

**EFFECTS OF MILK BULKING GROUPS ON SMALL-SCALE MILK
PRODUCERS' INCOMES IN THYOLO AND BLANTYRE DISTRICTS**

MSc (THESIS TRANSFORMATIVE COMMUNITY DEVELOPMENT)

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MZUZU UNIVERSITY

DECEMBER 2025.

**EFFECT OF MILK BULKING GROUPS ON SMALL-SCALE MILK
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**A THESIS SUBMITTED TO THE FACULTY OF ENVIRONMENTAL
SCIENCES, DEPARTMENT OF AGRI-SCIENCES IN FULFILMENT
OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF
SCIENCE DEGREE (MSC) IN TRANSFORMATIVE COMMUNITY
DEVELOPMENT.**

MZUZU UNIVERSITY

DECEMBER, 2025

DECLARATION

I hereby declare that this thesis titled “Effect of milk bulking groups on small-scale milk producers’ incomes in Thyolo and Blantyre Districts” has been written by me and is a record of my research work. All citations, references, and borrowed ideas have been duly acknowledged. This submission is made in fulfilment of the requirements for the award of the Degree of Master of Science (MSc) in Transformative Community Development at Mzuzu University. None of the present work has been submitted for any degree or examination at any other university.



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CERTIFICATE OF APPROVAL

This thesis, “Effect of milk bulking groups on small-scale milk producers’ incomes in Thyolo and Blantyre Districts by Jollam Jester, is submitted with our approval as university supervisors for the MSc in Transformative Community Development

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Date 10/12/2015

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Second Supervisor

DEDICATION

I dedicate this work to Almighty God, my aunt Lydia Meleka and her husband, for taking care of me since the death of my parents. I appreciate your motherly love and kindness. To my wife Mary and my children Khloe, Karen and Kai who inspire me to be a better person every day.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank Almighty God for His grace, love, and faithfulness in providing me with this opportunity to study and for the continued strength and sustenance that He has given me throughout my journey. Second, I would like to express my sincere gratitude to my supervisors, Dr. Frank Mnthambala and Dr Ulemu Msiska, for their timely feedback, invaluable expertise, and encouragement throughout this research project.

I also acknowledge all the participants for their time and the information they provided, which made this work possible.

Further, I also appreciate my wife Mary Thayo Jester for her constant support and encouragement. Lastly, I thank all my friends and classmates for their assistance and support.

The study was made possible using the researcher's resources.

LIST OF ABBREVIATIONS AND ACRONYMS

ATE	Average Treatment Effect
ESR	Endogenous Switching Regression
FIML	Full Information Maximum Likelihood
ICA	International Cooperative Alliance
MBG	Milk Bulking Group
MK	Malawi Kwacha
MZUNIREC	Mzuzu University Research Ethical Committee

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ABSTRACT

Small-scale dairy farmers in Malawi face persistent challenges in marketing their milk and improving their incomes. To address these issues, Malawi has promoted Milk Bulking Groups (MBGs), which provide facilities for bulk handling, storage, and cooling of milk before processors collect it. This study investigated the effect of MBG participation on the incomes of small-scale dairy farmers, the study aimed to (i) Evaluate the efforts of milk bulking groups towards improving dairy farmers' income (ii) Evaluate the factors that influence dairy farmers' decisions to join milk-bulking groups (iii) Assess the determinants of income among milk producers (iv) the study was conducted in Thyolo and Blantyre districts by comparing the incomes of members and non-members. The study employed a cross-sectional, mixed-methods approach with multi-stage, stratified, and simple random sampling. Data were gathered from 258 dairy farmers through surveys and from 8 key informants via qualitative interviews. Quantitative data were analysed using descriptive statistics, t-tests, and endogenous switching regression, while qualitative data underwent content analysis. Results show that MBG members notably benefited from advisory services, credit access, and extension support ($p < 0.001$), whereas non-members had greater access to bull services ($p < 0.001$). Key factors influencing MBG participation included herd size, household size, training, and access to extension services ($p < 0.005$). Determinants of income for MBG members included herd size, transportation mode, and extension services (e.g., each additional cow was associated with a $\beta \approx 0.4$ increase in log annual income, $p < 0.001$; access to extension was $\beta \approx 0.2$, $p < 0.001$). Participation in MBGs significantly increased annual milk income and production: non-members would earn about MK 259,873 more and produce 68 litres more milk per year if they joined an MBG ($p < 0.01$). The study concludes that MBG participation enhances income, productivity, and access to agricultural services for small-scale dairy farmers. Recommendations focus on improving financial support, expanding agricultural services, promoting training, and increasing awareness of MBG benefits.

Keywords: Farmer organisations, food security, participation, Milk Bulking Groups, Malawi

CHAPTER ONE: INTRODUCTION

1.1 Background

Milk production is one of the most important investment enterprises globally, with small-scale farmers earning a regular income, providing employment and contributing to household food security throughout the year (Omore et al. 2004). The dairy sector is estimated to contribute approximately a third of the agricultural Gross Domestic Product in developing countries, and this share is steadily increasing (Baltenweck et al. 2020). The rapid growth in livestock production in these countries is primarily driven by a fast-growing demand for livestock products, fueled by increasing urban populations and rising consumer incomes. Dairy farming is considered an essential activity in the developing world, providing supplementary income, employment, and nutrition to many people, especially in rural areas (Miller et al. 2021).

Increasing population, urbanization, and rising consumer income are expected to further increase the demand for milk and milk products in Malawi, as they form an integral part of the local diet (Hirvonen et al. 2024). In Malawi, small-scale landholders dominate milk production, and the number of milk producers is growing steadily. These conditions create opportunities for smallholder farmers to achieve greater market integration, particularly for serving urban consumers, which could significantly improve rural income. A study by Hirvonen et al. (2024) found that several governmental policies and international interventions have been implemented to foster the development of Malawi's emerging modern dairy value chain, which includes processing and caters to the growing urban market.

Milk-bulking groups (MBGs) play a critical role in reducing production and transaction costs, such as accessing high-quality services, technology, inputs, and transportation, while also improving coordination along the value chain (Guerrero et al. 2023). By reducing these costs,

MBGs facilitate market integration and improve farmers' access to urban markets (Staal, Delgado & Nicholson 1997). MBGs are particularly crucial in the dairy sector due to the perishable nature of dairy products, which makes them more vulnerable to opportunistic behavior from buyers compared to products that can be stored (Guerrero et al. 2023). Farmers in Malawi utilize various marketing channels, both formal and informal (Revoredo-Giha & Renwick 2016). Among these, cooperatives and MBGs stand out as key formal marketing channels. MBGs are farmer-based collectives that aggregate milk from smallholder farmers, store it in cooling tanks, and sell it to processors. These organizations help farmers by significantly reducing transaction costs, especially for those who otherwise struggle to access markets (Chitika 2008).

Small-scale dairy farming plays a crucial role in the agricultural livelihoods of many countries worldwide. Approximately 150 million households are involved in milk production worldwide, with a significant number being small-scale farmers in developing countries. Dairy farming provides essential contributions to household income, food security, and nutrition (Miller et al. 2021). In many developing regions, demand for milk and dairy products is steadily increasing due to population growth, urbanisation, and rising incomes, which, in turn, drives the expansion of smallholder dairy production. Sub-Saharan Africa exemplifies this trend, as dairy farming has become a significant source of rural income generation and employment, offering a consistent cash flow and improving household nutrition for farming communities (Onyango et al. 2023). Smallholder dairy farming is a cornerstone of rural economies in numerous developing countries, serving as a primary source of livelihood for farmers and contributing to food security (Omore et al. 2004). However, small-scale dairy farmers encounter several challenges, including limited market access, inadequate infrastructure, high transaction costs, and low bargaining power. In response to these obstacles, Milk Bulking Groups (MBGs) have emerged as a crucial strategy to enhance the productivity and incomes

of smallholder dairy farmers. By consolidating milk supply, providing access to essential services, and fostering collective action, MBGs aim to improve the situation for these farmers (Chitika 2008).

In Malawi, milk and its products are integral to the local diet, with small-scale farmers dominating the national milk production landscape. The number of dairy producers has been increasing, driven by various government policies and donor-funded initiatives aimed at developing a modern dairy value chain that connects rural producers to urban markets (Tong 2012). A key element of these dairy development efforts is the promotion of Milk Bulking Groups (MBGs) farmer organisations that collectively collect and market milk. Malawi has witnessed a surge in such groups in recent years; as of 2023, there were 121 registered milk bulking groups with over 17,000 smallholder members nationwide (Malawi Milk Producers Association 2025). These groups are widely regarded as a critical institutional framework for advancing dairy development in the country, aligning with national strategies for agricultural commercialisation and poverty reduction.

In addition to improving market access, MBGs offer various support services, such as veterinary care, artificial insemination (AI), training on best farming practices, and access to credit. These services collectively enhance the efficiency of dairy farming, leading to increased milk productivity and improved herd quality (Guerrero et al. 2023). Studies show that farmers participating in MBGs benefit from higher incomes, more reliable markets and reduced production costs due to economies of scale (Tong 2012).

Various factors, including economic incentives, access to key services, social networks, and institutional support, influence dairy farmers' decisions to join MBGs. Farmers are more likely to join MBGs when they perceive potential benefits such as higher milk prices, access to veterinary care, credit facilities and the support of government and non-governmental

initiatives promoting dairy cooperatives (Revoredo-Giha & Renwick 2016). Social networks and peer influence also play a significant role; farmers who observe their neighbours benefiting from group membership are often more inclined to join (Wambugu, Kirimi & Opiyo 2011).

While MBGs offer substantial benefits, their impact on smallholder incomes and production is not uniform. Factors such as herd size, management structure and infrastructure availability significantly affect the success of MBGs. Farmers with larger herds tend to benefit more from bulk selling and cooperative purchases of inputs, while smaller producers experience advantages, especially in terms of market access and reduced post-harvest losses (Chagwiza, Muradian & Ruben 2016). However, poorly managed MBGs, those lacking proper governance or infrastructure, may fail to deliver on their promises, reducing farmer trust and participation (Guerrero et al. 2023).

Despite the emphasis on organizing smallholder dairy producers into groups such as self-help groups, cooperatives, and companies to improve marketing efficiency, smallholder farmers remain hesitant to fully embrace modern marketing outlets (Wambugu, Kirimi & Opiyo 2011). One key condition for dairy farmers to benefit economically is the establishment of reliable and remunerative marketing outlets (Omore et al. 2004). Scholars argue that developing dairy farmer organizations is one of the most effective ways to minimize losses and maximize profits (Omore et al. 2004). However, the actual impact of MBG membership can only be understood when comparing the livelihoods and income of MBG members to those of non-members, as significant improvements are often evident among members.

1.1.1 Efforts of Milk Bulking Groups Towards Improving Rural Livelihoods

Milk Bulking Groups (MBGs) are farmer-based organizations designed to enhance smallholder dairy farmers' access to markets, services, and collective resources. These groups typically aggregate milk from individual farmers, provide cooling and storage facilities, and sell milk in

bulk to processors or urban consumers on behalf of their members. By organising farmers in this manner, MBGs undertake various initiatives aimed at improving rural livelihoods.

One of the primary contributions of MBGs is enhancing market access and bargaining power for small-scale producers. In Malawi, for instance, smallholder farmers utilize both informal and formal milk marketing channels, with cooperatives and MBGs serving as key formal avenues that help farmers navigate the high transaction costs and limited bargaining power associated with selling individually (Revoredo-Giha & Renwick 2016). Through collective bulking and marketing, MBGs empower farmers to negotiate better prices for their milk and ensure more reliable sales.

1.1.2 Factors Influencing Dairy Farmers' Decisions to Join Milk Bulking Groups

Given the array of services and benefits offered by milk bulking groups (MBGs), a crucial question arises: What motivates or deters small-scale dairy farmers from participating in these organisations? The involvement of farmers in MBGs is essential for the success of collective marketing initiatives, and understanding the factors driving this participation can inform strategies to enhance membership where it is advantageous.

Typically, the decision to join an MBG is influenced by a combination of economic, social, and institutional factors. Farmers often weigh the perceived benefits of membership against the costs or barriers associated with joining. Recent studies in sub-Saharan Africa have revealed that economic incentives serve as a primary motivator; farmers are more inclined to join a milk bulking group if they anticipate increased profits or a more stable income from such membership. For example, research conducted in Ethiopia and Kenya indicates that members of dairy cooperatives or groups frequently receive better prices for their milk compared to non-

members, thanks to enhanced bargaining power and the capability to sell in bulk to formal markets (Tissie, Geda & Hamo 2019; Singh et al. 2020).

In Zimbabwe, Musitini, Mushunje and Muroiwa (2019) demonstrated that smallholder dairy farmers engaged in milk bulking schemes experienced significantly higher incomes than those selling milk independently. This disparity largely results from the collective effort, which enables them to stabilise prices and mitigate the price volatility often found in informal markets (Musitini, Mushunje & Muroiwa 2019). The potential to lower transaction costs, such as by sharing transportation through an MBG's milk collection system, and to gain access to a more reliable milk outlet (with assured pickup and payment), makes group membership financially appealing to many farmers. Consequently, the prospect of higher and more stable milk prices, coupled with improved market access, serves as a compelling incentive for joining an MBG.

1.1.3 Determinants of Income Among Milk Producers

Income from small-scale milk production can vary significantly among farming households, with numerous studies examining the factors that contribute to these differences. Identifying the key determinants of dairy income is crucial for understanding how farmers can enhance their earnings and for designing effective interventions to support them. Generally, the factors influencing income among milk producers can be categorized into three main areas: farm-level factors (such as herd size, productivity, and production costs), market and institutional factors (including market access, pricing, cooperatives, and access to credit), and household socio-economic characteristics (such as education, experience, and gender dynamics). Each of these elements can profoundly affect the profitability of dairy farming. (Omore et al., 2005; Baltenweck & Staal, 2007)

The existing literature emphasises that dairy incomes are shaped by a multifaceted interplay of production capacity, market linkages, cost management, and socio-economic factors. Thus, interventions aimed at enhancing smallholder dairy incomes should adopt a holistic approach, focusing on improving herd productivity, bolstering market access through mechanisms such as Milk Bulking Groups (MBGs), reducing input costs, and building human capital—dimensions that will be further explored in the context of this study.

1.1.4 Impact of Participating in Milk Bulking Groups on Small-Scale Producers' Income and Production

Given the efforts made by milk bulking groups (MBGs) and the factors influencing farmer participation, a critical issue remains: the actual impact of MBG membership on the livelihoods of smallholder dairy farmers. This study specifically examines how joining an MBG influences a farmer's income from milk and the overall quantity of milk produced. The prevailing expectation, informed by numerous studies and rural development theories, is that participation in collective marketing groups, such as MBGs, should yield positive effects on both productivity and income. By pooling resources and leveraging marketing power, small-scale farmers can achieve economies of scale and enhanced market integration, which are typically associated with improved outcomes. Indeed, MBGs are widely acknowledged in agricultural economics literature as a significant driver of income growth for small-scale dairy producers, though the extent of this impact can vary based on the specific context (Odongo, Garcia & Viljoen 2010; Thomson et al. 2015).

One of the key advantages of participating in a Milk Bulking Group (MBG) is the potential to achieve higher farm-gate prices and more stable income through collective bargaining. Smallholders, when acting independently, often find themselves selling milk in local informal markets where prices are low and can fluctuate daily. However, by uniting under an MBG,

farmers gain the ability to negotiate supply contracts and secure better terms with large dairy processors and retailers. Odongo, Garcia and Viljoen (2010) noted that farmers organised in cooperative groups were able to harness economies of scale, allowing them to access formal markets that would otherwise be out of reach. Consequently, these farmers enjoyed higher average prices for their milk.

