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DEPARTMENT OF ECONOMICS

COLLEGE OF BUSINESS AND ECONOMICS



**DETERMINANTS OF MARKET PARTICIPATION OF SMALL SCALE DAIRY
FARMERS: THE CASE OF MEKELLE CITY**

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**A Thesis Submitted to the Department of Economics of Mekelle University
In Partial Fulfillment of the Requirements for the Masters of Science in
Economics Specialization-Trade Policy and Competition Economics**

March, 2025

Mekelle, Ethiopia

STATEMENT OF DECLARATION

This is to declare that this thesis work entitled “Determinants of market participation among small-scale dairy farmers in Mekelle city” submitted in partial fulfillment of the requirements for the award of the degree of MSc. in Economics (Trade policy and competition Economics) to the department of Economics College of Business and Economics, Mekelle University, is my an authentic work carried out by me. All sources of materials used for this thesis have been duly acknowledged.

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Date

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CERTIFICATION

This is to certify that this thesis “Determinants of market participation among small-scale dairy farmers in Mekelle city “submitted in partial fulfillment of the requirements for the award of the degree of MSc. in Economics (Trade policy and competition Economics) to the department of Economics, Mekelle University, done by Rahel Gebreyesus (ID No CBE/PE/045/08) is an authentic work carried out by under my guidance. To the best of our knowledge the matter embodied in this thesis work has not been submitted earlier for award of any degree or diploma.

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ACKNOWLEDGEMENTS

First and foremost, I thank the Almighty God for guiding me and giving me the strength, wisdom, and resilience needed to reach this milestone in my studies and in my life. I am profoundly grateful to my advisor, Mr. Menasbo Gebru, for his invaluable support throughout my MSc study. His patience, motivation, enthusiasm, and steadfast encouragement have guided me through every stage of this research and the writing process. I am truly fortunate to have had such a dedicated and insightful. I also want to express my appreciation to my family and friends, who have provided immense support and encouragement along this journey. Their love and understanding have sustained me through the challenges and celebrated my successes, and I am forever grateful. My sincere thanks also go to the farmers and residents of Mekelle City, whose willingness to participate in this study and fill out the questionnaire with honesty and care has been invaluable to this research. I deeply appreciate the time they took out of their busy lives to contribute to this work. Finally, I acknowledge and thank all others who have contributed directly or indirectly to the completion of this thesis.

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ACRONYMS

Acronyms	Meaning
ANOVA	Analysis of Variance
CSA	Central Statistical Agency (Ethiopia)
EMDIDI	Ethiopian Meat and Dairy Industry Development Institute
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IDF	International Dairy Federation
MoARD	Ministry of Agriculture and Rural Development (Ethiopia)
NBE	National Bank of Ethiopia
NGO	Non-Governmental Organization
POS	Point Of Sale
RBV	Resource-Based View
SPSS	Statistical Package for the Social Sciences
TPB	Theory of Planned Behavior
USAID	United States Agency for International Development

ABSTRACT

This study aimed to investigate the factors influencing market participation among small-scale dairy farmers in Mekelle city, focusing on demographic features, farm characteristics, access to services and infrastructure, credit availability, training programs, and access to information. A quantitative research design was employed, using a survey to collect data from 214 dairy farmers in urban area. The study utilized descriptive statistics and binary logistic regression analysis to identify key factors affecting market participation. The results revealed that farm ownership, access to essential services, credit access and availability of market had a significant positive impact on farmers' participation in dairy markets. Unexpectedly, participation in training programs was found to be negatively affecting market engagement. The study concluded that improving land ownership issues, access services and to credit, and timely market information would enhance market participation among dairy farmers. Policy recommendations included developing tailored financial service for smallholder farmers and improving access to market information. Future research could further explore the role of training on market participation of dairy farming.

Key words: Dairy farming, market participation, Mekelle city

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

With the global population surpassing seven billion, there has been a significant increase in demand for milk, which, however, has not been met by an equivalent growth in milk production. Over the past two decades, global milk production rose by 32%, yet the per capita milk availability declined by 9% (Gitau, 2018). Dairy farming is a critical economic sector in many countries, though the scale and structure of dairy farms vary widely. In 2011, global cow milk production was approximately 620.7 million tons, valued at \$292 billion, making up 8.9% of the value of all agricultural products (IDF, 2016).

Kenya ranks second to South Africa in dairy production and consumption within Sub-Saharan Africa, with small-scale farmers making up a significant portion of dairy output (USAID, 2018). Dairy contributes to 17% of Kenya's agricultural GDP and 4.5% of its total GDP, offering a primary income source for small-scale dairy farmers who produce 70% of the nation's milk supply (Mawa et al., 2020). The sector is poised for growth, driven by rising demand due to urbanization, population increase, and income growth. However, achieving its potential will require improving production efficiency (Wambugu et al., 2019).

In Ethiopia, with Africa's largest livestock population, dairy farming is pivotal to the economy, contributing about 16% of the national GDP and 30% of agricultural GDP (EMDIDI, 2015). Ethiopia's livestock population includes approximately 60.39 million cattle, with milk production playing an essential role in food security and household nutrition, particularly in rural areas. Despite its vast livestock resources, low productivity from traditional systems, high transaction costs, and market inefficiencies challenge Ethiopia's dairy sector, limiting it from meeting domestic demand (Barry et al., 2017).

The dairy systems in Ethiopia are diverse, comprising five main categories: pastoral, agro-pastoral, mixed crop-livestock systems, urban and peri-urban smallholder dairies, and commercial intensive dairies. These systems are dominated by smallholders, especially in rural areas where milk production often supports the household's nutritional needs rather than the market (Azage, 2018). In addition, the dairy sector's reliance on local breeds with lower productivity contributes to low per capita milk availability, which is below the African average (EMDIDI, 2019). The small-scale production model focuses on local consumption, with most milk used in household diets or transformed into butter, yogurt, and cheese to extend shelf life (Getachew et al., 2019).

In urban areas, there is a growing demand for milk, with smallholders and commercial enterprises working to meet this need. For smallholders, dairy farming offers year-round employment and serves as a "cash crop," helping improve household income. However, Ethiopia remains import-dependent for milk products, with a significant portion of milk being imported as powdered milk and cream (MoARD, 2019). The milk collection system is split into two categories: the informal system, which dominates national milk distribution, and the formal system, mainly in urban centers like Addis Ababa, where milk is collected by cooperatives and transported to processing plants (EMDIDI, 2015).

In Tigray, Ethiopia's fourth most populous region, dairy farming is integral to the local economy, with 4.8 million cattle, of which 52,238 are dairy cows. Mekelle, one of the primary milk-producing areas, has both modern intensive dairy farms and smallholder operations. While intensive farms like Kalamino and Agazi supply high-quality milk while most smallholder farms focus on local sales. Dairy production in Mekelle includes three primary smallholder models: pure fresh milk suppliers, suppliers to retail shops, and mixed farms producing both cereal crops and milk. Dairy farming is largely supplementary for most of Mekelle's smallholders (CSA, 2018).

A study on dairy cow productivity in Mekelle highlights constraints such as year-round fodder shortages, high feeding costs, limited veterinary services, and market seasonality, all of which hinder productivity and market participation for small-scale farmers (Niraj et al., 2019). Factors such as urbanization and income growth have driven dairy demand, but the sector's market participation is hindered by high input costs, lack of access to credit, and fluctuating milk prices (Land O'Lakes, 2020).

This study was analyze factors influencing the market participation of small-scale dairy farmers in Mekelle, Ethiopia, exploring both demand and supply-side factors to understand the dynamics and challenges of dairy marketing within this context.

1.2. Statement of the Problem

Small-scale dairy farming played a crucial role in the livelihoods of many urban and peri-urban households in Ethiopia, contributing to food security, employment, and income generation (Tadesse & Beshir, 2019). In Mekelle city, dairy farming had been an important economic activity for many smallholder farmers, enabling them to participate in local markets and meet the growing demand for fresh milk and dairy products. Despite its significance, the level of market participation among small-scale dairy farmers remained low due to numerous constraints. Many farmers were unable to access formal markets, leading to inefficiencies, low income, and limited growth in the sector (Gebremedhin & Jaleta, 2018). The challenges

that hindered their market participation required in-depth investigation to develop appropriate policy interventions and support mechanisms.

One of the main issues affecting market participation was inadequate access to infrastructure and essential services. Small-scale dairy farmers faced difficulties related to transportation, storage, and milk processing facilities, which significantly affected their ability to supply milk to the market in a timely manner (Shiferaw et al., 2019). The lack of proper cold chain infrastructure increased the risk of milk spoilage, forcing farmers to sell their products at lower prices or discard them altogether. Additionally, limited access to reliable markets and poor road networks restricted farmers' ability to transport their milk efficiently, further discouraging their participation in market activities (Tegegne et al., 2018).

Financial constraints also posed a major challenge for smallholder dairy farmers in Mekelle. Limited access to credit and loans restricted farmers' ability to invest in improved dairy breeds, high-quality feed, and veterinary services, all of which were essential for increasing milk production and market competitiveness (Bekele et al., 2020). Many small-scale dairy farmers lacked the collateral required to secure loans from formal financial institutions, making it difficult for them to expand their operations (Mekonnen et al., 2017). The absence of affordable credit options meant that farmers were unable to adopt modern dairy production technologies, leading to lower productivity and reduced market participation.

Access to market information was another critical factor influencing smallholder farmers' ability to participate in formal markets. Studies indicated that farmers, who had access to updated market prices, demand trends, and potential buyers were more likely to make informed decisions and secure better returns for their products (Lemma & Tekalign, 2021). However, in Mekelle, many small-scale dairy farmers lacked access to reliable information sources, leading to information asymmetry and reduced bargaining power. This situation often resulted in farmers selling their milk at lower prices to middlemen and traders who capitalized on their lack of market knowledge (Haile et al., 2019). The absence of organized marketing systems and cooperatives further exacerbated the problem, leaving farmers vulnerable to exploitation.

Another significant barrier to market participation was the lack of training and extension services for small-scale dairy farmers. Many farmers had limited knowledge of modern dairy farming practices, including improved feeding systems, disease management, and value addition techniques (Yilma et al., 2020). The unavailability of regular extension support meant that farmers continued to rely on traditional practices, which often resulted in low milk yields and poor-quality products that did not meet market standards (Tadesse & Beshir, 2019). Without proper training, farmers were unable to improve their productivity or compete effectively in the formal dairy market.

Gender disparities also played a role in limiting dairy farmers' participation in markets. Female dairy farmers, despite being actively involved in milk production and processing, often faced additional challenges in accessing resources such as land, credit, and extension services (Kassa & Alemu, 2018). Cultural and institutional barriers restricted women's ability to participate in decision-making processes related to dairy farming, further limiting their opportunities for market integration. Addressing gender-specific challenges was crucial to ensuring inclusive growth and enhancing the overall productivity of the dairy sector.

Despite the extensive research conducted on dairy farming in Ethiopia, several critical gaps remained in understanding the determinants of market participation among small-scale dairy farmers in urban settings such as Mekelle.

Many previous studies applied classical economic theories that assumed perfect market conditions, overlooking the complexities of real-world markets. Small-scale dairy farmers in Mekelle operated in imperfect markets characterized by information asymmetry, weak institutional support, and high transaction costs. There was a need for theoretical frameworks that incorporated behavioral economics and institutional perspectives to better explain farmers' market participation decisions (Negassa & Jabbar, 2017).

While several studies had used descriptive analysis to examine market participation, few had employed advanced econometric modeling techniques such as binary logistic regression to quantify the determinants of participation. There was a lack of rigorous empirical research that incorporated multiple explanatory variables, including financial access, information availability, and gender-based constraints, to provide a comprehensive analysis (Mekonnen et al., 2017).

While various development programs and government initiatives had been implemented to support smallholder dairy farmers, there was limited evidence on their effectiveness in enhancing market participation. Farmers continued to experience difficulties in accessing credit, infrastructure, and training despite the presence of such programs. There was a need for studies that evaluated the impact of existing policies and interventions to inform more effective support mechanisms (Bekele et al., 2020).

The low market participation of small-scale dairy farmers in Mekelle city posed significant challenges for the sustainability and profitability of the sector. Limited access to infrastructure, financial constraints, inadequate training, lack of market information, and gender disparities collectively hindered farmers from fully engaging in formal markets. These barriers needed to be addressed to ensure the long-term viability of

the dairy industry and improve the livelihoods of smallholder farmers.

This study aimed to bridge existing knowledge gaps by providing empirical evidence on the key determinants influencing market participation among small-scale dairy farmers in Mekelle.

Understanding the factors that influenced market participation was critical for designing interventions that would enable small-scale dairy farmers to transition from subsistence production to commercial dairy farming. Strengthening market linkages, improving infrastructure, expanding access to credit, and enhancing extension services were essential steps in increasing market participation and improving the competitiveness of small-scale dairy farmers in Ethiopia. The findings of this study would help inform policies that supported smallholder dairy farmers in overcoming market challenges and realizing the full economic potential of the dairy sector.

Moreover, a number of studies have been undertaken on the determinants of dairy farming market participation in Ethiopia. However, there inconsistencies in conclusion and as per the researcher's knowledge little empirical studies are under taken focusing on Mekelle city urban dairy farming. There by using recent cross sectional data this study intends to show if there recent developments in market participation status of small scale dairy farmers.

1.3. Research questions

To achieve the objectives of this study, the following research questions will be addressed:

1. What is the effect of demographic characteristics (age, education level and gender) of dairy farmers on the market participation?
2. What is the effect of farm ownership on the market participation of small-scale dairy farmers in Mekelle City?
3. What is the effect of amount of daily milk production/sales on the market participation of small-scale dairy farmers in Mekelle City?
4. What is the impact of access to services and infrastructure on farmers' market participation?
5. What is the role of access to credit in influencing small-scale dairy farmers' ability to engage in the milk market?
6. What is the influence of training programs on improving farmers' market participation?
7. What is the effect of market information access on the likelihood of dairy farmers selling their products in

the market?

1.4. Objectives of the study

1.4.1. General objective

The general objective of this study was to investigate the determinants of market participation of small-scale dairy farmers in Mekelle city.

1.4.2. Specific objectives

The specific objectives of the study are to:

- ✚ To examine the demographic characteristics (age, education level and gender) of dairy farmers on their market participation?
- ✚ To examine the effect of farm ownership on the market participation of small-scale dairy farmers in Mekelle city.
- ✚ To assess the impact of average daily milk production/sales amount on their level of market participation
- ✚ To assess the impact of access to services and infrastructure on farmers' market participation.
- ✚ To evaluate the role of access to credit in influencing small-scale dairy farmers' ability to engage in the milk market.
- ✚ To analyze the influence of training programs on improving farmers' market participation.
- ✚ To investigate the effect of market information access on the likelihood of dairy farmers selling their products in the market.

1.5. Significance of the study

This study was significant for several reasons, contributing both to academic understanding of market participation and to practical policy and program development for small-scale dairy farmers. By identifying the determinants of market participation, the study provided insights into the challenges and opportunities faced by small-scale dairy farmers in Mekelle City. These insights helped formulate strategies aimed at improving their access to more profitable formal markets, thereby increasing their incomes and enhancing their economic well-being.

The findings of this study offered valuable data to government agencies, NGOs, and policymakers interested in promoting sustainable dairy farming in urban areas. By understanding the factors that limited

or enhanced market participation, policymakers could design targeted interventions, such as improving market infrastructure, enhancing access to credit, or providing technical training, to boost market engagement among small-scale dairy farmers.

Small-scale dairy farming played a crucial role in Ethiopia's agricultural sector. This study contributed to efforts aimed at developing the dairy industry by addressing key bottlenecks in the supply chain, particularly in urban settings like Mekelle City. Such efforts helped improve food security and create employment opportunities. By providing recommendations on how to overcome the barriers to market participation, the study empowered small-scale dairy farmers to take advantage of market opportunities, thereby enhancing their economic resilience and improving their livelihoods.

1.6. Scope of the study

This study focused on examining determinants of market participation among small-scale dairy farmers in Mekelle city, Ethiopia. It was geographically confined to urban and peri-urban areas of Mekelle, where dairy farming activities were concentrated. The target population included small-scale dairy farmers who owned and operated dairy farms with relatively small herd sizes, typically less than 10 cows. The study emphasized factors influencing farmers' decisions to participate in both formal and informal milk markets, as well as the volume of milk marketed.

The research primarily analyzed socio-economic, institutional, and infrastructural determinants affecting market participation. Key variables included demographic characteristics such as age, gender, and education, along with household features like family size and labor availability. Economic factors, including income, herd size, and asset ownership, were also assessed. Institutional aspects, such as access to credit, extension services, and cooperative membership, alongside market-related factors like market distance, transportation facilities, and price information, were explored.

Data collection focused on the most recent production year to capture current market trends. Both primary and secondary data sources were utilized, including surveys, interviews, and focus group discussions with farmers and stakeholders. Reports from government offices, NGOs, and prior research studies provided supplementary information.

The study excluded large-scale commercial dairy farms and dairy processing industries, limiting its findings to small-scale producers. Furthermore, the results were specific to Mekelle City and might not be generalizable to other regions due to differences in socio-economic and infrastructural conditions.

1.7. Limitations of the Study

While this study aimed to provide valuable insights into the determinants of market participation among small-scale dairy farmers in Mekelle city, several limitations may have impacted the findings and the generalizability of the results. One key limitation was data availability and accuracy. Many small-scale dairy farmers did not maintain comprehensive records of their production, sales, or market interactions. As a result, the study relied on farmers' recollection of past events and informal records, which may have introduced inaccuracies or inconsistencies, potentially affecting the reliability of the findings.

External factors beyond the control of the study may also have influenced the results. Fluctuating market prices, policy changes, and unforeseen events, such as economic shocks or climatic variations, during the study period may have impacted farmers' market participation in ways that were not captured in the analysis. Limited cooperation or the unavailability of accurate data from these institutions may have hindered a thorough assessment of their role in market participation.

