

**THE ECONOMIC CONTRIBUTION OF DUAL-PURPOSE CATTLE
PRODUCTION SYSTEMS ON HOUSEHOLD WELFARE IN
SEMBABULE DISTRICT, CENTRAL UGANDA**

THESIS

**By:
NATURINDA MOVADI**



**MASTER PROGRAM IN AGRIBUSINESS
FACULTY OF ANIMAL AND AGRICULTURAL SCIENCES
UNIVERSITAS DIPONEGORO
2024**

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**As One of the Requirements for Obtaining an Agricultural Master's Degree in
Master Program in Agribusiness, Faculty of Animal and Agricultural Sciences
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STATEMENT

I declare truthfully that the thesis I have compiled as a requirement for obtaining a Master's Degree from the Master Program in Agribusiness is entirely my own work and has never been submitted as a fulfillment of the requirements for obtaining a Master's Degree from Diponegoro University.

As for certain parts of the thesis writing that I quoted from the work of others, the source has been clearly written in accordance with the norms, rules and ethics of scientific writing. Hereby declare as follows:

1. Titled Thesis: **The Economic contribution of Dual-purpose cattle production systems on household welfare in Sembabule district, central Uganda.**

I also admit that this final project can be completed because of the full guidance and support of my supervisor, they are: Main Supervisor: Ir. Joko Mariyono, M.Si., Ph.D.

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2. If in the future it is found that all or part of this thesis is not my own work or there is plagiarism in certain parts, I am willing to accept the revocation of my academic degree and other sanctions in accordance with the applicable laws and regulations.

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PREFACE

This thesis is submitted as one of the requirements for obtaining an agricultural master's degree in Master Program in Agribusiness at Diponegoro University. Thesis entitled “The Economic contribution of Dual-purpose cattle production systems on household welfare in Sembabule district, central Uganda.” was conducted under the supervision of Bapak, Ir. Joko Mariyono, M.Si., Ph.D and Bapak. Prof. Agus Setiadi, S.Pt., M.Si., Ph.D. as member of Advisors. Dual Purpose cattle was not practiced on large scale this research will help to give farmers the best insight on dual purpose cattle production. For completing this thesis, author only would not finish this research; let’s praise the presence of God Almighty for the Gift that has been given, so that the author can complete the writing of the Thesis.

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I take this opportunity to express my gratitude to the people who have been very helpful in the successful completion of this thesis, as follows:

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support may almighty Allah reward you all.

Semarang,

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SUMMARY

Mr. NATURINDA MOVADI under the supervision of BAPAK, JOKO MARIYONO AND BAPAK Ags has worked the thesis research entitled “**The Economic contribution of Dual-purpose cattle production systems on household welfare in Sembabule district, central Uganda.**”

Globally, livestock farming, including cattle production, is an essential component of agriculture, contributing significantly to food security and economic development. Dual-purpose cattle, valued for both meat and dairy, play a crucial role in many economies, providing nutrition, income, and employment opportunities. Cattle production in Uganda remains one of the farming activities carried out in the cattle corridor of Uganda and particularly east, central and western Uganda predominantly the indigenous type of cattle is being kept for milk and beef products although exotic, dual and cross breed animals have also been introduced.

The study aims to assess the economic contributions of dual-purpose cattle production on household welfare, analyze the socio-economic factors influencing the choice of dual-purpose cattle farming on household welfare, assess the challenges faced by farmers in dual-purpose cattle production, and evaluate the efficiency of dual-purpose cattle production on household welfare.

The study employed a mixed-methods approach, combining both qualitative and quantitative methods to provide a comprehensive understanding of the subject. 269 households from a population of 820 dual cattle production farmers was used from the Cochran formula of sample size determination and on average approximately each household had 230 cows to enhance their welfare. 164 males participated in dual cattle production system representing 60.97% against their counter parts 105 females representing 39.03%. Data collection tools included structured questionnaires, and interview guides. Purposive and stratified sampling techniques were used to gather information from respondents.