Participation in a milk bulking group (MBG) generally has a beneficial effect on the incomes and production levels of small-scale dairy farmers, as demonstrated by various studies and examples from Malawi and similar contexts. Membership in an MBG tends to enhance the prices farmers receive, stabilise their sales, and provide essential inputs and knowledge needed to increase milk production. This often results in higher household incomes derived from dairy farming (Thomson et al., 2013). However, the extent of this impact can vary and is most pronounced under conditions of effective group management, adequate infrastructure, and additional support, such as access to credit and extension services. For farmers in the Thyolo and Blantyre Districts of Malawi the focus of this study these documented benefits of MBGs highlight the potential gains they could realize. Concurrently, it is vital to rigorously assess and quantify these impacts within the local context, as past research may have overlooked the specific contributions of MBGs in contrast to broader cooperative structures.

1.2 Problem Statement

The dairy sector in Malawi remains an important livelihood source for over 12,000 smallholder dairy farmers, yet the country produces only 65–75 million litres of milk per year, far below the national demand of 150 million litres (DAHLD, 2023). This persistent production gap contributes to low farmer incomes and reliance on imported dairy products. To address these challenges, Milk Bulking Groups (MBGs) have been promoted as a key institutional mechanism for improving milk collection efficiency, strengthening farmers' bargaining power,

and enhancing access to stable markets. Malawi currently has 121 MBGs with more than 17,000 registered members (Malawi Milk Producers Organisation, 2023), demonstrating their growing importance in the dairy value chain.

Despite these investments, the question of how much MBG participation actually increases farmers' income and milk production in Malawi remains insufficiently documented. Evidence from other regions such as India and East Africa shows that cooperative participation can raise milk yields by 15–30%, reduce marketing costs by up to 20%, and increase farm profits (BIRTHAL & JOSHI 2009; Gaillard & Dervillé 2022). However, Malawi-specific studies have largely focused on issues such as milk quality, compliance with standards, or cooperative governance (Kumar, Wright & Singh 2011; Vandeplas & Anneleen 2011). Few studies have quantified the income and production effects of MBGs on Malawian farmers, leaving a significant empirical gap.

Furthermore, smallholder dairy farmers in Malawi continue to face systemic challenges including price fluctuations of up to 40% between dry and rainy seasons, delayed payments by processors, limited access to extension services (with extension-worker-to-farmer ratios exceeding 1:1,800), and high input costs which undermine the potential benefits of MBGs (Shiferaw, Hellin & Muricho 2016; DAHLD, 2022). Variations in governance structures, gender inclusiveness, and market linkages also lead to uneven MBG performance across districts.

This lack of clear evidence has broader implications for national development goals. Malawi's struggle to commercialize the dairy sector undermines progress towards SDG 1 (No Poverty), SDG 2 (Zero Hunger), and SDG 8 (Decent Work and Economic Growth). It also contradicts Malawi Vision 2063, which prioritizes agricultural commercialization and strong producer

organizations, as well as the National Agricultural Policy (2016) and National Livestock Development Policy, which highlight dairy development as a pathway to rural transformation.

Given these gaps, this study sought to determine the extent to which participation in milk bulking groups improves the income and milk production of smallholder dairy farmers in Thyolo and Blantyre. By comparing MBG members and non-members, the study provides empirical evidence on whether MBGs are fulfilling their intended role as a rural development strategy in Malawi's dairy sector. Failure to address this knowledge gap risks continued low incomes among smallholder farmers, persistent rural poverty, and limited growth of the dairy value chain.

1.3 Study Objectives

1.3.1 Main Objective

The main objective of this study was to assess the effects of milk bulking groups in improving farmers' incomes in Thyolo and Blantyre districts, Malawi

1.3.2 Specific Objectives

The specific objectives of this study were to:

1. Assess the efforts of milk bulking groups towards improving dairy farmers' income.
2. Examine the factors that influence dairy farmers' decisions to join milk-bulking groups;
3. Evaluate the determinants of income among milk producers
4. Analyse the impact of participating in milk bulking groups on milk producers' income and production

1.4 Research Questions

The study attempted to answer the following questions:

1. What efforts do milk bulking groups put in place towards improving rural income?
2. What factors influence dairy farmers' decision to join milk-bulking groups?
3. What are the determinants of income among the dairy farmers?
4. What are the impacts of participating in milk bulking groups on small-scale milk producers' milk production quantity and income?

1.5 Study Justification

A systematic evaluation of the specific efforts and services provided by Milk Bulking Groups (MBGs) is fundamental to establishing their baseline contribution to rural development. This assessment moves beyond subjective accounts to provide an empirical account of how MBG activities from input provision to market linkage translate into tangible livelihood improvements for their members, thereby offering a clear foundation for understanding their operational role in the dairy value chain.

Understanding the drivers and barriers to MBG membership is critical for fostering inclusive and sustainable cooperative growth. Identifying the socio-economic and resource factors that predispose farmers to join provides essential intelligence for designing targeted recruitment strategies and ensuring that the benefits of collective action are accessible to a broad spectrum of producers, including marginalized smallholders.

Isolating the key factors that drive profitability is essential for enhancing the economic resilience of dairy farmers. This analysis distinguishes the influence of cooperative membership from other critical production and management variables, thereby pinpointing the most powerful levers for income growth. The findings provide a strategic evidence base for farmers and advisors to prioritize investments and practices that deliver the highest financial returns.

Knowing how much MBG participation improves farmers' income is particularly important for several reasons. First, it provides evidence on whether these institutions are effectively

delivering on their promise to reduce rural poverty and improve livelihoods, as envisioned under Sustainable Development Goals (SDGs) 1 and 2 and Malawi Vision 2063's pillar of agricultural commercialization and wealth creation. Second, it allows policymakers and development partners to make informed decisions on where to channel resources and how to strengthen dairy cooperatives for maximum impact. Third, it empowers farmers and stakeholders with data-driven insights on the tangible benefits of collective action, which can encourage broader participation and sustainability of MBGs.

Quantifying the causal impact of MBG participation, therefore, represents the ultimate test of the model's value proposition. This objective provides robust, empirical evidence on the specific contributions of membership to key performance indicators such as income and yield. Such evidence is indispensable for guiding policy, investment, and extension strategies that support inclusive and transformative growth in Malawi's dairy sector.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviews various literature related to the impacts of Milk Bulking Groups (MBGs) on the income of small-scale dairy producers in Malawi and elsewhere. Its purpose, therefore, is to present a review of the international experience of farmer organizations in the broader context of agricultural development as documented in secondary literature on the subject matter. (Onyango et al., 2023; Gaillard & Dervillé, 2022; Dube et al., 2022). (Cheng et al., 2025; Azeze et al., 2024; Nyambo et al., 2024).

2.2 Efforts of milk-bulking groups toward improving rural income

Milk-bulking groups play a crucial role in enhancing rural incomes by implementing various efforts to improve smallholder dairy farmers' access to markets, increase milk productivity, and strengthen dairy value chains. These groups are established to create collective action, enabling farmers to overcome structural challenges such as low bargaining power, market inefficiencies and inadequate access to essential dairy production inputs and services.

Milk-bulking groups are improving market access for farmers by consolidating milk supplies and establishing linkages with large-scale dairy processors and urban markets. Tak et al (2019) found that milk-bulking groups negotiate better prices on behalf of farmers, ensuring they receive fair compensation for their produce. Farmers benefit from reduced transaction costs and greater price stability by selling milk in bulk, protecting them from seasonal price fluctuations. In rural Zimbabwe, Dube et al. (2022) found that milk-bulking groups actively coordinated transportation and storage facilities, allowing smallholder farmers to penetrate more profitable urban markets and sustain consistent milk sales.

Emukule et al. (2018) emphasizes that training and advisory initiatives help maintain high milk quality, thereby enhancing its marketability. Njiru et al. (2023) observed that milk-bulking groups in Kenya organized regular training workshops, leading to increased farmer productivity and better compliance with dairy industry standards. Furthermore, these groups provide advisory support on disease control, pasture management, and efficient feeding strategies, ensuring that farmers optimize their milk production potential. Similarly, a study by Omore et al. (2004) emphasized that extension support through milk-bulking groups enhances farmer knowledge on best dairy farming practices, including efficient milking techniques, pasture management, and disease prevention strategies. Tak et al. (2019) further noted that regular extension visits and farmer engagement sessions contribute to increased farm efficiency and improved productivity, leading to higher income

Andreas Wilkes (2019) found that dairy cooperatives in East Africa actively partnered with financial institutions to secure loans and grants for farmers. By offering credit facilities, these groups enable farmers to expand their dairy enterprises, upgrade their infrastructure, and increase their milk yields, ultimately improving their incomes. Additionally, some milk-bulking groups establish internal savings and loan schemes among members, fostering financial resilience and enabling farmers to reinvest in their businesses (Omore et al. 2004). Abot (2020) reported that milk-bulking groups in Uganda have actively promoted AI adoption, leading to improved dairy breeds with higher milk yields and greater disease resistance. In cases where AI is inaccessible, bull services are coordinated to ensure smallholder farmers continue to benefit from structured breeding programs. Kaumbata et al. (2021) highlight that organized breeding services have resulted in superior dairy herds, which translate into increased milk production and higher farmer incomes. Milk-bulking groups also make significant efforts in veterinary services provision, ensuring the health and productivity of dairy cattle. Odongo et al. (2010) found that through these groups, farmers receive coordinated

disease surveillance, vaccination programs, and routine veterinary checkups, which reduce livestock mortality rates and improve milk yields. The collective approach to veterinary services enables farmers to access expert support at lower costs compared to individual arrangements, making livestock health management more affordable and effective.

A study by Njiru et al. (2023) reported that dairy cooperatives in East Africa distribute subsidized concentrated feed and high-quality fodder seeds to members, ensuring proper cattle nutrition while Mwangi et al. (2023) found that farmers who received improved fodder varieties, such as Napier grass and lucerne, recorded significant increases in milk production by promoting better feeding techniques and ensuring continuous access to nutritious feed.

Research in other contexts reinforces these advantages. In rural Zimbabwe, dairy groups that bulk and market milk on behalf of farmers have been shown to secure fair prices and shield farmers from seasonal price fluctuations by negotiating supply contracts with processors (Dube-Takaza, Maumbe & Parwada 2022). By selling in bulk, farmers also benefit from reduced transport and transaction costs, thereby increasing their net returns. This collective approach stabilizes incomes and protects farmers from the exploitative practices of middlemen, which often occur when perishable products like milk are sold individually without coordination (Guerrero et al. 2023). Overall, the market linkage and price negotiation functions of MBGs enable rural dairy producers to achieve higher and more stable earnings for their milk, thereby directly contributing to improved livelihoods.

Beyond marketing, Milk Bulking Groups (MBGs) offer various support services that enhance productivity and alleviate the challenges faced by smallholder dairy farmers. Among these efforts, training and extension services stand out as significant initiatives. Many MBGs regularly organize farmer training programs, workshops, and on-farm demonstrations to promote best practices in animal husbandry, milk handling, and business management. For

example, dairy cooperatives in Kenya have been observed conducting routine training sessions for their members, which have resulted in improved compliance with quality standards and increased farm productivity (Njiru, Namusonge & Thogori 2023).

Likewise, the extension support provided by MBGs—offering guidance on disease control, pasture management, and enhanced feeding techniques—has been shown to elevate farmers' knowledge and skills, ultimately leading to greater milk yields and improved milk quality (Emukule et al. 2018; Omore et al. 2004). These initiatives translate into higher incomes for farmers. For instance, regular extension visits and farmer field schools organized by dairy groups in East Africa have been associated with notable enhancements in herd productivity and farm efficiency, consequently boosting household dairy income (Tak, Shankar & Kadiyala 2019). By fostering human capital through training and advisory services, MBGs empower farmers to produce more milk of higher quality, thereby strengthening their livelihoods.

An essential initiative of MBGs is enhancing farmers' access to financial services and essential inputs, which are frequently inaccessible to isolated smallholders. Many dairy cooperatives collaborate with financial institutions or establish internal savings and loan programs to provide credit to their members. According to Wilkes, Dijk and Odhong (2019), dairy cooperatives in East Africa have effectively facilitated farmers' access to loans and grants by acting as guarantors or intermediaries with banks. Through these credit facilities, small-scale farmers can invest in expanding their dairy operations, such as acquiring additional cows, constructing improved barns, or purchasing milk-cooling equipment—all of which can boost productivity and income.

In some instances, MBGs themselves create revolving funds or savings groups among their members, promoting financial resilience and enabling continuous reinvestment at the farm level (Omore et al. 2004). Access to credit and capital has a direct influence on rural

livelihoods, alleviating a major constraint on smallholder intensification: the liquidity needed for farm improvements. Moreover, MBGs often engage in bulk purchasing of farm inputs, providing them to members at subsidized rates. These inputs may include cattle feed, mineral supplements, and various farm equipment. A recent study in East Africa revealed that dairy cooperatives distribute subsidized high-quality feed concentrates and improved fodder seeds, such as Napier grass and lucerne, to their members, ensuring better nutrition for their cattle (Njiru, Namusonge & Thogori 2023; Mwangi et al. 2023). Farmers who accessed these improved fodder varieties through their groups reported significant increases in milk production, attributed to enhanced nutritional feeding practices (Mwangi et al. 2023). By leveraging collective action to lower input costs and enhance input quality, MBGs help farmers increase productivity and reduce unit costs, thereby improving profit margins and household incomes.

Milk bulking groups (MBGs) play a pivotal role in enhancing the capacities and incomes of smallholder dairy farmers by investing in essential breeding and veterinary services that would otherwise be unaffordable for individual farmers. A salient example of this is the promotion of artificial insemination (AI) within several milk bulking groups, which enables the coordination of breeding programs aimed at improving the genetic quality of members' herds. In Uganda, the proactive encouragement of AI usage among smallholder dairy groups has led to the development of higher-yielding, disease-resistant crossbred cattle, resulting in increased milk production per animal (Abot 2020).

In circumstances where AI services are not readily available, MBGs have been known to establish bull centres or community bull services, thereby ensuring that even remote farmers can breed their cows in a timely and organised manner (Abot 2020; Kaumbata et al. 2021). Empirical studies suggest that such organised breeding services foster the development of

superior dairy herds over time, which correlates with augmented milk production and heightened incomes for farmers (Kaumbata et al. 2021).

Moreover, MBGs frequently provide crucial animal health services by collaborating with veterinarians and animal health practitioners to implement comprehensive herd health programs for their members. These programs typically encompass regular vaccinations, deworming, and disease surveillance. Such a collective approach to veterinary care has demonstrated effectiveness in reducing both livestock mortality and morbidity. For instance, research conducted by Odongo, Garcia and Viljoen (2010) revealed that farmers engaged in organised dairy groups benefited from coordinated veterinary services, which significantly decreased disease incidence and improved overall herd productivity.

By distributing the costs associated with veterinary services among group members and scheduling routine farm visits, MBGs enhance the affordability and accessibility of animal healthcare for smallholders. Healthier and more productive cows not only increase milk yields but also experience more frequent calving, thereby contributing to a sustainable rise in farmers' incomes over time.

Through initiatives that encompass market access, training, input provision, credit facilitation, improved breeding practices, and veterinary support, milk bulking groups deliver comprehensive and multifaceted assistance to small-scale dairy farmers. These initiatives aim to strengthen the capacities of farmers, mitigate the structural challenges they face, and ultimately enhance rural livelihoods by securing higher and more stable incomes derived from dairy farming.

2.3 Factors that influence dairy farmers' decisions to join milk-bulking groups

Milk-bulking groups play a crucial role in the dairy industry by improving farmers' market access, increasing their bargaining power, and providing essential production support. The decision of dairy farmers to join these groups is influenced by multiple factors, including economic benefits, access to services, social networks, and institutional support. Understanding these factors is essential for promoting wider participation and enhancing the effectiveness of milk-bulking initiatives.

According to Tissie, Geda and Hamo (2019), farmers who join MBG often receive better milk prices due to increased bargaining power. Bulk selling reduces transaction costs and ensures a more reliable market for dairy farmers, making group membership financially attractive while a study by Musitini, Mushunje and Muroiwa (2019) found that in rural Zimbabwe, farmers who were part of milk-bulking groups earned significantly higher incomes compared to those selling milk individually. The collective approach allows for price stabilization, mitigating the risk of extreme price fluctuations that often characterize informal milk markets.