Another limitation was the cross-sectional nature of the study, which collected data at a single point in time. This approach may not have adequately reflected changes in market participation behavior over time, particularly in response to seasonality, policy interventions, or evolving market dynamics.

Despite these limitations, the study was carefully designed to provide meaningful insights into the research questions. By employing both qualitative and quantitative data collection methods, the research sought to mitigate some of these challenges. The limitations acknowledged here were considered when interpreting the results and formulating recommendations.

1.8. Structure of the Thesis

This paper is divided into five chapters; the first chapter deals with the introduction of the study that is background, statement of the problem, research questions and objective, significance and scope of the study. The second chapter discussed the hypothetical and experimental literature. The third chapter is about the methodology of the research that is research design, research approach, sampling size Sampling technique, method of data collection, data collection instrument, method of data analysis. The fourth chapter of the paper was present the finding as well as the quantitative and qualitative data analysis. Finally, the fifth chapter was deals with conclusion and recommendation of the study.

CHAPTER TWO

REVIEW OF LITERATURE

2.1. Concepts and Definitions

In this section, we will explore key concepts and definitions relevant to the study of market participation among small-scale dairy farmers. Understanding these concepts is vital for framing the research and analyzing the determinants that influence market engagement in the dairy sector.

2.1.1. Market Participation

Market Participation refers to the engagement of farmers in selling their agricultural products, in this case, dairy products, in formal or informal markets. It encompasses various activities, including production, processing, and distribution, as well as the choices made by farmers regarding the types of markets to engage with. Market participation can be influenced by several factors, including socio-economic status, access to resources, and institutional support (Kumar & Singh, 2021).

2.1.2. Small-Scale Dairy Farmers

Small-Scale Dairy Farmers are typically defined as farmers who manage a limited number of dairy animals and operate on relatively small plots of land. These farmers often rely on traditional farming practices and face numerous challenges, such as limited access to markets, credit, and modern technology. The International Dairy Federation (IDF) emphasizes that small-scale dairy farmers play a crucial role in local economies and food security, particularly in developing countries (IDF, 2020).

2.1.3. Determinants of Market Participation

Understanding the factors influencing market participation among small-scale dairy farmers is essential for addressing barriers and designing effective interventions. Market participation determinants can be broadly categorized into socio-economic characteristics, market-related factors, and institutional factors. Each dimension impacts farmers' ability to participate in and benefit from the dairy market.

I) Socio-Economic Characteristics:

Socio-economic characteristics such as age, education level, household size, and farming experience play a crucial role in influencing a farmer's decision to participate in the market. Studies have shown that younger and more educated farmers are more likely to adopt market-oriented practices due to their openness to innovation and ability to process information on market trends (Gebremedhin & Tesfaye, 2022). Additionally, household size can impact market participation, as larger households often require additional

income sources, motivating farmers to sell dairy products to meet household needs (Tessema & Belay, 2020). Income diversification also affects market participation, as farmers with multiple income streams may invest more in dairy production and seek market opportunities (Girma & Alemu, 2021). Gender is another socio-economic factor that significantly influences market participation, with female farmers often facing unique challenges related to limited access to land, finance, and market information (Abera & Getahun, 2023).

II) Market-Related Factors

Market-related factors include access to market information, transportation facilities, and price stability, all of which affect the decision to participate in the market. Access to timely and reliable market information enables farmers to make informed decisions about when and where to sell their products, potentially improving profitability (Negash & Berhe, 2021). Without proper market information, farmers may experience price fluctuations that discourage them from engaging fully in the market (Demeke & Tesfaye, 2020).

Transportation availability and infrastructure quality also play a critical role in market participation. Poor roads and limited transportation options can increase the costs and risks associated with delivering dairy products to market, particularly in rural areas. This challenge is compounded by the perishable nature of dairy products, which require efficient transport to maintain product quality and avoid losses (Yimer & Mesfin, 2022). Additionally, price stability is a significant determinant, as fluctuating prices may deter farmers from engaging consistently in the market if they feel prices are too volatile to provide reliable income (Kebede & Asfaw, 2019).

III) Institutional Factors

Institutional support is a crucial factor in determining small-scale farmers' market participation, including access to extension services, credit facilities, and cooperative memberships. Extension services provide technical support and market guidance, helping farmers improve production efficiency and make better-informed marketing decisions. Farmers who frequently interact with extension agents are more likely to adopt market-oriented practices (Mulugeta & Birhanu, 2021).

Access to credit is another essential institutional factor, as it provides farmers with the financial resources needed to purchase inputs, improve production, and cover transportation costs. However, credit availability and accessibility remain challenges for many small-scale farmers in Ethiopia, limiting their ability to expand production and reach new markets (Gebreyesus & Tadesse, 2023). Cooperative membership also facilitates market participation by allowing farmers to pool resources, share market information, and negotiate better prices. Cooperatives often help small-scale farmers overcome individual limitations by providing access to inputs and facilitating market access (Tesfaye & Abebe, 2022).

Institutional factors can thus either enable or inhibit market participation, depending on the level and quality of support provided. Tailored institutional interventions addressing the unique needs of small-scale dairy

farmers are necessary to enhance their market participation and improve their livelihoods.

2.2. Importance of Dairy Farming in Ethiopia

Dairy farming plays a vital role in Ethiopia's agricultural sector and overall economy, providing critical contributions to food security, income generation, and employment opportunities. The dairy sector serves as an essential source of nutrition, particularly in urban areas where demand for dairy products has steadily increased due to population growth and urbanization (Bekele et al., 2020). It also offers economic benefits for small-scale farmers by serving as a reliable source of income and a buffer against financial shocks (Tesfaye & Tamiru, 2019).

In Ethiopia, smallholder farmers dominate the dairy sector, producing approximately 98% of the total milk output (Alemayehu et al., 2021). These small-scale operations provide livelihoods for millions of households, especially in peri-urban and rural areas, and help sustain local economies by creating demand for related services, such as feed supply, veterinary services, and milk distribution (Negash & Ayele, 2022).

The government has also recognized the sector's potential for contributing to economic development and has implemented various initiatives to support small-scale dairy farmers through training, infrastructure development, and access to credit (Gebremedhin et al., 2019). However, challenges such as inadequate market access, limited infrastructure, and the seasonal variability of milk production remain significant barriers (Woldeyes & Demeke, 2021).

Additionally, dairy farming contributes to improved gender dynamics in rural economies, as women are heavily involved in dairy production and income management, particularly at the household level. Women's participation in dairy farming empowers them economically, offering them a degree of financial independence and influencing decision-making within the family (Gebru & Tekalign, 2020).

Overall, the importance of dairy farming in Ethiopia lies in its role in enhancing food security, improving livelihoods, and driving local economic development. Continued focus on addressing the sector's challenges, particularly in market access and gender equity, could further enhance its positive impact on Ethiopian society.

2.2.1. Market Participation in Agriculture

Market participation is a critical factor for smallholder farmers in agriculture, as it enhances their ability to generate income, improve productivity, and contribute to food security. Market participation in agriculture refers to the degree to which smallholder farmers are integrated into formal and informal markets, allowing

them to sell their produce, access resources, and engage with value chains (Gebremedhin & Jaleta, 2021). Engaging with markets enables farmers to earn cash income that can be reinvested into farm inputs, household needs, and community development (Wolde & Tadesse, 2022).

Several factors influence market participation among smallholder farmers, including access to infrastructure, such as roads and market facilities, access to information, and the availability of institutional support like cooperatives and credit facilities (Negash et al., 2020). Studies show that when farmers have better access to roads, transportation, and communication, they are more likely to participate in markets due to reduced transaction costs and increased access to buyers (Abebe & Alemayehu, 2019). Additionally, institutional support through cooperatives and credit access helps farmers by providing financial resources and collective bargaining power, improving their overall market engagement (Teshome & Tekalign, 2021).

Market participation also varies depending on gender, with women often facing unique challenges due to social norms and resource constraints that limit their engagement in markets (Mesfin & Alemu, 2021). Supporting women farmers with training, access to capital, and decision-making opportunities can enhance their involvement in markets and improve household welfare (Alemayehu et al., 2022).

For smallholder dairy farmers, market participation is particularly relevant due to the perishable nature of dairy products. Efficient and timely access to markets is essential for minimizing post-harvest losses and maximizing profits (Mulugeta & Tsegaye, 2023). Formal market channels, such as cooperatives and direct buyers, can help small-scale dairy farmers access consistent buyers, but informal markets often remain crucial, particularly in peri-urban settings where they offer more flexible terms of sale (Getahun & Assefa, 2020).

Overall, enhancing market participation among smallholder farmers requires addressing infrastructure gaps, providing institutional support, and promoting gender-inclusive strategies. Doing so would significantly impact the livelihoods of small-scale producers and contribute to broader economic development in the agricultural sector.

2.2.2. Barriers to Market Participation

Despite the potential benefits of market participation, smallholder farmers in developing countries, including Ethiopia, face multiple barriers that restrict their engagement. These barriers limit their ability to access formal markets, reduce transaction costs, and gain fair returns on their products, all of which affect their overall productivity and income (Gebrehiwot & Tadesse, 2020). Identifying and addressing these

challenges is essential to enhance the participation of smallholder farmers in both formal and informal markets.

Lack of Infrastructure: Poor infrastructure, particularly in rural areas, remains a significant barrier. Limited access to quality roads, transport facilities, and market centers increases transaction costs, making it difficult for smallholder farmers to access markets, especially for perishable goods like dairy (Alemu et al., 2021). Inadequate infrastructure also reduces the incentive to produce surplus goods since transporting them to markets is often costly and inefficient.

Limited Access to Market Information: Access to timely and accurate market information is crucial for farmers to make informed decisions about where and when to sell their products. However, many smallholder farmers lack access to reliable market data on prices, demand trends, and quality requirements (Wolde & Berhe, 2019). This information gap leads to exploitation by intermediaries, who often purchase produce at lower-than-market rates due to farmers' limited negotiating power.

Financial Constraints and Lack of Credit: Financial limitations are a common barrier to market participation for smallholder farmers. Many lack the capital to invest in improved inputs, transport, and storage, which are necessary for effective market engagement. Additionally, access to credit is often restricted due to limited collateral, high-interest rates, and complex lending processes (Negash et al., 2022). Without adequate financing, smallholder farmers struggle to expand production or manage the risks associated with market participation.

Gender Inequities: Gender-based constraints further impact market participation, as women farmers frequently face more barriers than their male counterparts. Social norms, restricted access to resources, and limited mobility can prevent women from fully engaging in markets (Teklehaimanot & Solomon, 2020). Addressing these gender-specific barriers through targeted support and inclusive policies can help improve the participation rates of women farmers in both formal and informal markets.

Institutional and Policy Gaps: Weak institutional support and inconsistent policies can hinder market participation for smallholder farmers. For instance, limited access to extension services, lack of farmer cooperatives, and the absence of organized market structures reduce the support available to smallholder farmers in Ethiopia (Haile & Gebremedhin, 2021). Additionally, policy gaps, such as inadequate protection against market price fluctuations, expose farmers to significant economic risk.

High Transaction Costs and Risks: The high costs associated with entering and maintaining participation in formal markets are often prohibitive for smallholder farmers. Transaction costs, which include

transportation, fees, and time spent on negotiation, increase considerably for farmers who live far from market centers (Mengistu et al., 2019). Additionally, risks related to price volatility, poor weather, and pest outbreaks can further dissuade farmers from engaging with markets.

Inadequate Skills and Knowledge: Limited knowledge of marketing practices, business skills, and value addition restricts farmers' ability to optimize their earnings from market participation. Training and education programs aimed at improving these skills can empower smallholder farmers to make better production and marketing decisions (Assefa & Getahun, 2023).

To address these barriers, it is crucial to implement comprehensive strategies that include improving infrastructure, expanding access to market information, providing financial support, enhancing gender inclusivity, and strengthening institutional frameworks. By overcoming these challenges, smallholder farmers in Ethiopia can achieve more stable and profitable market engagement, leading to improved livelihoods and economic development.

2.2.3. Role of Institutions in Market Participation

Institutions play a fundamental role in enhancing market participation among smallholder farmers, especially in contexts like Ethiopia, where agriculture is the backbone of the economy. Effective institutional support can provide the resources, infrastructure, and policy frameworks necessary to empower farmers to engage with markets on favorable terms (Abebe et al., 2021). Institutions in this context refer to a broad spectrum, including government agencies, cooperatives, financial institutions, extension services, and non-governmental organizations that support agricultural development.

Access to Credit and Financial Institutions: Financial institutions, such as rural banks and microfinance organizations, are crucial in providing smallholder farmers with access to capital. Access to affordable credit enables farmers to invest in inputs like seeds, fertilizers, and equipment, which can enhance productivity and facilitate market participation. In Ethiopia, where many farmers face credit constraints, financial institutions are essential for reducing liquidity issues, although challenges like high-interest rates and collateral requirements persist (Tadesse & Mekonnen, 2022). Expanding access to credit through microfinance programs tailored to the needs of smallholders can significantly increase their ability to engage with markets.

Agricultural Cooperatives: Cooperatives play an important role in increasing market access by pooling resources, improving bargaining power, and enabling bulk sales, which can reduce transaction costs.

Through cooperatives, farmers can access inputs at lower prices and sell their products collectively, which reduces exploitation by intermediaries and improves profitability (Yohannes & Fisseha, 2020). Additionally, cooperatives often provide members with access to storage facilities, transport, and processing services that can help improve product quality and shelf life, particularly important in perishable markets like dairy.

Extension Services: Agricultural extension services are critical for disseminating information about modern farming practices, market trends, and value addition. These services help smallholder farmers enhance productivity, adopt better farming practices, and meet market standards, increasing their competitiveness in both local and larger markets (Berhanu & Girma, 2021). Extension programs that provide technical knowledge, along with marketing and financial training, are particularly beneficial for farmers seeking to transition from subsistence to commercial farming.

Market Infrastructure Development: Government and non-governmental institutions play a key role in the development of infrastructure that facilitates market access, such as roads, market centers, and storage facilities. Improved infrastructure reduces transportation costs, minimizes product losses, and ensures that goods can reach markets in better condition. In Ethiopia, limited infrastructure remains a major barrier, underscoring the importance of investments in rural transport and logistics systems (Habtewold et al., 2023).

Policy and Regulatory Frameworks: Supportive policies and regulations, such as those promoting fair trade practices, establishing price controls, or protecting against market volatility, can significantly enhance market participation. Government policies that promote price stabilization mechanisms and protect farmers from extreme price fluctuations are essential to mitigate risks associated with market participation (Ayele & Tsegaye, 2020). Furthermore, policies that foster transparent market information systems can improve farmers' ability to make informed decisions.

Role of Non-Governmental Organizations (NGOs): NGOs often support smallholder farmers through training programs, grant funding, and capacity-building initiatives. Many NGOs also collaborate with local institutions to provide market access, establish farmer networks, and promote sustainable agricultural practices. For instance, NGOs in Ethiopia have been instrumental in connecting smallholder farmers with local and international markets, enabling them to diversify income sources (Girma & Kebede, 2022).

Institutions are thus indispensable in supporting smallholder farmers by addressing multiple constraints that impact market engagement. Through financial support, improved infrastructure, market information, and

inclusive policies, institutions can create an enabling environment that fosters increased market participation, which is crucial for rural development and poverty alleviation.

2.2.4. Urban and Peri-Urban Dairy Farming

Urban and peri-urban dairy farming has gained increasing attention in recent years due to the rapid urbanization in many developing countries, including Ethiopia. As urban populations grow, so does the demand for fresh dairy products, creating both challenges and opportunities for small-scale dairy farmers operating near city centers. Urban and peri-urban dairy farming offers a viable means of food production close to consumer markets, potentially reducing transportation costs, improving product freshness, and contributing to local food security (Alemayehu et al., 2021).

Market Demand and Economic Opportunities: Urban and peri-urban dairy farming meets a rising demand for milk and dairy products among urban populations, who typically have higher purchasing power and preference for fresh, locally produced goods. This market demand presents a significant economic opportunity for small-scale farmers who can produce and sell dairy products directly within urban settings, often at higher prices compared to rural markets (Tadesse & Tesfaye, 2022). The close proximity to markets also allows for more rapid feedback on consumer preferences, enabling farmers to adjust their production to meet changing demands.

Resource Constraints and Environmental Challenges: Despite these advantages, urban dairy farmers face several constraints, such as limited space for livestock rearing and challenges with waste management. Keeping dairy cows within city limits or nearby areas can result in environmental and public health issues due to inadequate waste disposal and lack of space for feed cultivation (Belay & Alemu, 2020). Farmers are often reliant on purchased feed, which can drive up production costs, and may lack access to grazing lands, thereby affecting profitability.

Access to Inputs and Infrastructure: Urban and peri-urban dairy farmers benefit from easier access to certain inputs, such as veterinary services, feed suppliers, and extension services, which are more readily available in urban areas. However, infrastructure issues, like inadequate roads and unreliable cold storage facilities, remain a challenge in Ethiopia. Without proper storage, the risk of spoilage increases, particularly for dairy products, which are highly perishable. Limited infrastructure can thus hinder farmers' ability to fully capitalize on urban markets (Girma & Abebe, 2021).

Institutional Support and Policy Considerations: Urban and peri-urban dairy farmers often require specific

policy support, as their needs differ from those of rural farmers. For instance, policies that support access to affordable urban land or subsidies for feed and equipment are particularly beneficial. Additionally, local governments play a key role in regulating urban agriculture to ensure it aligns with environmental and public health standards. Enhanced institutional support, such as tailored extension programs and financial services, can help urban farmers overcome unique challenges and increase their participation in the dairy market (Mulugeta & Tesfay, 2023).

