, fertilizers and farm machinery is high especially in remote households of the fact of increasing cost of production and transport. This underscores a critical financial constraint that hampers the ability of smallholder farmers to invest in necessary inputs, technology, and sustainable farming practices.

Addressing this barrier may require targeted financial interventions, access to credit, or the development of alternative financing mechanisms and regulating timely availability and affordability of seeds, agro-chemicals and fertilizers.

The second most frequently cited obstacle, with 43.0% of respondents highlighting it, is the limitation imposed by intercropping systems. When compared to sole-cropping, increased biodiversity in intercropping systems can boost the production, resilience, stability, and efficient utilization of resources of the intercropped crop (Ebrahimi *et al.*, 2016). Wheat crop management and machinery harvesting systems in Karatu do not allow intercropping of other species in the same piece of land. Due to limited farming land and the increasing demand for food crops, many farmers abandoned wheat production and opted for other crops that can me intercropped with other food crops (Aziz *et al.*, 2015). The pieces of land used for wheat production are limited while others are set for food crops to meet family food demands. It was found that 89 percent of farmers produce their own food which are basically maize, beans, peas and cassava. Food crop production is done for domestic use and commercial purpose. **Figure 4.1** bellow indicates the distribution of the farming land to the production of varieties of crops in Kataru smallholder farmers. Wheat and food crops were the most common types of crops produced by smallholder farmers in Karatu (80 %), while wheat, flowers and food crops as well as Wheat and Flowers accounted for about 8 % respectively. Only wheat as types of crops produced by smallholder farmer were carried out by the least number of respondents (5 %). This finding suggests that the current cropping practices may not be optimized for wheat production, potentially affecting yield and overall farm productivity. Further investigation into specific intercropping practices, alongside educational initiatives and extension services, could be instrumental in overcoming this particular challenge.

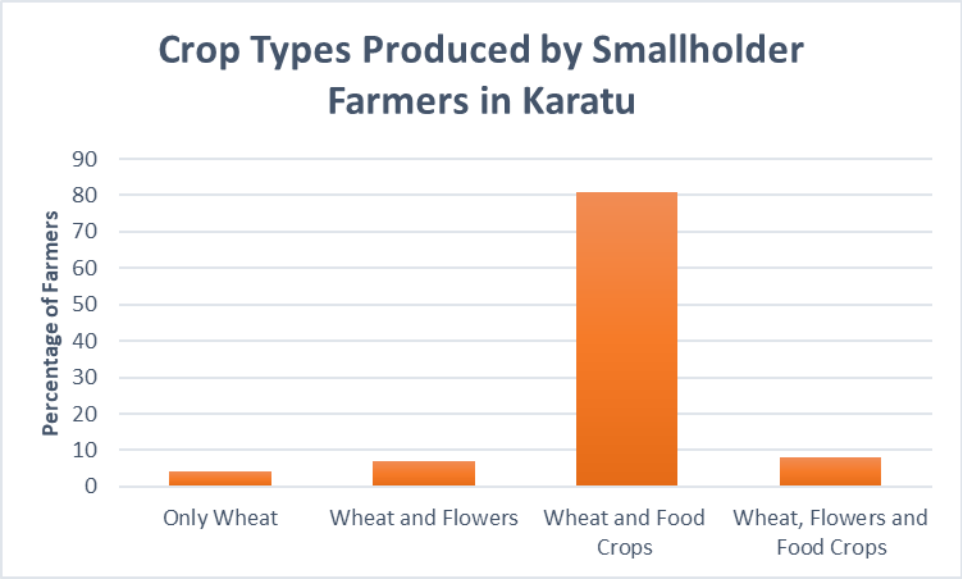

Figure 4.1: Crop types produced by smallholder farmers in Karatu
Source: Field data

Insufficient farming land is identified by 10.7% of respondents as a significant barrier. This is in line with another study that also highlighted land size as an influencer of wheat production (Khan, 2019). While it ranks lower in frequency, the scarcity of land for cultivation remains a notable concern. Despite the sufficient and suitable land in the Karatu district, most of the arable land is reserved for the Ngorongoro conservation area and its buffer zone. However, due to emerging dangerous wild animals particularly elephants, wheat suitable land along the buffer zone were not utilized yet. The pieces of limited land for wheat in the villages are also affected by climate challenges, soil erosion, and infertility limiting productivity. **Table 4.4** indicates the differences between average geographical requirement for successful wheat production and the found actual status in Karatu district. This makes land suitable for wheat production insufficient and requires high investment for its production. Strategies to address this issue might involve land-use planning, promoting sustainable intensification practices, or exploring community-based approaches to optimize land utilization among smallholder farmers.