Access to essential services such as veterinary care, breeding programs, and financial credit also motivates farmers to join milk-bulking groups Habiyaremye et al. (2021) reported that farmers who were members of dairy cooperatives had better access to artificial insemination (AI) and bull services, leading to improved herd genetics and higher milk yields. Similarly, Odongo, Garcia and Viljoen (2010) found that milk-bulking groups in Southern Africa facilitated veterinary services, including disease control programs, vaccinations, and regular health check-ups, which reduced livestock mortality and increased productivity. Financial support is another critical factor as some milk-bulking groups provide access to credit facilities that enable farmers to invest in better breeds, infrastructure, and feed. Omore et al. (2004) observed that dairy cooperatives in East Africa had established partnerships with financial

institutions, allowing members to obtain loans for dairy farm expansion. Rahaman and Abdulai (2020) argued that social networks and peer influence often determine whether a farmer joins a milk-bulking group or not, farmers who see their neighbors benefiting from group membership are more likely to join. Institutional support from government agencies, NGOs, and dairy processors encourages participation. Onyango et al. (2023) found that government-backed initiatives promoting dairy cooperatives led to increased membership, as farmers were assured of market stability and technical support.

A study by Gladys (2023) highlighted that access to quality feed and fodder is an important factor that influences farmers to join milk-bulking groups since they often supply concentrated feed and distribute improved fodder seeds, such as Napier grass and lucerne, which enhance milk production. Farmers who struggle to access these inputs independently may be more inclined to join such groups to benefit from subsidized feed prices and extension services related to dairy nutrition. Nyokabi et al. (2021) reviewed that farmers who received training on milk handling, hygiene, and dairy management through milk-bulking groups produced higher-quality milk and gained access to premium markets. Regular extension visits and advisory services increase farmers' confidence in adopting modern dairy farming techniques, making membership in these groups more appealing.

The factors influencing participation in milk bulking groups (MBGs) are multifaceted and closely tied to access to various services and inputs provided through membership in these groups. As elaborated in the preceding section, MBGs frequently provide critical resources, including veterinary services, artificial insemination (AI), feed and fodder supplies, credit, and training. Farmers who acknowledge these advantages may be inclined to join such groups to gain access to essential support.

A thorough examination of dairy cooperative members in Rwanda revealed that individuals affiliated with cooperatives enjoyed significantly improved access to vital services, including AI and veterinary care, compared to their non-member counterparts (Habiyaemye et al. 2021). The enhanced provision of livestock breeding services via these groups not only fosters genetic improvements but also contributes to increased milk yields, thereby serving as a strong incentive for participation among farmers. Furthermore, research by Odongo, Garcia and Viljoen (2010) highlighted that collective organizations in Southern Africa played a crucial role in enabling farmers to obtain vaccinations and regular animal health check-ups, which subsequently enhanced herd productivity and survival rates.

Access to credit and financial services through MBGs is also a critical determinant. Certain milk bulking groups offer their members opportunities to secure small loans or advances against their milk deliveries, while others maintain partnerships that facilitate financial investments in dairy operations (Omore et al. 2004; Abdul-Rahaman & Abdulai 2020). Such financial support mechanisms are particularly appealing to resource-constrained farmers who would otherwise face challenges in affording dairy input or expanding their herds.

Additionally, the availability of subsidised inputs, such as concentrated feed or improved forage seeds, serves as another compelling incentive for farmers to join. Many individuals struggle to secure high-quality feed independently due to prohibitive costs or supply chain issues; therefore, membership in an MBG that offers discounted feed or fodder planting materials can be particularly advantageous. Studies conducted in East Africa have underscored the notion that farmers often prioritise the benefits associated with access to inputs when deliberating group membership. For instance, dairy groups that supply affordable feed and fodder are likely to experience higher enrollment rates, as farmers seek to enhance their milk

production through improved nutrition (Njiru, Namusonge & Thogori 2023; Mwangi et al. 2023).

Moreover, farmers who participate in MBG-facilitated training programs focused on milk hygiene, handling, and overall dairy management are better able to produce higher-quality milk that meets the standards of formal markets. (Nyokabi et al. 2021). The potential for training and capacity building in contemporary dairy practices, which may unlock opportunities to enter premium markets, makes membership more attractive to progressive farmers. In summary, access to a comprehensive array of critical services and inputs, including veterinary care, breeding programs, feed, credit, and training, has a significant influence on farmers' decisions to engage in milk bulking groups.

The decision to join a Milk Bulking Group (MBG) is significantly influenced by social and network factors, which play a crucial role in shaping farmers' perceptions and decisions. The dissemination of information and the behaviour of peers can markedly impact an individual farmer's inclination to participate in an MBG. Evidence indicates that farmers are more likely to engage in these groups when they observe neighboring peers or family members benefiting from membership. For instance, research conducted in Ghana has demonstrated that the success of fellow farmers in collective marketing initiatives catalyzes encouraging others to participate (Abdul-Rahaman & Abdulai 2020). Similar anecdotal evidence from Malawi's dairy communities suggests that informal discussions among farmers regarding milk prices and services contribute to this trend; when members of a bulking group report enhanced earnings or improved veterinary services, nearby non-members may be compelled to join to avoid potential disadvantages.

The social capital embedded within farmer organizations, characterized by a sense of solidarity and mutual assistance, emerges as a significant motivator for participation, particularly in

cohesive rural settings. Furthermore, the influence of the institutional framework and policy environment is paramount in determining participation rates. Initiatives spearheaded by governments or non-governmental organizations (NGOs) that advocate for cooperative development can bolster farmers' confidence in joining, as they often associate these groups with authoritative backing and developmental support. Evidence from Kenya indicates that government-supported dairy cooperative programs have led to a notable increase in membership uptake, as farmers perceive these schemes to provide more stable market access and technical assistance (Onyango et al. 2023). In Malawi, the proactive encouragement of milk bulking group formation by the Department of Animal Health and Livestock Development under its dairy development policies likely fosters positive farmer attitudes towards MBG participation.

Conversely, historical mistrust or adverse experiences associated with cooperative institutions may serve as significant barriers to entry. Farmers' apprehensions regarding mismanagement or inequitable distribution of benefits within a group can deter them from participation, despite the potential advantages. Therefore, the level of trust in the governance of the MBG and the perceived transparency of its operations are critical determinants influencing farmers' decisions to join.

Farmers' decisions to join milk bulking groups are influenced by a complex interplay of factors. Economic incentives, such as improved prices and reduced costs, serve as the initial draw. Additionally, the access to services and inputs provided by these groups offers tangible benefits that can significantly boost a farmer's productivity and income. Social influences and institutional support further shape these decisions; they can either enhance the attractiveness of milk bulking groups or, conversely, deter participation if negative. Understanding these dynamics is crucial for policymakers and development practitioners seeking to promote

cooperative membership as a means of enhancing the income and livelihoods of smallholders. It is vital to strengthen the benefits offered by these groups, ensuring they provide higher prices, reliable services, and equitable credit, while also addressing common barriers such as lack of information, trust issues, and high entry fees. When these factors converge positively, dairy farmers are much more inclined to engage with milk bulking groups, thereby positioning themselves to capitalize on the collective opportunities available within the dairy value chain.

This implies that the decision to join milk-bulking groups is shaped by multiple interrelated factors, including economic incentives, access to key services, social networks, and institutional support. Strengthening these factors through targeted interventions can encourage higher participation rates and improve the overall performance of dairy cooperatives. Therefore, this study will evaluate the factors that influence dairy farmers' decisions to join milk-bulking groups.

2.4 Determinants of income among milk producers

Milk production plays a vital role in the livelihoods of smallholder farmers, especially in rural areas where it serves as a primary source of income. Numerous studies have highlighted a range of factors that influence dairy farmers' income levels, such as farm size, herd composition, market access, milk quality, and access to financial and institutional support. Farm size, in particular, is a critical determinant of income, with larger farms generally yielding higher milk production. Kiplagat et al. (2024) and Habiyaremye et al. (2021) emphasise that farmers with larger herd sizes, especially those incorporating crossbred or exotic breeds, experience higher incomes due to increased milk production and better resource utilisation. This supports Chivunda (2024), who noted that improvements in farm management practices such as feeding strategies and veterinary care also lead to enhanced milk yields and, consequently, higher income.

Market access and the pricing mechanisms farmers use are equally significant. Studies by Singh et al. (2020) found that farmers selling their milk through formal value chains, such as dairy cooperatives or milk-bulking groups, generally secure better and more stable prices compared to those relying on informal markets. This observation mirrors the findings by Omore et al. (2004), who argue that milk quality certification programs in certain regions enable farmers to sell to processors, which increases their income by ensuring access to premium markets. However, despite the benefits of formal market participation, the challenge of price volatility and limited market access remains a constant theme in the literature, especially in rural settings (Singh et al. 2020).

The role of technology adoption in enhancing income cannot be overlooked. Several studies, including those by Sankar (2023) and Guruprasad T.K & Bhat (2022), highlight the positive impact of modern dairy technologies such as automated milking machines and precision feeding systems on productivity and income. These technologies help farmers reduce input costs while increasing milk yield, making them an important consideration for improving income stability. This argument is supported by the findings of Salehi (2021), who noted that farmers engaging in value-added dairy processing also experience better financial returns by diversifying their products, such as producing yogurt and cheese.

In contrast, while technological adoption and value addition provide opportunities for increased income, the challenges posed by high production costs remain a key issue. Mwangi et al. (2023) highlighted the importance of managing production costs effectively, noting that access to subsidized feeds, veterinary services, and artificial insemination programs can significantly reduce operational expenses and increase profitability. Conversely, farmers relying on expensive or poor-quality inputs struggle with profitability. Similarly, Duguma

(2022) emphasized that poor access to resources like quality feed and veterinary services hampers productivity, directly affecting farmers' income levels.

Socio-economic factors, such as education, training, and gender dynamics, also influence dairy farming outcomes. Omore et al. (2004) and Njiru et al. (2023) found that farmers with higher education levels and access to training programs generally show higher productivity and income due to their ability to adopt modern farming practices and make informed business decisions. Interestingly, gender disparities remain a significant barrier to income generation, with women facing challenges in accessing resources and training (Salehi 2021). However, when women are empowered with the right resources and opportunities, their participation in both milk production and dairy product processing contributes positively to household income.

Environmental factors, including climate change, also affect milk production. Unpredictable rainfall patterns and droughts can decrease milk yield and increase reliance on costly feed, as (Tebug et al. 2012) found in their study of Malawi. Implementing climate-smart dairy practices, such as water conservation and drought-resistant fodder cultivation, can help stabilize income despite climatic challenges. This aligns with the broader narrative that sustainable farming practices, supported by government policies and institutional support, are essential for long-term income stability (Odongo, Garcia & Viljoen 2010).

Finally, government policies, institutional support, and access to financial services are critical in shaping income outcomes for dairy farmers. Habiyaemye et al. (2021) highlight the role of microfinance institutions, cooperative savings schemes, and government subsidies in improving farmers' income by enabling them to invest in productivity-enhancing technologies. However, despite the significant impact of government and NGO interventions in many regions, access to these services remains limited in some rural areas, underscoring the need for more inclusive and accessible support systems.

2.5 Impact of participating in milk bulking groups on small-scale milk producers' incomes and production.

Milk bulking groups (MBGs) are widely recognized as a key driver of improved productivity and income among small-scale dairy farmers. By collectively aggregating milk, these groups enhance market access, stabilize prices, and promote efficiency in milk production. Numerous studies support the argument that participation in MBGs increases farmer incomes by offering better prices and reducing transaction costs. However, the extent of these benefits varies depending on factors such as management structure, infrastructure, and herd size.

According to Odongo, Garcia and Viljoen (2010) farmers who participate in MBGs benefit from economies of scale, which allow them to negotiate higher milk prices and gain access to formal markets. Individually, small-scale farmers often sell their milk at lower and fluctuating prices, particularly in informal markets. In contrast, MBGs enable collective bargaining, resulting in stable and predictable incomes. Similarly, Thomson et al. (2015) found that farmers selling through MBGs earn 20–30% more per liter compared to those selling individually. Milk collection centers reduce transportation costs, further boosting farmers' net earnings.

A study by Tebug et al. (2012) and Chagunda et al. (2016) reports that farmers in well-organized MBGs are more likely to invest in better feed, veterinary care, and improved breeding practices, leading to higher milk yields per cow. However, Makanji (2023) further reported that farmers in structured MBGs achieved a 15–25% increase in milk yield due to improved access to extension services and bulk-purchase discounts on feed and supplements. Similarly, Nyokabi et al. (2023) emphasize that proper management and training within MBGs lead to improved milk quality, allowing farmers to sell at premium prices.

However, Njiru et al (2023) found that farmers with larger herds (5 or more cows) benefit more from MBGs than those with only 1 or 2 cows. This is because larger producers can supply

greater milk volumes, maximizing the advantages of bulk selling and cooperative input purchases. Nevertheless, smallholder farmers with 2–3 cows still benefit by gaining access to structured markets and better storage facilities, reducing post-harvest losses and spoilage (Salehi 2021)

Empirical evidence from Malawi supports this trend: a study by Thomson et al. (2015) on milk bulking groups found that farmers selling through MBG-operated collection centres earned approximately 20–30% more per litre of milk compared to those selling directly to consumers or independently to traders. This price advantage, along with reduced transport costs from shared delivery systems, significantly enhanced the net income of member farmers. Moreover, MBGs typically offer regular payment schedules, such as monthly or biweekly, which can stabilise income flow and aid in household financial planning, as opposed to the erratic daily sales typical of informal markets. Thus, the tangible benefits of MBG participation, including income stability and increased prices per unit, are evident across various regions.

Another notable impact of participation in Milk Bulking Groups (MBGs) is the increase in milk production volume. Smallholder farmers involved in effective MBGs often see substantial improvements in productivity and overall output. This enhancement can be attributed to several interrelated factors: improved access to inputs and services (as highlighted in Section 1.1.1), the adoption of better practices through training, and a heightened motivation to produce more when a reliable market is guaranteed. Tebug et al. (2012) and Chagunda et al. (2016) noted that in environments where dairy farmers were organised into efficient groups, these farmers were more inclined to invest in productivity-enhancing measures, such as superior feed and breed upgrades, leading to increased milk yields per cow. Similarly, a recent study conducted in Kenya by Ogola, Ngesa and Makanji (2023) found that membership in well-structured dairy groups resulted in a 15–25% increase in milk yield among smallholders, primarily due to

improved extension services and the ability to purchase feed and supplements in bulk at reduced prices. Furthermore, MBG members often gain access to milk cooling facilities, which help minimise spoilage losses and enable farmers to milk more cows (including during the evening) without the risk of waste. This directly boosts the volume of marketable milk. Nyokabi et al. (2023) emphasize that with effective group management and training, MBGs can enhance not only the quantity but also the quality of milk, allowing farmers to meet the standards required for higher-paying markets. Higher quality milk can attract premium prices or quality bonuses from processors, further increasing income. Consequently, the overall impact of MBG participation on productivity is evident in both heightened output and potential quality improvements.

It is essential to recognize that the advantages of participating in Milk Bulking Groups (MBGs) regarding income and production can vary significantly, influenced by specific farm characteristics and group attributes. Research indicates that farmers with larger herds tend to experience more substantial benefits from joining an MBG compared to those with only a few animals. For instance, a farmer with five or more dairy cows can increase production considerably and fully leverage services such as volume-based feed discounts or breeding programs, resulting in a more pronounced increase in total milk output and income. Njiru, Namusonge and Thogori (2023) found that in cooperative settings, farmers selling larger volumes of milk received greater rewards, while those with only one or two cows also benefited, albeit to a lesser degree in absolute terms. Nevertheless, even smallholders with just a couple of cows gain significant advantages from MBGs, particularly through access to a structured market and reduced post-harvest losses. By delivering milk to a bulking centre, a farmer with a small herd can mitigate the spoilage that could occur if they fail to sell the milk promptly on their own, especially in the absence of refrigeration. Salehi (2021) highlights that providing adequate storage and cooling through collective facilities greatly reduces milk

spoilage and quality deterioration, which can represent a hidden loss for many isolated farmers. In this way, even smaller producers can secure income that might otherwise be lost due to spoilage.