Social and Economic Contributions: Urban and peri-urban dairy farming contributes to local employment and income generation, especially for women, who are often involved in the management and sale of dairy products. In addition, it contributes to urban food systems by providing a sustainable source of fresh dairy products. This sector also enhances the resilience of urban food supplies by diversifying local food production sources and reducing dependency on rural or imported dairy products (Berhane et al., 2022).

Urban and peri-urban dairy farming, therefore, holds significant potential for both economic and social development in urban areas. However, maximizing these benefits requires targeted policy interventions, investment in infrastructure, and sustainable practices that mitigate the environmental impact associated with intensive livestock farming in densely populated areas. Supportive policies and tailored institutional support can help urban and peri-urban farmers overcome challenges and enhance their capacity to meet the growing demand for dairy products in cities.

2.3. Empirical Reviews

This section reviews empirical studies that explore the determinants of market participation among dairy farmers at the global, African, and Ethiopian levels. By examining these studies, we can gain insights into the factors influencing market participation and identify common themes and variations across different contexts.

2.3.1. Global Perspectives on Dairy Market Participation

Globally, research on dairy market participation has identified a variety of determinants influencing farmers' decisions to engage in markets. A study by Swinkels et al. (2020) highlighted that socio-economic factors such as income levels, education, and access to credit significantly impact farmers' market participation in several countries. The research emphasized that farmers with higher education levels tend to participate more in formal markets due to better access to information and resources. Furthermore, the study revealed that market infrastructure, including roads and transportation, is crucial in enhancing market access for dairy farmers.

In another global review, Hu et al. (2021) examined the role of technological adoption in market participation among dairy farmers. The study found that farmers who adopted modern dairy farming practices, such as

improved breeding and feeding techniques, were more likely to participate in markets. This adoption was linked to increased productivity and better-quality products, making farmers more competitive in the market.

2.3.2. African Context of Dairy Market Participation

In Africa, several studies have focused on the determinants of market participation among smallholder dairy farmers. For instance, a study conducted in Kenya by Karanja et al. (2019) identified market access, socio-economic characteristics, and institutional factors as key determinants. The research found that farmers who were members of cooperatives had better access to markets and were more likely to engage in formal market activities. Additionally, the study highlighted the importance of gender dynamics, noting that women often face more barriers in market participation compared to men.

Similarly, a study in Tanzania by Msambichaka et al. (2020) explored the factors influencing smallholder dairy farmers' market participation. The results indicated that access to information, land tenure security, and social networks significantly influenced market engagement. Farmers with strong social networks were more likely to receive information about market opportunities and prices, enhancing their participation.

2.3.3. Ethiopian Insights on Dairy Market Participation

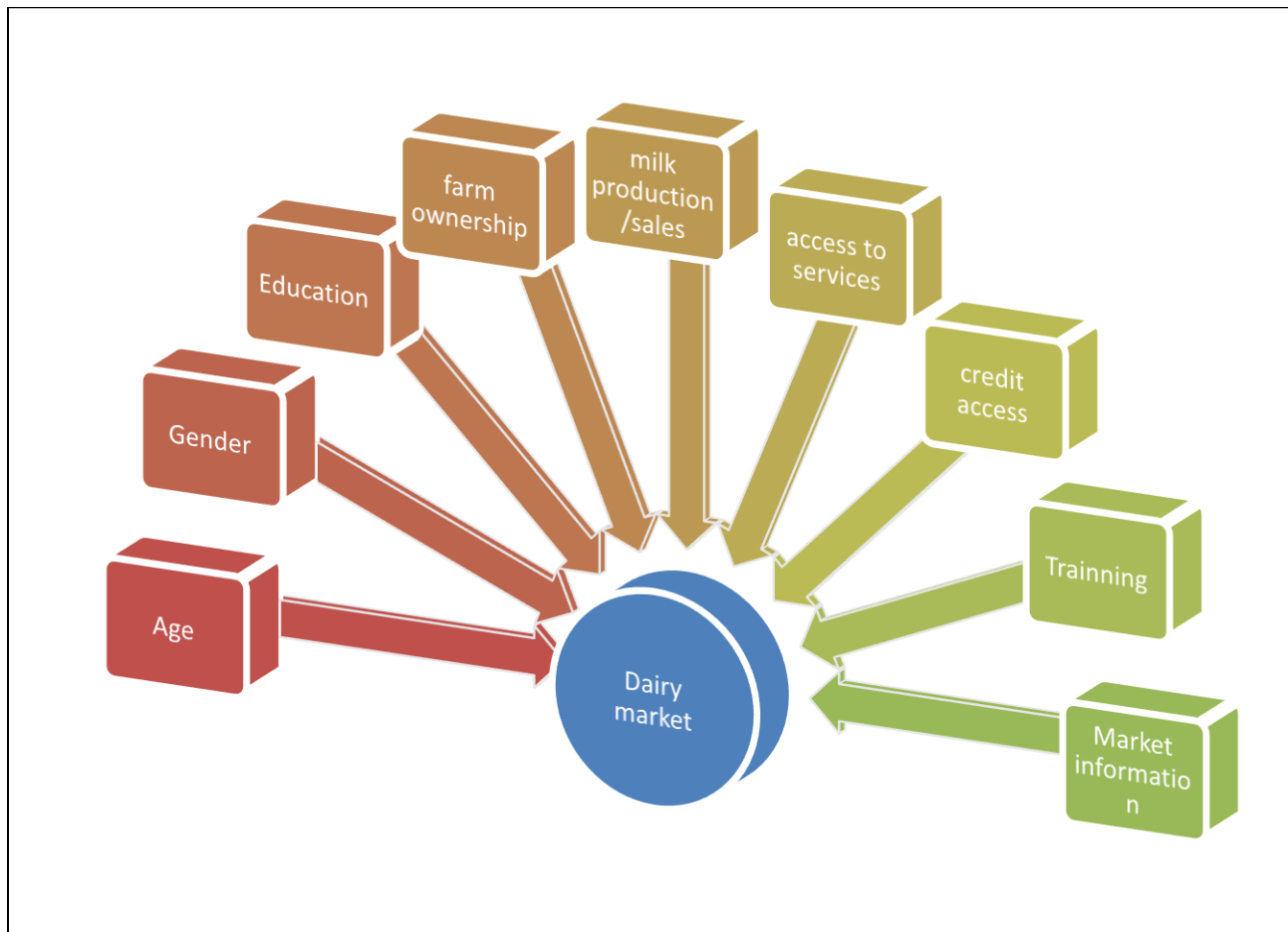
In Ethiopia, empirical studies have shed light on the determinants of market participation among small-scale dairy farmers. A recent study by Abebe et al. (2021) examined the socio-economic and institutional factors affecting market participation in the dairy sector. The findings revealed that education, access to extension services, and participation in farmer cooperatives were positively associated with market participation. Farmers who received training and support from extension services were more likely to engage in the market due to improved production practices and better access to market information.

Another study by Dejene et al. (2022) focused on urban and peri-urban dairy farming in Ethiopia, highlighting the unique challenges faced by farmers in these settings. The research identified barriers such as limited access to infrastructure, high transportation costs, and inadequate market information. The study emphasized the need for targeted interventions to address these challenges and improve market participation among urban dairy farmers.

2.4. Conceptual Model

The conceptual model serves as a visual representation of the various factors influencing market participation among small-scale dairy farmers in Mekelle City.

Figure 1: Conceptual framework



Source: Model developed by the researcher based on extended model sintayehu, (2015)

It integrates the dimensions identified in the study and illustrates the relationships between different variables. The model provides a framework for understanding how these factors collectively impact market engagement.

This conceptual model provides a structured framework for analyzing the determinants of market participation among small-scale dairy farmers in Mekelle City. By examining the relationships between these various factors, the study aims to uncover the complexities of market engagement and provide insights for effective interventions and policy recommendations to enhance market access for smallholder farmers.

CHAPTER THREE

RESEARCH DESIGN & METHODOLOGY

3.1. Introduction

According to Ghauri et al. (1995), research methodology can be conceived as a system of rules and procedures. Such rules and procedures are important in research for the purposes of reasoning i.e. reporting how the researcher has obtained the findings, and communication i.e. reporting in a manner to enable others to replicate or criticize.

This chapter describes the methodology applied in this study. Specifically, it consists of research approach, research design, research technique, sample design, data collection procedures, and instruments. Furthermore, the chapter describes how the data were processed, analyzed and presented. Finally, ethical considerations and data validity and reliability have also been described in this chapter.

3.2. Research Design

Kothari (2004) stated that the research design is the conceptual arrangement within which the research is conducted; it constitutes the blueprint for the collection, measurement, and analysis of data. Research design facilitates study efficiency and yielding maximal information (Chimwani et al., 2014). In general terms, the research design is considered as a program to guide the research in the collection, analysis, and interpretation of observed facts (Ghauri & Gronhaug, 2005).

The choice of research design depends on the objectives of the research. The purpose of this research is to study the determinants of market participation among small-scale dairy farmers in Mekelle City. The study is a Causal Explanatory research because it explains the relationships among the independent and dependent variables and how a change in the independent variable changes the dependent variable. A Causal Explanatory research goes further beyond than indication relationships between variables it also indicates the direction of the relationship. As shown in the diagram of the conceptual framework of the research there are five independent variables and one dependent variable. So a change in the independent variables (socio-economic characteristics, production-related factors, market-related factors, institutional support, Environmental and Infrastructure Factors) will change the dependent variable (market participation). So to investigate the research questions and test the hypothesis a Causal study was required. Explanatory research involves collecting data in order to test the hypothesis or to answer questions concerning the current status of the subject of the study (Noor, 2008).

3.3. Research Approach

The research approach in this study would be quantitative in nature which involves the use of primary and secondary data in order to answer the research questions and achieve its research objective. Moreover, quantitative research method was undertaken by delivering questionnaires to the respondents. In order to attain the objective of the study and to answer the research questions.

The quantitative approach involves the generation of data in a quantitative form that can be subjected to rigorous quantitative analysis in a formal and rigid fashion (Kothari, 2004). The researcher used the principle of replication, adhered to standardized methodological procedures, measured with numbers and then analyzed the data with statistics (Lincoln & Guba 1985). Under the quantitative research method of data collection, standard questionnaire were employed to collect quantitative data for this study. Quantitative research design method is used to establish and study the relationship between two variables or concepts. These variables are measured numerically, and the results are analyzed numerically through statistics or graphs.

3.4. Source and Type of Data

For a study on the determinants of market participation of Small-Scale Dairy Farmers in Mekelle City, the data would typically come from both primary and secondary sources. These sources help to gather comprehensive information relevant to the research objectives. In order to strength the result and findings of the study the researcher examine the finding and conclusion some related researches. This helped to see what others say about the subject matter, what are their findings and recommendations.

3.4.1. Questionnaire

According to Yin (1989), structured questioners are important method for collecting primary data and that it further allows the researcher to be well focused on the specific research topic.

In order to collect sufficient data so as to answer the research questions, researcher designed two surveys; the first was a questionnaire to get quantified results. The items were developed based on previous empirical literature. Specifically most of the items were taken from the model that was developed by Wu and Tao (2012). The questionnaire has two parts; the first part aimed at the collection of demographic information of the participants such as sex, age, marital status, education level.

The second part of the questionnaires consist instruments which measure determinants. This was enabled the researcher to determine which dimension has more impact on market participation.

3.4.2. Secondary data

Secondary data is the type of data obtained from other findings. Secondary data include published books, reports, newspapers, magazines, journals, theses, dissertations, and papers covering the determinants of market participation among small-scale dairy farmers. Also, the researcher made use of internet to search for materials related to the research topic. To get all materials mentioned above, the researcher made use of library resources and internet resources in order to get information related to the determinants of market participation among small-scale dairy farmers.

3.5. Sampling Design

A sample design is a definite plan determined before any data are actually collected for obtaining a sample from a given population. The researcher would adopt a procedure in selecting a sample (Kothari, 2004). likewise, Saunders & Thornhill (2009) mentioned that, sample design provides a range of methods that enable a researcher to reduce the amount of data need to collect by considering only data from a subgroup rather than all possible cases or elements because in research work it is difficult to consult all the population that is under the study. Therefore, taking a representative sample must be important to save time and important resources to conduct the study effectively and efficiently.

For this research, in order to select an appropriate and representative sample from the target population and to make the findings more accurate, the researcher structured the sample design that comprises the five sampling steps of Malhotra et al. (2006); these steps are closely interrelated and relevant to all aspects of the research. Those are identified target populations, determine the sampling frame, select sampling techniques, determine the sample size and execute the sampling process.

3.5.2. Target Population

The target population for this study consisted of small-scale dairy farmers residing in Mekelle City, Ethiopia. These farmers were characterized by owning and managing relatively small herd sizes, typically fewer than 10 dairy cows. The study focused on individuals and households engaged in milk production primarily for subsistence and semi-commercial purposes.

The selection of this population was based on their significant role in local dairy production and their potential contributions to the milk supply chain. The target group included farmers operating in both urban and peri-urban areas of Mekelle, where dairy farming activities were more concentrated. Emphasis was placed on smallholders who faced challenges in accessing formal markets, institutional support, and

modern production technologies.

By focusing on this specific group, the study aimed to identify the key socio-economic, institutional, and infrastructural factors influencing their participation in dairy markets. The findings were intended to provide insights into improving market access and promoting commercialization among small-scale dairy farmers in the study area.

Mekelle City is administratively divided into seven sub-cities (also known as "Kifle Ketemas"), each consisting of smaller administrative units known as kebeles (neighborhoods). For a study focusing on small-scale dairy farmers in Mekelle, the sub-cities provide a useful basis for geographic stratification in the sampling process. Sampling frame is the source material or device from which a sample is drawn.

3.5.2. Sampling Technique

For the study on the Determinants of Market Participation of Small-Scale Dairy Farmers in Mekelle City, selecting an appropriate sampling technique is crucial to ensure that the sample is representative of the target population. Since the population is spread across different sub-cities with diverse characteristics, stratified random sampling is the most suitable technique for this research. Below is a breakdown of the sampling technique.

The researcher was utilized two sampling methods. First stratified sampling method was used by dividing the population into seven subgroups (strata) based on the sub-city they found. The researcher was used Stratified random sampling as it is an appropriate methodology for this research purpose, in order to make proportionate and meaningful, comparisons between subgroups in the population Gay (1987).

After determining the sample size for each sub-city, the next step is to randomly select the required number of farmers from each sub-city. This can be done using: Simple random sampling within each stratum (sub-city). Farmers can be randomly selected from a list obtained from local agriculture offices, cooperatives, or community leaders.

3.5.2. Sample Size

Sample size refers to the number of items to be selected from the universe to constitute a sample. Sampling sizes depend on the types of research design being used, the desired level of confidence in the result, the amount of accuracy wanted and the characteristic of the population of interest (Kothari, 2004).

Sampling is concerned with the choice of a subgroup of individuals from the target population in order to enable the estimation of the characteristics of the entire population (Singh 2014). It is vital to use an

adequate number of subjects so as to ensure a higher probability that results of the study would be more generalizable and interpretable (Magenta, 2018). In estimating the sample size, a 5% margin of error (confidence interval) and 95% confidence level was used.

Using the sample size formula for a population of 600, we calculate the required sample size. For a 95% confidence level ($Z = 1.96$) and a 5% margin of error, we can use the formula:

$$n = Z^2 \cdot P \cdot (1-P) / e^2$$

Where:

$Z = 1.96$ (Z-value for 95% confidence level)

$P = 0.5$ (estimated proportion of the population with the characteristic of interest, to maximize variability)

$e = 0.05$ (margin of error, 5%)

Let's calculate the initial sample size:

$$n = (1.96)^2 \cdot 0.5 \cdot (1-0.5) / (0.05)^2$$

$$n = 3.8416 \times 0.5 \cdot 0.5 / 0.0025$$

$$n = 0.96040 / 0.0025$$

$$n = 384.16$$

This suggests an initial sample size of 384 for finite population.

Since the total population of small-scale dairy farmers is 600 (finite population), we adjust the sample size using the finite population correction formula:

$$n_{adj} = n / (1 + n - 1/N)$$

Where:

$n_{\{adj\}}$ = Adjusted sample size for finite population

n = Initial sample size (384)

N = Total population (600)

$$n_{adj} = 384 / (1 + 384 - 1 / 600) \quad n_{adj} = 384 / 1 + 0.6383 \quad n_{adj} \approx 234.5$$

Thus, the adjusted sample size for a population of 600 small-scale dairy farmers would be approximately 235.

To ensure proportional representation, the sample size can be allocated across the seven sub-cities

based on the estimated number of farmers in each sub-city:

Table 1: Population and sample distribution of smallholder dairy farmers

Sub-City	Number of Dairy Farmers	Proportion of Total Population	Sample Allocation
Hawelti	120	$120 / 600 = 0.20$	$235 * 0.20 = 47$
Adihaki	90	$90 / 600 = 0.15$	$235 * 0.15 = 35$
Ayder	70	$70 / 600 = 0.12$	$235 * 0.12 = 28$
Hadnet	100	$100 / 600 = 0.17$	$235 * 0.17 = 40$
Quiha	80	$80 / 600 = 0.13$	$235 * 0.13 = 31$
Semien (North)	60	$60 / 600 = 0.10$	$235 * 0.10 = 24$
Kedamay Weyane	80	$80 / 600 = 0.13$	$235 * 0.13 = 31$
Total	600	100%	235

Source: agricultural offices or cooperatives, 2024

This ensures that the sample is proportional to the distribution of small-scale dairy farmers across Mekelle City's sub-cities.

3.6. Data processing and analysis

After clearing the collected questionnaire and processing the data, both descriptive statistics and econometric models were employed. Using descriptive statistics the mean, range, minimum as well as maximum values of variables were indicated. The econometric models were used to study the relationship between variables empirically. Thus, the binary logit model was used to analyze the access to credit of respondents.