The findings reveal that 63.57% had improved household welfare against 36.43%. Economic contributions of dual-purpose cattle production were found to significantly impact household income through enhancing food security and generating income. However, the productivity and output of milk and meat showed a low positive relationship with improving household welfare. Socio-economic factors such as education level and access to resources were significant influencers of the choice of dual-purpose cattle farming on household welfare, while full-time employment was not. Challenges faced by farmers, particularly limited market access, proved to significantly affect household welfare, whereas access to finance and credit, as well as climate change impacts, did not exhibit significant relationships. The efficiency of dual-purpose cattle production, including milk and meat production efficiency, market demand, and consumer preference, was found to be significant for household welfare, although the cost of production did not show a significant relationship. The study recommends the adoption of cost-effective feeding strategies, aligning production with consumer preferences, and improving market access and veterinary services to promote sustainable dual-purpose cattle production and enhance household welfare.

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CHAPTER I

INTRODUCTION

1.1 Background

Livestock farming, including cattle production, holds a pivotal position in global agriculture, significantly contributing to food security and economic development. Dual-purpose cattle, valued for both meat and dairy, play a crucial role in many economies by providing essential nutrition, income, and employment opportunities. According to the Food and Agriculture Organization (FAO,2017), livestock contribute approximately 40% of the global agricultural output. Understanding the socio-economic dynamics of dual-purpose cattle production is critical for addressing global challenges such as food security, poverty, and sustainable development goals.

In Africa, where agriculture is the backbone of many economies, employing a majority of the population and contributing significantly to the GDP, livestock farming, particularly cattle rearing, serves as a vital source of livelihood for millions. Cattle are not only crucial for food and income but also possess significant cultural and social significance in many African countries. However, the sector faces challenges such as limited access to markets, climate change impacts, and inadequate veterinary services, hindering its full potential.

Uganda, situated in East Africa, heavily relies on agriculture, which accounts for a substantial portion of its GDP. Cattle farming is a fundamental aspect of Ugandan agriculture, providing meat, milk, and income for households. According to the Uganda Bureau of Statistics, agriculture contributes to about 24% of the country's GDP and employs over 70% of the population. Despite its significance, Ugandan farmers face

challenges related to market access, climate change, and healthcare services for livestock. Uganda's livestock sector has been growing at an average rate of 2.2% per annum since 2012, with the cattle industry being a prominent contributor to this growth, subdivided into the beef and dairy sub-sectors (UBOS, 2019). This sector plays a significant role in supporting the livelihoods of about 4.5 million people in Uganda, being the leading source of milk and meat.

Contextually, Sembabule District in Central Uganda possesses a significant agricultural base, with a substantial number of households relying on dual-purpose cattle farming. These cattle provide not only meat and dairy products but also serve as a source of livelihood, contributing significantly to the local economy. Understanding the economic impact of these cattle production systems is vital for developing targeted policies and interventions to enhance household welfare.

In light of the above, this comprehensive study aims to investigate the economic contribution of dual-purpose cattle production systems to household welfare in Sembabule District, Central Uganda. The specific objectives of this study encompass assessing the economic contributions of dual-purpose cattle production on household income and food security, analyzing the socio-economic factors influencing the choice of dual-purpose cattle farming on household welfare, evaluating the challenges faced by farmers in dual-purpose cattle production, including market access, healthcare, and environmental factors, and assessing the role of Dual-Purpose Cattle Production on household welfare. The study's hypotheses will guide the research, allowing for a structured approach to testing the significance of economic contributions, socio-

economic factors, challenges, and the role of dual-purpose cattle production on household welfare.

Through this research, we seek to address critical questions regarding the extent of economic contributions made by dual-purpose cattle production, the socio-economic factors influencing the choice of engaging in this farming practice, the challenges faced by farmers, and how dual-purpose cattle production affects household income and food security. By examining the interconnections within a carefully crafted conceptual framework, this study aims to provide valuable insights into the economic contributions of dual-purpose cattle production systems to household welfare in Sembabule District, Central Uganda. This will pave the way for a holistic understanding of the topic and contribute to informed policy recommendations for sustainable agricultural development.

1.2 Research Problem

The dual-purpose cattle production systems in Sembabule District, Central Uganda, significantly contribute to household welfare, income generation, and the regional economy (Kalemera Ruhangawebare, 2010), constituting approximately 30% of household income. However, this vital agricultural sector faces numerous challenges, including limited market access (20% of farmers), inadequate veterinary services (affecting 70% of farmers), input costs, diseases and the adverse impacts of climate change.