The positive impacts of Milk Bulking Groups (MBGs) are contingent upon the efficacy of their management and support infrastructure, rather than being inherently guaranteed. Ineffective management practices can hinder MBGs from achieving their anticipated benefits. For instance, challenges such as inadequate governance, delayed payments to farmers, and the failure to sustain market linkages can erode farmer trust, thereby diminishing the perceived advantages of group membership. Mwangi et al. (2023) assert that certain dairy groups in East Africa experience setbacks attributable to managerial inefficiencies and a lack of transparency, resulting in outcomes where members do not realize significantly greater incomes compared to non-members. Documented instances of mismanagement and elite capture within cooperatives further exacerbate these issues, marginalizing small farmers even within ostensibly supportive group structures.

Furthermore, insufficient infrastructure illustrated by a lack of adequate milk cooling facilities, substandard transportation routes linking farms to collection centres, and limited transport capacity can severely constrain the effectiveness of MBGs. Omore et al. (2004) emphasise that in regions characterised by infrastructural deficits, even well-organised farmers may endure high milk spoilage rates and elevated transportation costs, undermining potential income enhancements. Thus, the magnitude of impact achievable by MBGs is deeply influenced by these enabling factors.

Conversely, when MBGs integrate supplementary financial services, such as savings initiatives or microcredit programs, for their members, they can significantly enhance the long-term effects by facilitating investments in herd improvement. Onyango et al. (2023) discovered that

farmers with access to microloans through their cooperatives could invest in additional livestock and superior agricultural inputs, fostering a virtuous cycle of increased production and income over time. Nonetheless, various constraints persist even for MBG members. Kiplagat, Cheruiyot and Mukunda (2024) highlight that many smallholders, despite their cooperative affiliation, face capital limitations that hinder their ability to scale up production. Consequently, not all members can afford immediate purchases of additional cattle or equipment, implying that the realization of the full potential income impact may require an extended timeframe.

While MBGs offer numerous benefits, their success is not guaranteed and depends on effective management, governance, and infrastructure. Mwangi et al. (2023) argue that poorly managed MBGs fail to secure stable markets, leading to delayed payments or financial mismanagement, which reduces farmer trust and participation. Similarly, Omore et al. (2004) highlight that in regions with poor milk storage and transportation infrastructure, farmers may struggle with spoilage and reduced earnings. Onyango et al. (2023) found that farmers with access to microcredit or savings schemes within MBGs were able to invest in better inputs, expand their herds, and improve production efficiency. However, Kiplagat et al. (2024) note that many small-scale farmers still face financing barriers, limiting their ability to scale up milk production despite being part of MBGs.

2.6 Theoretical Background for Regression Variables

The regression variables used in this study are grounded in socio-economic and agricultural production theories that explain how farmer characteristics influence milk income. Gender is expected to affect income because male farmers generally have greater access to productive resources than female farmers (FAO 2011). Age may influence income through accumulated experience, although older farmers may be less willing to adopt innovations, making its effect

ambiguous (Deressa et al. 2009). Education is theorised to enhance decision-making, information processing and technology adoption, thereby increasing productivity and income (Asfaw & Admassie 2004). Household size can provide labour for dairy activities but may also increase consumption needs, making its influence unclear, while the number of working adults is expected to positively affect milk income through increased labour availability (Binswanger et al. 1993). Dairy herd size remains one of the strongest predictors of milk income, as larger herds directly increase production potential (Omore et al. 2009). Experience is expected to improve management skills and efficiency, leading to higher income (Bagamba et al. 2011). Participation in dairy-related training equips farmers with improved husbandry skills and thus enhances productivity (Ngigi et al. 2010). Transporting milk on foot is expected to reduce income due to delays, spoilage risks, and reduced delivery volumes (Barrett 2008). Planting improved pastures increases feed availability and milk yield, resulting in higher income (Munjuga et al. 2020). Record keeping supports better farm management and profitability (Chagunda et al. 2016). Farmers whose main occupation is agriculture are more likely to invest time and resources in dairy production, increasing their income (Hyuha et al. 2007). Finally, access to extension services is expected to positively influence milk income by improving farmers' knowledge and uptake of best practices (Anderson & Feder 2004).

2.7 Conceptual Framework

The framework illustrates a cause-effect relationship that begins with dairy farmers making a decision to join MBGs, shaped by relative and personal factors such as economic benefits, access to services, social networks, and institutional support. Once farmers join, they benefit from various MBG efforts and services they offer to their members, such as training, finance support and extension services, which in turn lead to increased production and better market

engagement. These outcomes directly influence the income levels of small-scale dairy producers.

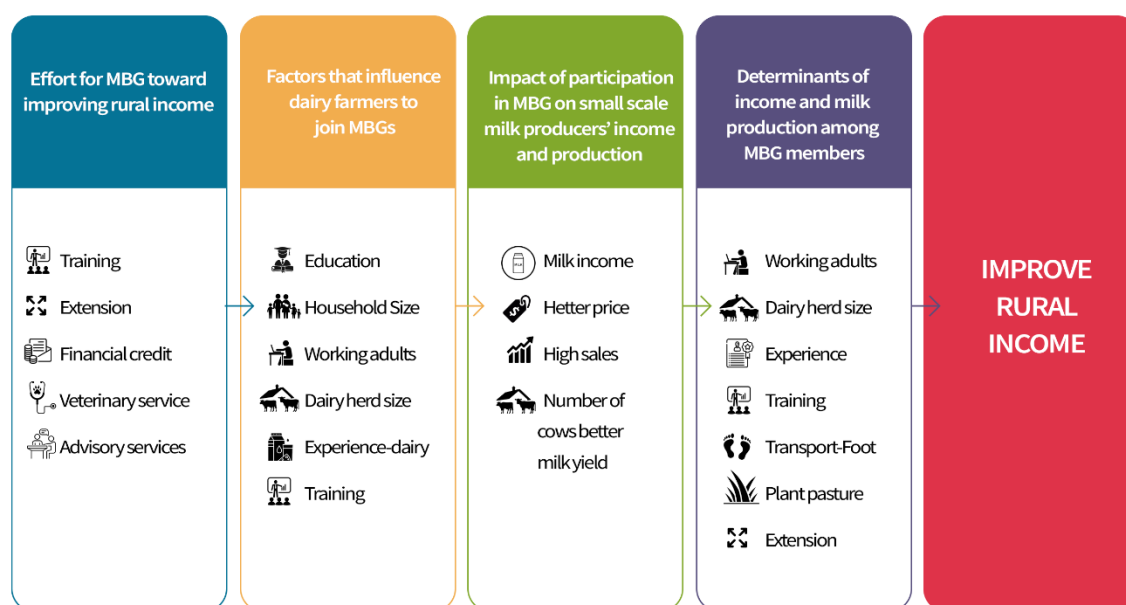


Figure 1: conceptual framework(source Author)

CHAPTER THREE: METHODOLOGY

Introduction

This chapter introduces the methods employed to achieve the study objectives. It presents the study area, the research designs, sampling techniques, data collection methods, and data analysis techniques.

3.1 Study Area

The study was conducted in Thyolo and Blantyre districts, southern Malawi, under the Blantyre Agricultural Development Division (BLADD). These districts are among the top producers of dairy in the division, with many smallholder farmers engaged in milk production. Most farmers rear small herds of dairy cows and dairy farming contributes significantly to household income. Thyolo and Blantyre are supported by several initiatives to enhance dairy production, including the Shire Highlands Milk Producers Association (SHIMPA), which provides technical support, market linkages, and input supply for dairy farmers. The study areas were selected due to the high density of dairy farmer organizations, which allowed the collection of relevant data to address the research gaps. It is noted that smallholder farmers in these districts typically operate on small landholdings and rely on dairy as a key cash income source. Initiatives like SHIMPA have been central to providing a structured market through MBGs, making this an ideal context to study their impact.

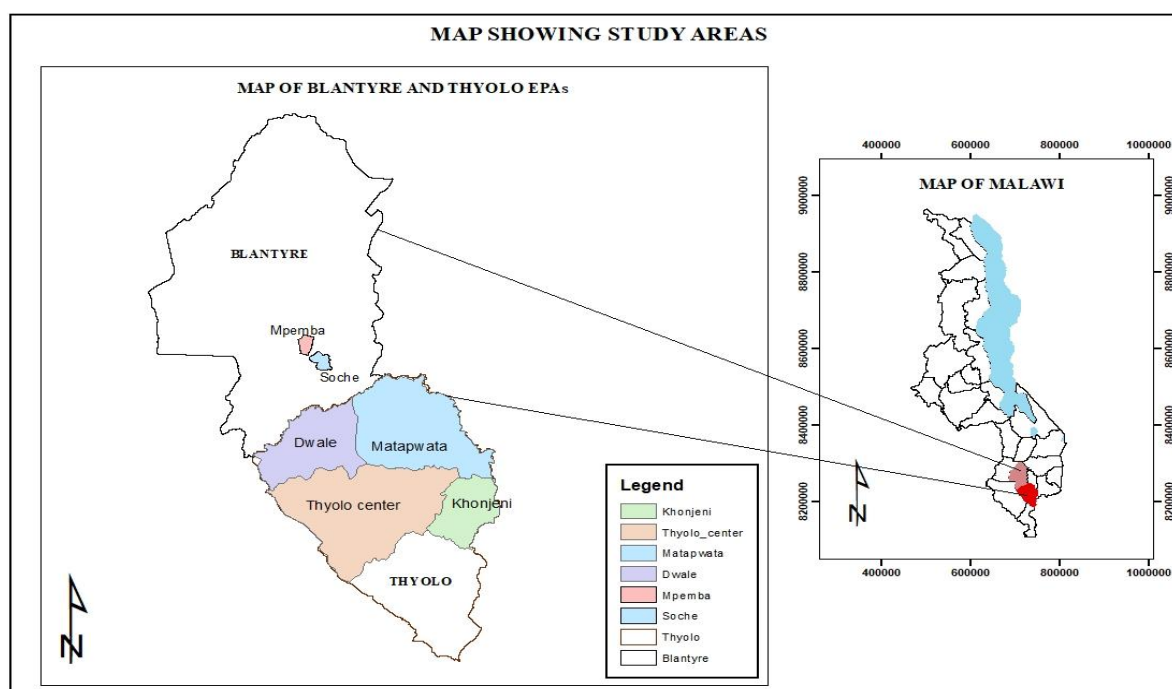


Figure 2: Map of study area

3.2 Research Approach and Design

The study used explanatory sequential design. This is a type of research design in which a researcher collects data from multiple individuals at a single point in time (Thomas 2022). A mixed-methods approach was employed, combining quantitative data from a household dairy survey and qualitative data from key informant interviews. This approach allows integration of numerical and contextual information to provide a more comprehensive understanding of MBG participation and its effect on income and production. (Creswell et al. 2002).

3.3 Study Population

Mugo (2002) defined the study population as “a finite part of a statistical population whose properties are studied to gain information about the whole.” For this study, the population consisted of both Milk Bulking Group members and non-members. Farmers’ involvement in dairy production varies, with some participating in collective marketing through MBGs, while others sell independently. These farmers have diverse experience in dairy farming, ranging

from a few months to over 10 years, and engage in different production practices depending on available resources and access to extension services. According to data from District Agriculture Offices in Thyolo and Blantyre, there are 51 dairy farmer organisations, while in Blantyre, there are 6 dairy groups.

3.4 Sampling Procedure

The study used multistage stratified and random sampling. Farmers were divided into MBG members and non-members and respondents were randomly selected proportionally across the districts. Although Yamane's formula calculated a sample size of 388, only 258 farmers participated due to voluntary participation. This sample still provides meaningful insights, as it represents 66.5% of the calculated sample and covers both member and non-member groups across the study areas. Purposive sampling was used to select 9 key informants, including DAHLDO officers, Area Veterinary Officers, Agriculture Extension Development Officers, SHIMPA representatives, and MBG chairpersons, to provide in-depth information on MBG operations

Sample Size Calculation

Yamane's (1967) formula was used to calculate the sample size of the survey participants. Thyolo has 12,627 dairy farmers (Thyolo DAO, 2023): 6692 (53%) are MBG members and 5939 (47%) are non-members. Blantyre Soche and Mpemba have 1,077 dairy farmers; 862 (80%) are MBG members while 215 (20%) are non-MBG members. By distribution, Blantyre Soche has 250 MBG members and 165 non-MBG members whereas Mpemba has 612 members and 50 non-members. Thyolo and Blantyre have 13,704 dairy farmers, of which 51.3% are MBG members. The sample size was calculated as below.

$$n = \frac{N}{1 + N(e^2)}$$

Where:

n = sample size,

N = Population size and

e = precision level of $\pm 5\%$

$$= \frac{13,704}{1 + 13,704(0.05^2)}$$

The calculated sample size was 388 dairy farmers. However, 258 farmers willingly participated in the survey (177 MBG members and 81 non-members).

3.5 Data Collection Methods

3.5.1 Data Types

The present study used primary. Zikmund (2003) defines primary data as data gathered directly from the field for the first time, specifically for a research project, to address a particular problem.

3.5.2 Data Collection methods

The study employed two primary data collection methods: a survey of dairy farmers and key informant interviews. These methods were chosen to collect complementary quantitative and qualitative data aligned with the specific objectives.

3.5.2.1 Survey Questionnaire

This research study used semi-structured questionnaires to collect the primary data. A questionnaire is a research tool that consists of a series of questions designed to collect data from respondents (McLeod, 2018). The questionnaire consisted of both closed-ended and open-ended questions, providing respondents with the opportunity to explain important information. Semi-structured questionnaires were administered face-to-face to 258 farmers

using tablets. The survey was designed to collect data directly corresponding to the study's specific objectives. It captured: 1) Data on income and milk production to assess MBG impact (Obj. 1 & 4); 2) Data on farmer and farm characteristics to analyse factors influencing the decision to join MBGs (Obj. 2); and 3) Data on productive assets and practices to determine the drivers of income (Obj. 3)

3.5.2.2 Key informant interviews

A key informant is an individual who holds a position that provides them with knowledge about the topic under study, allowing them to provide relevant information to the researcher during data collection (McLeod, 2018). In the present study, A total of 9 key informants were interviewed, selected purposively based on their expertise and roles within the dairy value chain. the key informants included were District Animal Health and Livestock Development Officers (DAHLDO) from both Blantyre and Thyolo, Area Veterinary Officers (AVO) from Thyolo and Blantyre, Agriculture Extension Development Officers (1 from Thyolo and 1 from Blantyre), the representative of Shire Highlands Milk Producers Association and 3 milk bulking group chairpersons. Interviews explored MBG operations, market linkages, governance, and institutional support for dairy farmers, providing qualitative insights complementing the survey data.

3.5.3 Description of Variables and Expected Relationships

In this study, two dependent variables were considered: milk income and milk production. Milk income was measured as the total annual revenue earned from milk sales (log-transformed to normalize the distribution), while milk production was measured in litres per year. These indicators are widely used in impact evaluation studies examining dairy productivity and income outcomes (Lokshin & Sajaia, 2004).

The principal exogenous variable of interest was membership in a Milk Bulking Group (MBG), measured as a dummy variable (1 = member, 0 = non-member). Based on collective action theory, MBG participation is expected to have a positive effect on both milk income and production because it enhances market access, improves bargaining power, and reduces transaction costs (Chagwiza et al., 2016).

Herd size, measured as the total number of dairy cows owned, was expected to positively influence income and production, as larger herds increase the volume of milk available for sale (Shiferaw et al., 2016). Education level, measured in years of schooling, was also expected to show a positive relationship, given that educated farmers are more likely to adopt productivity-enhancing practices (Birthal & Joshi, 2009).

The effect of age, measured in years, was considered ambiguous. Younger farmers may more readily adopt innovations, while older farmers may benefit from accumulated experience (Vandeplas & Anneleen, 2011). Gender, measured as a dummy variable (1 = male, 0 = female), may influence income either positively or negatively due to gender differences in access to resources and control over farm decisions.