In decision studies, responses to a question such as whether respondents are participant or not could be 'yes' or 'no', a typical case of dichotomous variable. A variety of statistical models (LPM, probit model and logit model) can be used to establish a relationship between the respondent's characteristics and the status of the respondents. Therefore, a binary logistic regression model was used to study the decision behavior of sampled respondents. The primary reasons for choosing the logistic distribution is that from a mechanical point of view, it is an extremely flexible and it lends itself to a meaningful interpretation (Gujarati, 2004).

Following Hosmer and Lemshew (1989), the logistic distribution function for identification of customers who have access to credit and who haven't access to credit can be defined as:

$$P_i = \frac{1}{1+e^{-Z_i}} \dots\dots\dots (1)$$

Where P_i is the probability of market participation for the i^{th} customer and Z_i is a function of m explanatory variables (X_i), and expressed as:

$$Z_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_m X_m + \epsilon_i \dots\dots\dots (2)$$

Where β_0 is the intercept, β_i are the slope parameters and ϵ_i represents the disturbance term in the model. The slope tells how the log-odds in favor of dependent as independent variables change.

Since the conditional distribution of the outcome variable follows a binomial distribution with a probability given by the conditional mean P_i , interpretation of the coefficient will be understandable if the logistic model can be rewritten in terms of the odds and log of the odds, (Gujarati, 1995). The odds to be used can be defined as the ratio of the probability that a respondent will participate in market (P_i) to the probability that he/she will not ($1-P_i$).

Given that

$$1 - P_i = \frac{1}{1+e^{Z_i}} \dots\dots\dots (3)$$

Therefore,

$$\frac{P_i}{1-P_i} = \frac{1+e^{Z_i}}{1+e^{-Z_i}} = e^{Z_i} \dots\dots\dots (4)$$

And,

$$\frac{P_i}{1-P_i} = \frac{1+e^{Z_i}}{1+e^{-Z_i}} = e^{\beta_0 + \sum_{i=1}^m \beta_i X_i + \epsilon_i} \dots\dots\dots (5)$$

Taking the natural logarithm of the odds ratio of equation (5) will result in what is known as the logit model as indicated below:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \ln(e^{\beta_0 + \sum_{i=1}^m \beta_i X_i + \epsilon_i}) \dots\dots\dots (6)$$

If the disturbance term ϵ_i is taken into account the logit model becomes

$$Z_i = \beta_0 + \sum_{i=1}^m \beta_i X_i + \epsilon_i \dots\dots\dots (7)$$

Notice the betas (β) are not marginal effect on probability but on latent variable. The probability are nonlinear function of $\beta'X$. But latent variable is linear function of $\beta'X$. To get marginal effect (on probability) we have to use the following

$$P(1) = \Phi(\beta'X) \dots\dots\dots (8)$$

$$\frac{\partial P(1)}{\partial X} = \frac{\partial \Phi(u)}{\partial u} \frac{\partial u}{\partial X} = \beta \phi(\beta'X) \text{ given } \frac{\partial \Phi(u)}{\partial u} = \phi(\beta'X) \ \& \ \beta'X = u \dots\dots\dots (9)$$

3.6.1. Multicollinearity test

Before running the models, it would be necessary to check whether there is multicollinearity among the candidate continuous variables and verify the degree of association among discrete variables. The reason is that the existence of multicollinearity will affect seriously the parameter estimates. If multicollinearity turns out to be significant, the simultaneous presence of the two variables reinforces the individual effect of the variables. According to Gujarati (1995), there are various indicators of multicollinearity and no single diagnostic will give us a complete handle over the collinearity problem. Of various indicators of multicollinearity, the variance inflation factor (VIF) or tolerance (TOL) having the following decision rules is used in this study to check whether there is multicollinearity or not among the continuous explanatory variables.

- ✚ If the VIF of a variable exceeds 10, which will happen if R^2_k exceeds 0.90, or the closer is TOL_k to zero, the greater the degree of co linearity of that variable with the other regresses.
- ✚ If the VIF of a variable is less than 10, or the closer TOL_k is to 1, the greater the evidence that X_k is not collinear with the other regresses.

Further, in this study to correct the nature of the variance of error term (heteroscedasticity problem) robust standard error will be estimated.

3.6.2. Model goodness of fit

Commonly used test of model fit for the logit model is the Hosmer and Lemeshow's goodness-of-fit test (Hilbe, 2009). The idea behind the Hosmer and Lemeshow's goodness-of-fit test is that the predicted frequency and observed frequency should match closely, and that the more closely they match, the better the fit. The Hosmer-Lemeshow goodness-of-fit statistic is computed as the Pearson chi-square from the contingency table of observed frequencies and expected frequencies. A good fit as measured by Hosmer and Lemeshow's test will yield a large p-value.

3.6.3. Model specification test

The misspecification of the link function is usually not too severe compared with using other alternative link function choices such as probit (based on the normal distribution). In practice, we are more concerned with whether our model has all the relevant predictors. The idea behind link test is that if the model is properly specified, one should not be able to find any additional predictors that are statistically significant except by chance. Link test uses the linear predicted value (\hat{y}) and linear predicted value squared (\hat{y}^2) as the predictors to rebuild the model. The variable \hat{y} should be a statistically significant predictor, since it is the predicted value from the model. This will be the case unless the model is completely misspecified. On the other hand, if our model is properly specified, variable \hat{y}^2 shouldn't have much predictive power except by chance (Hosmer and Lemeshow's, 2013). This specification test was used in our binary logit model to check if there are omitted relevant variables.

Once the analytical procedures and their requirements are known, it is necessary to identify the potential explanatory variables and describe their measurements.

The dependent variable of the model is dichotomous nature representing market participation. It was represented in the model by 1 for those respondents who are participating dairy market and 0 otherwise for those respondents who not. The following variables (table 2) are hypothesized to influence respondents' access to credit;

Table 2: Definition of independent variables

#	Variables Code	Definition	Measurement	Expected sign
1	Age	Age category of respondents	categorical variable	+
2	Gender	Gender of respondents	Dummy variable (1- if male)	+
3	Education	Education level of customers	categorical variable	+
4	Farm	Whether the farmer owned the land used for dairy farming	Dummy variable (1- if yes)	+
5	Milk production	Average daily milk production in liters	categorical variable	+
6	Access	Whether the farmer had access to veterinary services, transportation etc	Dummy variable (1- if yes)	+
7	Credit	Whether the farmer received credit in the past year	Dummy variable (1- if yes)	+
8	Training	Whether the farmer received formal training in dairy farming or marketing	Dummy variable (1- if yes)	+
9	Information	Whether the farmer received regular market information	Dummy variable (1- if yes)	+

3.7. Ethical Consideration

Ethical considerations were fundamental to ensuring responsible conduct throughout this study, from data collection to reporting. Adhering to ethical standards helped build credibility and respect for all participants involved. One critical aspect was informed consent, where participants were fully informed about the study's purpose, objectives, procedures, and their rights, including the option to withdraw at any time without repercussions. Informed consent was essential for respecting participants' autonomy and was a widely recognized practice in ethical research (Resnik, 2018).

To protect participants' privacy, confidentiality was maintained throughout the study. All personal identifiers were removed from data sets, and only aggregated information was used in any reporting or publication, ensuring that individual responses could not be traced back to specific participants. This aligned with best practices in ethical research, where protecting data privacy was critical to upholding trust (Beskow, Check, & Ammarell, 2018). Secure storage of digital data with restricted access further safeguarded confidentiality.

Additionally, honesty and transparency were paramount in reporting research findings. Results were presented accurately and objectively, without any misrepresentation or manipulation, as transparency in findings strengthened the credibility of the research (Kadam & Bhalerao, 2017).

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1. Descriptive analysis

4.1.1. General Response Rate

From the data assembled, out of the 235 questionnaires distributed, 214 usable copies were completed and returned with a response rate of 91%. This rate concurs with Mugenda and Mugenda (2013) who explains that for hypothesis a response rate of half is palatable for examination and reporting, 60% is extraordinary and a response rate of 70% and over is awesome, thus 91% was surprising for an examination. This high response rate can be credited to the data gathering systems, where the researcher pre-told the potential individuals and associated the drop and pick technique where the surveys were picked at a later date to allow the respondents rich time to fill the reviews.

4.1.2. Demographic characteristics of respondents

This section gives information on gender, age, and experience and education level of the respondents.

The gender distribution of the respondents revealed that a majority of the dairy farmers in the study area were female, with 54.7% of the respondents identifying as female. This suggests that women played a significant role in dairy farming in the region, potentially taking on primary or secondary responsibilities in farm management and milk production. This higher representation of women in dairy farming may reflect broader socio-economic dynamics, including gender roles and labor distribution within the agricultural sector.

The age distribution of the respondents revealed several insights about the demographic composition of small-scale dairy farmers in the study area. The findings showed that the majority of the participants were in the middle-aged groups, with 39.7% of the respondents being between 45 and 54 years old. This age group constituted the largest proportion of dairy farmers, indicating that most of the farmers were in the later stages of their careers. Middle-aged farmers likely have more experience in the dairy farming sector, which could contribute to a better understanding of market dynamics, farming practices, and the overall dairy industry.

The educational background of the respondents revealed notable trends regarding the level of formal education attained by small-scale dairy farmers in the study area. A majority, 63.55% of the respondents, had completed secondary education. This suggests that more than half of the dairy farmers in the study area had attained a relatively high level of formal education. This level of education is likely sufficient to equip

farmers with basic literacy, numeracy, and problem-solving skills, which are essential for managing a farm. Secondary education also offers the foundation for further learning, such as acquiring new knowledge about market trends, farming techniques, and technological advancements that could enhance dairy farming practices. Given that secondary education is common in many parts of the world, it indicates that dairy farming in the region may attract individuals who are capable of integrating modern practices into their operations. Additionally, these farmers may be more likely to engage with government programs, cooperatives, or other institutional support mechanisms that require a certain level of literacy and formal education.

The distribution of years of experience in dairy farming among the respondents revealed important insights into the level of expertise and knowledge possessed by the farmers in the study area. The largest group, 49.5% of the respondents, had been involved in dairy farming for 7 to 10 years. This indicates that almost half of the respondents had substantial experience in the field, which suggests they were familiar with the common challenges and opportunities that come with dairy farming. Farmers in this category likely had a deep understanding of essential practices such as animal health management, milk production, feeding systems, and overall farm management. These farmers may have refined their skills over the years, making them more adept at managing their operations and solving problems that arise in the course of farming. The extended experience also suggests that they were likely better positioned to weather challenges such as fluctuating market prices, varying feed costs, or unpredictable weather conditions that could affect milk production.

Table 3: Basic respondent’s characteristics

characteristics	Attributes	frequency	Percent
Gender	Female	117	54.67
	Male	97	45.33
Age in years	below 25 years	13	6.07
	25 - 34 years	30	14.02
	35 - 44 years	60	28.04
	45 - 54 years	85	39.72

	55 years and above	26	12.15
Education level	No formal education	-	-
	Primary education	27	12.62
	Secondary education	136	63.55
	Diploma/Technical training	51	23.83
	University degree and above	-	-
Work experience	Less than 2 years	6	2.80
	2-5 years	11	5.14
	6-10 years	29	13.55
	11-20 years	106	49.53
	More than 20 years	62	28.97

4.1.3. Farm Characteristics to market participation

The analysis of farm characteristics in relation to market participation provided deeper insights into factors influencing small-scale dairy farmers' decisions to engage in the market.

The cross tabulation between market participation and average daily milk production revealed important insights into the relationship between the amount of milk produced and farmers' engagement in the market. The findings highlighted differences in milk production between market participants and non-participants, offering a deeper understanding of how production levels could influence market behavior.

Table 4: Average daily milk production cross tabulation

			What is your average daily milk production?					Total
			Less than 5 liters	5-10 liters	11-20 liters	21-50 liters	More than 50 liters	
Market Participation	No	Count	6	27	16	22	25	96
		%	6.3%	28.1%	16.7%	22.9%	26.0%	100.0%
	Yes	Count	9	24	11	45	29	118
		%	7.6%	20.3%	9.3%	38.1%	24.6%	100.0%
Total		Count	15	51	27	67	54	214
		%	7.0%	23.8%	12.6%	31.3%	25.2%	100.0%

Sources: - own Survey result, 2024

For non-market participants (96 respondents), the distribution of milk production showed that a significant portion, 28.1%, produced 5-10 liters of milk daily. This group represents a large segment of non-market participants, suggesting that many farmers with small to medium-scale production were not involved in commercial milk sales. This could be attributed to a range of factors, including limited access to markets, lack of financial capacity to invest in production for sale, or challenges related to transportation and logistics. In addition to this group, 26.0% of non-market participants produced more than 50 liters daily, indicating that while some non-market farmers were capable of producing large quantities of milk, they did not engage in the market. This is an intriguing finding, as it suggests that factors other than production capacity, such as market access or financial constraints, may prevent these farmers from participating in commercial dairy markets. A smaller group, 16.7%, of non-market participants produced between 11-20 liters, indicating that some farmers in this category were capable of moderate production but still chose not to participate in the market. This further supports the idea that production alone may not be the primary factor driving market participation. Finally, 6.3% of non-market participants produced less than 5 liters of milk daily, which is more likely associated with small-scale, subsistence farming, where milk production is primarily for household consumption rather than for commercial sale.

In contrast, market participants (118 respondents) displayed a different pattern of milk production. The largest group of market participants, 38.1%, produced 21-50 liters of milk per day, which represents a significant proportion of the total market participants. This group likely consisted of farmers who were producing milk at a scale large enough to justify market participation, suggesting that production volume is

a key factor in market engagement. Market participants who produced more than 50 liters daily accounted for 24.6% of the total, further reinforcing the notion that larger-scale milk production tends to align with market participation. These farmers likely had access to the necessary resources, infrastructure, and markets to sell their milk. On the lower end of the production spectrum, 20.3% of market participants produced 5-10 liters daily. Although this is a smaller quantity compared to the other categories, it still represents a significant portion of market participants who are producing enough milk to engage in commercial transactions. A much smaller portion of market participants, 7.6%, produced less than 5 liters daily, suggesting that most market participants were producing at least a moderate quantity of milk that could be sold.

Overall, the entire sample of 214 farmers showed a varied distribution of daily milk production. The highest percentage of farmers, 31.3%, produced between 21-50 liters per day. This finding suggests that a significant portion of farmers, both market participants and non-participants, fall into this middle range of production. The second largest group, 25.2%, produced more than 50 liters daily, which is indicative of larger-scale dairy farming. Farmers who produced 5-10 liters and 11-20 liters accounted for 23.8% and 12.6% of the total sample, respectively, while 7.0% of farmers produced less than 5 liters daily. This general distribution aligns with the trends seen in market participation, where higher milk production is often linked with market engagement.

From these findings, it was clear that market participants tended to produce larger quantities of milk. 38.1% of market participants produced between 21-50 liters, and 24.6% produced more than 50 liters. This suggests that larger-scale production may facilitate market participation, as farmers with higher production are better positioned to engage in commercial sales, possibly due to economies of scale, better access to resources, and more developed marketing channels. Conversely, non-market participants were more likely to produce smaller quantities of milk, with 28.1% of them producing 5-10 liters and 26.0% producing over 50 liters. This distribution suggests that while some non-market farmers may be producing substantial volumes, they might face barriers in accessing markets or may prefer to use the milk for personal consumption rather than commercial sales.

The findings also indicated that factors beyond milk production, such as market access, financial constraints, infrastructure, and the availability of markets, play critical roles in determining whether a farmer participates in the market. Even farmers producing significant amounts of milk may choose not to engage in the market due to logistical challenges or the lack of appropriate outlets to sell their milk. The differences in milk production volumes between market participants and non-participants highlighted the

potential impact of farm size and production capacity on a farmer's ability to participate in the dairy market.

In conclusion, the cross tabulation revealed that larger-scale milk production was strongly associated with market participation. However, it also highlighted that non-participants, despite producing large quantities of milk, often faced challenges in accessing markets or were possibly focused on subsistence farming. Thus, the relationship between production volume and market participation is complex, influenced not only by the amount of milk produced but also by other external factors such as market access, infrastructure, and financial support. These results underscore the importance of addressing the broader challenges faced by small-scale dairy farmers to enhance market participation, even among those capable of producing larger volumes of milk.

The cross tabulation between market participation and the main source of animal feed provided a deeper understanding of how dairy farmers' feed sourcing decisions related to their involvement in the market. The findings revealed some key trends and relationships between the source of feed and market participation.

For the group of farmers who did not participate in the market (96 respondents), a significant proportion, and 29.2%, reported relying on other sources of animal feed. This could suggest that these farmers' utilized non-commercial or locally sourced feed, which may include feed collected from local resources, like grasses, crop residues, or even discarded food items. This could indicate that non-market participants might have fewer resources or less access to commercial feed markets, prompting them to rely more on locally available or less expensive feed sources. Additionally, 22.9% of the non-market participants depended on government-subsidized feed, showing that external support, such as government subsidies, played a crucial role in helping these farmers meet their feed requirements. Government subsidies are often aimed at reducing the cost burden for farmers, and this reliance may also suggest that non-market participants are more dependent on external financial assistance, potentially due to smaller farm operations or limited financial capacity to purchase commercial feed. Moreover, 18.8% of the farmers who did not participate in the market relied on own farm production for animal feed. This indicates that while these farmers might be self-sufficient in feed production, they might not be capitalizing on market opportunities for dairy sales. This self-reliance could be due to the limited scale of their operations, which might not justify the costs and logistics involved in market engagement.