These challenges undermine the economic potential of dual-purpose cattle farming and hinder households from optimizing economic benefits. Therefore, there is a critical need for research to comprehensively investigate the factors influencing farmers' choice of production systems. By doing so, this research aims to identify the economic

contribution of dual cattle production systems on household welfare as well as strategies and interventions that can enhance household welfare and livelihoods, ensuring the sustainable growth of dual-purpose cattle farming in the region.

1.3 General Purpose of the Study

This comprehensive study aims to investigate the economic contribution of dual-purpose cattle production systems to household welfare in Sembabule District, Central Uganda. This research endeavor is crucial to understanding the socio-economic dynamics of the region and promoting sustainable agricultural practices among local communities.

1.4 Overall objective of the Study

To assess the economic contributions of dual-purpose cattle production systems on household income and livelihoods in Sembabule District, Central Uganda.

1.4.1 The specific objectives of this study are as follows;

1. To assess the economic contributions of dual-purpose cattle production on household income and food security.
2. To analyze the socio-economic factors influencing the choice of dual-purpose cattle farming on household welfare.
3. To assess the challenges faced by farmers in dual-purpose cattle production, including market access, healthcare, and environmental factors on household welfare.
4. To evaluate the efficiency of Dual-Purpose Cattle Production on household welfare.

1.5 Hypothesis of the study.

1. H1: there is no significant economic contributions of dual-purpose cattle production on household welfare.
2. H2: there is no significant socio-economic factors influencing the choice of dual-purpose cattle farming among households.
3. H3: there is no significant challenges faced by farmers in dual-purpose cattle production, on household welfare.
4. H4: there is no significant efficiency of dual-purpose cattle production in influencing household welfare.

1.6 Research questions.

- 1) To what extent has economic contributions made by dual-purpose cattle production improved household welfare?
- 2) What socio-economic factors influence households in their choice of engaging in dual-purpose cattle farming?
- 3) What challenges do farmers face in dual-purpose cattle production, particularly concerning market access, healthcare, and environmental factors?
- 4) How does dual-purpose cattle production affect household income and food security, and what are the mechanisms through which this impact is realized?

1.7 Conceptual Framework.

The conceptual framework for this study provides a structured approach to understanding the economic contributions of dual-purpose cattle production systems to household welfare in Sembabule District. It integrates key elements influencing these contributions, thereby forming the basis for comprehensive analysis and interpretation.

1. Socio-Economic Factors.

- i. Education Level: Education influences farmers' awareness of modern agricultural practices, financial management, and access to resources.
- ii. Employment and Livelihoods: Evaluate the quality of employment (e.g., full-time, part-time) and its impact on household welfare.
- iii. Access to Resources: Availability of land, capital, and technological resources affect the scale and efficiency of cattle farming.

2. Challenges in Dual-Purpose Cattle Farming.

- i. Market Access: Limited access to markets affects the sale of cattle and cattle products, influencing income generation.
- ii. Access to Finance and Credit: Understanding the challenges related to accessing finance and credit for dual-purpose cattle farming activities, including loans, grants, and financial support mechanisms.
- iii. Climate Change Impacts: Examining the impact of climate change and environmental conditions on dual-purpose cattle farming, including the availability of grazing land and the changing patterns of rainfall and temperature.

3. Economic Contributions.

- i. Food Security: Investigating how dual-purpose cattle production contributes to household food security through increased access to milk and meat and analyzing the nutritional impact of cattle products on household members.
- ii. Welfare Indicators: Economic contributions influence overall household welfare, including access to education, healthcare, and living standards.

4. The efficiency of dual-purpose cattle production.

- i. Milk Production Efficiency. assessing the average milk yield per cow over a specified period to evaluate the efficiency of milk production in dual-purpose cattle.
- ii. Meat Production Efficiency: Determining the rate at which the cattle gain weight, indicating the efficiency of meat production.
- iii. Cost of Production: Evaluate the expenses associated with feeding the cattle relative to the output of milk and meat, considering factors such as feed quality and quantity.
- iv. Market Demand and Consumer Preference: dual-purpose cattle products and preferences influences consumer demand for dual-purpose cattle products in terms of milk and meat quality.

5. Outcome.

Enhanced Household Welfare: Effective dual-purpose cattle farming, facilitated by addressing challenges and implementing best practices, leads to improved household welfare, including income, food security, and overall quality of life.

By analyzing the interconnections within this conceptual framework, the study aims to provide valuable insights into the economic contributions of dual-purpose cattle production systems to household welfare in Sembabule District, Central Uganda. It serves as a guide for understanding the complex dynamics of the topic, facilitating a holistic approach to research, analysis, and policy recommendations.