Household size, defined as the number of individuals in the household, was expected to show a positive relationship with milk production because larger households provide more labour for dairy operations (Onyango et al., 2023). Access to extension services, measured as a dummy variable, was expected to positively influence income and production since extension improves farmers' technical knowledge and management practices (Kumar et al., 2011).

Similarly, access to credit, also measured as a dummy variable, was expected to positively affect outcomes as credit enables investment in feed, veterinary care, and other essential inputs (Asfaw, 2010). Mode of milk transportation, measured as a binary variable (1 = transporting

milk on foot, 0 = other means), was expected to have a negative relationship with income, as transporting milk on foot increases losses and limits the volume delivered (Chagwiza et al., 2016). Finally, fodder or pasture planting, measured as a dummy variable, was expected to positively affect production because improved feeding enhances milk yield and animal health.

3.6 Data analysis

To evaluate the impact of MBG participation and determinants of income, the Endogenous Switching Regression (ESR) model was employed. The ESR model was selected over simpler models like the standard probit or OLS because it simultaneously accounts for self-selection into MBG membership (based on both observable and unobservable factors like entrepreneurial motivation) and estimates regime-specific outcome equations, thereby providing unbiased estimates of the treatment effect.

The selection equation modeled the probability of MBG membership, while outcome equations estimated income and milk production separately for members and non-members.

The exogenous variables included age, gender, education, household size, herd size, extension access, credit access, transport mode, training, and pasture planting. These were selected based on theoretical justification and prior empirical studies. Diagnostic tests such as likelihood ratio tests, heteroskedasticity checks and normality of residuals were performed to validate the ESR model.

Quantitative data were analyzed using descriptive statistics, t-tests, and chi-square tests to summarize characteristics and differences between MBG members and non-members. Qualitative data from interviews were analyzed using thematic analysis, providing triangulation and contextual understanding of the MBG impact.

3.6.1 Evaluate the efforts of milk bulking groups towards improving rural income

In this objective, quantitative data were analysed using descriptive statistics, chi-square test and t-tests. Descriptive statistics were used to generate frequency and percentages, measures of central tendency, and dispersion, and the findings were presented in tables. Descriptive statistics are brief informational coefficients that summarize a given data set, which can represent the entire population or a sample of a population (Hayes, 2022). Descriptive statistics help summarize data in simple quantitative measures such as percentages or means. (Kaliyadan & Kulkarni, 2019). The t-test was applied to ascertain statistical differences in the cooperatives' mean characteristics between participants and non-participants.

Qualitative data derived from one-on-one oral interviews was analyzed through a thematic analysis type. The study adopted the six-step thematic approach analysis as postulated by Kiger & Varpio (2020), which involves familiarization with the data, coding, theme generation, review and theme naming and final write-up. The audio data from the one-on-one interviews was transcribed, and later the transcribed data was coded. Nvivo computer software was used to generate codes. Thematic analysis method was adopted in this study because it is flexible and robust (Kiger & Varpio, 2020).

3.6.2 Evaluate the Factors that Influence Dairy Farmers' Decisions to Join Milk-Bulking Groups

In this objective, the endogenous switching regression model (ESR) was employed to identify factors influencing farmers' choices of milk market outlets. The ESR results isolated and interpreted the influence of farmers' choice of market outlets in a similar way as the findings of the probit-regression model. A more detailed discussion of the ESR model is presented in the subsequent section.

Qualitative data derived from one-on-one oral interviews under this objective were analysed using thematic analysis, as described in the previous section.

3.6.3 Assess the Determinants of Income of Milk Producers

The endogenous switching regression model was determinants of income and milk production quantity for both MBG members and non-members in milk production. The ESR model addresses unobserved characteristics that influence both the choice of the market and are likely to be correlated with unobserved factors affecting farmers' income (Onyango et al. 2023). Biased estimates may result from ignoring the endogeneity issue with market outlet selection. The model consists of two stages. In the first step, a Probit model is used to estimate the farmers' decision to sell to the market outlet. The effect of this decision on income and milk production quantity was assessed in the next step (separately).

The decision of a household to sell milk to MBG can be represented by Equation 1, which assumes that the household's choice of milk selling outlet is motivated by the maximization of utility (anticipated income advantages) based on random utility theory.

$$P_i^* = \gamma Z_i + \mu_i \quad (1)$$

where P_i^* is the latent variable indicating the choice of MBG, Z_i is a vector of exogenous variables influencing the choice of MBG, γ is a vector of parameters to be estimated (income/milk production quantity), and μ_i is the random error term associated with the choice of MBG. Equation 1 is also known as the selection equation.

We may create two distinct regimes from the part. Equation 1 displays the revenue levels of farmers who participated in MBG marketing and those who did not. The ESR model is the second step, which comprises the derived equations 2 and 3 (Tambo & Wünscher, 2017). The selection equation (1) and the outcome equations (3) and (4) are simultaneously estimated

using the complete information maximum likelihood (FIML) method (Lokshin & Sajaia, 2004).

$$\text{Regime 1 (MBG Participants)} Y_{1i} = \beta_1 X_{1i} + \varepsilon_{1i} \text{ if } P_i = 1 \quad (2)$$

$$\text{Regime 2 (Non – MBG Participants)} Y_{2i} = \beta_2 X_{2i} + \varepsilon_{2i} \text{ if } P_i = 0 \quad (3)$$

where Y_{1i} and Y_{2i} are latent variables (household income level/milk production quantity) that define observed income levels, $P_i = 1$ or $P_i = 0$ (whether the household participated or not). χ is a vector of exogenous variables determining the income level/level of milk production, β is the vector of parameters to be estimated while ε_{1i} and ε_{2i} are the disturbance terms. χ contains factors affecting income levels/production levels that are observable only.

According to Greene (2012), the error term from the result equation (equations 2 and 3) and the selection equation (eq. 1) is assumed to be normally distributed, with a covariance matrix and zero mean. Since Y_{1i} and Y_{2i} are not determined simultaneously, the covariance between ε_{1i} and ε_{2i} is represented by dots (Maddala, 1983).

Similarly, the qualitative data derived from one-on-one oral interviews under this objective was analyzed using thematic analysis, as described in section 3.7.1 above. The qualitative findings were used to compare and triangulate the quantitative findings.

3.6.4 Assess the Impact of Participating in Milk Bulking Groups on Small-Scale Milk Producers' Milk Production and Income

The treatment effect of the ESR was used to assess the impact of farmers' participation in milk-bulking groups on milk production and income levels. This method was chosen ahead of matching methods because it controls for both the observables and the unobservable of participation in dairy farming groups.

3.6.4.1 Conditional expectations and treatment

After estimating the model's parameters, the following conditional expectations can be used to compare the various expected outcomes of the dairy farmers:

(a) that joined the dairy groups or milk bulking groups

$$E(y_{1i} / I_i = 1, x_{1i}) = x_{1i}\beta_1 + \sigma_{\varepsilon 1\mu}\lambda_{1i} \quad (4a)$$

(b), that did not join the dairy groups or the milk bulking groups

$$E(y_{2i} / I_i = 0, x_{2i}) = x_{2i}\beta_2 + \sigma_{\varepsilon 2\mu}\lambda_{2i} \quad (4b)$$

(c) that the dairy group members did not join, and

$$E(y_{2i} / I_i = 1, x_{2i}) = x_{2i}\beta_1 + \sigma_{\varepsilon 2\mu}\lambda_{1i} \quad (4c)$$

(d) that the non-dairy group members joined.

$$E(y_{1i} / I_i = 0, x_{1i}) = x_{1i}\beta_2 + \sigma_{\varepsilon 1\mu}\lambda_{2i} \quad (4d)$$

Cases (a) and (b) represent the actual expectations observed in the sample while cases (c) and (d) represent the counterfactual expected outcomes. The effect of the treatment on the treated (TT) (impact of farmers' participation in milk-bulking group on milk production levels and income) is the difference between (a) and (c) while the impact of the treatment on the untreated (TU) for the dairy farmers that actually did not join the dairy groups is the difference between (d) and (b).

According to Asfaw (2010), the effects of heterogeneity due to unobservable factors such as management skills can also be estimated. These include the difference in the expected outcomes of the farmer who is a milk bulking group member (a) and that of the non-members, assuming they were members (d). Similarly, for the farmers that decided not to belong to the dairy group members, this is the difference between (c) that the members did not join and (b) the non-members.

Similarly, the qualitative data derived from one-on-one oral interviews under this objective was analyzed using thematic analysis, as described in section 3.7.1 above. The qualitative findings were used to compare and triangulate the quantitative findings.

3.7 Ethical consideration

The ethical approval was sought from Mzuzu University Research Ethics Committee (MZUNIREC). Permission from the respected authorities of the study sites was sought from the forestry department and Traditional Leaders (TAs and GVH). The researcher ensured that consent is obtained from study participants. In research, consent must be given freely. Voluntary consent was obtained upon full explanation of what will be involved in the research. Participants' agreement to participate in this study was obtained only after a thorough explanation of the research process. On the same note, as regards voluntary participation, informed consent, and harmlessness, the researcher explained to study participants that their participation in the study was voluntary and that they had the freedom to withdraw from the study at any time without any unfavorable consequences, and that they would not be harmed as a result of their participation or non-participation in the study.

The anonymity and confidentiality of the participants was preserved by not revealing their names and identities in the data collection, analysis, and reporting of the study findings. Privacy and confidentiality of the interview environment was managed carefully during interview sessions, data analysis, and dissemination of the findings.

The results will be disseminated through publications in reputable journals, in addition to dissemination through conference presentations to foster discussions and gain valuable feedback.

CHAPTER FOUR: RESULTS

4.1 Introduction

This chapter presents the study findings. It starts by describing the characteristics of the study respondents. The study then presents the efforts made by MBGs to improve the income of participating households, followed by an examination of the determinants of MBG participation. Lastly, the study presents the impact of participating in MBGs on household income.

4.2 Socio-Economic Demographic Characteristics of Respondents

Results in Table 1 show the socioeconomic demographic characteristics of the survey respondents. The study participants were 68.6% MBG members and 31.4% non-members. About MBG members, 58.8% were females, and 41.2% of non-members were female. On average, the study participants attained primary education, with 7.3 and 7.4 years spent on education, respectively, MBG members and non-members. The MGB members had a significantly higher household size than the MGB non-members households ($P < 0.001$). The average household size in the study area was about 5 in MGB-members' households and 4 in non-members' households, with about 3 working adults in both categories.

On average, the study found that each household in both categories had 2 dairy cows at the time of the survey, with farming experience of about 10 years for MBG members and non-members dairy farmers. The study also revealed that the majority of the dairy farmers were using their own transport whenever they went to deliver or sell their milk. There was no significant difference on average to the nearest market where the farmers selling milk ($P > 0.086$). The MBG members were travelling the average of 3 Km while the non-members were travelling 2.29 Km on average to the milk selling point.

Table 1: Socio-economic and demographic characteristics of the respondents.

Variable	Options	Non -member	MBG membership	p-value
Gender	Female	55 (67.9%)	104 (58.8%)	0.161
	Male	26 (32.1%)	73 (41.2%)	
Age	In years	42 (16.02)	41.678 (14.076)	0.582
Education	Years in school	7.383 (3.820)	7.311 (3.472)	0.881
HH Size	Number	4.494 (1.817)	5.395 (1.516)	<0.001
Working adults	Number	2.765 (1.248)	3.000 (1.709)	0.269
Dairy herd size	Number	2.160 (1.512)	1.876 (1.146)	0.096
Experience dairy	Number	9.840 (8.399)	10.29 (9.194)	0.483
Transport mode	None	12 (14.8%)	8 (4.5%)	0.024
	On foot	35 (43.2%)	65 (36.7%)	
	On foot	0 (0.0%)	5 (2.8%)	
	Own transport	30 (37.0%)	85 (48.0%)	
	Own transport on foot	2 (2.5%)	9 (5.1%)	
	Public transport	2 (2.5%)	5 (2.8%)	
Distance to the nearest market	In Km	2.293 (3.309)	3.025 (3.141)	0.086

Results in Table 2 present the results on agricultural practices among MBG members and non-members record-keeping, 42.9% of the MBG members reported that they keep records. On the other hand, 42% of the MBG non-members keep records. The majority of the MBG members had access to extension services, and 67.9% of the MBG non-members had access to extension services as well. The proportion of farming households that grow pasture for grazing their cows is very low in both members (15.2%) and non-members (11.1%).

Table 2: Agriculture practices among MBG member and non-members

Variable	Options	Non-members	MBG members	p-value
Plant pasture	No	72(88.9%)	150(84.7%)	0.373
	Yes	9(11.1%)	27(15.3%)	
Record keeping	No	47(58.0%)	101(57.1%)	0.885
	Yes	34(42.0%)	76(42.9)	
Extension	No	26(32.1%)	16(9.0%)	<0.001
	Yes	55(67.9%)	161(91.0%)	

4.3 Efforts of MBGs towards Improving Rural Income

Results in **Table 3** show the different services MBG members and non-members accessed to support dairy production. Overall, the results show a significant difference between the two categories in accessing several services, specifically favouring MBG members. A significant proportion of MBG members (68.4%) have access to training as compared to MBG non-members (24.7%) ($P < 0.001$). Further, a significant proportion of MBG members had access to advisory services, financial credit, concentrated feed and access to extension services ($P < 0.001$). About 11.3% of the members had access to bull services while none of the non-members had access to bull services ($P < 0.01$). The study found no significant difference between the members and non-members in accessing veterinary services, folder feed and breeding services ($P > 0.05$)

The quantitative findings are consistent with the qualitative findings solicited from the key informants who are the key stakeholders of the MBGs.

“We provide loans in the form of concentrated feed and minerals. We deliver them once a month. Our farm technicians also train the farmers through the MBGs on leadership, management and auditing, to mention but a few... The training is free,

but the minerals are under the revolving package.” One of the SHIMPA Officers narrated.

“Sometimes, we receive minerals and “gaga” (maize bran) from SHIMPA in the form of loans through the MBGs. They collect the loan at the end of the month after we sell the milk to the milk processors/buyers... The money is deducted before we receive it in our hands. There is a good arrangement between the farmers and the service providers. These services help us increase milk production and ultimately high income.” One of the MBG Chair narrated.

Table 3: Dairy Support Services Accessed by MBG Members and Non-Members

	Variable	Non-members (%)	Members (%)	X²
1	Training	24.7	68.4	42.76***
2	Advisory services	21.0	67.8	48.89***
3	Financial credit	0	26.6	26.30***
4	Artificial insemination	4.9	11.9	3.05
5	Bull services	0	11.3	9.92**
6	Veterinary services	40.7	43.5	0.17
7	Concentrated feed	2.5	20.3	14.13***
8	Folder seed	12.3	9.0	0.67
9	Breeding	32.1	31.6	0.005
10	Extension services	67.9	91.0	21.68***

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

4.4 Factors that influence dairy farming decision to join MBG

Table 4 presents the factors influencing farmers' participation in milk bulking groups (MBGs).

Herd size, household size, dairy herd size, training, and extension services influenced dairy farmers' participation in MBGs.

4.4.1 Dairy Herd Size

The study found that dairy herd size has a statistically negative effect on MBG participation (coef=-0.032, p=0.027. This shows that the number of dairy herd size increase the likelihood of farmers to join MBG to decrease

4.4.2 Household Size

Household size significantly influenced farmers' participation in MBG ($P = 0.000$). The households with more household members were likely to join the groups, unlike those with fewer.

4.4.3 Number of Working Adults

In addition, the findings also showed number of working adults within the household negatively influence dairy farmers' participation in MBGs at 10% significance level. The results showed that the households with relatively more number of working adults were unlikely to participate in MBG

4.4.4 Training

The study found that training is one of the significant factors influencing farmers' participation in milk-bulking groups with a p-value of <0.000. The model depicts that the farmers with access to training were likely to join the MBGs.

4.4.5 Extension

The study found that extension service is one of the significant factors influencing farmers' participation in milk-bulking groups at $P < 0.001$. The model depicts farmers with access to extension services as likely to join the MBGs.