Table 5: Main source of animal feed Cross tabulation

		What is your main source of animal feed?					Total
		Own farm production	Purchased from the market	Combination of both	Government-subsidized feed	Other	
Market Participation	No	17	11	18	22	28	96
	Count						
	%	17.7%	11.5%	18.8%	22.9%	29.2%	100.0%
	Yes	11	25	18	28	36	118
	Count						
	%	9.3%	21.2%	15.3%	23.7%	30.5%	100.0%
Total	Count	28	36	36	50	64	214
	%	13.1%	16.8%	16.8%	23.4%	29.9%	100.0%

Sources: - own Survey result, 2024

In contrast, the group of market participants (118 respondents) showed a different trend in their feed sourcing strategies. The largest portion of this group, 30.5%, reported using other sources of animal feed. This category likely includes alternative feed options such as foraged materials or non-commercial feeds, reflecting that market participants may also diversify their feed sources. These farmers might be more flexible in sourcing feed from various channels, potentially due to their greater access to information or the need to reduce feed costs while maintaining their market operations. It could also suggest that market participants might be more adaptive and resourceful, sourcing feed from multiple avenues based on availability and cost.

Another significant group of market participants (23.7%) relied on government-subsidized feed, indicating that government assistance continued to play an important role in supporting dairy farmers who engage in the market. Subsidies help ease the financial burden of purchasing feed, particularly for farmers who are working to scale up production and meet market demands. These participants may rely on subsidized feed to maintain competitive milk prices, especially in an environment where feed costs can vary. Additionally, 21.2% of the market participants purchased feed from the market, demonstrating a more commercialized

approach to sourcing animal feed. These farmers likely have the financial capacity and infrastructure to engage in the market for feed, allowing them to purchase higher-quality or specialized feeds that could improve milk production or animal health. This indicates a shift toward more professional, market-oriented dairy farming practices, where market participants can access a broader range of resources to optimize their operations.

Moreover, 15.3% of market participants used a combination of both purchased feed and own farm production. This suggests that these farmers strategically balance between producing their own feed and buying it from the market. A mixed strategy may allow them to maintain a level of self-sufficiency while also benefiting from the specialized feed available in the market. By using both sources, these farmers can potentially ensure that their livestock receives a balanced and consistent diet while optimizing costs.

Across all the farmers surveyed, the total distribution indicated some overarching patterns. 29.9% of the total respondents relied on other sources of animal feed, emphasizing the widespread use of locally available or non-commercial feed. This highlights the importance of such feed sources in the local dairy farming community, as they may be more accessible and affordable than commercially purchased or government-subsidized feed. Furthermore, 23.4% of respondents depended on government-subsidized feed, suggesting that many dairy farmers, both market participants and non-participants; rely on external support to mitigate the costs of feed. A diverse distribution was also evident, with 16.8% of respondents purchasing feed from the market, and 16.8% relying on a combination of both farm production and purchased feed. This mix reflects the different strategies employed by farmers, with some seeking a balance between self-production and external sourcing, while others depend entirely on market options or subsidies.

Overall, the data suggested that while government subsidies were a common source of feed for both market participants and non-participants, market participants showed greater diversity in their feed sourcing, using a combination of market purchases, subsidized feed, and other sources. The higher reliance on other feed sources across both groups indicates that local and non-commercial options remain important in the dairy farming landscape. However, the increased reliance on purchased feed among market participants suggested a more commercial approach to dairy farming, where farmers are more integrated into the market and likely have better access to financial resources to purchase feed. Additionally, the use of government-subsidized feed by both groups demonstrated the ongoing role of government support in ensuring the sustainability of dairy farming in the region.

In conclusion, the findings from the cross tabulation showed that market participants tended to have a more varied approach to sourcing feed, possibly reflecting their greater financial flexibility, access to resources,

and adaptability. Non-market participants, on the other hand, often relied more on self-produced feed or government subsidies. The results highlighted the critical role of government support in maintaining dairy farming, regardless of market participation, and indicated that alternative or non-commercial feed sources remain an essential part of the farming landscape.

Table 6: Land ownership Cross tabulation

			Do you own the land used for dairy farming?		Total
			No	Yes	
Market Participation	No	Count	75	21	96
		%	78.1%	21.9%	100.0%
	Yes	Count	32	86	118
		%	27.1%	72.9%	100.0%
Total		Count	107	107	214
		%	50.0%	50.0%	100.0%

Sources: - own Survey result, 2024

The cross tabulation between market participation and land ownership provided insights into the relationship between farmers' land ownership status and their involvement in the dairy market.

For non-market participants (96 respondents), a significant majority, 78.1%, did not own the land used for dairy farming. This suggests that land ownership may be a factor affecting market participation, with non-owners being more likely to refrain from participating in dairy markets. The remaining 21.9% of non-market participants did own the land they farmed, which might imply that even with land ownership, other factors, such as access to markets, resources, or financial constraints, could prevent farmers from engaging in dairy sales.

In contrast, for market participants (118 respondents), 72.9% owned the land they used for dairy farming. This indicates that land ownership was more prevalent among those involved in the dairy market, suggesting that owning land might facilitate market participation. The remaining 27.1% of market participants did not own the land, indicating that market participation can still occur without land ownership, although it is less common.

In total, 50.0% of the entire sample (214 respondents) owned the land they used for dairy farming, while the other 50.0% did not. This balanced distribution further supports the notion that land ownership is an

important factor, but it is not the sole determinant of market participation. Other factors such as access to resources, market opportunities, and financial conditions likely play significant roles in a farmer's decision to participate in the dairy market.

In summary, the findings suggest that land ownership is strongly associated with market participation. A higher percentage of market participants owned the land they farmed (72.9%) compared to non-market participants (21.9%), highlighting land ownership as a key enabling factor for engaging in dairy markets. However, the fact that a portion of both market participants and non-market participants did not own land indicates that land ownership, while important, is not the only factor influencing market participation in dairy farming.

4.1.4. Access of Service and Infrastructure to market participation

The analysis of service access in relation to market participation provided deeper insights into factors influencing small-scale dairy farmers’ decisions to engage in the market.

Table 7: Access to veterinary services

Do you have access to veterinary services?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	107	50.0	50.0	50.0
	Yes	107	50.0	50.0	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

The data on access to veterinary services revealed a balanced distribution, with 50.0% (107 respondents) of farmers reporting that they had access to veterinary services, while the other 50.0% (107 respondents) indicated that they did not. This even split underscored a critical issue within the dairy farming community, as access to veterinary services is crucial for maintaining the health of livestock, improving milk production, and ensuring overall farm productivity. The fact that half of the respondents did not have access to veterinary services reflected a significant challenge that many small-scale dairy farmers face in terms of limited access to essential support for disease prevention, treatment, and livestock management.

Farmers without access to veterinary services may struggle with managing the health of their animals, which could lead to increased risks of disease outbreaks, lower milk yields, and reduced animal longevity. Without regular veterinary care, many farmers are likely to face challenges related to the quality and

quantity of milk production, which could directly impact their ability to participate in the dairy market. In addition, the absence of veterinary support may lead to higher mortality rates among livestock, contributing to a lack of productivity and financial losses. These factors may contribute to the lower levels of market participation observed among some dairy farmers, especially those who are unable to maintain their animals' health and performance.

Conversely, the 50.0% of farmers who had access to veterinary services were likely to benefit from professional care, disease management, and preventative treatments, such as vaccinations and parasite control, which are all vital to improving livestock productivity. This access could potentially enhance both the quality and quantity of milk produced, thereby increasing these farmers' capacity to engage in the market. Veterinary services play a significant role in managing animal health, preventing disease outbreaks, and improving production efficiency, all of which are essential for successful market participation. Therefore, farmers with access to veterinary care are more likely to have healthier, higher-producing herds, enabling them to compete more effectively in the dairy market.

Moreover, access to veterinary services could contribute to the adoption of best practices in dairy farming. Farmers who have regular access to veterinarians may also benefit from expert guidance on nutrition, breeding, and animal welfare practices, all of which can lead to improved farm management and profitability. The role of veterinary services in boosting both productivity and market participation cannot be underestimated, as healthy livestock are fundamental to maintaining consistent production levels and achieving higher profits.

In conclusion, the data showed that access to veterinary services was evenly split between market participants and non-participants. While half of the farmers had access to these essential services, the other half faced significant challenges in maintaining their livestock's health without professional veterinary support. This disparity likely had a direct impact on the farmers' ability to improve their dairy farming practices and participate in the market. Addressing the issue of limited access to veterinary services could play a crucial role in enhancing the health and productivity of small-scale dairy farms, leading to greater market participation and improved livelihoods for farmers.

The data on the distance to the nearest veterinary service provided insights into the accessibility of veterinary care for dairy farmers in the area. The findings indicated a wide variation in the distance that farmers needed to travel to access veterinary services, which could have implications for both the health of their livestock and their ability to engage in the dairy market.

Table 8: Distance to the nearest veterinary service

What is the distance to the nearest veterinary service?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 2 km	20	9.3	9.3	9.3
	2-5 km	71	33.2	33.2	42.5
	6-10 km	39	18.2	18.2	60.7
	11-20 km	69	32.2	32.2	93.0
	More than 20 km	15	7.0	7.0	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

A notable portion of the respondents, 33.2% (71 respondents), reported that the nearest veterinary service was located between 2 and 5 kilometers away. This group of farmers was relatively close to veterinary services, suggesting that they had relatively good access to professional care when needed. While this distance may have been manageable for many farmers, especially those with reliable transportation, it still posed a potential challenge for those with limited access to vehicles or those living in areas with poor infrastructure. Despite this, the proximity to veterinary services could have facilitated timely interventions in case of disease outbreaks or health concerns, thus supporting the farmers' ability to maintain healthy herds and participate in the dairy market.

Another significant portion, 32.2% (69 respondents), stated that the nearest veterinary service was between 11 and 20 kilometers away. For these farmers, the distance was much more considerable. This could have represented a substantial barrier to accessing veterinary services, as traveling such distances would have required more time and resources. Additionally, farmers in this group were likely to face increased transportation costs, which could have made it more difficult to seek veterinary care, particularly in emergency situations or for routine health maintenance. As a result, delays in accessing veterinary care could have negatively affected animal health, leading to lower productivity and a possible reduction in market participation due to decreased milk production or higher veterinary expenses.

A smaller proportion of respondents, 18.2% (39 respondents), reported that the nearest veterinary service was located between 6 and 10 kilometers away. Although this was a moderate distance, it still could have posed logistical challenges for some farmers. Accessing veterinary care from this distance might have been feasible for those with available transportation, but for farmers without reliable vehicles or those facing

financial constraints, this distance could have been an obstacle. These farmers may have been more likely to delay seeking veterinary assistance, which could have had a negative impact on the health and productivity of their dairy herds.

Meanwhile, 9.3% (20 respondents) reported that the nearest veterinary service was less than 2 kilometers away. This small group of farmers likely had easy and relatively quick access to veterinary care. Such proximity would have facilitated timely interventions, allowing farmers to manage their animals' health effectively and reduce the risk of disease outbreaks. This access to close veterinary services could have contributed to better livestock management, higher milk yields, and overall improved market participation, as farmers were able to maintain healthier herds.

The least common response came from 7.0% (15 respondents), who indicated that the nearest veterinary service was more than 20 kilometers away. For these farmers, the distance to veterinary care was a significant challenge. The travel time and cost involved in reaching a veterinary service over such a long distance likely deterred many from seeking professional care as often as necessary. This lack of timely veterinary assistance could have led to health issues among their livestock, such as diseases or infections going untreated, which could in turn negatively impact milk production and market participation. Moreover, farmers in this group were more likely to face financial strain due to the additional costs of transportation and veterinary services, further limiting their ability to effectively manage their farms.

In summary, the data indicated that while some farmers had relatively easy access to veterinary services, a significant proportion of respondents faced considerable distances, which likely posed challenges in accessing timely care. Farmers who lived farther from veterinary services, particularly those located more than 10 kilometers away, were more likely to experience delays in managing their animals' health, which could have detrimental effects on both livestock productivity and market participation. The distance to veterinary services was therefore a critical factor in determining the overall health and success of dairy farms, and improving access to veterinary care for farmers located in more remote areas could help enhance the productivity and sustainability of dairy farming.

The data on the mode of transport used by dairy farmers to deliver milk to the market indicated significant variation, highlighting the different levels of access to resources and infrastructure among the respondents. This diversity in transportation methods likely reflects the socio-economic conditions of the farmers, as well as their geographic location and access to financial resources.

Table 9: Mode of transport

What mode of transport do you use to deliver milk to the market?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Own vehicle	16	7.5	7.5	7.5
	Rented/Hired vehicle	18	8.4	8.4	15.9
	Public transport	53	24.8	24.8	40.7
	On foot/Bicycle	61	28.5	28.5	69.2
	Other	66	30.8	30.8	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

A large portion of the respondents, 30.8% (66 respondents), reported using “Other” forms of transportation. While this category was not specifically detailed in the data, it could have included a range of unconventional or community-based transport options. For example, some farmers might have relied on shared rides with other farmers, used motorcycles or three-wheeled vehicles, or even engaged in informal transport arrangements with friends or family. This suggests that for many farmers, particularly those in rural or less accessible areas, traditional transportation methods may not have been readily available, pushing them to seek alternative, often less reliable, means of transport. The use of informal transport methods could also indicate that farmers were trying to reduce costs, as these options may have been cheaper, though they may have come with the trade-off of less reliability and efficiency.

The second largest group, 28.5% (61 respondents), indicated that they transported milk on foot or by bicycle. This finding points to the limited access to motorized transport for a significant number of farmers. These methods of transport are more affordable but come with several challenges. For example, farmers using bicycles or walking to the market likely faced significant limitations in the amount of milk they could transport at one time, which would restrict their market reach and ability to generate income. Additionally, milk is highly perishable, and the time it takes to deliver milk on foot or by bicycle could have led to delays in getting the milk to the market in fresh condition. This mode of transport is more likely to be used by farmers with smaller-scale operations or those located closer to markets, but for farmers with larger herds or those further from market areas, it would have posed a considerable logistical challenge.

A smaller proportion of respondents, 24.8% (53 respondents), relied on public transport to deliver milk. Public transport is often seen as a more accessible and cost-effective option, especially for farmers without

personal vehicles. However, while public transport could have provided a viable solution for reaching the market, it likely presented several limitations. These included concerns around the availability and reliability of public transport, particularly in more rural areas, as well as issues related to the proper handling of milk during transport. Public transport may not have been designed to accommodate perishable goods, which could have led to problems in milk quality, delays in transport, and potential losses for the farmers.

18.4% (39 respondents) of farmers indicated that they rented or hired vehicles to transport their milk. This method suggested that a portion of the farmers had the financial ability to hire transport services but did not own vehicles themselves. Hiring vehicles could have provided these farmers with a greater degree of flexibility, allowing them to transport larger quantities of milk and potentially reach markets farther from their farms. However, rental or hired vehicles also involved additional costs, which might have been a burden for smaller-scale or less financially stable farmers. The reliance on hired vehicles may have limited the frequency and regularity with which these farmers could transport their milk, and any increases in rental costs could have had an adverse effect on their overall profitability.

The smallest group, 7.5% (16 respondents), reported owning their own vehicles. These farmers had a significant advantage over others in terms of transport flexibility, as owning a vehicle allowed them to transport milk on their own schedule without relying on external providers. The ability to own a vehicle also likely provided these farmers with greater control over the timing of milk deliveries, which would be crucial in maintaining milk quality and freshness. However, owning a vehicle involves both significant upfront costs and ongoing maintenance expenses, which may have limited this option to farmers with better financial means. Despite the advantages, the cost of vehicle ownership could have still presented challenges for many small-scale farmers.

In conclusion, the data indicated that most dairy farmers in the study relied on non-motorized transport methods such as bicycles, walking, or public transport to deliver their milk to the market. This reliance on less efficient and slower transportation options likely had a negative impact on the farmers' ability to reach markets quickly, maintain milk quality, and ultimately participate effectively in the dairy market. Farmers who owned their own vehicles or rented transport services had a logistical advantage, but these options were not available to the majority of respondents, suggesting that improving access to affordable and reliable transportation could significantly enhance market access, reduce costs, and improve the livelihoods of small-scale dairy farmers.

4.1.5. Credit Availability to market participation

The analysis of credit and loan in relation to market participation provided deeper insights into factors influencing small-scale dairy farmers' decisions to engage in the market.

Table 10: credit and loan

Have you received any credit/loan for dairy farming in the past year?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	106	49.5	49.5	49.5
	Yes	108	50.5	50.5	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

The data on whether dairy farmers had received any credit or loans for dairy farming in the past year indicated a fairly balanced distribution between those who had accessed credit and those who had not. Of the 214 respondents, 49.5% (106 respondents) reported that they had not received any credit or loans for their dairy farming activities in the past year. In contrast, 50.5% (108 respondents) indicated that they had successfully accessed some form of financial support.

The fact that almost half of the respondents (50.5%) had received credit or loans highlights the importance of financial support for small-scale dairy farmers in maintaining or expanding their operations. These loans or credits likely provided farmers with the necessary capital to purchase inputs such as feed, veterinary services, equipment, and even to improve their infrastructure. Credit access could also help farmers manage cash flow, particularly in times of market fluctuations or unexpected expenses. Receiving credit or loans is often a critical factor in the ability of farmers to scale up their operations, increase productivity, and invest in new technologies, which could enhance their competitiveness in the market.

On the other hand, the fact that 49.5% of the respondents did not receive any credit or loans suggests that financial access remains a significant challenge for a large proportion of small-scale dairy farmers. The inability to access credit could limit farmers' capacity to invest in necessary inputs or infrastructure improvements. This lack of access may also result in farmers continuing to rely on traditional or less efficient farming practices, which can hinder their growth and market participation. Several factors might contribute to this lack of credit access, including the absence of collateral, which many financial institutions require for lending, as well as strict lending terms, high-interest rates, or a lack of financial

literacy among farmers. In some cases, farmers might also lack the necessary documentation or formal recognition to qualify for loans, especially in rural or informal settings.