1.8 Definition of terms

- a) Dual-purpose cattle production systems: are those that involve the use of cattle for both milk and meat production. In other words, households raise cows for the simultaneous production of milk and meat.
- b) Efficiency in the context of agriculture and food security refers to the optimal use of resources to achieve the highest possible productivity and sustainability. It involves maximizing outputs (such as milk and meat in the case of dual-purpose cattle) while minimizing inputs (such as feed, water, and labor). Efficient farming practices ensure that resources are used in a way that enhances productivity, reduces waste, and sustains environmental health.
- c) Welfare, specifically in the context of food security, refers to the well-being of individuals and households with respect to their access to sufficient, safe, and nutritious food. Food security is a key component of welfare, ensuring that people have consistent access to adequate food to lead healthy and active lives. In agricultural settings, welfare also encompasses economic stability, health, and quality of life improvements derived from agricultural activities.
- d) a household is a unit of people who live together and make joint decisions about resource allocation, income, and expenditure. It is often used as a unit of analysis for understanding agricultural production, consumption, and livelihoods.
- e) household income refers to the total earnings or revenue generated by all members of a household from various sources, including e.g dual purpose cattle farming

CHAPTER II

LITERATURE REVIEW

2.1 Theoretical review on household welfare

The economic contribution of dual-purpose cattle production systems on household welfare is a critical area of research, especially in agricultural-based economies like Uganda. Understanding how these systems impact household welfare is essential for informing policy decisions and improving the livelihoods of rural households. This literature review aims to provide an overview of existing research on this topic, both globally and within the context of Uganda.

Dual-purpose cattle production systems involve raising cattle for both meat and milk production. Research on the economic contribution of such systems globally emphasizes the multifaceted benefits they offer to households. Livestock, including cattle, are known to contribute significantly to poverty alleviation, food security, and income generation in various parts of the world (Swain, 2017). The dual-purpose approach not only provides a diversified source of income but also enhances nutritional outcomes within households (Garcia and Thiele, 2017). These global insights serve as a foundation for understanding the potential impact of dual-purpose cattle production systems on household welfare in the context of Sembabule District, Uganda.

In Uganda, livestock, including cattle, play a crucial role in the livelihoods of rural communities. Cattle farming is a significant source of income and sustenance for many households in the country, particularly in rural areas. The dual-purpose cattle production system, which involves utilizing cattle for both meat and milk production, is prevalent in Uganda (Waiswa et al., 2021). This system contributes to household welfare by providing food security, income, and employment opportunities (Kugonza et al., 2012). Additionally, the integration of cattle farming with crop production enhances agricultural sustainability through manure production for soil fertility improvement (Tumwebaze et al., 2016).

2.1.1 Roles in Dual-Purpose Cattle Production

In dual-purpose cattle production in Uganda, both men and women play crucial roles, each contributing to different aspects of the farming process. Women's activities typically include calf care, where they feed, monitor, and provide health care to young calves, and milk processing, involving milking, processing, and marketing dairy products. Women also engage in herd management by overseeing breeding, calving, and animal health, as well as preparing feed for the cattle, including harvesting and storing fodder. Additionally, they are often responsible for marketing dairy products, meat, or live animals, maintaining records of cattle health, breeding, and production, and assisting with farm maintenance such as repairs and fencing. Men, on the other hand, usually handle breeding and selection by choosing breeding stock and managing bull selection and breeding programs. They manage pasture by overseeing grazing, pasture rotation, and forage production, and ensure herd health through veterinary care, vaccinations, and parasite control. Men are also involved in cattle handling, equipment maintenance, fencing and infrastructure tasks, and marketing and sales, where they negotiate sales,

transport animals, and market products. Shared activities between men and women include decision-making on farm operations, labor sharing during peak periods, and knowledge sharing about best practices, new technologies, and market trends.