Due to climatic stress, several farmers have moved to maize, cassava and bean cropping. The delay of rainfall and under-average precipitation switched farmers turn to beans because they tend to produce better than wheat in low-rainfall climates. Karatu district

wheat production has been yearly declining due to low yield experienced in the previous seasons. Farmers have been reducing their portions of land they used for wheat and switch to produce other climatic suitable and profitable crops instead. High variation in environmental characteristics have been common in east Africa highlands wheat farms and t is a great challenge in a successful production and yield quantity (Tadesse *et al.*, 2019). The same abiotic stress has been noticed in Karatu district with high degree of moisture and temperature variations. Researchers found that the wheat crop yield will decrease by 6 to 10 percent for every 1°C increase in temperature throughout the growing season (Asseng *et al*., 2015).

Table 4:4 Geographic requirement for the growth of wheat versus actual status

Growth Stage	-	Average Rainfall (mm)	Max Temp. (ºC)	Min Temp. (ºC)	Average Temp. (ºC)	Soil pH	Altitude (Meters above sea level)
Initial (March)	Crop Requirement	40.35	20.8	5.25	13	5.5 - 7.5	1500-2900
	Actual Status	253	25.3	15.4	20	6.2	1400-2000
Development (April)	Crop Requirement	82.44	23.35	9	17.2	5.5 - 7.5	1500-2900
	Actual Status	229	22.8	15.3	18.5	6.2	1400-2000
Mid Growth (May)	Crop Requirement	238.66	27.45	11.95	19.7	5.5 - 7.5	1500-2900
	Actual Status	142	21.2	14	17.3	6.2	1400-2000
Late Growth (June)	Crop Requirement	31.3	30.15	14.05	22.1	5.5 - 7.5	1500-2900
	Actual Status	42	20.4	11.2	15.6	6.2	1400-2000

Source: Field data; climate-data.org 2024; Yayeh *et al.*, 2023; Vijaya Kumar *et al.*, 2016 and URT, 2008

The cumulative insights from **Table 4.4** underscore the multifaceted nature of challenges faced by smallholder farmers in wheat production. A holistic approach to agricultural development should encompass financial support mechanisms, improvements in cropping systems, and interventions to address land constraints. Tailoring solutions to these specific barriers will be essential for fostering a resilient and sustainable smallholder farming community in the context of wheat production. Moreover, collaboration between policymakers, agricultural extension services, and financial institutions may be crucial in implementing effective strategies that address these challenges and enhance the overall productivity and well-being of smallholder farmers in the wheat production sector.

Table 4.4: Barriers of smallholder farmers in wheat production

Barriers	Frequency	Percentage
Insufficient farming land	29	10.7
Limit intercropping system	116	43.0
Lack of capital	125	46.3
Total	**270**	**100**

Source: Field data, (2023)

4.6 Marketing Extent of the Wheat Smallholder Farmers in Karatu District

Table 6 provides an insightful perspective on the marketing extent and decision-making factors of wheat smallholder farmers in Karatu district. The data is categorized into various dimensions, shedding light on the key elements influencing farmers' marketing choices and the factors guiding their decisions.

In terms of wheat price advantages, capital support, availability and access to input, technical support, and market assurance are identified as critical factors. Notably, technical support and market assurance emerge as the dominant influences, both reported by 41.5% of respondents. This suggests that smallholder farmers in Karatu district highly value support systems that enhance their technical know-how and provide assurance in the marketing process. Policymakers and stakeholders can leverage this information to tailor programs that focus on improving technical skills and creating reliable market mechanisms to bolster farmers' confidence in wheat production and marketing.

The distribution of market outlets reveals a diverse landscape, with AMCOS (Agricultural Marketing Cooperative Societies) and brokers being the most prevalent options. This diversity implies that farmers have various channels through which they can sell their wheat, fostering competition and potentially providing opportunities for negotiation. Understanding the dynamics of these market outlets can guide interventions to strengthen existing systems and explore ways to expand market access for smallholder farmers.

The decision-making factors for choosing market outlets showcase that better price and good condition are the primary considerations for 41.9% and 45.6% of respondents, respectively. This insight emphasizes the economic and quality-driven motivations behind farmers' choices. Policymakers and market facilitators can use this information to design initiatives that address pricing mechanisms and ensure that market outlets maintain quality standards, thereby aligning with farmers' preferences.

Lastly, the presence of alternative options in the "Others" category, chosen by 7.0% of respondents, underlines the importance of recognizing the diversity in farmers' preferences. Customized approaches to accommodate various choices can contribute to a more inclusive and supportive marketing environment.