The nearly equal split between farmers who had received credit and those who had not also implies that access to credit might not be uniformly distributed across different segments of the farmer population. There could be variations in credit access based on farm size, farm income, geographical location, or even the relationship between farmers and financial institutions. Larger farms or those with more established operations might have had better access to credit compared to smaller or newer farms. Similarly, farmers in urban areas or those with better financial connections might have found it easier to access loans, while those in more remote areas might have faced challenges in obtaining financial support.

Moreover, it is possible that some of the farmers who did not receive credit may have faced difficulties in obtaining loans from formal financial institutions, which are often perceived as having stringent criteria and high collateral requirements. This group of farmers may have resorted to informal lending sources, or perhaps they did not seek loans due to a lack of awareness or confidence in the credit system.

In summary, the data indicates that while a significant proportion of dairy farmers had access to credit or loans, nearly half had not. These points to a critical gap in financial inclusion, which could be limiting the growth potential of small-scale dairy farmers; Addressing this issue by improving access to affordable and flexible credit options, along with supporting financial literacy programs, could enable farmers to enhance their productivity, better manage their operations, and increase their participation in the dairy market. Improved credit access could be a vital factor in empowering farmers to overcome the financial barriers that hinder their development and growth within the dairy farming sector.

The data on why dairy farmers did not receive credit highlights several significant barriers that limited their access to financial support. Of the 214 respondents, 47.7% (102 respondents) reported that the primary reason for not receiving credit was the absence of a financial institution nearby. This indicates that a large portion of dairy farmers, especially those in rural or remote areas, faced geographical limitations that made it difficult to access formal credit channels. The lack of proximity to banks or microfinance institutions is a major obstacle for farmers who might want to apply for loans but cannot do so due to the absence of nearby financial services. This suggests a need for better financial infrastructure in rural areas, such as establishing mobile banking services or outreach programs that bring financial institutions closer to farmers.

Table 11: Reasons lack of credit

		If No, what is the reason?			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No collateral	8	3.7	3.7	3.7
	High-interest rates	13	6.1	6.1	9.8
	Lack of information on credit sources	15	7.0	7.0	16.8
	No financial institution nearby	102	47.7	47.7	64.5
	Other	76	35.5	35.5	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

Another notable barrier, identified by 35.5% (76 respondents), was classified under "other" reasons. This broad category likely encompasses a range of issues specific to individual farmers. For example, some farmers might have experienced previous difficulties with loan repayment or faced challenges in establishing creditworthiness. Others may have mistrusted financial institutions or opted out of seeking credit because of unfavorable experiences in the past. The diversity of issues captured in this category points to the complex and multifaceted nature of financial access problems that small-scale farmers face. It suggests that simply addressing the availability of loans may not be enough; efforts to improve farmers' relationships with financial institutions and rebuild trust are also critical.

Additionally, 7.0% (15 respondents) cited a lack of information about credit sources as a barrier to accessing loans. This shows that for a portion of farmers, the challenge was not the availability of credit per se but the knowledge and understanding of where and how to apply for loans. Lack of information could stem from poor communication about available financial products, inadequate outreach programs, or a lack of financial literacy among farmers. This highlights the need for increased efforts to inform farmers about the various credit options available to them, including government-backed loan programs, microfinance institutions, and other alternative lending sources. Providing more accessible information through local workshops, radio programs, or partnerships with extension services could help mitigate this barrier.

The issue of high-interest rates was also a concern for 6.1% (13 respondents). For these farmers, even though credit might have been available, the cost of borrowing was prohibitive. High-interest rates can

deter farmers from taking loans, particularly when they are unsure of their ability to repay. For small-scale dairy farmers, whose income may fluctuate due to seasonal changes in milk production or market prices, taking on loans with high-interest rates can be a significant financial risk. This suggests that lowering interest rates, offering subsidized loans, or providing flexible repayment terms could make credit more accessible and less burdensome for farmers.

Finally, 3.7% (8 respondents) reported that they did not receive credit because they lacked collateral. This barrier is particularly relevant for small-scale farmers who may not own enough assets to secure loans. In many cases, financial institutions require collateral as a form of security for loans, and without it, farmers are unable to qualify for credit. This can be especially difficult for farmers starting out or those with limited access to resources. To address this, financial institutions could consider offering microloans or collateral-free loans, or using alternative forms of collateral, such as future milk sales or group guarantees.

In conclusion, the data illustrates that several factors contributed to the lack of credit access among dairy farmers. The most significant barrier was the lack of financial institutions in rural areas, but other important challenges included insufficient information on credit sources, high-interest rates, and the need for collateral. To improve access to credit, a multifaceted approach is required, including expanding financial infrastructure, enhancing financial literacy, reducing loan costs, and offering more flexible lending criteria

Table 12: Main purpose of the credit

If yes, what was the main purpose of the credit?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Buying dairy cows	37	17.3	17.3	17.3
	Buying animal feed	63	29.4	29.4	46.7
	Improving farm infrastructure	42	19.6	19.6	66.4
	Expanding market access	56	26.2	26.2	92.5
	Other	16	7.5	7.5	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

The data provided on the main purposes for which dairy farmers used credit highlights the key areas of investment that farmers prioritize to improve their operations and overall productivity. Among the 214 respondents, the most common use of credit, with 29.4% (63 respondents), was for purchasing animal feed. This indicates that for many dairy farmers, the cost of feed is a significant financial burden, and access to credit provides an opportunity to manage this cost. Animal feed is essential for the sustenance and

productivity of dairy cows and without adequate feed, milk production could be severely compromised. By using credit to purchase animal feed, farmers likely aimed to ensure a consistent and reliable food supply for their livestock, ultimately improving milk yields. This finding underscores the importance of feed as a critical input for dairy farming and the need for financial support to secure it.

The second most common use of credit, reported by 26.2% (56 respondents), was to expand market access. This suggests that access to credit allowed farmers to invest in activities that would help them increase the reach of their products. Expanding market access could include efforts such as improving transportation to distant markets, increasing the scale of milk production, and investing in packaging or marketing strategies to attract more customers. For many small-scale dairy farmers, market access can be a significant challenge, particularly when dealing with the logistics of getting their products to urban centers or large consumer bases. Credit provided an avenue for overcoming these barriers, enabling farmers to reach more buyers and thus improve their income streams.

The third largest category, with 19.6% (42 respondents), was the use of credit for improving farm infrastructure. This includes investments in buildings, equipment, or other physical assets that directly contribute to the operational efficiency of the farm. Improving infrastructure can involve the construction of better housing for the livestock, installation of better milking equipment, or upgrading storage and refrigeration facilities to preserve milk quality. These infrastructure improvements help increase operational capacity, ensure the health and welfare of the animals, and reduce costs over time. Many farmers understand that investments in infrastructure not only support day-to-day operations but also contribute to the long-term sustainability of the farm.

A substantial proportion of farmers, 17.3% (37 respondents), used credit to buy dairy cows. Increasing herd size is a direct strategy for expanding milk production, and this finding highlights that many farmers were seeking to increase their livestock numbers to meet market demand or improve production efficiency. Buying more cows could also have been an effort to replace older or less productive animals, thus improving the overall genetic quality of the herd and increasing milk yields. For farmers looking to grow their operations, acquiring more livestock is an essential step, and credit served as a tool to finance this investment.

Lastly, 7.5% (16 respondents) used credit for purposes that were not specifically categorized in the survey and fell under the "other" category. These purposes could vary widely and might include things like veterinary care, labor costs, or other necessary investments in the dairy farming operation. This category suggests that there are additional, less prominent but still important reasons for seeking credit. It also

highlights the diversity of needs within the dairy farming community, where credit may be used for a wide range of activities beyond the main production and marketing purposes.

Overall, the findings demonstrate that credit was predominantly used to address the critical challenges of dairy farming: securing animal feed, expanding market access, improving infrastructure, and increasing livestock numbers. These areas are essential for the growth, productivity, and profitability of dairy farms. The results suggest that credit played a crucial role in helping small-scale dairy farmers overcome financial constraints, improve operational efficiency, and grow their businesses. Furthermore, the use of credit for improving market access indicates that many farmers were keen on entering larger and more profitable markets, while the investment in infrastructure and livestock shows their focus on improving both the capacity and quality of their farms. This highlights the importance of credit as a tool for supporting the expansion and modernization of dairy farming operations.

4.1.6. Training Programs to market participation

The analysis of training program in relation to market participation provided deeper insights into factors influencing small-scale dairy farmers’ decisions to engage in the market.

Table 13: formal training

Have you received any formal training on dairy farming and marketing?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	107	50.0	50.0	50.0
	Yes	107	50.0	50.0	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

The data on whether dairy farmers had received formal training in dairy farming and marketing revealed an equal distribution of responses, with 50% (107 respondents) reporting that they had received formal training, while the remaining 50% (107 respondents) indicated that they had not. This suggests that formal training was available to half of the farmers but not to the other half. The fact that there was a 50-50 split provides insight into the potential knowledge gaps that may exist among the farmers. Formal training in dairy farming typically covers crucial topics such as animal husbandry, milking techniques, disease management, feeding practices, and overall farm management. Additionally, marketing training usually focuses on how to promote and sell dairy products, how to identify market trends, set competitive prices, and improve access to broader markets.

For the farmers who had received formal training, they were likely in a better position to apply best practices and improve their productivity. Such training may have empowered them with the necessary tools and techniques to enhance milk production, ensure better quality products, and access more lucrative markets. These farmers would have likely gained a competitive edge by utilizing more efficient farming techniques, which could contribute to the overall sustainability of their operations. They may also have been better able to expand their market reach and implement more effective sales strategies, leading to improved income and business growth.

However, the fact that the other 50% of respondents had not received any formal training suggests that many dairy farmers may be missing out on the benefits of these critical educational resources. This could be due to a variety of reasons, including limited access to training programs, geographical challenges, lack of awareness about available opportunities, or financial constraints that prevent them from participating. The absence of training could result in suboptimal practices in areas such as herd management, disease control, or feeding, ultimately affecting milk production and quality. Furthermore, without marketing training, these farmers may struggle to effectively sell their products, limit their access to markets, or set appropriate prices, which could hinder their ability to increase profitability.

The equal distribution of responses also suggests that training opportunities have not been uniformly distributed among the farming population. Some farmers may have had better access to educational programs due to their location, affiliation with cooperatives, or participation in government or NGO initiatives. In contrast, others may have been left out of these programs, leading to an imbalance in knowledge and capacity within the farming community. This disparity could result in a situation where some farmers are more advanced in their farming practices and market strategies, while others remain reliant on traditional methods that may not be as efficient or profitable.

In conclusion, the findings highlight the importance of ensuring that training opportunities in dairy farming and marketing are accessible to all farmers, particularly those who have not yet had the chance to benefit from formal education. Bridging this gap would help improve the overall productivity and profitability of dairy farming in the region. The results also emphasize the need for more targeted outreach and support to ensure that training programs reach farmers who are currently excluded, enabling them to enhance their skills and improve their livelihoods. Providing such training on a broader scale would not only benefit individual farmers but could also have a positive impact on the local economy, as it could lead to higher quality dairy products, greater market access, and increased overall production.

Table 14: Training providers

		If yes, who provided the training?			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Government agencies	10	4.7	4.7	4.7
	NGOs	15	7.0	7.0	11.7
	Private sector	24	11.2	11.2	22.9
	Dairy cooperatives	102	47.7	47.7	70.6
	Other	63	29.4	29.4	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

The data on the sources of formal training for dairy farmers revealed a diverse range of providers, with dairy cooperatives being the most prominent source. A substantial 47.7% (102 respondents) of the farmers indicated that they received their training from dairy cooperatives. This finding highlights the significant role that cooperatives played in supporting dairy farmers. Cooperatives are often directly involved in the dairy industry and are well-positioned to provide practical and relevant training on a wide array of topics, such as best farming practices, herd management, milk quality control, and market access. The cooperative model likely enabled farmers to receive training that was both specialized and directly applicable to their farming operations. Furthermore, the cooperative structure often fosters collaboration among farmers, creating an environment where knowledge sharing is encouraged and peer support is available, thus enhancing the overall effectiveness of the training programs.

The private sector was the second largest source of training, with 11.2% (24 respondents) reporting that they received training from private entities. These private sector players could include companies involved in supplying agricultural equipment, veterinary services, or dairy processing. Their training programs might have been focused on improving productivity through the use of modern technology, enhancing milk handling processes, or boosting the efficiency of the supply chain. The private sector is likely to have provided more commercially driven training, which could have been tailored to the specific needs of farmers who were looking to expand their business operations or improve their technical expertise.

NGOs emerged as another important source of training, with 7.0% (15 respondents) of farmers receiving training from non-governmental organizations. NGOs often target underserved or rural farming

communities and focus on improving agricultural practices, sustainability, and farmers' livelihoods. Their training might have emphasized topics such as organic farming, disease management, sustainable water use, or improving access to markets. NGOs frequently collaborate with local communities to offer training programs that aim to empower farmers, particularly those who may not have access to other formal educational resources. This group of farmers might have benefited from community-driven approaches and support mechanisms designed to address both their immediate farming needs and broader socio-economic challenges.

Government agencies, however, were reported as the source of training for only 4.7% (10 respondents) of the farmers. This relatively low percentage indicates that government-led initiatives in dairy farming training may have been less effective or less widespread. Factors such as limited outreach, bureaucratic hurdles, or inadequate funding could have hindered the government's ability to provide comprehensive training programs for dairy farmers. Although government agencies often have the capacity to reach large numbers of farmers, this data suggests that there may have been challenges in the delivery of services or in ensuring that all dairy farmers were able to access such programs. The low involvement of government agencies in training suggests that there may be an opportunity to improve these services to ensure that they reach a broader segment of the farming population.

Additionally, 29.4% (63 respondents) of farmers received training from other sources, which could include local experts, agricultural suppliers, informal networks, or peer-to-peer training. These informal sources of training might have been more accessible to farmers who lived in areas with limited access to formal training programs or who were unable to engage with larger organizations such as cooperatives or NGOs. While this group might have received training that was less structured or formalized, it still represents an important channel for knowledge dissemination within the farming community. Peer-to-peer training, in particular, can be highly effective, as farmers often trust the advice and experiences of fellow farmers who share similar circumstances and challenges.

In summary, the results of the data analysis highlight the central role that dairy cooperatives played in providing formal training to farmers, with other sources such as the private sector, NGOs, and informal training channels also contributing to farmers' knowledge and skill development. The relatively low involvement of government agencies in training suggests that there are areas for improvement in government support for the dairy sector. Expanding and diversifying training opportunities could ensure that all farmers, regardless of their location or affiliation, have access to the skills and knowledge needed to enhance their productivity, increase market access, and improve the sustainability of their operations.

Furthermore, the role of informal training sources should not be underestimated, as they could be instrumental in reaching farmers who may not have access to formal institutions.

Table 15: Focus of training

What was the focus of the training?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Dairy production techniques	11	5.1	5.1	5.1
	Marketing and business management	74	34.6	34.6	39.7
	Disease prevention & veterinary	41	19.2	19.2	58.9
	Financial management	72	33.6	33.6	92.5
	Other	16	7.5	7.5	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

The distribution of training topics among dairy farmers reflects a strong interest in improving the business aspects of their operations, with marketing and business management, as well as financial management, emerging as key areas of focus. Of the respondents, 34.6% (74 respondents) reported receiving training in marketing and business management. This indicated a significant demand for skills that could help dairy farmers optimize their market engagement. Farmers likely learned how to better navigate market conditions, set competitive prices, and improve their overall business strategies to increase sales. This focus on business management suggests that dairy farmers, particularly those looking to expand market participation, sought to gain expertise in managing their operations efficiently and profitably, possibly in response to challenges such as fluctuating milk prices and market access.

Training in financial management was the second most common focus, with 33.6% (72 respondents) indicating they received such training; this is critical for the sustainability of any business, including dairy farming, which often requires substantial capital investments; Financial management training likely included guidance on budgeting, handling cash flow, saving, and planning for future growth, as well as advice on obtaining loans or credits. With dairy farming being resource-intensive, farmers with enhanced financial management skills would have been better positioned to allocate resources effectively, reduce unnecessary expenditures, and make informed decisions about investments in infrastructure, equipment, and feed.

Disease prevention and veterinary services were another prominent focus, with 19.2% (41 respondents) of the farmers having received training in this area. This training was essential to maintaining herd health, as diseases can significantly reduce milk yield and quality. By equipping farmers with the knowledge to prevent and treat common illnesses, training on veterinary services ensured that farmers could maintain a healthy and productive herd. This focus on health and animal care likely helped reduce veterinary costs and increased milk production in the long run by preventing large-scale outbreaks and ensuring that cows remained in optimal condition.

In contrast, training specifically related to dairy production techniques, such as milking practices, feed management, and breeding methods, was less frequently reported, with only 5.1% (11 respondents) of farmers indicating this as their main focus. This relatively low percentage could suggest that the majority of farmers already possessed basic technical knowledge or that they prioritized business-related training to enhance their market participation and overall farm management. It is possible that farmers felt that improving the financial and business aspects of their farms was more urgent, particularly if they were already satisfied with the technical skills they had in dairy production.

Lastly, 7.5% (16 respondents) received training in other areas, which may have included sustainable farming practices, environmental management, or regulatory compliance. These additional training topics would have further broadened the scope of farmers' knowledge, helping them adapt to evolving market demands and environmental considerations. Such training would likely be valuable for farmers aiming to diversify their operations or align with industry standards and regulations.

In summary, the results revealed that dairy farmers were most concerned with strengthening their business and financial management skills to improve profitability and market competitiveness. The high rate of training in marketing, business management, and financial management suggests that dairy farmers were increasingly recognizing the need for professional management practices to supplement their technical expertise. While training on dairy production techniques was less common, it remains an important area that could be further developed to ensure optimal milk production. The focus on disease prevention and veterinary care also highlighted the critical importance of animal health in achieving sustainable and high-quality dairy farming. Expanding training programs to include more technical aspects of dairy farming and addressing the broader needs of farmers would likely enhance overall productivity and market participation.