Table 4: Factors influencing dairy farmers to participate in MBGs

MBG membership	Coef.	St.Err.	t- value	p- value	[95% Conf Interval]	Sig
Gender	.489	.346	1.41	.157	-.189 1.167	
Age	.001	.014	0.08	.934	-.026 .028	
Education	.034	.051	0.67	.503	-.065 .133	
Household Size	.482	.12	4.00	0.00	..246 .718	***
Working adults	-.195	.112	-1.73	.083	-.415 .025	*
Dairy herd size	-.302	.137	-2.21	.027	-.57 -.034	**
Experience-dairy	.003	.018	0.17	.869	-.031 .037	
Training	1.403	.355	3.95	0.00	.707 2.099	***
Transport mode	.182	.141	1.29	.195	-.094 .458	
Plant pasture	.677	.477	1.42	.156	-.258 1.612	
Record keeping	-.147	.346	-0.42	.671	-.824 .531	
Occupation	-.456	.472	-0.97	.334	-1.381 .47	
Extension	1.014	.425	2.39	.017	.181 1.848	**
Constant	-4.506	1.387	-3.25	.001	-7.225 -1.787	***
Mean dependent var	0.686		SD dependent var		0.465	
Pseudo r-squared	0.215		Number of obs		258	
Chi-square	68.951		Prob > chi2		0.000	

*** $p < .01$, ** $p < .05$, * $p < .1$

4.5 Determinants of Income and Milk Production among Milk Farmers

4.5.1 Determinants of Income and Milk Production among MBG Members

The results in Table 5 indicate the factors influencing milk income and production among the dairy farmers involved in milk bulking groups within the study area.

4.5.1.1 Gender

The second column in Table 5 shows that gender significantly affects the milk income of the dairy farmers selling income through MBGs at a 0.5 significant level. The results showed that females had higher incomes, while males had lower incomes. The results showed that gender have significantly affect milk income among MBG members.

4.5.1.2 Age

The results in Table 5 show that age had a negative significant effect on the number of dairy cows owned by the farmers at a 0.05 significant level. .

4.5.1.3 Education

The results in Table 5 show that education level has a positive significant effect on the milk income of dairy farmers participating in MBGs at a 0.05 significance level. The dairy farmers who attained relatively higher education had more milk income, however education level did not significantly affect the milk produced among dairy farmers participating in MBGs.

4.5.1.4 Dairy Herd Size

The results in Table 5 indicate that dairy herd size had a positive significant effect on milk income and milk produced among dairy farmers participating in MBGs at 0.001 significance level. The farmers with more dairy cows produced more milk and had more milk incomes than those with fewer dairy cows.

4.5.1.5 Experience in Dairy Farming

The results in Table 5 demonstrate that farmers' experience in dairy farming had no significant effect on milk income or production. However, the dairy experience of farmers positively influenced the number of cows they owned, with a significance level of 0.001. Farmers with relatively greater experience tended to own more cows.

4.5.1.6 Training

The results in Table 5 showed that access to training had a negative effect on the farmers' milk income at a 0.01 significant level.

4.5.1.7 Transportation Mode

The results in Table 5 showed that transportation mode significantly affected milk income among dairy farmers' participation in MBGs at the 0.05 significance level. The farmers who transported their milk to MBGs on foot had more milk income than those who used other transportation modes.

4.5.1.8 Record Keeping

The results in Table 5 showed that record keeping had positive significant effect on milk income and milk produced among dairy farmers participating in MBGs at the 0.05 significance level. The dairy farmers keeping records produced more milk and had more milk income.

4.5.1.9 Extension

The results in Table 5 show that access to extension services positively and significantly affected milk income and dairy farmers participating in MBGs at the 0.001 significance level. The dairy farmers with access to extension services had more income than those who did not have access to extension services in the study area.

4.5.1.10 MBG membership

The results in Table 5 show that MBG membership has a positive significant effect on milk income and milk produced among farmers at the 0.001 significance level. The farmers with membership in MBGs produced more milk and had higher incomes.

Table 5: ESR Model of the determinants of income and milk production among MBG members

Variable	Ln milk income	Milk income	Milk Produced	Number of Cows
Gender	-0.146* (-0.164)	0.034 (-14755.0)	0.041 (-7.91)	0.022 (-0.039)
Age	0.109 (-0.006)	0.046 (-724.526)	-0.008 (-0.307)	-0.108* (-0.002)
Education	0.174* (-0.027)	0.034 (-2850.847)	0.032 (-1.218)	0.004 (-0.007)
HH Size	-0.024 (-0.054)	0.091 (-6427.853)	0.077 (-3.206)	-0.104* (-0.016)
Working adults	-0.05 (-0.05)	0.093 (-6513.779)	0.048 (-2.838)	0.068 (-0.015)
Dairy herd size	0.208** (-0.074)	0.405*** (-7917.016)	0.404*** (-3.515)	0.857*** (-0.02)
Experience	-0.119 (-0.001)	-0.055 (-73.205)	-0.011 (-0.031)	0.128** (-0.003)
Training	0.006 (-0.177)	-0.181* (-20996.06)	0.031 (-10.432)	-0.147** (-0.052)
Transport-Foot	0.271*** (-0.073)	0.115 (-7956.784)	0.044 (-3.423)	-0.097* (-0.02)
Plant pasture	0.078 (-0.226)	-0.062 (-26463.345)	0.072 (-11.518)	-0.03 (-0.066)
Record keeping	0.136* (-0.167)	0.132* (-19137.709)	0.123* (-8.064)	-0.022 (-0.047)
Occupation	0.03 (-0.225)	0.047 (-27184.716)	0.017 (-11.536)	0.089* (-0.069)
Extension	0.195** (-0.284)	-0.085 (-27306.341)	-0.067 (-12.454)	0.015 (-0.066)
MBG membership=1	0.204* (-0.367)	0.847*** (-23360.75)	0.436** (-24.32)	0.378*** (-0.084)

Standard errors in parentheses * p<0.05, ** p<0.01, *** p<0.001

4.6 Determinants of Milk Income and Milk Production among MBG Non-Members

The results in Table 6 show the determinants of milk income and milk produced among dairy farmers who were not participating in milk bulking groups.

4.6.1 Dairy Herd size

The results in Table 6 showed that dairy herd size had a positive significant effect on milk income and milk produced among dairy farmers not participating in MBGs at 0.05 and 0.01 significance levels. The farmers with more dairy cows produced more milk and had more milk incomes than those with fewer dairy cows.

4.6.2 Dairy Farming Experience

The results in Tables 6 show that the dairy farming experience had a significant negative effect on milk income and milk produced among dairy farmers who are not participating in MBGs at the 0.01 and 0.05 significance levels, respectively. The dairy farmers who possessed more years of experience produced less milk and had less milk income.

4.6.3 Training

Table 6 results show that access to training had a positive significant effect on milk income and milk produced among the farmers at 0.001 significance level. The farmers who had access to training in dairy farming produced more milk and had more milk income.

4.6.4 Extension

The results in Table 6 show that access to extension services had a positive significant effect on milk income and dairy farmers who were not participating in MBGs at the 0.05 significance level. The dairy farmers with access to extension services had more income than those who did not have access to extension services in the study area.

4.6.5 5 Household Size

The results in Tables 6 show that household size positively and significantly affected milk income and milk produced among MBG non-participating dairy farmers at the 0.05 and 0.001 significance levels. The households with more household members produced more milk and had more milk income.

Table 6: ESR Model of the determinants of income and milk production among MBG non-members

MBG membership	Ln milk income	Milk income	Milk Produced	Number of Cows
Age	-0.606 (0.015)	-0.021 (0.007)	0.063 (0.008)	-0.051 (0.008)
Education	0.794 (0.054)	0.229 (0.027)	0.208 (0.029)	-0.026 (0.031)
Household Size	0.238 (0.107)	0.574* (0.063)	1.071*** (0.068)	1.020*** (0.065)
Working adults	-0.511 (0.073)	-0.374 (0.059)	-0.403 (0.062)	-0.545* (0.061)
Dairy herd size	-0.883 (0.146)	-0.705*** (0.073)	-0.547* (0.081)	-0.357 (0.082)
Experience dairy farming	47.153** (0.037)	0.137 (0.008)	1.075 (0.013)	0.097 (0.013)
Training	-0.111 (0.353)	0.847*** (0.194)	0.882*** (0.206)	0.788*** (0.212)
Transport-Foot	-0.542 (0.148)	0.155 (0.076)	0.296 (0.081)	0.377 (0.088)
Pasture Production	0.156 (0.447)	0.291 (0.253)	0.29 (0.27)	0.153 (0.283)
Record Keeping	-0.998 (0.337)	-0.111 (0.18)	-0.076 (0.199)	-0.128 (0.202)
Occupation	-0.601 (0.379)	-0.14 (0.259)	-0.197 (0.269)	-0.217 (0.285)
Extension	0.972* (0.444)	0.446* (0.242)	0.499* (0.253)	0.478* (0.256)
athrho	-0.157	-0.166***	-0.231	-0.218***
Insigma	-0.053	-0.059***	-0.05***	-0.073***
Observations	180	258	258	234

Standard errors in parentheses * p<0.05, ** p<0.01, *** p<0.001

4.7 The Impact of Participating in Dairy Farmer Groups on Small-Scale Milk Producers' Incomes and Milk Production

4.7.1 The Treatment Effects on Smallholder Dairy Farmers' Income

Farmers participating in milk bulking groups (MBGs) formed the treatment group, while those participating in other milk marketing structures formed the control group. Table 7 summarizes the mean treatment effects and their counterfactual effect on dairy farmers' incomes. The average treatment effect positively and significantly impacted milk incomes at a 0.001 significance level. The mean milk income of non-participants in the milk bulking group would have increased by MK 259,872.7 if they had participated.

The quantitative findings are inconsistent with the qualitative findings gathered from key informants. One of the interviewees reported that the MBG participating members make higher incomes at the end of the month due to collective marketing and accumulated income. This is different from individual sellers because they can't keep their daily sales for the whole month, as they spend it daily, they sell their milk.

"We can get high income at the month's end due to selling our milk using the MBGs. The buyer gives us our money at the end of the month, making it better to invest it in other profitable household activities. On the contrary, those who sell to other outlets (non MBG members) can't have the huge sums of money at once because they use the money they get on a daily basis and can't make profitable investments". Narrated one of the MBG members.

4.7.2 The treatment effects on smallholder dairy farmers' milk production annually (litres)

Results Tables 7 present the mean treatment effects and their counterfactual effect on the annual quantity of milk produced by the dairy farmers. The average treatment effect demonstrated that the participation in milk bulking groups significantly increased the amount of milk produced annually at the 0.01 significance level. In other ways, the amount of milk produced by MBG non-participating dairy farmers would have increased by 68 litres if they had participated. Similarly, the average treatment effect depicted that the participation in milk bulking groups significantly increased the number of cows.

Table 7: The Treatment effects on MBG dairy farmers' participation on income and milk production.

Outcome Variable	MBG membership	Coefficient	Std. err	[95% conf.	interval]
Ln milk income	(1 vs 0)	0.8022*	0.3670184	0.0828354	1.521521
Milk income	(1 vs 0)	259872.7***	23360.75	214086.5	305658.9
Milk Produced	(1 vs 0)	68.3**	24.31989	20.672	116.0042
Number of Cows	(1 vs 0)	0.431***	0.0836767	0.2666433	0.59465

CHAPTER FIVE: DISCUSSION

This chapter discusses the research findings regarding research objectives and tries to link the findings of this study with those of previous scholars and literature.

5.1 Efforts of MBGs towards improving rural Income

The findings from Table 3 demonstrate that Milk Bulking Groups (MBGs) play a central role in supporting smallholder dairy farmers through services such as training, extension, inputs, and financial support. These services contribute directly and indirectly to improving household income. The high provision of extension services (91%) supports the argument by Emukule et al. (2018) found that access to training and advisory services enhances farmers' technical skills, leading to improved productivity and increased profitability. Similarly, Tak, Shankar and Kadiyala, (2019)Emphasize that extension accelerates technology adoption among smallholders, which is essential for increasing milk yields and, consequently, income.

Despite these strengths, the study found a low uptake of financial credit (26.6%). This aligns with Amanullah et al. (2020), who note that farmers often face barriers such as collateral requirements and high interest rates, limiting their use of credit even when cooperatives facilitate access. Limited credit uptake constrains farmers' ability to invest in feed, improved breeds, or better housing—inputs that directly influence milk yield and income. Thus, while MBGs provide a pathway to financial services, structural barriers weaken the income-enhancing potential of this support.

Similarly, the relatively low adoption of livestock improvement services (AI and bull services) reflects findings by Kaumbata et al. (2021), who noted that high costs and limited awareness discourage farmers from adopting genetic improvement technologies. Since improved breeds significantly increase productivity, the low adoption rate in this study suggests that many

farmers may not be fully benefiting from the potential income gains associated with improved livestock genetics.

The low uptake of concentrated feed (20.3%) and fodder seed (9.0%) further reinforces a pattern observed by (Wilkes, Dijk & Odhong 2019), who reported that the affordability and availability of specialized inputs often limit adoption. This has important implications because feed quality directly affects milk yield. Limited access to improved feed among MBG members can therefore reduce the extent to which MBGs translate into higher milk production and income.

Overall, the findings show that MBGs provide essential services that are consistent with global literature on cooperative benefits. However, the limited use of key productivity-enhancing services credit, improved genetics, and quality feed suggests that the income benefits of MBGs may not be fully realized. Addressing these bottlenecks is crucial for strengthening MBGs' role in improving rural incomes. Future interventions should prioritize reducing financial barriers, enhancing farmer education on livestock improvement, and improving access to quality feed to ensure that farmers can fully benefit from MBG participation

5.2 Factors that influence farmer's participation in milk bulking groups

The findings reveal several socio-economic and institutional factors that influence dairy farmers' decisions to join Milk Bulking Groups (MBGs). Household size showed a positive and significant relationship with MBG participation. Larger households may have greater labour availability and higher milk production needs, making group membership attractive for improving efficiency and accessing support services. This aligns with Garcia and Lensink (2019), who argued that households with more members tend to participate in collective action due to the increased need for shared resources, labour support, and information networks.

The study also found a negative relationship between herd size and MBG participation, meaning farmers with larger dairy herds were less likely to join MBGs. This contradicts the common assumption that larger producers benefit more from cooperative structures. One plausible explanation is that larger-scale farmers already have the financial capacity, networks, and bargaining power to sell directly to private buyers, making MBG services less essential. Lwesya-Sibale & Fischer (2023) similarly observed that better-resourced farmers prefer operating independently because they can negotiate favourable milk prices and secure markets without collective arrangements. This suggests that MBGs may currently be more attractive to smaller-scale farmers who rely heavily on shared infrastructure and support to reduce transaction costs.

Training and extension services were strong positive predictors of MBG participation. Farmers exposed to training are more likely to appreciate the economic and technical benefits of group membership, such as improved milk handling, better feeding practices, and reliable market access. This is consistent with Odongo, Garcia and Viljoen (2010), who emphasized that training enhances farmers' competencies, making them more willing to join formal farmer organizations. Similarly, extension services provide technical advice and continuous information flow, which builds trust and encourages engagement in group activities, as supported by Abdul-Rahaman and Abdulai (2020).

Overall, the results indicate that MBGs attract farmers who lack independent capacity (small herds, limited resources) but are connected to training and extension systems. This suggests that strengthening outreach and farmer education can further improve MBG enrolment, while designing incentives tailored to larger herd owners may expand membership across all farmer categories.

5.3 The Determinants of Income and Milk Production among Dairy Farmers

5.3.1 Gender and Education

In MBG-participating households, gender was found to significantly influence milk income. , with females farmers earning milk-related income than male farmers. This outcome reflects the growing evidence that women's participation in cooperative structures enhances their access to resources, strengthens decision-making power, and improves household welfare Seble et al. (2020) similarly observed that women often reinvest a larger proportion of agricultural income back into production and household needs, leading to improved productivity and financial returns. In the context of MBGs, women may also benefit more from structured support, such as collective marketing and training, which can enhance the economic outcomes of their dairy enterprises.