Therefore, **Table 4.5** provides a nuanced understanding of the marketing dynamics in Karatu district, offering valuable insights for designing interventions that enhance technical capabilities, improve market assurance, and align with farmers' decision-making criteria, ultimately contributing to the sustainable development of smallholder wheat farming in the region.

Table 4.5: Marketing extent of the wheat smallholder farmers in Karatu district

Market extent	Frequency	Percentage
Wheat price advantages		
Capital support	19	7.0
Availability and access of input	27	10.0
Technical support	112	41.5
Market assurance	112	41.5
Market outlets		
Brokers	106	39.3
AMCOS	110	40.7
Companies	20	7.4
Local markets	15	5.6
Others	19	7.0
Decision to market outlets		
Better price	113	41.9
Good condition	123	45.6
No alternatives	34	12.6

Source: Field data, (2023)

4.7 Factors Influencing Smallholder Market Decision in Karatu District

Table 4.6 presents the results of a multinomial regression analysis aimed at identifying factors influencing smallholder farmers' market decisions in Karatu district. The analysis considers various independent variables, with associated coefficients, standard errors, Wald statistics, degrees of freedom, significance levels, and odds ratios (Exp(B).

The use of multinomial logistic regression in this study is justified because the dependent variable smallholder farmers' market decisions is categorical with multiple unordered choices (e.g., selling locally, selling to cooperatives, or not selling), requiring a model that compares several outcomes against a reference category. Unlike binary logistic regression, multinomial regression provides a better understanding of how different factors influence farmers' choices. The independent variables, including both categorical (e.g., AMCOS membership) and continuous (e.g., wheat production) predictors, are well-suited for this method. The model's odds ratios (Exp(B)) quantify the impact of each

variable, such as the significant positive effect of low wheat production (Exp(B)=1.118, p=0.001) on market decisions. Although the pseudo-R^2 values (Cox & Snell=0.075, Nagelkerke=0.100, McFadden=0.056) indicate moderate explanatory power—common in agricultural studies—the 61.5% classification accuracy confirms reasonable predictive performance. By distinguishing significant factors (e.g., production levels) from non-significant ones (e.g., farm distance), the analysis helps policymakers prioritize interventions. Overall, multinomial regression was the appropriate choice, as it effectively identifies key determinants of market participation, supporting data-driven agricultural policies.

The intercept coefficient of -0.794, with a significance level of 0.044, indicates that the model's baseline (when all other variables are zero) has a statistically significant effect on market decisions. The likelihood ratio test and goodness of fit statistics suggest that the model fits the data well, with a significant contribution to explaining the variation in the dependent variable.

Examining specific variables, the coefficient for "Price variation= Not vary" is -0.342, though it is not statistically significant at the 0.05 level. This suggests that the variation in wheat prices may not significantly influence market decisions among smallholder farmers in the district.

In contrast, "Wheat production=<1000 hectare/tonnes" has a significant positive effect on market decisions, with a coefficient of 1.118 and a p-value of 0.001. This indicates that farmers with wheat production below 1000 hectare/tonnes are more likely to make different market decisions compared to the reference category. This results was consistent with Ahmed *et al*. (2016) who has found that quantity of crop harvested positively affect farmers participation decision in market.

The variables related to "Farm distance" and "Membership of Agricultural Marketing Cooperative Society (AMCOS)" do not show significant effects on market decisions, as their coefficients are not statistically different from zero. This implies that the distance of

the farm from home and membership in an AMCOS may not be critical determinants of market choices for smallholder farmers in this context.

The pseudo-R-square values suggest a moderate level of explanatory power for the model, with Cox&Snell=0.075, Negelkerke=0.100, and McFadden=0.056. The classification accuracy is reported at 61.5%, indicating that the model correctly predicts the market decisions for about 61.5% of the cases.

The multinomial regression analysis in Table 4.7 provides important insights into the factors shaping smallholder farmers' market decisions in Karatu district. The model demonstrates a statistically significant baseline effect (intercept coefficient = -0.794, p=0.044), confirming its validity in explaining market choices. Among the key findings, wheat production levels emerge as the most influential factor—farmers producing less than 1,000 hectare/tonnes are significantly more likely to alter their market decisions (coefficient = 1.118, p=0.001), aligning with prior research (Ahmed *et al.*, 2016). In contrast, price variation, farm distance, and AMCOS membership show no significant impact, suggesting these factors may not drive marketing behaviour in this context. While the model's explanatory power is moderate (pseudo-R^2: Cox & Snell = 0.075, Nagelkerke = 0.100) and its prediction accuracy stands at 61.5%, the results underscore that enhancing production capacity—rather than focusing on price stability or cooperative membership—should be prioritized in policy interventions to improve smallholder farmers' market participation. These findings offer actionable guidance for agricultural development strategies in Karatu and similar settings.