4.1.7. Information availability to market participation

The analysis of information data in relation to market participation provided deeper insights into factors influencing small-scale dairy farmers' decisions to engage in the market.

Table 16: Market price information

Do you regularly receive market price information for dairy products					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	101	47.2	47.2	47.2
	Yes	113	52.8	52.8	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

The survey results revealed that a slight majority of dairy farmers, 52.8% (113 respondents), reported regularly receiving market price information for dairy products, while 47.2% (101 respondents) indicated they did not have access to such information. This suggests a relatively balanced divide in terms of market information access, which could have important implications for the market behavior and decision-making of dairy farmers.

For the farmers who received market price information, it was likely a valuable resource that helped them make informed decisions about when and where to sell their dairy products. Having access to up-to-date market prices allows farmers to time their sales for periods when prices are most favorable, ensuring they maximize their income from milk sales. Moreover, receiving market price information could empower farmers to engage in negotiations with buyers or cooperatives, as they would be better equipped to understand prevailing market trends and prices. This might have led to better price-setting strategies, which could help farmers avoid selling at a loss, particularly in cases of price fluctuations or seasonality in the dairy market.

In contrast, the 47.2% of respondents who did not regularly receive market price information might have faced challenges in navigating the market effectively. Without this information, these farmers could have been at a disadvantage when it came to setting competitive prices or identifying the best times and locations to sell their milk and dairy products. This lack of information may have made them more susceptible to selling at lower prices, either due to being unaware of higher prevailing prices or being unable to negotiate better terms with buyers. Such challenges could have resulted in reduced profits or even financial losses, as they lacked the crucial information needed to make optimal market decisions.

The lack of market price information for almost half of the respondents indicates a gap in the

communication and information channels available to dairy farmers. This could be due to limited access to information systems, a lack of reliable sources of price data, or insufficient dissemination of market information by agricultural agencies, cooperatives, or other relevant stakeholders. It is possible that farmers without access to market price information were more isolated from broader market trends, relying on word-of-mouth or less reliable sources to determine prices, which may have hindered their ability to compete effectively in the market.

Overall, the results underscored the importance of market price information for dairy farmers and highlighted the need for greater efforts to provide consistent, accessible, and accurate pricing data to all farmers. Expanding the availability of market information, particularly to those farmers who do not currently receive it could contribute to more efficient and profitable dairy farming. By ensuring that more farmers have access to real-time market information, agricultural organizations, cooperatives, or government bodies could help improve the decision-making processes of farmers, ultimately boosting market participation, financial stability, and the sustainability of the dairy sector as a whole.

Table 17: Main source of market information

If yes, what is your main source of market information?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Radio/TV	14	6.5	6.5	6.5
	Internet/social media	18	8.4	8.4	15.0
	Cooperatives	51	23.8	23.8	38.8
	Extension officers	62	29.0	29.0	67.8
	Other	69	32.2	32.2	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

The data revealed diverse sources of market information among dairy farmers, with a significant proportion of farmers using multiple channels. Of the respondents, 52.8% (113 individuals) reported receiving market price information for dairy products, while 47.2% (101 individuals) indicated they did not have access to such information.

For those who received market information, the most common source was extension officers, with 29% (62 respondents) of farmers relying on them. Extension officers typically work as intermediaries between farmers and agricultural institutions or government agencies. They are often viewed as trusted sources of

information and provide farmers with advice not only about market prices but also on farming techniques, disease prevention, and government policies. The high reliance on extension officers underscores their crucial role in the rural agricultural ecosystem, where formal education and market infrastructure may be lacking.

Cooperatives were the second most common source of market information, with 23.8% (51 respondents) of the farmers using them. Cooperatives, as collective farming organizations, are able to provide farmers with direct access to market price information through their connection with buyers and market players. This relationship often enables farmers to obtain better prices for their products and engage in cooperative bargaining. The role of cooperatives in providing market information emphasizes their importance in rural communities, where farmers benefit from pooling resources and accessing a larger market share.

Other noteworthy sources included the "Other" category, which accounted for 32.2% (69 respondents). This category likely represented informal channels of communication, such as word-of-mouth from fellow farmers, local traders, community meetings, or other informal networks. These sources, while informal, are still crucial in rural settings where access to formal communication systems can be limited. Word-of-mouth and local networks often play an integral role in the dissemination of information, especially in regions with lower levels of technological access.

Internet and social media were used by 8.4% (18 respondents) of the farmers, which reflects a growing trend of farmers turning to digital platforms for information. However, this percentage is relatively low compared to other sources, likely due to limited access to the internet or digital literacy challenges in rural areas. Despite this, social media platforms have the potential to become increasingly important sources of market information, especially as rural internet infrastructure improves.

Radio and TV were cited by 6.5% (14 respondents) as a source of market information. Although these traditional media outlets can reach a broad audience, their effectiveness in delivering specific and timely market data might be limited compared to more direct and tailored communication channels like extension officers and cooperatives.

In conclusion, extension officers and cooperatives were the dominant sources of market information among dairy farmers, which reflects their trusted and accessible roles in rural agricultural settings. Informal sources such as community networks, as well as digital media like social media and radio/TV, were also part of the information ecosystem, although they played a less prominent role. These findings suggest that improving farmers' access to reliable and timely market information through formal channels, such as extension services and cooperatives, could greatly enhance their ability to make informed decisions and

participate more effectively in the market.

Table 18: frequency of receive market price

How frequently do you receive market price updates?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Daily	25	11.7	11.7	11.7
	Weekly	35	16.4	16.4	28.0
	Monthly	57	26.6	26.6	54.7
	Occasionally	78	36.4	36.4	91.1
	Never	19	8.9	8.9	100.0
	Total	214	100.0	100.0	

Sources: - own Survey result, 2024

The data on how frequently farmers received market price updates indicates that there was a wide range of access to this information, which could have had a significant impact on their decision-making regarding the sale of dairy products. A considerable portion of farmers, 36.4% (78 respondents), reported that they only received market price updates "occasionally." This infrequent access to information may have hindered their ability to act promptly in response to price changes, leaving them potentially disadvantaged when market conditions fluctuated unexpectedly. Without regular access to pricing information, these farmers may have been less able to optimize the timing of their sales and pricing decisions.

The next most common response, "monthly," was reported by 26.6% (57 respondents) of the farmers. Receiving price updates once a month, although more frequent than occasionally, still may not have been frequent enough for some farmers to stay competitive in the market. Monthly updates could have been too slow to adapt to rapid price changes, particularly in a dynamic market. Therefore, farmers receiving this level of information likely had less flexibility in their decision-making, possibly affecting their ability to secure better prices.

"Weekly" updates were received by 16.4% (35 respondents) of the farmers, which indicates that a smaller group had access to more consistent price information. This frequency of updates allowed for better monitoring of price trends, enabling farmers to adjust their strategies with more agility than those receiving monthly or occasional updates. Weekly price updates may have provided a sufficient level of market awareness for some farmers, allowing them to take advantage of minor price fluctuations and potentially enhancing their market participation.

A smaller group, 11.7% (25 respondents), indicated they received "daily" updates on market prices. This was the most frequent access reported and suggests that these farmers were better positioned to make timely and informed decisions based on real-time data. Daily updates would have enabled these farmers to respond quickly to price changes, optimize their selling strategies, and potentially secure better prices for their dairy products. However, this level of access was available to only a small proportion of farmers.

Finally, 8.9% (19 respondents) reported that they "never" received market price updates. This group represented a significant portion of the participants who likely faced substantial barriers in accessing current market information. Not having access to regular price updates could have made it difficult for these farmers to compete effectively in the market. Without up-to-date information, these farmers might have faced challenges in deciding when to sell, potentially affecting their profitability and market engagement.

In conclusion, the frequency of market price updates varied significantly among the farmers surveyed, with many lacking consistent and timely access to this vital information. Those who received market price updates less frequently were potentially at a disadvantage compared to those with daily or weekly updates, as they may have been less equipped to react quickly to market shifts. Improving the availability and frequency of market price information could empower more farmers to participate more effectively in the dairy market and make more informed decisions that enhance their profitability.

4.2. Econometric analysis

In the preceding parts of this thesis, the descriptive analysis was discussed. In this section, the selected independent variables were used to estimate the binary logistic regression model to analyze the determinants of market participation.

Before going to the discussion of the results, it is important to show how the model is specified and tests are conducted on significance of the independent variables and the existence of multicollinearity problem.

4.2.1. Model goodness of fit test

An intuitively appealing way to summarize the results of a fitted logistic model is via a classification table. This classification is the result of cross-classifying the outcome variable, y , with a dichotomous variable whose values are derived from the estimated logistic probabilities. In this approach, estimated probabilities are used to predict group membership. Presumably, if the model predicts group membership accurately according to some criterion, then this is thought to provide evidence that the model fits. The model results show that the logistic regression model correctly predicted 84.11% of the total sample respondents: 86.84%

market participants and 81% non-participants. The sensitivity (correctly predicted market participants) and specificity (correctly predicted non-participants) of the model is 83.90% and 84.38% respectively. This indicates that the model has estimated the market participants and non- participants respondents correctly (annex 1).

4.2.2. Model specification test

Moreover, the link test was applied to show if the model is properly specified. The specification test in our binary model shows that “hat square” is insignificant (P-value=0.747), then the link test is insignificant. This means we have no omitted relevant variable(s) and our link function is correctly specified (Annex 2).

Moreover, the likelihood ratio test statistics exceeds the Chi-square critical value at less than 1% probability level indicating the hypothesis that all coefficients except the intercept are equal to zero is rejected. The value of Pearson Chi-square test shows the overall goodness of fit of the model at less than 1% probability level (Annex 3).

4.2.3. Multicollinearity test

This study used the variance inflation factor (VIF) to test the existence and the magnitude of multicollinearity. VIF shows how the variance of an estimator is influenced by the presence of multicollinearity. Therefore, the result shows that there is no multicollinearity. Because the VIF of all variable is less than 10 (mean VIF = 2.45), or the TOL_i is closer to 1, means the greater the evidence that X_i is not collinear with the other explanatory variables (Annex 4).

4.2.4. Heteroscedasticity test

In this study to correct the nature of the variance of error term (heteroscedasticity problem) robust standard error was estimated.

4.2.5. Estimated results of the model

The estimated coefficients of the binary logit model together with the levels of significance are presented in following table 19. Eventually, a set of nine independent variables were included in the model and used in the binary logistic analysis. To identify the best subset of independent variables that are good predictors of the dependent variable, the logistic regression was estimated using Stata.

Table 19: Primary result of the logit regression Model

Variable	Coefficient	Robust standard error	Z - statistics	P - value
Constant	-2.24506	1.575511	-1.42	0.154
Age_1	-0.10003	0.9122	-0.11	0.913
Age_2	0.078046	0.891381	0.09	0.93
Age_3	-0.13108	0.853898	-0.15	0.878
Age_4	-0.6115	0.982994	-0.62	0.534
Gender	-0.45014	0.464331	-0.97	0.332
Education_2	-0.76222	0.60285	-1.26	0.206
Education_3	-0.54943	0.821189	-0.67	0.503
Farm	3.390819	0.623969	5.43	0
Milkproduction_1	-0.19347	0.977926	-0.2	0.843
Milkproduction_2	-0.85445	1.108876	-0.77	0.441
Milkproduction_3	0.257911	0.903025	0.29	0.775
Milkproduction_4	-0.15124	0.917484	-0.16	0.869
Access	1.280819	0.453657	2.82	0.005
Credit	3.154998	0.507999	6.21	0
Training	-2.11093	0.452933	-4.66	0
Information	1.544828	0.479803	3.22	0.001
Summary statistics				

Number of observations = 214	
Wald chi2(10) = 74.16	
Prob. > chi2 = 0.0000	
* shows significance at 5% probability level.	

The parameter estimates of the binary logit model provide only the direction of the influence of the independent variables on the dependent variables; dairy market participation. However, these estimates do not represent the actual magnitude of changes or probabilities. Thus, the marginal effects from the binary logit model, which measure the expected change in probability of being participant with respect to a unit change in the independent variable, are presented in following [table 20](#) below.

Table 20: Marginal effect of the logit regression Model

Variable	Marginal effect	Z - statistics	P - value	X_i – mean
Age_1	-0.0242177	-0.11	0.913	0.140187
Age_2	0.0187073	0.09	0.93	0.280374
Age_3	-0.0316006	-0.15	0.878	0.397196
Age_4	-0.1507186	-0.62	0.535	0.121495
Gender	-0.1082994	-0.96	0.335	0.453271
Education_1	0.1251331	0.71	0.48	0.126168
Education_2	-0.0508471	-0.34	0.735	0.635514
Farm	0.6759376	8.32	0.000*	0.5
Milkproduction_1	-0.0469353	-0.2	0.844	0.238318
Milkproduction_2	-0.2101408	-0.78	0.433	0.126168

Milkproduction_3	0.0613517	0.29	0.773	0.313084
Milkproduction_4	-0.036618	-0.16	0.87	0.252336
Access	0.2990594	2.96	0.003	0.5
Credit	0.6443892	8.87	0	0.504673
Training	-0.4695008	-5.08	0	0.5
Information	0.3584567	3.6	0	0.528037
* shows significance at 5% probability level.				

4.2.6. Interpretation of the Independent Variables

The association between Farm ownership and market participation is positive and significant indicating that farmers with their own land have better probability to participate in market by 66% relative to those farmers work by renting land. This finding aligns with several studies that have pointed out the positive relationship between farm size and market participation (Babatunde et al., 2008; Ouma et al., 2010). Larger farms often benefit from economies of scale, which enable them to lower production costs and generate surplus milk for sale. The results support the argument that larger farms, with better access to resources and infrastructure, are more likely to succeed in market participation (Nkamleu & Adesina, 2000).

The study revealed that access to essential services and infrastructure was another key factor influencing dairy farmers' participation in the market. Farmers with access to essential services and infrastructure have 29.90% higher probability to participate in the dairy market compared with their counterpart. Various types of services and infrastructure, including transportation, veterinary services, access to markets, and communication networks, were found to have significant effects on farmers' ability to successfully engage in dairy marketing. The results of this study align with the work of Akinyele (2011), Minten et al. (2013), and Iqbal et al. (2014).

Provision of credit is significant at 5% and related positively with the market participation of dairy farmers, implying that farmers who received credit were about 64.43% higher probability more likely to engage in market activities compared to those who did not. This strong association underscored the vital role that financial resources play in enabling farmers to access markets invest in production, and expand their operations. The result of this study is in conformity with Royer & Olson, 2017 and Mottaleb et al., 2015.

On the other hand, Training had a negative effect on market participation which is unexpected with marginal coefficient for training (-0.46). This suggested that training was associated with a reduced likelihood of market participation. Specifically, those who received training were less likely to participate in the market by approximately 47% for farmers who had received training. This could be due to factors like the type of training received or a misalignment between the training content and market-oriented needs.

Finally, Information was a significant positive predictor of market participation. The marginal coefficient for Information was 0.3584. This indicated that farmers who received information about market prices, opportunities, and trends were more than 35.84% as likely to participate in the market. This result highlighted the importance of information dissemination in supporting market decision-making and encouraging farmers to engage in dairy markets. This finding aligns with previous research, which has consistently highlighted the importance of timely and relevant information in facilitating improved agricultural outcomes (Fisher et al. 2018) and (Davis, 2016).

In conclusion, the logistic regression analysis revealed that farm ownership, Access to services, Credit availability, and Information were all positively associated with increased likelihood of market participation. However, Training had an unexpected negative relationship with market participation. These results emphasized the critical factors that influence dairy farmers' decisions to participate in the market, offering valuable insights for policymakers and development organizations aiming to enhance market access and participation in the dairy sector.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This section presented the conclusions and recommendations based on the findings and discussions outlined in the preceding sections. The study had aimed to explore the factors influencing market participation among dairy farmers, focusing on farm characteristics, access to services and infrastructure, access to credit and loans, training programs, and access to information. The findings provided valuable insights into the challenges and opportunities faced by dairy farmers in their efforts to engage with the market. Based on these findings, recommendations were formulated to enhance market participation, improve productivity, and increase farmers' income.

The conclusions derived from the study were based on the analysis of data collected from dairy farmers in the study area. These conclusions sought to highlight the key findings and their implications for policy, practice, and further research. Furthermore, the recommendations aimed to assist policymakers, development organizations, and other relevant stakeholders in designing targeted interventions and strategies to overcome barriers to market participation and support the growth of the dairy sector.

The following sections outlined the key conclusions of the study and provided specific recommendations aimed at improving market participation and addressing the challenges that were identified during the research process.

5.2. Conclusions

The study provided important insights into the factors influencing market participation among dairy farmers, specifically focusing on farm characteristics, access to services, credit and loan facilities, training programs, and access to information. Based on the findings discussed earlier, several key conclusions can be drawn. These conclusions address the broader implications of the study's results and offer a clearer understanding of the dynamics surrounding market participation in the dairy farming sector.

Firstly, farm characteristics, including the ownership of land and the size of the farm, played a critical role in determining market participation. It was concluded that farmers who owned their land and had larger farms were more likely to participate in the market. This conclusion highlights the importance of land ownership and farm size as key enablers of market engagement. Farmers with better access to productive resources were found to be more capable of producing surplus milk, which they could sell in the market.

This finding aligns with previous research, which indicated that farm size and resource access often directly influence a farmer's ability to market their products (e.g., Kaur et al., 2014).