Education had a positive and significant effect on both milk income and milk produced across both MBG members and non-members. This implies that Educated farmers are more likely to adopt improved dairy technologies, maintain better animal health practices, and effectively interpret extension messages. This finding is consistent with Barrett et al. (2001), who found that education enhances farmers' ability to respond to market signals and implement improved production strategies. Thus, investing in farmer education both formal and informal, remains a critical determinant of dairy sector performance.

5.3.2 Experience in dairy production

Dairy farming experience had a positive and significant effect on milk income among non-MBG dairy farmers. This implies that, for farmers outside formal groups, accumulated practical knowledge compensates for the absence of institutional support and structured training. Experienced farmers may rely on indigenous knowledge, accumulated skills, and

trial-and-error learning to enhance productivity. This finding is consistent with Habiyaremye et al. (2021) who indicated longer experience in dairy farming increased monthly milk yield and revenues. The finding is also consistent with Singh et al. (2020) noted that non-participating farmers often depend heavily on personal experience due to limited access to external support services.

5.3.3 Training

One of the most unexpected findings of this study was that training had a negative effect on milk income among MBG participants, while it had a positive effect among non-participants. This mixed relationship suggests several possible explanations.

For MBG members, the negative relationship may indicate that training provided through MBGs is not adequately tailored to the specific needs of farmers, or that it emphasizes compliance and quality standards that initially increase production costs before income benefits are realized. Training may also highlight deficiencies in production practices, leading farmers to make adjustments that temporarily reduce income. In contrast, for non-MBG farmers, training fills a critical knowledge gap, allowing them to improve their production systems, adopt improved feeding practices, and increase sales, which directly boosts earnings. The findings are inline with Chivunda (2024) who found that dairy husbandry training significantly improves milk volumes, processing capacity, and farmer income.

These findings underscore the need for MBGs to reassess the relevance, delivery and follow-up support linked to their training programs.

5.3.4 Dairy Herd Size and Transportation

Herd size showed contrasting effects on milk income and production between the two farmer groups. Among MBG participants, herd size had a positive and significant effect, indicating

that farmers with larger herds benefit more from collective marketing, standardized quality testing, and guaranteed market access. These institutional arrangements reduce transaction costs and improve bargaining power, enabling farmers to maximize returns from larger herds.

However, herd size had a negative effect among non-MBG farmers, suggesting inefficiencies in managing larger herds outside structured group systems. Without access to MBG services—such as veterinary support, chilling facilities, and collective transport—farmers with large herds incur higher production and marketing costs, resulting in lower yields and income. This highlights the essential role that MBGs play in improving production efficiency and market access.

Transportation mode also influenced income. Farmers who transported milk on foot earned higher incomes than those using other means. This reflects the proximity of MBG facilities to farmers' homes, which reduces transport costs and milk spoilage. This finding is consistent with Van der Lee et al. (2020) who found that the proximity to local service center causes better market quality for inputs and outputs, smaller farms with less available labor, use of more purchased feeds and services, higher stocking rates, higher yields, and higher margins.

5.3.5 Extension and Record Keeping

This study found that access to extension services had a positive effect on milk income for both MBGs members and non-members. This implies that extension officers provide guidance on feeding, animal health, milk hygiene, and market conditions factors that directly contribute to improved productivity. This finding is consistent with the study of Onyango et al. (2023), which found that access to extension services was significant in determining farmers' income

Record keeping positively affected milk production and income among dairy farmers participating in milk bulking groups. It becomes very easy for a farmer to track progress made

when they keep records of dairy farming. This finding highlights the importance of record keeping among milk bulking group members.

These findings highlight the need for tailored interventions that consider the unique contexts of both MBG and non-MBG farmers. Strengthening training programs within MBGs, improving access to extension services, and promoting record keeping can significantly enhance productivity and income. Additionally, non-MBG farmers with large herds may benefit from targeted support to reduce inefficiencies associated with independent production. Overall, enhancing institutional support and farmer capacity will improve dairy sector performance and increase household incomes

5.4 Impacts of Farmers Participation in MBGs in Milk Income and Milk Production

The average treatment effect (ATE) showed that participation in milk bulking groups (MBGs) had a strong positive impact on dairy farmers' income and milk production. The results indicated that milk income increased significantly at the 0.001 significance level, implying that non-participants would have earned MK 259,872.70 more per year had they joined an MBG. Furthermore, participation significantly increased the quantity of milk produced annually at the 0.01 significance level. In Kenya, Odongo, Garcia and Viljoen (2010) similarly found that cooperative participation increased farmers' incomes by approximately 10%, reiterating the important role that organized groups play in enabling smallholder farmers to overcome market imperfections.

This study demonstrates that MBG membership is particularly beneficial for smallholders who rely heavily on dairy income as a pathway out of poverty. Through improved market linkages, better price negotiation, and reduced post-harvest losses, MBGs create an enabling environment for both increased production and income growth.

5.4.1 The Treatment Effects on the Number of Cows

The results also show that MBG membership is associated with a higher number of cows per household. On average, MBG members owned 0.431 more cows than non-MBG members, a statistically significant finding ($p < 0.001$). This implies that MBG participation not only increases milk production but also enables farmers to expand their herd size. This could be attributed to several factors. This is in line with a study by Njiru et al. (2023) who demonstrated that farmers in organized groups had more consistent cash flows, which facilitated the purchase of additional livestock and other farm improvements. The qualitative findings further support this, as key informants mentioned that MBG members often receive assistance in acquiring cattle through loans or subsidies. This financial support enables them to expand their herds, which in turn increases their milk production

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

The chapter presents the conclusions and recommendations drawn from the study findings.

6.1 Conclusion

Milk Bulking Groups (MBGs) significantly enhance dairy farming by improving access to essential services like training, veterinary care, and market linkages. This strengthened support system directly leads to the adoption of better practices and greater commercial engagement.

Membership in MBGs is primarily driven by farmers with larger herds, sufficient household labor, and prior access to training. This suggests that individuals who are already somewhat resourceful are more likely to engage with these cooperative structures.

The most significant impact of MBG membership is a substantial livelihood improvement, evidenced by an average increase of MK 260,000 in annual milk income and 68 liters in production. This confirms the direct economic benefit of collective action.

Ultimately, while herd size remains the primary driver of milk income, MBG participation, coupled with good management practices and extension support, serves as a powerful catalyst for increasing profitability and resilience among dairy farmers.

6.2 Recommendations

- To unlock the full potential of dairy farmers, it is essential to facilitate access to affordable credit. This will enable investments in critical infrastructure like cooling systems and transportation, which are fundamental for reducing losses, improving marketability, and ultimately increasing household incomes.
- Complementing financial support, there is a clear need to strengthen extension and training services systematically. Focused programs in advanced dairy husbandry and

financial literacy will equip farmers with the knowledge to boost productivity and effectively manage their enterprises for greater profitability.

- To ensure equitable and sustainable growth, promotion of inclusivity and peer-to-peer learning within the sector is vital. Efforts should ensure the active participation of women and leverage experienced farmers as mentors to encourage the widespread adoption of best practices across the community.
- Finally, broadening participation is key. Targeted outreach should integrate more smallholders into Milk Bulking Groups, while also ensuring non-members have pathways to access cooperative benefits, technical training, and improved credit opportunities to foster inclusive development throughout the value chain

6.3. Areas for further research

- a. Gender Dynamics in Dairy Farming: The Role of Women in Milk Bulking Groups
- b. The Influence of Climate Change on Milk Production and Adaptation Strategies within Milk Bulking Groups
- c. Impact of Milk Pricing Strategies on Smallholder Dairy Farmers' Income
- d. Comparative study on dairy cooperatives as opposed to milk bulking group model.

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APPENDICES

Appendix 1: Mzuzu University Research Ethics Committee Informed Consent Form

(English)



Mzuzu University Research Ethics Committee (MZUNIREC)

Informed Consent Form for Research in effect of milk bulking groups on income of smallholder farmers.

Introduction

I am **Jollam Jester** from the Department of Agri-Sciences in the Faculty of Environmental Sciences at Mzuzu University. We are doing research on “effect of milk bulking groups on income of smallholder farmers in Thyolo and Blantyre Districts”. This consent form may contain words that you do not understand. Please ask me to stop as we go through the information and I will take time to explain. If you have questions later, you can ask them of me or of another researcher.

Purpose of the research

The study aims to analyse the impact of small holder farmers’ milk bulking groups in improving their income in Thyolo and Blantyre districts.

Type of Research Intervention

This research will involve your participation in answering an individual interview.

Participant Selection

You are being invited to take part in this research because of your capacity as citizen/ community policing forum member/ police officer.

Voluntary Participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate nothing will change. You may skip any question and move on to the next question.

Duration

The research takes place from the month of September 2023 to November 2023.

Risks

You do not have to answer any question or take part in the discussion/interview/survey if you feel the question(s) are too personal or if talking about them makes you uncomfortable.

Reimbursements

You will not be provided any incentive to take part in the research.

Sharing the Results

The knowledge that we get from this research will be shared with you and your community before it is made widely available to the public. Following, we will publish the results so that other interested people may learn from the research.

Who to Contact

If you have any questions, you can ask them now or later. If you wish to ask questions later, you may contact: Christopher Mbukwa (supervisor) 0992782100, Mzuzu University, Private Bag 201, Luwinga, Mzuzu 2. Email: chrismbukwa@yahoo.co.uk; or you can contact Dr Ulemu Msiska (postgraduate coordinator) 0994954025, ulemumsiska2004@yahoo.com, Department of Agri-Sciences, Mzuzu University, Private Bag 201, Luwinga, Mzuzu 2.

This proposal has been reviewed and approved by Mzuzu University Research Ethics Committee (MZUNIREC) which is a committee whose task it is to make sure that research participants are protected from harm. If you wish to find about more about the Committee, contact Mr. Wanangwa Msowoya, Mzuzu University Research Ethics (MZUNIREC) Administrator, Mzuzu University, P/Bag 201, Luwinga, Mzuzu 2, Phone: 0995483293.

Do you have any questions?

Part II: Certificate of Consent

I have been invited to participate in research about the impact of dairy farmer groups on livelihoods of small-scale milk producers.

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask questions about it and any questions I have been asked have been answered to my satisfaction. I consent voluntarily to be a participant in this study

Print Name of Participant _____

Signature of Participant _____

Date _____

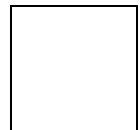
Day/month/year

If illiterate ¹

I have witnessed the accurate reading of the consent form to the potential participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Print name of witness _____

Thumb print of participant



Signature of witness _____

Date _____

Day/month/year

Statement by the researcher/person taking consent

¹ A literate witness must sign (if possible, this person should be selected by the participant and should have no connection to the research team). Participants who are illiterate should include their thumb print as well.

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands the research project. I confirm the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent _____

Date _____

Day/month/year

Appendix 2: Mzuzu University Research Ethics Committee Informed Consent Form (Chichewa)



Mzuzu University Research Ethics Committee (MZUNIREC)

Informed Consent Form for Research in effect of milk bulking groups on income of smallholder farmers in Thyolo and Blantyre districts.

Mau oyamba

Ine ndine Jollam Jester kuchokera ku gawo la maphunziro la AgriSciences mu nthambi ya Environmental Sciences ku Mzuzu University. Tikuchita kafukufuku pa zotsatira za kukhala mmagulu a alimi a mkaka pa ndalama zimenen alimi amapeza ku maboma a Thyolo ndi Blantyre. Kalata ya chilolezoyi itha kukhala ndi mau oti simukutha kuwavetsa bwino. Chonde muzindiuza kuti ndiime ndifotokozele pamene tikuchita kafukufukuyu. Ngati muli ndi mafuso ena, ndifuseni ineyo kapena azanga omwe ndikuchita nawo kafukufukuyu.

Cholinga cha kafukufuku

Kafukufukuyu akufuna kupeza phindu lomwe alimi amalipeza pokhala mmagulu osonkhanitsa ndi kugulitsira pamodzi mkaka mmboma la Thyolo ndi Blantyre.

Mtundu wa kafukufuku

Kafukufukuyu akudalila kutengapo gawo kwanu poyankha mafuso amene ndikufuseni mkucheza kwathu.

Mchifukwa chani mwasankhidwa?

Mwasankhidwa kuti muchite nawo kafukuyu potengela udindo wanu ngati mzika, wachitetezo wakumudzi/wapolice.

Kutengapo gawo pa kafukufuku mosakakamiza

Kutengapo gawo kwanu pa kafukufukuyu mkosakakamiza. Muli ndi ufulu kutengapo gawo kapena ayi. Mukasankha kusachita nawo kafukufukuyu palibe icho chisinthe. Muli ndi ufulu kusiya mafuso ena osayankha mkuyankhako ena.

Kafukufukuyu atenga nthawi yotalika bwanji?

Kafukufukuyu ayamba mwezi wa September mpaka November chaka chomwe chino.

Zodzetsa Nkhawa

Simukuyenera kuyankha mafuso kapena kutengapo mbali mkucheza ngati mukuona kuti mafuso ena salibwino kapena simunasangalare nawo.

Cholowa/Kulipidwa

Kutenga nawo gawo pa kafukufukuyu ndi kwa ulere ndipo simudzalandira kalikonse.

Kugawana zotsatila za Kafukufuku

Zotsatila za kafukufukuyu zidzagawidwa kwa inu amene mutengapo mbali ndi anthu a mdela lanu zisanagawidwe ku mtundu wose wa aMalawi. Zotsatila za kafukufukuyu zidasindikizidwa mu m'buku kuti anthu ose ofuna kuva zambiri za kafukufukuyu athe kutero.

Oti mungathe kulumikizana nawo

Ngati muli ndi mafuso, mutha kufusa panopa kapena nthawi ina. Ngati mukufuna kudzapusa nthawi ina chonde alembeleni kalata awa: Christopher Mbukwa (oyang'anira), Mzuzu University, Private Bag 201, Luwinga, Mzuzu 2. Email: chrismbukwa@yahoo.co.uk komwe ndi aphuzitsi ku Mzuzu University pa adilesi iyi: Private Bag 201, Luwinga, Mzuzu, kapena ayimbireni ma thenifolo pa 0992782100. Mutha Kulembelaso Dr Ulemu Msiska (Post-Graduate Coordinator), Department ya Agri-Sciences, Mzuzu University, Private Bag 201, Luwinga, Mzuzu 2. Foni: 0994954025, Imelo adilesi: ulemumsiska2004@yahoo.com.

Kafukufukuyu waunikidwa ndi kuvomerezedwa ndi a Mzuzu University Research Ethics Committee (MZUNIREC) yomwe ndi komiti yoonetsetsa kuti ochita nawo kafukufuku ndi otetezedwa mu njira ina iliyose. Ngati mukufuna kuva zambili za komitiyi lumikizani ndi a Msowoya pa adilesi iyi: Mzuzu University Research Ethics (MZUNIREC) Administrator, Mr Wanangwa Msowoya, Mzuzu University, P/Bag 201, Luwinga, Mzuzu 2, Ma nambala awo a foni: 0995483293.

Muli ndi mafuso Lirilonse?

Gawo lachiwiri: Kalata yovomereza

Ndaitanidwa kuti ndichite nawo kafukufuku pa mmene kafukufuku pa anthu kutengako mbali pa chitetezo kudzera mu masamba a mchezo mu chitetezo cha kumudzi ku Muloza ku Malawi.

Ndawelenga komaso andiwelengera zose zoyenera pa kafukufukuyu. Ndinapatsidwa mwayi oti ndifunse mafuso pa kafukufukuyu ndipo mafuso ose ndinafusa andiyankha mogwira mtima. Ndikuvomereza kuchita nawo kafukufuyu mwakufuna kwanga

Dzina la ochita nawo kafukufuku _____

Signature _____

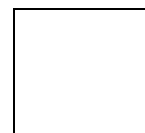
Tsiku _____

Tsiku/Mwezi/Chaka

Ngati ali osatha kelemba ndi Kuwelenga²

Ndaonelela kuwerenga kolondola kwa kalata ya chivomerezo kwa otenga nawo mbali pa kafufukufuku. Ndipo otenga nawo mbaliyu anapatsidwa mwayi ofusa mafuso.