Table 4.6: Multinomial regression results to determine factors that influence smallholder market decision in Karatu district

	B	Std. Error	Wald	df	Sig.	Exp(B)	95% Confidence Interval for Exp(B)	
							Lower Bound	Upper Bound
Intercept	-0.794	0.395	4.040	1	0.044			
[Price variation= Not vary]	-0.342	0.256	1.784	1	0.182	0.710	0.430	1.173
[Price variation= Vary]	0			0				
[Wheat production=<1000 hectare/tonnes]	1.118	0.352	10.113	1	0.001	3.060	1.536	6.097
[Wheat production=1000-1500 hectare/tonnes]	0			0				
[Farm distance=1-5 Km]	0.118	0.475	0.061	1	0.804	1.125	0.443	2.853
[Farm distance= 6-10 Km]	0			0				
[Membership of AMCOS= No]	-0.136	0.255	0.282	1	0.596	0.873	0.529	1.441
[Membership of AMCOS= Yes]	0			0				

Key:

1. Likelihood ratio test: Model fitting criteria -2 log-likelihood=42.897, X2=20.921, df=4 and P-value=0.000
2. Goodness of Fit: Pearson: X2=4.872, df=7, P-value=0,676, Deviance: X2=5.339, df=7 and P-value=0.619
3. Pseudo R-square: Cox&Snell=0.075, Negelkerke=0.100 and McFadden=0.056
4. Classification 61.5%

Source: Field data, (2023)

CHAPTER FIVE: CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

Smallholder wheat production levels in Karatu district were below-average wheat production. This shows that smallholder farmers in the district face challenges that limit their wheat yield. Wheat production in Karatu is mainly affected by the farmers having insufficient land size which limits them into having high wheat yields. Smallholder farmers put less concern in wheat production due to poor productivity of the crop, having alternative sources of income (tourism activities) better performance of other crops (Maize, Flowers, Peas and Beans) wheat market stress and lack of external motivation. According to literature, these factors match factors affecting smallholder farmers in the other regions of developing countries particularly sub-Sahara Africa. The gap of barriers to wheat production and marketing, and performance of wheat sector have been narrowed in developing countries which imply that the challenges are manageable. The responses from farmers in Karatu District and the government mean that wheat production and marketing challenges are well known and the government and farmers are aware about the downfall of the production but there are no serious measures that have been taken yet.

The analysis of wheat production levels among smallholder farmers in Karatu District reveals a significant disparity in yield performance. A majority 66.3% of farmers produce less than 1,000 kg, indicating widespread production constraints. These challenges are linked to environmental, biological, and technological factors, with climate variability particularly precipitation and temperature changes. These were identified as a major contributor to reduced yields. Conversely, 33.7% of farmers achieve yields between 1,000 and 1,500 kg, shows that improved farming practices, better resource access, and effective management strategies can enhance wheat productivity in Karatu.

The findings from the second objective reveal two major barriers hindering wheat production among smallholder farmers in Karatu District. The foremost challenge, reported by 46.3% of respondents, is the lack of capital. This financial constraint limits farmers' ability to acquire essential inputs such as seeds, fertilizers, pesticides, labor, and machinery, thereby undermining productivity and access to modern agricultural practices.

The second major barrier, cited by 43.0% of respondents, relates to intercropping limitations. Due to small land sizes and high food demand, many farmers prioritize food crops that allow intercropping such as maize and beans over wheat, which requires monoculture farming for effective management. The incompatibility of wheat production with current land use strategies and machinery constraints contributes to reduced wheat cultivation.

Objective three give key insights into the marketing behaviour and decision-making factors of wheat smallholder farmers in Karatu District. The results reveal technical support and market assurance are the most influential factors, each identified by 41.5% of respondents. This show that farmers place high value on accessible agricultural knowledge and dependable market structures, underscoring the need for capacity-building and stable marketing systems. Farmers utilize a range of market outlets, with AMCOS and brokers being the most prominent. The factors influencing farmers' choice of outlet are largely driven by better pricing (41.9%) and favourable market conditions (45.6%), reflecting a strong preference for economic viability and quality of service.

5.2 Conclusion

This study provides critical, actionable insights into the determinants of smallholder farmers' market participation in Karatu district, with compelling evidence that production capacity is the dominant driver of market decisions. The multinomial regression analysis decisively demonstrates that farmers producing less than 1000 hectare/tonnes of wheat exhibit significantly different market behaviours (coefficient = 1.118, p=0.001), reinforcing that enhancing productivity must be the cornerstone of agricultural interventions. Contrary to conventional assumptions, price fluctuations, farm proximity, and cooperative membership showed no measurable impact, challenging existing narratives and redirecting policy priorities. While the model’s moderate explanatory power (Nagelkerke R^2=0.100) confirms the complexity of market decisions, it also highlights an urgent need for further research to uncover additional influencing factors—potentially including access to credit, market information systems, or climatic variables.