Second, the study found that access to veterinary services and infrastructure significantly impacted market participation. Farmers who had better access to veterinary services were more likely to participate in the market, as these services ensured that their livestock remained healthy, increasing productivity and milk quality. Moreover, the availability of infrastructure, such as roads and market access, was also found to be critical. Poor infrastructure hindered the ability of farmers to transport their milk to markets, which, in turn, limited their participation in market activities. The conclusion drawn here is that improving infrastructure and veterinary services is essential for boosting dairy farmers' market participation, which is consistent with studies suggesting that infrastructure improvements lead to enhanced market access for rural producers (e.g., Binswanger-Mkhize, 2012).

Third, access to credit and financial services was found to be a major barrier to market participation for a significant portion of farmers. Although many dairy farmers expressed a desire to expand their operations or improve their production, the lack of access to credit prevented them from investing in necessary inputs like better breeds, animal feed, and infrastructure. The conclusion here is that enhancing access to affordable credit and financial services is crucial for enabling farmers to increase production and improve the quality of their products, which will ultimately facilitate greater market engagement. This conclusion is supported by previous research, which highlighted the critical role of financial services in supporting agricultural development and market participation (e.g., Tadesse, 2013).

Furthermore, the study concluded that training programs significantly impacted farmers' knowledge and skills related to dairy farming and marketing. Farmers who received training were more likely to participate in the market, as they were better equipped to manage their farms efficiently and engage with market dynamics. The conclusion drawn from this finding is that targeted training programs focused on dairy production techniques, disease management, and business skills are essential for improving market participation. This finding is in line with earlier studies that emphasized the importance of agricultural extension and training programs for enhancing farmers' productivity and market participation (e.g., Mignouna et al., 2011).

Lastly, the study concluded that the availability and access to timely market information were key determinants of market participation. Farmers, who had access to up-to-date information about market prices, demand, and other relevant factors were better able to make informed decisions about when and

where to sell their milk. This finding underscores the importance of information dissemination mechanisms, such as mobile platforms, radio, and farmer cooperatives, in facilitating market engagement. The conclusion aligns with previous research that emphasized the role of market information in improving market access and decision-making for smallholder farmers (e.g., Aker, 2011).

In summary, the study concluded that several factors land ownership, access to veterinary services, infrastructure, credit, training programs, and market information are interrelated and collectively determine the level of market participation among dairy farmers. The conclusions drawn from these findings underscore the need for integrated approaches to address the barriers faced by farmers, ranging from resource access to information dissemination. By enhancing these factors, policymakers and stakeholders can create an enabling environment that supports increased market participation and sustainable growth in the dairy farming sector.

These conclusions provide a foundation for the recommendations that follow, which aim to address the challenges identified and facilitate the development of strategies to enhance market participation among dairy farmers.

5.3. Recommendations

Based on the findings and conclusions of this study, several key recommendations were made to improve market participation among dairy farmers. These recommendations are divided into three main areas: empirical/theoretical, policy, and future concerns. Each recommendation is designed to address the barriers identified in the study and to offer actionable solutions to enhance market engagement in the dairy sector.

The study found that farm characteristics, such as farm size and land ownership, significantly influenced market participation. It was recommended that policies aimed at enhancing farm productivity and providing access to land should be implemented. Land reforms that allow secure land tenure for farmers were considered essential, especially for smallholder dairy farmers who struggle with limited land for production. Additionally, improving farm management through enhanced training programs focused on dairy farming techniques and better resource utilization was also recommended. Such measures would enable farmers to increase production and, consequently, their participation in the market.

Access to veterinary services, roads, and other essential infrastructure was found to be a key determinant of market participation. The study highlighted the importance of improving rural infrastructure to allow farmers to reach broader markets. The provision of adequate veterinary services was also crucial to ensure that dairy

farmers could maintain healthy livestock, which is critical to increasing milk production and ensuring its quality. Therefore, it was recommended that both government and development agencies focus on improving rural roads and establishing cold storage and processing facilities for dairy products.

The study also found that credit access was a major barrier to market participation. Dairy farmers who had access to financial services were better able to invest in their farms and expand production. Based on these findings, it was recommended that both formal and informal financial institutions design financial products tailored specifically for smallholder farmers. These products should have flexible terms, lower interest rates, and reduced collateral requirements to encourage more farmers to take out loans. Additionally, the provision of financial literacy training was seen as necessary to help farmers understand credit facilities and manage their finances effectively.

The study indicated that farmers who participated in training programs were more likely to engage in the market. The recommendations included expanding the scope of training programs to cover areas such as dairy production, financial management, marketing, and disease prevention. These programs should be accessible to farmers in both rural and remote areas and delivered through multiple platforms including agricultural extension services, farmer cooperatives, and digital channels. Additionally, strengthening public-private partnerships to provide sustainable and context-specific training to farmers was considered crucial to ensuring long-term improvements in dairy production.

The availability of accurate and timely market information was identified as an essential factor for increasing market participation. Based on the findings, it was recommended that efforts be made to expand the dissemination of market data through various channels, including mobile applications, radio programs, and cooperatives. This would allow farmers to stay informed about prevailing market prices, demand trends, and potential buyers, enabling them to make better decisions and maximize their profits. Ensuring that market information is easily accessible to farmers, especially in remote areas, was considered fundamental to improving their market engagement.

The findings of this study highlighted the role of infrastructure in determining the success of market participation. In light of this, it was recommended that policymakers prioritize investments in rural infrastructure. This includes improving roads, market facilities, cold storage units, and transportation networks that facilitate the movement of dairy products from farms to markets. Government efforts should focus on creating an enabling environment that supports rural agricultural development through targeted infrastructure projects.

The study also found that farmers' access to credit and loans was a significant barrier to market participation. Based on this, it was recommended that policymakers work towards reforming the financial systems to make them more accessible to smallholder dairy farmers. Policies should aim at reducing barriers to financial inclusion, such as high-interest rates and the need for extensive collateral. Introducing subsidized credit lines, providing insurance services for farmers, and ensuring that banks are more responsive to the needs of the agricultural sector were suggested as potential policy interventions.

In line with the findings of the study, it was recommended that policymakers integrate training programs into national agricultural strategies. By including training initiatives in policy frameworks, governments could ensure that farmers have access to the necessary resources to improve both their productivity and market engagement. Policies should also encourage the involvement of both public and private sectors in delivering training programs, making them more widespread and diverse in scope.

To facilitate sustainable growth in the dairy farming sector, it was recommended that governments foster public-private partnerships (PPPs). PPPs could help mobilize resources for the development of rural infrastructure, the delivery of training programs, and the provision of credit services to farmers. Such collaborations could leverage the expertise and resources of both sectors to create more effective and long-term solutions to the challenges faced by dairy farmers.

5.4. Future Research Direction

The role of digital platforms in enhancing market participation has become increasingly important. Given the rise in mobile technology usage among farmers, further studies should focus on exploring how digital tools can help farmer's access market information and make informed decisions about pricing and sales. Future research could assess the effectiveness of mobile apps, online marketplaces, and digital platforms in connecting farmers with buyers and enhancing their participation in the dairy market.

While this study focused on market participation in general, further research could investigate the specific barriers faced by women dairy farmers. Gender dynamics often influence access to resources such as land, credit, and training. Future studies should examine how gender impacts market participation, and policies should be adjusted accordingly to address these disparities. Understanding the gendered aspects of agricultural market engagement could lead to more inclusive policies and interventions.

Future research could focus on evaluating the long-term effects of training programs on market participation. This research would help determine whether training interventions lead to sustained

improvements in production, marketing, and financial management. Longitudinal studies could track farmers over time to assess the enduring impact of training on their ability to participate in the market.

Lastly, further studies could explore the role of cooperatives in enhancing market participation. Cooperatives play a vital role in improving farmers' bargaining power and access to resources. Future research could investigate how cooperatives can help smallholder farmers increase their participation in the dairy market and whether they provide a viable model for rural agricultural development.

In conclusion, the recommendations presented here provide a comprehensive framework for improving market participation among dairy farmers. Through a combination of policy reforms, practical interventions, and further research, it is possible to address the challenges faced by farmers and create an environment where they can thrive in the market. By focusing on improving access to resources, services, and information, and fostering inclusive training and education, the dairy farming sector can experience sustainable growth and development.

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Annex

Annex 1: Model goodness of fit measures

```
. estat classification
```

```
Logistic model for participation
```

```
----- True -----
```

Classified	D	~D	Total
-----+-----+-----			
+	99	15	114
-	19	81	100
-----+-----+-----			
Total	118	96	214

```
Classified + if predicted Pr(D) >= .5
```

```
True D defined as participation != 0
```

```
-----
```

Sensitivity	Pr(+ D)	83.90%
Specificity	Pr(- ~D)	84.38%
Positive predictive value	Pr(D +)	86.84%
Negative predictive value	Pr(~D -)	81.00%

False + rate for true ~D	Pr(+ ~D)	15.63%
False - rate for true D	Pr(- D)	16.10%
False + rate for classified +	Pr(~D +)	13.16%
False - rate for classified -	Pr(D -)	19.00%

Correctly classified		84.11%

Annex 2: Model specification test

linktest

Iteration 0: log likelihood = -147.20066

Iteration 1: log likelihood = -74.703293

Iteration 2: log likelihood = -73.893513

Iteration 3: log likelihood = -73.88467

Iteration 4: log likelihood = -73.884668

```
Logistic regression                Number of obs   =       214
                                   LR chi2(2)         =       146.63
                                   Prob > chi2        =       0.0000
Log likelihood = -73.884668        Pseudo R2      =       0.4981
```

```
-----
participation |      Coef.   Std. Err.      z    P>|z|    [95% Conf. Interval]
-----+-----
      _hat |   .9933799   .1368026    7.26  0.000   .7252516   1.261508
     _hatsq |   .0174353   .054102    0.32  0.747  -.0886026   .1234732
     _cons |  -.0397358   .2409476   -0.16  0.869  -.5119844   .4325129
-----
```

Annex 3: Likelihood ratio test

```
. quietly logit participation i.age gender i.education farm i.milkproduction access credit
training information
```

```
. estimates store modelfull
```

```
. quietly logit participation
```

```
. estimates store modelconstant
```

```
. lrtest (modelfull) (modelconstant)
```

```
Likelihood-ratio test                LR chi2(16) =    146.53
```

```
(Assumption: modelconstant nested in modelfull)    Prob > chi2 =    0.0000
```

Annex 4: Multicollinearity Test

. vif

Variable	VIF	1/VIF
-----+-----		
age		
1	2.96	0.337997
2	4.18	0.239442
3	4.71	0.212281
4	2.72	0.367859
gender	1.06	0.939047
education		
2	2.29	0.436941
3	2.29	0.436237
farm	1.16	0.864603
milkproduc~n		
1	3.43	0.291294
2	2.49	0.401562
3	3.81	0.262218
4	3.48	0.287401
access	1.14	0.876217
credit	1.27	0.785686
training	1.14	0.880037
information	1.09	0.919027
-----+-----		
Mean VIF	2.45	

Annex 5: Estimation result for binary logit regression model

```
. logit participation i.age gender i.education farm i.milkproduction access credit training
information,robust
```

Iteration 0: log pseudolikelihood = -147.20066

Iteration 1: log pseudolikelihood = -75.131492

Iteration 2: log pseudolikelihood = -73.948119

Iteration 3: log pseudolikelihood = -73.935333

Iteration 4: log pseudolikelihood = -73.935326

```
Logistic regression                Number of obs    =          214
                                   Wald chi2(16)     =          74.16
                                   Prob > chi2       =          0.0000
Log pseudolikelihood = -73.935326  Pseudo R2       =          0.4977
```

		Robust				
	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
participation						
age						
1	-.100028	.9122	-0.11	0.913	-1.887907	1.687851
2	.0780459	.891381	0.09	0.930	-1.669029	1.825121
3	-.1310772	.8538982	-0.15	0.878	-1.804687	1.542533
4	-.611496	.9829941	-0.62	0.534	-2.538129	1.315137
gender						
	-.4501418	.4643314	-0.97	0.332	-1.360215	.4599309
education						
2	-.7622198	.6028496	-1.26	0.206	-1.943783	.4193438
3	-.5494269	.8211894	-0.67	0.503	-2.158929	1.060075

farm		3.390819	.6239691	5.43	0.000	2.167862	4.613776
milkproduction							
1		-.1934694	.9779261	-0.20	0.843	-2.110169	1.723231
2		-.8544456	1.108876	-0.77	0.441	-3.027803	1.318912
3		.2579105	.9030246	0.29	0.775	-1.511985	2.027806
4		-.1512434	.9174843	-0.16	0.869	-1.949479	1.646993
access		1.280819	.4536573	2.82	0.005	.3916675	2.169971
credit		3.154998	.5079989	6.21	0.000	2.159339	4.150658
training		-2.110927	.4529332	-4.66	0.000	-2.99866	-1.223195
information		1.544828	.4798026	3.22	0.001	.6044323	2.485224
_cons		-2.245064	1.575511	-1.42	0.154	-5.333008	.8428796

Annex 6: Marginal effects after the binary logit regression model

. mfx

Marginal effects after logit

y = Pr(participation) (predict)
 = .59725947

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
age1*	-.0242177	.22215	-0.11	0.913	-.459626 .411191	.140187
age2*	.0187073	.21279	0.09	0.930	-.39836 .435775	.280374
age3*	-.0316006	.2064	-0.15	0.878	-.436145 .372944	.397196
age4*	-.1507186	.24315	-0.62	0.535	-.627293 .325856	.121495
educat~1*	.1251331	.17728	0.71	0.480	-.222325 .472591	.126168
educat~2*	-.0508471	.15038	-0.34	0.735	-.345582 .243887	.635514
gender*	-.1082994	.11242	-0.96	0.335	-.328631 .112032	.453271
farm*	.6759376	.08128	8.32	0.000	.51663 .835245	.5
milkpr~1*	-.0469353	.23901	-0.20	0.844	-.515388 .421518	.238318
milkpr~2*	-.2101408	.26815	-0.78	0.433	-.735698 .315417	.126168
milkpr~3*	.0613517	.2124	0.29	0.773	-.35495 .477654	.313084
milkpr~4*	-.036618	.22344	-0.16	0.870	-.474555 .401319	.252336
access*	.2990594	.10109	2.96	0.003	.100931 .497188	.5
credit*	.6443892	.07265	8.87	0.000	.502002 .786776	.504673
training*	-.4695008	.09248	-5.08	0.000	-.650753 -.288249	.5
inform~n*	.3584567	.09951	3.60	0.000	.16343 .553484	.528037

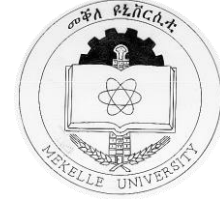
(*) dy/dx is for discrete change of dummy variable from 0 to 1

APPENDIX

QUESTIONNAIRE



MEKELLE UNIVERSITY
COLLEGE OF BUSINESS & ECONOMICS
DEPARTMENT OF ECONOMICS



General Instruction

A. To the Respondents

This questionnaire is prepared by an MSc student in the department of Economics at Mekelle University. The title of this study is “**Determinants of Market Participation of Small Scale Dairy Farmers: The Case of Mekelle City**” in partial fulfillment for MSc in Economics. The objective of this study is to investigate the determinants of market participation of small scale dairy farmers in Mekelle city. Confidently this research has a significant contribution in an effort to expand small-scale urban dairy. Therefore, your valid contribution by giving accurate information is highly valuable in achieving the objective of this research. The information I will collect from you will serve only for academic purpose and it will be kept confidential. Thus, please feel free to convey the required information honestly.

Thank you in advanced for your cooperation.

SECTION A: DEMOGRAPHIC INFORMATION

1- Gender:

[1] Male

[0] Female

2- Age Group:

[0] Below 25 years

[1] 25 - 34 years

[2] 35 - 44 years

[3] 45 - 54 years

[4] 55 years and above

3- Education Level:

[0] No formal education

[1] Primary education

[2] Secondary education

[3] Diploma/Technical training

[4] University degree and above

4- Years of Experience in Dairy Farming:

[1] Less than 2 years

[2] 2-5 years

[3] 6-10 years

[4] 11-20 years

[4] More than 20 years

SECTION B: MARKET PARTICIPATION

5- Do you sell milk or dairy products?

Yes (1)

No (0)

6- If No, what is the main reason?

Low market price

No access to buyers

Low production levels

High transportation cost

Other

7- If Yes, where do you sell your dairy products?

Local market

Cooperatives

Direct to consumers

Restaurants/hotels

Other

8- Do you own the land used for dairy farming?

Yes

No

9- What is your average daily milk production?

Less than 5 liters

5-10 liters

11-20 liters

21-50 liters

More than 50 liters

10- What is your main source of animal feed?

- Own farm production
- Purchased from the market
- Combination of both
- Government-subsidized feed
- other

11- Do you have access to veterinary services?

- Yes
- No

12- What is the distance to the nearest veterinary service?

- Less than 2 km
- 2-5 km
- 6-10 km
- 11-20 km
- More than 20 km

13- What mode of transport do you use to deliver milk to the market?

- Own vehicle
- Rented/Hired vehicle
- Public transport
- On foot/Bicycle
- Other

14- Have you received any credit/loan for dairy farming in the past year?

Yes

No

15-If No, what is the reason?

No collateral

High-interest rates

Lack of information on credit sources

No financial institution nearby

other

16- If yes, what was the main purpose of the credit?

Buying dairy cows

Buying animal feed

Improving farm infrastructure

Expanding market access

Other

17- Have you received any formal training on dairy farming and marketing?

Yes (1)

No (0)

18- If yes, who provided the training?

Government agencies

NGOs

Private sector

Dairy cooperatives

Other

19- What was the focus of the training?

Dairy production techniques

Marketing and business management

Disease prevention and veterinary services

Financial management

other

20- Do you regularly receive market price information for dairy products?

Yes

No

21- If yes, what is your main source of market information?

Radio/Television

Internet/social media

Cooperatives

Extension officers

other

22- How frequently do you receive market price updates?

Daily

Weekly

Monthly

Occasionally

Never

Thank you!!!