2.1.2 Consumption and Cultural Significance of Dual-Purpose Cattle Products

In Uganda, dual-purpose cattle products play a significant role in both the diet and culture. Dairy products such as raw milk are consumed directly or used in beverages like tea and coffee. Fermented milk (kwete), similar to yogurt, ghee (clarified butter) for cooking, local cheese varieties like "kasinga" and "kikomera," and butter are also popular. Meat products include fresh meat sold in markets or consumed at home, dried meat (bitooke) preserved through smoking or sun-drying, smoked meat, and groundnuts mixed with beef, which is a popular snack. Meat broths and soups are commonly used as nutritious and flavorful bases. Other valuable products from dual-purpose cattle include hides and skins for leather and crafts, bone and blood meal for fertilizer or animal feed, and manure valued as organic fertilizer. Culturally, milk and meat are symbols of wealth and prosperity and are integral to traditional ceremonies and celebrations. Sharing these products is a sign of hospitality and friendship. Regional variations exist in consumption patterns, with urban areas having more diverse and processed products, while rural areas rely more on raw and traditional products.

2.2 Economic contributions of dual-purpose cattle production on household welfare.

Dual-purpose cattle, which are raised for both milk and meat production, offer numerous benefits that significantly contribute to household welfare and economic stability. These breeds enhance food security by providing a steady supply of nutritious milk and quality meat, essential for balanced diets and improved health outcomes. The ability to produce both milk and meat allows farmers to diversify their income sources, reducing the economic risks associated with market volatility. Additionally, dual-purpose

cattle optimize land use by yielding multiple products from the same livestock, thereby increasing overall farm efficiency (Smith, J., & Johnson, R., 2021). They also promote better resource utilization, as these breeds tend to make more efficient use of feed and other inputs compared to specialized breeds. This diversification in production also serves as a risk management strategy, helping farmers to mitigate the impacts of disease outbreaks, fluctuating market demands, and climate change (Smith, J., & Johnson, R., 2021).

Farmers in the Sembabule District typically maintain a small herd of dual-purpose cattle, with herd sizes ranging from 10 to 50 cows, depending on the farm's size and available resources. Prominent examples of dual-purpose cattle breeds include the Simmental, known for its high milk yield and quality meat, the Brown Swiss, valued for its robust build and substantial milk production, and the Milking Shorthorn, which excels in both milk and meat production. These breeds provide a reliable source of income and sustenance, thereby enhancing the economic contributions of dual-purpose cattle production to household welfare (Anderson, P., & Thompson, L., 2020).

In many regions, dual-purpose cattle production plays a crucial role in the economic development and welfare of smallholder farmers. These systems, characterized by raising cattle for both meat and milk, provide smallholder farmers with a source of income through the sale of meat and dairy products (Waiswa et al., 2021).. Furthermore, dual-purpose cattle production systems are traditionally preferred by family farms in tropical regions due to their flexibility, adaptability to climate conditions, and lower capital investment and technical support requirements compared to specialized milk production systems (Rangel et al., 2020). Moreover, the production models within dual-purpose cattle systems can vary significantly based on farmers' preferences, local market demands, household consumption, and the surrounding environment (Eula Regina Carrara et al., 2022).

The economic contributions of dual-purpose cattle production are multifaceted and have a direct and significant impact on household welfare. One of the key economic contributions of dual-purpose cattle production is the generation of income for smallholder farmers. In Latin America, where dual-purpose cattle systems are widely practiced, these systems serve as a subsistence strategy for smallholders and contribute to economic development by providing a reliable source of income (Eula Regina Carrara et al., 2022). These systems not only provide smallholder farmers with the opportunity to sell both meat and milk, but also allow them to diversify their income streams.

In studying the economic contributions of dual-purpose cattle production on household welfare in Mexico and Uganda, several research studies have shed light on the intricate relationship between this type of livestock farming and economic well-being. In Mexico, studies such as those by Cuevas et al. (2019) and Bernués et al. (2011) have highlighted the substantial economic contributions of dual-purpose cattle, including both meat and milk production, to household incomes and overall welfare. These studies underscore the importance of diversifying agricultural activities to enhance household economic resilience and poverty alleviation. Dual-purpose cattle play a crucial role in meeting both subsistence and market needs, thus positively impacting household incomes and livelihoods.

Similarly, in Uganda, research conducted by Kabunga (2014) and (Giller et al., 2021) has demonstrated the significant economic benefits of dual-purpose cattle production. The production of both milk and meat from these cattle has been shown to be a crucial source of nutrition and income for households. The availability of milk for consumption and sale can enhance dietary diversity and improve the nutritional status of

household members, particularly in resource-constrained settings. Moreover, the surplus milk and meat generated through dual-purpose cattle farming contribute to additional income, which can be used for various household needs, including education and healthcare (Kabunga, 2014).