These findings not only refine the understanding of smallholder decision-making but also provide a data-driven foundation for policymakers to design targeted, evidence-based strategies that maximize market engagement and economic resilience in Karatu and similar agrarian economies. Future studies should build on this work to untangle the remaining unexplored dimensions of farmers' market choices.

5.3 Recommendations

5.3.1 Strengthening Technical Support Programs

Given the strong link between wheat production levels and market participation, agricultural extension officers must focus on enhancing smallholder productivity through targeted capacity-building. This involves providing practical training on improved agronomic practices, climate-smart technologies, and post-harvest management. Key actions include conducting hands-on demonstrations of efficient farming techniques, organizing localized farmer field schools for skill reinforcement, and facilitating access to high-quality inputs like drought-resistant seeds and micro-irrigation. By equipping farmers with these tools, extension officers can boost yields and improve market decisions, while regular monitoring ensures adoption and measures impact.

5.3.2 Promoting Access to Finance

The study identified the lack of capital as a prevalent barrier among smallholder farmers. Policymakers and financial institutions should collaborate to develop and implement accessible financial support mechanisms, including credit facilities and grants, to alleviate the financial constraints faced by farmers and enhance their capacity to invest in inputs and technologies.

5.3.3 Facilitating Market Assurance Mechanisms

Recognizing the importance of market assurance in farmers' decision-making, efforts should be directed towards establishing reliable market structures. Strengthening market institutions, ensuring transparent pricing mechanisms, and providing information on

market trends can contribute to building farmers' confidence and encouraging more strategic market choices.

5.4 Further Research

Considering the increasing demand for wheat in Karatu and national wide, efforts to ensure better production and supply are inevitable. Despite the challenges covered by this research to be the major barrier, there is no clear research on the wheat breeds that fit the location and description of soil characteristics and location in respect to varieties of fertilizers, type of seeds and chemicals.

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APPENDICES

Appendix I: Respondents Questionnaire

KENYATTA UNIVERSITY

MASTERS OF ENVIRONMENTAL PLANNING AND MANAGEMENT

BARRIERS TO SMALLHOLDER FARMERS PRODUCTION AND MARKETING OF WHEAT IN KARATU DISTRICT

HOUSEHOLD/INDIVIDUAL QUESTIONNAIRE

I am Masters Student from the Department of Environmental Planning and Management at Kenyatta University. In order to fulfil the requirements of this degree programme, I am carrying out a study titled: **BARRIERS TO SMALLHOLDER FARMERS PRODUCTION AND MARKETING OF WHEAT IN KARATU DISTRICT.** I am kindly seeking your indulgence in fulfilling this questionnaire. The information provided in the questionnaire will be used for academic purpose only and will be treated as confidential.

1. Please fill in the information below

Name (Optional)		
Telephone (Optional)		
District		
Ward		
Village		
Sub Village/Kitongoji		
GPS Coordinate	X	Y

2. Household Characteristics

Household Member (optional)	Sex	Age (yrs)	Education Level	Main occupation	Farming land size	Earnings from main occupation
1.						
2.						
3.						
4.						
5.						
6.						
7.						
8						

3. Please indicate the total monthly income of your household (Tshs)

[ ] ≤ 100,000 **[ ]** 100,001 – 200,000 **[ ]** 200,001 – 300,000 **[ ]** 300,001 – 400,000 **[ ]** 400,001 – 500,000 **[ ]** 500,001 – 700,000 **[ ]** 700,001 – 1,000,000 **[ ]** Over 1,000,000

4. i. a) Indicate land ownership.

Leasehold	Freehold	Trust Land	Private

b) If leasehold, indicate the amount paid (per acre)?.....Tsh.

ii. What is the size of land used for farming? ……..acres

5. (a) Do you cultivate wheat? Yes [ ] No [ ]

(b) If yes in 5 (a) above what type of farming do you practice? [ ] Irrigation [ ] Rainfed

(c) Do you farm for commercial, subsistence or for both?

Commercial [ ] Subsistence [ ] both [ ]

(d) What size of land do you cultivate wheat?

[ ] ≤ ¼ acre [ ] ½ - 1 acre [ ] 1.1 – 5 acres [ ] 5.1 – 10 acres [ ] more than 10 acres

(e) Why do you cultivate the mentioned size of land in 5 (d) above?