Ndikutsimikizira kuti otenga nawo mbaliyu wavomereza yekha kutenga nawo mbali pa kafukufukuyu.



Dzina la mboni _____ Otenga nawo mbali adinde ndi chala apa

² Mboni yodziwa kulemba imusainile uyu ochita nawo kafukufuku (ngati mkotheke mboniyi isankhindwe ndi uyu ochita nawo kafukufuku osati awo ochititsa kafukufuku). Ochita nawo kafukufuku omwe sadziwa kulemba adindeso ndi chala.

Signature ya mboni _____

Tsiku _____

Tsiku/Mwezi/Chaka

Statement by the researcher/person taking consent

I have accurately read out the information sheet to the potential participant, and to the best of my ability made sure that the participant understands the research project. I confirm the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent _____

Date _____

Day/month/year

Appendix 3: Household questionnaire

Effects of milk bulking groups on income of smallholder farmers in Thyolo and Blantyre districts

Household Questionnaire

I am **Jollam Jester** a postgraduate student pursuing Master of Science Degree in Transformative Community Development. I am conducting research titled **“effect of milk bulking groups on income of smallholder farmers in Thyolo and Blantyre Districts”**. The study aims at analyzing the impacts of dairy farmer groups on livelihoods on small-scale milk producers in Thyolo and Blantyre. I would like to take few minutes of your time to ask you questions on the same. Be assured that the information given will be treated with confidentiality and will be used solely for academic purposes.

A. General information

Name of farmer.....

Date of interview:

Location of farm: 1. Rural ☐ 2. Urban ☐ 3. Peri-urban ☐

Village name.....

Member of Milk Bulking Group: Yes ☐ No ☐

If yes, name of Milk Bulking Group.....

B. Household characteristics

1. Gender 1. Male 2. Female

2. Age (years)

3. Education level (years):

4. Household size:

5. Number of adults (above 18 years): working on the farm

Working off the farm

Total

6. Number of children (below 18 years): Working on the farm

Total

7. Dairy herd size:

8. Farming experience (years):.....

9. Sources of income: 1. Dairy ☐ 2. Other agricultural activities 3. Off-farm employment

4. Remittances ☐ 5. Pension Other.....

10. Type of assets in the farm:

	Type of asset	Initial cost (MK)	Estimated useful life (Years)	Current value of asset (MK)
1.	Milking parlour			
2.	Milking machine			
3.	Milking utensils 1..... 2..... 3..... 4.....			
4.	Dairy cows 1..... 2..... 3.....			
5.	Chilling facilities 1..... 2..... 3.....			
6.	Other			

C. Livestock owned at present

11. What type of livestock do you currently own?

	Type of animal	Type of breed	Total
1.	Cows		
2.	Oxen		
3.	Bulls		
4.	Heifers		
5.	Sheep		
6.	Goats		
7.	Chickens		

D. Farm inputs

12. What are the inputs used for dairy production monthly?

12.1 Non-labour inputs:

Type of input	Quantities used	Unit cost (MK)	Total cost/ month (MK)
Feed: Forage Hay Supplements Concentrates			

Breeding: AI Bulls			
Veterinary			
Transport costs			
Electricity costs			
Water			
Other			

12.2 Labour input

	Activity	Unit cost (E)		Total cost (E)
		Family labour	Hired labour	
1.	Milking			
2.	Feeding			
3.	Cleaning of the milking parlor			
4.	Marketing of milk			
5.	Transporting milk for sale			
6.	Dairy animals care (e.g. administering drugs)			
7.	Caring for calves			
8.	Culling of dairy animals			

E. Production

13.

Cows	No of dairy cows	No of lactating cows	Average milk yield		Average milk sold		Average milk consumed (litres)
			Per day (litres)	Per month (litres)	Per day (litres)	Per month (litres)	
Indigenous: 1. Nguni							
Breed: 2. Friesian 3. Holstein 4. Jersey 3 Other							
Total							

F. Dairy marketing activities

14. Where do you sell your produce?

1. MBG ☐ 2. Farm gate ☐ 3. Traders ☐ 4. Local markets ☐ 5. Do not sell
6. Other ☐

15. Reasons for the specified marketing channel:

1. Close to production site ☐ 2. Offer better price ☐ 3. Can get immediate cash ☐ 4.
Collection centre is close by ☐

Other (specify).....

16. Distance travelled to market (Km):

17. Are you satisfied with your marketing channel? 1. Yes ☐ 2. No

.....

18. If not, why?

.....

.....

.....

19. Quantity of milk sold

Receiving agents	Quantity Sold per week (Litres)	Price/ Litre (MK)	Amount of money received per week (MK)	Amount of money received in the month (MK)
MBG				
Farm gate				
Traders				
Local markets				
Other				

G. Transport

20. How do you transport your milk to the market?

1. Public transport ☐ 2. Own transport ☐ 3. On foot ☐
4. Ox cart ☐ 5. Car hire ☐ 6. Other (specify).....

21. How much does it cost to use the mode of transport you have mentioned?

.....
22. Are there any major constraints in relation to transportation of your produce to the market?

1. Expensive ☐ 2. Poor roads ☐ 3. Long distances ☐
4. Other (specify).....

H. GOOD MANAGEMENT AND FARM PRACTICE

Milking system

23. Which milking system do you use?

1. Manual ☐ 2. Portable milking machine ☐ 3. Fixed dairy parlour

Feeding system

24. Which type of feeding system do you use?

1. Stall feeding ☐ 2. Grazing ☐ 3. Both

25. Types of grazing

1. Communal ☐ 2. Private ☐ 3. Zero

26. Please indicate the type of feed given to the following animals:

	Type of animal	Type of feed	Season
1.	Lactating		
2.	Pregnant		
3.	On dry period		
4.	Calves		

Pasture establishment and management

27. Do you have planted pasture? 1. Yes ☐ 2. No ☐

28. How big is the grazing area?.....

29. Do you sell fodder and at how much?

Milk handling and hygiene

30. Are there any quality control measures taken to ensure milk is of good quality?

.....
.....

31. What cost do you incur in application of the quality control measures?

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

32. What are the problems encountered in ensuring milk is of good quality?

1. Lack of training ☐ 2. Poor milking utensils ☐ 3. Expensive/Costly ☐
4. Other.....

33. Is record keeping practised on the farm? 1. Yes ☐ 2. No ☐

34. If so, which type of records are kept and why?

1. Milk production ☐ 2. Inputs used and costs ☐ 3. Marketed milk ☐
4. Income ☐ 5. Other (specify).....

35. Is there a health management program practised in the farm?

1. Yes ☐ 2. No ☐

36. Please state the type of disease, control and cost for each disease:

	Type of disease	Season	Control	Cost/animal (E)
1.				
2.				
3.				
4.				
5.				

Water sources

37 Which source of water do you use?

1. Rivers and streams ☐ 2. Piped water ☐ 3. Borehole
4. Other.....

Milk losses

38 Do you incur any milk losses? 1. Yes ☐ 2. No ☐

39. If so, how much do you lose/week? 1. < 5 ☐ 2. 5 - 10 ☐ 3. 10 ☐

40. What do you attribute the losses to?

1. Long distance to market ☐ 2. Poor milk handling ☐ 3. Lack of chilling facilities
5. Other ☐

4. Minimal market opportunities ☐

41. How do you deal with spoiled milk? 1. Used for home consumption ☐ 2. Fed to calves

3. Used to make sour milk ☐ 4. Given to neighbour

5. Other.....

I. Household Income

42. Sources of income

Sources of income	Amount per month (MK)	Total amount per year (MK)
Milk sales		

Livestock sales		
Off-farm employment		
Remittances		
Other		

J. Provision of Services Training

43. Have you ever participated in dairy production training for the past three years?

1. No ☐ 2. Yes ☐

44. If the answer is no, what are the reasons?

1.
2.
3.

45. If yes, specify the type of training and the organisation responsible for the training:

	Type of training	Duration	Organisation
1.	Proper milking and clean milk handling		
2.	Record keeping		
3.	Milk marketing		
4.	Dairy health		
5.	General farm management		
6.	Pasture establishment and management		
7.	Dairy cattle feeding		
8.	Heat detection		
9.	Other		

46. Has the training been helpful in gaining knowledge and skills to solve your practical problems related to dairy production and marketing? 1. Yes ☐ 2. No ☐

If not, why?
.....
.....

47. What is your source of market price information?

1. Extension officer ☐ 2. NGO ☐ 3. Radio ☐ 4. Newspaper ☐
5. Co-operative ☐ 6. Other.....

Extension service

48. Do you have an extension officer operating in the area?

49. How many times does he visit in a year? 1. <3 times ☐ 2. 3- 5 times ☐
3. 5- 10 times ☐ 4. > 10 times ☐ 5. Not ☐ at all

50. Have the visits been helpful? 1. Yes ☐ 2. No ☐

51. If yes, how?.....

.....

Support provided

52. Please state support provider and type of support provided.

Support provider	Type of support									
	1	2	3	4	5	6	7	8	9	10
1.SDB										
2.NGOs										
3.MBG										
4.MOAC										
5.Microfinance institutions										
6.Others										

1= training, 2= advisory services, 3= credit provision, 4= provision of AI services, 5= provision of bull services, 6= veterinary services, 7= concentrated feed, 8= fodder seed, 9= breeding, 10=other (specify)

K. MBG members Membership of the dairy marketing MBGs and benefits obtained

53. What were the main reasons motivating you to be a member of the dairy co-operative?

1. To get secured market for the milk ☐
2. To get dairy inputs timely and with fair price. ☐
3. To get dividends from the MBG ☐
4. To get education, training & extension advisory services from the co-operative ☐ 5. To gain access to credit ☐
6. Others (specify)

54. How long have you ☐ sold milk to the MBG?

1. Less than a year ☐
2. 1- 3 years ☐
3. Greater than 3 years ☐

Benefits of being a MBG member

55. Ways in which the MBG has been of help to you:

1. Marketing of milk ☐ 2. Provision of inputs ☐ 3. Procurement of cows ☐
4. Provision of vet services ☐ 5. Extension services ☐ 6. Feed and concentrates ☐
7. Provision of AI services ☐ 8. Access to credit ☐ 9. Improvement in milk quality ☐
10. Provision of training ☐

11. Other (specify).....

56. Are there any changes since you have been marketing your milk through a MBG? 1. Production level

2. Income ☐

Please explain.....

.....

.....

57. Do you think being a member of a MBG is more advantageous than being on your own? 1. Yes

2. No ☐

58. Please explained why.....

.....

.....

59. As a member of the MBG, have you gained any new information:

1. Related to access to technology: 1. Yes ☐ 2. No ☐

Please explain.....

.....

2. Related to price and marketing: 1. Yes ☐ 2. No ☐

Please explain.....

.....

3. Related to production, milk handling and good farm management practices:

1. Yes ☐ 2.No ☐

Please explain.....

.....

60. Do you believe that the MBG is doing a good job in solving problems farmers are facing these days?

1. Yes ☐ 2. No ☐

61. If not, what are the major commonly felt problems that are not being solved by the MBG in your area?

1. Lack of adequate milk collection centres near to my home
2. Lack of adequate dairy inputs for members
3. Lack of access to necessary services
4. Lack of chilling facilities to preserve milk
5. Lack of support by Govt and other stakeholders
6. High transaction costs
7. Others (specify)

.....

Governance of co-operatives

62. Are you satisfied with MBG leadership? 1. Yes ☐ 2. No ☐

Please explain.....

63. Are leaders elected through voting of members? 1. Yes ☐ 2. No ☐

64. Are you satisfied with the way elections are held? 1. Yes ☐ 2. No ☐

Please

explain.....

65. Are the leaders transparent and accountable, especially in utilisation of funds?

1. Yes ☐ 2. No ☐

Please explain.....

66. Are you satisfied with member participation in decision making? 1. Yes ☐ 2. No ☐

If not, why?.....

67. What are the main problems the MBG is faced with?

Problem	Very important	Important	Least important

68. Do you wish to remain a MBG member? 1. Yes ☐ 2. No ☐

69. Why/why not?.....

Constraints in dairy production and marketing

70. What are the major milk production constraints you have observed?

	Production constraints		Marketing constraints	
1.	Lack of grazing land		Distance of milk collection centres from my home	
2.	Inadequate water supply		Lack of access to adequate markets	
3.	Inadequate feed		Inadequacy of labour to transport milk	
4.	Prevalence of diseases		Spoilage of milk during transportation	
5.	Dairy cattle procurement		Inadequate market information	
6.	Poor veterinary services		Inadequate infrastructural development	
7.	Other			

71. What are your suggestions on improving dairy production and marketing activities?

	Improving production	Improving marketing
1.		
2.		
3.		
4.		
5.		
6.		

Thank you for your participation

Appendix 4: Interview Guide and FDG Guide

Target: MBG members (FGD/interviews)

1. Can you tell us about your organisation?
2. How many MBGs do your organisation monitor?
3. What kind of support do your organisation provide to dairy farmers through MBGs?

4. Do you think dairy farmers are adequately supported?
5. What has been the trend of support have your organisation been providing to dairy farmers for the past 5 years?
6. What changes in livelihoods of dairy farmers have you observed among the dairy farmers who receive support from your organisation? (Probe more)
7. What challenges are you facing in the course of providing the support to the dairy farmers?
8. How do you deal with the challenges?

Target: Key informants

1. What is your role, do you play in milk-bulking groups?
2. What are the roles of milk-bulking groups in improving small-scale dairy farmers' livelihoods?
3. Do you think participation in MBGs improves the dairy farmers' incomes and milk production?
4. What are the challenges do you think the MBG participants are facing? What solutions can you propose to deal with those challenges?
5. What advice can you provide to small-scale dairy producers who are not participating in milk bulking groups?
6. Do you have anything to add? If yes, please do so.

Appendix 5: Mzunirec Approval Letter



MZUZU UNIVERSITY

DIRECTORATE OF RESEARCH

Mzuzu University
Private Bag 201
Luwinga
Mzuzu 2
MALAWI
TEL: 01 320 722
FAX: 01 320 648

MZUZU UNIVERSITY RESEARCH ETHICS COMMITTEE (MZUNIREC)

Ref No: MZUNIREC/DOR/24/215

04/12/2024.

Jollam Jester,
Mzuzu University,
P/Bag 201, Luwinga,
Mzuzu 2.

Email: jesterjollam@gmail.com

Dear Jollam,

**RESEARCH ETHICS AND REGULATORY APPROVAL AND PERMIT FOR
PROTOCOL REF NO. MZUNIREC/DOR/24/215: IMPACT OF DAIRY FARMER
GROUPS ON LIVELIHOODS OF SMALL-SCALE MILK PRODUCERS IN
THYULO AND BLANTYRE DISTRICTS.**

Having satisfied all the relevant ethical and regulatory requirements, I am pleased to inform you that the above referred research protocol has officially been approved. You are now permitted to proceed with its implementation. Should there be any amendments to the approved protocol in the course of implementing it, you shall be required to seek approval of such amendments before implementation of the same.

This approval is valid for one year from the date of issuance of this approval. If the study goes beyond one year, an annual approval for continuation shall be required to be sought from the Mzuzu University Research Ethics Committee (MZUNIREC) in a format that is available at the Secretariat. Once the study is finalised, you are required to furnish the Committee with a final report of the study.

1

The Committee reserves the right to carry out compliance inspection of this approved protocol at any time as may be deemed by it. As such, you are expected to properly maintain all study documents including consent forms.

Wishing you a successful implementation of your study.

Yours Sincerely,

Wanangwa K. Msowoya
MZUNIREC Secretariat
FOR: MZUNIREC CHAIRPERSON



Mzuzu University Research Ethics Committee
Directorate of Research
Mzuzu University
P/Bag 201
Luwinga
Mzuzu 2
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