……
……

6. (a). What are the inputs required for wheat production?

i…….
ii……
iii…….
iv……
(b). How much do you cultivate?

Land size	Input cost	Expected output	Actual output

7. What is the general cost of inputs per acre? ……Tsh.

8. What is the likely general maximum output per acre? …….Kg/Tones.

9. How much do you usually produce per acre?..... Kg/Tones.

10. Where do you sell your wheat produce?

At Farm [ ] Home [ ] Store [ ] Local market [ ] Other [ ]

11. a) To whom do you sell the produce?

Broker [ ] Large scale farmer[ ] cooperative [ ] Manufacturer [ ] Government [ ]

b) Give reason to 11. a) above

……
……..

12. What is the amount of price variation between buyers? ……Tsh

13. When do you sell the produce? Soon after Harvest [ ] After storage [ ]

14. a) Do you practice any value addition to your produce? Yes [ ] No [ ]

b) If yes in a) above, which value addition?
.....……

c) In what cost?.....Tsh

d) What is the price of the produce after value addition? …….Tsh.

15. a) How long do you store your produce before selling? ……..Months

b) Give reason in a
above.....

16. What are the other crops do you cultivate?

Crop	Reason for selection	Production challenge	Marketing challenges

17. What are the advantages of wheat farming to your household?

.....
.....
.....
.....
.....

18. Challenges of wheat

	Pre-production	During production	Harvesting/storage	Marketing
Biophysical				
socioeconomic				
technological				

cultural				
political/policy				
Others				

19. Comment on the suitability of the wheat farming given the climate elements of the area.

……
……
……
……
……
…….....

20. In your opinion, what measures need to be put in place by the following stakeholders in order to promote wheat production and marketing?

Stakeholder	**Comments**
1. Government agencies (specify)	
2. The Community (Famers & CBOs)	
3. NGOs	
4. Any other stakeholders (Specify)	

Appendix II: Institutional Questionnaire

KENYATTA UNIVERSITY

MASTERS OF ENVIRONMENTAL PLANNING AND MANAGEMENT

BARRIERS TO SMALLHOLDER FARMERS PRODUCTION AND MARKETING OF WHEAT IN KARATU DISTRICT

I am Masters Student from the Department of Environmental Planning and Management at Kenyatta University. In order to fulfill the requirements of this degree programme, I am carrying out a study titled: **BARRIERS TO SMALLHOLDER FARMERS PRODUCTION AND MARKETING OF WHEAT IN KARATU DISTRICT.** I am kindly seeking your indulgence in fulfilling this questionnaire. The information provided in the questionnaire will be used for academic purpose only and will be treated as confidential.

1. Please fill in the information required in the table below

Name of Institution	
Year of establishment	
Mandate (in relation Karatu smallholder farmers)	

2 (a). What are the policies governing wheat farming and marketing in Karatu District?

Policy initiative	**Policy admin level**	**Strength**	**Weaknesses**	**Comments on Way forward**
1.				
2.				
3.				

(b). What challenges are faced in the enforcement of the above-named policies?

……
……
……

3. (a). What is the allocated budget for wheat farming in Karatu?

……

(b). What is the total population of Karatu District?

…….

4. What is the number of farmers cultivating wheat in Karatu?

……

5. (a). i. What is the wheat production level?.....

ii. What was the target?

…….....

(b). How much land is under wheat production?

……..

(c). What are other crops production and target?

Type of crop	Target Production	Actual Production

6. What problems constrain the wheat production in Karatu District?

……
……
……

7. What are other suitable crops in Karatu Agro-Ecological Zone?

i…….
ii……
iii……..
iv……

8. Comment on the availability of the following; to small holder farmers wheat production and marketing (tick one)

	Poor	Available	Sufficient
Suitable land			
Quality seeds			
Affordable fertilizer			
Training			
Market			
Favorable climate			
Capital			
Labour			
Pesticides			
Technology			
Government support			
Others (specify)			

9. What are the challenges facing farmers in production and marketing of wheat?

Production	Marketing

10. What is your institutional role in influencing production and marketing of wheat in Karatu District?.....

11. Comment on the smallholder farmers commitment in production and marketing of Wheat.

……
……

12. In your opinion, what measures need to be put in place by the following stakeholders in order to promote Smallholder wheat production in Karatu?

Stakeholder	**Comments**
Government agencies (specify)	
The Community (Famers & CBOs)	
NGOs	
Any other stakeholders (Specify)	

Appendix III: Tanzanian Ministry Approval

UNITED REPUBLIC OF TANZANIA

MINISTRY OF AGRICULTURE, LIVESTOCK AND FISHERIES

F78

Phone Address: "KILIMO"
TELEFAX: +255 22 2861910
+255 22 2861908
Phone: +255 22 250 2314
Email: info@kilimo.go.tz

Administration Department,
Kilimo1 Nelson Mandela
Road,
P. O. Box 9152
Dar es Salaam

Ref. No.: MA/TR/NS/152/2020

27th October, 2020

Mr. Bonaventura Audifas Tarimo
P. O. Box 994,
MOROGORO.

RE: PERMISSION TO CONDUCT RESEARCH ON WHEAT IN KARATU DISTRICT

Dear Mr. Tarimo,

I acknowledge receipt of your letter and research proposal dated 26th October 2020, requesting permission to conduct study research on **Barriers to smallholder Farmers in Production and Marketing of Whet in Karatu District, North Tanzania**. The Ministry of Agriculture, Livestock and Fisheries, appreciates your interest in contributing to agricultural research, which is vital for the development of the sector in Tanzania.

After reviewing your request, I am pleased to inform you that permission is hereby granted for you to proceed with your research in Karatu District. You are required to report to the Karatu District Executive Director (DED) for coordination and necessary guidance before commencing your fieldwork. The DED's office will facilitate your engagement with local authorities and farmers as needed.

Adhere to the following conditions:
1. Compliance with Ethical Standards: Ensure that your research follows all ethical guidelines, including obtaining informed consent from participants and respecting local norms and regulations.
2. Data Sharing: Submit a copy of your final research findings to the Ministry of Agriculture Livestock and Fisheries, for review and potential policy recommendations.
3. Coordination: Maintain regular communication with the District Agricultural Officer and the DED's office throughout your study.

We appreciate your commitment to advancing knowledge in wheat production and marketing.

Wishing you success in your research endeavors.

Sincerely,

Haule G. Machela
For Permanent Secretary
Ministry of Agriculture, Livestock and Fisheries

Cc:
- District Executive Director, Karatu
-Training and Research Department

Appendix IV : Tanzanian Regional Administrative Approval

UNITED REPUBLIC OF TANZANIA
PRESINDENT'S OFFICE
REGIONAL SECRETARY AND ADMINISTESTRATIVE

KARATU DISTRICT COUNCIL

Phone: +255 27 297 0650
Fax: +255 27 297 0649
Email: ded@karatudc.go.tz
Website: www.karatudc.go.tz
When replaying please quote: -
Ref. No. KDC/DED/CD/3/VOL. III/237

S. L. P. 190,
Karatu,
Arusha.

Date 28th April,2025

Dean, Graduate School
Kenyata University
P. O. Box 43844, 00100
NAIROBI - KENYA

RE: RESEARCH PLACEMENT FOR MR. BONAVENTUREA AUDIFAS TARIMO

Refer to the above heading and Letter dated 17TH February 2021 with Ref. N50EA/38527/2017.

I am glad to inform you that the above-mentioned student has been given an opportunity to collect Data Concerning for his Research Titled "Barriers to Small holder Farmers Production and Marketing of Wheat in Karatu District North Tanzania" as requirement for the fulfillment for his studies from May, 2021 to May, 2022.

We gave him maximum cooperation.

Yours sincerely,

Magreth L. Mmasi
For District Executive Director
KARATU

MKURUGENZI MTENDAJI
HALMASHAURI YA WILAYA
KARATU

Copy to: -

1. DALFO – Karatu
2. Mr. Bonaventurea Audifas Tarimo

Appendix V: Kenyatta University Authorization Letter

(4)

KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Our Ref: N50EA/38527/2017 DATE: 26th October, 2020

Director General,
National Commission for Science, Technology
and Innovation
P.O. Box 30623-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR AUDIFAS BONAVENTURA REG. NO. N50EA/38527/2017

I write to introduce Mr. Audifas Bonaventura who is a Postgraduate Student of this University. He is registered for M.Env. degree programme in the Department of Environmental Planning and Management.

Mr. Bonaventura intends to conduct research for a M.Env. Project Proposal entitled, "Barriers to Smallholder Farmers Production and Marketing of Wheat in Karatu District, North Tanzania".

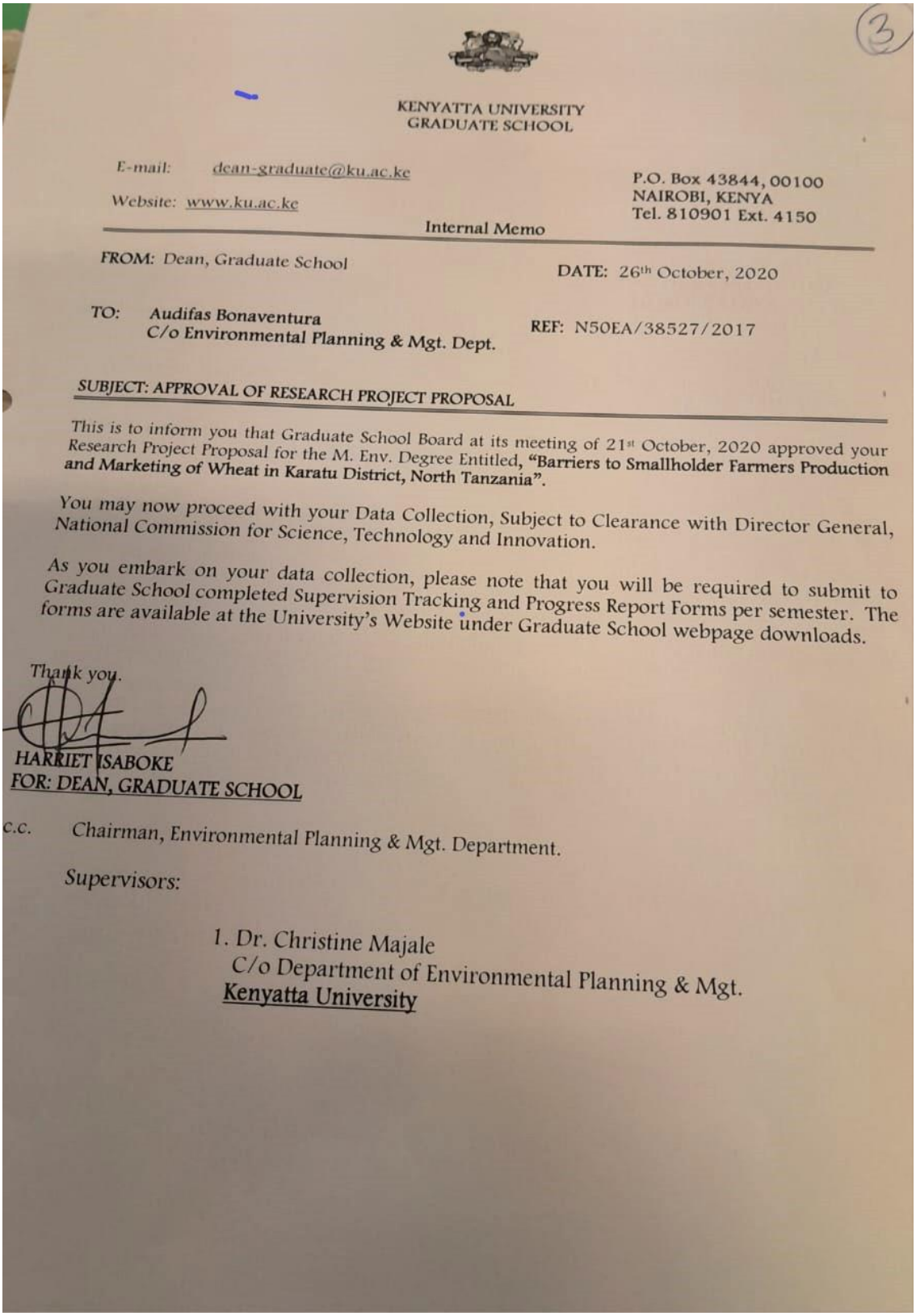
Any assistance given will be highly appreciated.

Yours faithfully,

PROF. ELISHIBA KIMANI
DEAN, GRADUATE SCHOOL

HI/enj

Appendix VI : Kenyatta University Approval Letter



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke
Website: www.ku.ac.ke

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 810901 Ext. 4150

Internal Memo

FROM: Dean, Graduate School

DATE: 26th October, 2020

TO: Audifas Bonaventura
C/o Environmental Planning & Mgt. Dept.

REF: N50EA/38527/2017

SUBJECT: APPROVAL OF RESEARCH PROJECT PROPOSAL

This is to inform you that Graduate School Board at its meeting of 21st October, 2020 approved your Research Project Proposal for the M. Env. Degree Entitled, **"Barriers to Smallholder Farmers Production and Marketing of Wheat in Karatu District, North Tanzania".**

You may now proceed with your Data Collection, Subject to Clearance with Director General, National Commission for Science, Technology and Innovation.

As you embark on your data collection, please note that you will be required to submit to Graduate School completed Supervision Tracking and Progress Report Forms per semester. The forms are available at the University's Website under Graduate School webpage downloads.

Thank you.

HARRIET ISABOKE
FOR: DEAN, GRADUATE SCHOOL

c.c. Chairman, Environmental Planning & Mgt. Department.

Supervisors:

1. Dr. Christine Majale
C/o Department of Environmental Planning & Mgt.
Kenyatta University