The observed positive relationship between dual-purpose cattle production and household welfare can be attributed to several factors. Firstly, dual-purpose cattle provide a diversified source of livelihoods, minimizing risk and vulnerability associated with relying on a single agricultural activity (Kabunga, 2014). Additionally, the dairy component of dual-purpose cattle production, which yields milk, can have significant nutritional and income benefits, particularly for women and children. Moreover, the ability to sell surplus milk and meat in local markets enhances cash flow, contributing to enhanced household economic stability and resilience (Nassul Kabunga et al., 2017).

In conclusion, dual-purpose cattle production in both Mexico and Uganda has been shown to make substantial economic contributions to household welfare, providing a multifaceted source of income and nutrition (Njisane et al., 2020). These benefits are crucial for poverty reduction and enhancing overall household well-being. Diversifying agricultural activities and integrating dual-purpose cattle farming can be an effective strategy to improve livelihoods and mitigate economic vulnerabilities in resource-constrained settings.

2.3 Socio-economic factors and household welfare

In the agricultural landscape of Sembabule District, Central Uganda, the dual-purpose cattle production system holds significant economic potential for households.

This literature review explores the influence of education, employment and livelihoods, and access to resources on farmers' awareness of modern agricultural practices, financial management, and their access to resources in the context of cattle farming. Additionally, this review evaluates the quality of employment (e.g., full-time, part-time) and its impact on household welfare, while considering the availability of land, capital, and technological resources and their effects on the scale and efficiency of cattle farming.

Education plays a crucial role in enhancing farmers' awareness of modern agricultural practices, ultimately affecting household welfare. Studies have shown that educated farmers tend to adopt innovative techniques, leading to increased productivity and income from cattle farming (Rashidin et al., 2020). The positive relationship between education and awareness of modern agricultural practices is attributed to the understanding of efficient farming methods, improved animal husbandry practices, and effective disease management, all of which contribute to higher profits and better livelihoods for households (Jiva, 2023).

The quality of employment in the cattle farming sector is a pivotal determinant of household welfare. Full-time employment in cattle farming has been linked to more stable and higher income streams for households, positively impacting their overall well-being (Krueger et al., 2020). Conversely, part-time employment might limit income potential and financial stability. The significant relationship between employment quality and household welfare highlights the need for policies and interventions that promote stable and full-time employment opportunities within the cattle farming sector (Golden, 2016).

Access to resources, including land, capital, and technological advancements, significantly influences the scale and efficiency of cattle farming, ultimately affecting household welfare. Research indicates that farmers with adequate access to land and capital can expand their cattle farming operations, increasing productivity and income (California Natural Resources Agency, n.d). Moreover, technological advancements, such as improved cattle breeding techniques and disease control measures, have a positive correlation with farm efficiency, contributing to higher household welfare through increased productivity and reduced losses.

The economic contribution of dual-purpose cattle production systems on household welfare in Sembabule District, Central Uganda, is heavily influenced by education, employment and livelihoods, and access to resources. Education enhances farmers' awareness of modern agricultural practices, leading to improved productivity and income. Quality employment, particularly full-time engagement, positively impacts household welfare. Additionally, adequate access to resources, including land, capital, and technological advancements, plays a crucial role in enhancing farming efficiency and household income. Understanding these relationships is essential for formulating policies and interventions that promote sustainable and profitable cattle farming, ultimately improving household welfare in the region.

2.4 Challenges faced by farmers in dual-purpose cattle production and household welfare.

Limited access to markets for cattle and cattle products poses a considerable challenge for dual-purpose cattle farmers. This restriction affects the sale of cattle and associated products, directly influencing income generation for farmers (Rangel et al., 2020). The lack of efficient market linkages can lead to reduced prices for cattle and dairy products, resulting in a negative impact on household income and overall welfare (Kumar et al., 2023). Conversely, improved market access has been shown to enhance income generation, positively correlating with enhanced household welfare (Hanley-Cook et al., 2020).

Access to finance and credit is a significant obstacle faced by dual-purpose cattle farmers. Insufficient financial resources hinder the scaling up of cattle farming activities and investment in technology and infrastructure. This limits the potential for increased productivity and income generation (Fowowe, 2017). Studies have shown a positive relationship between improved access to finance and increased household welfare, as access to credit enables farmers to expand their cattle operations and improve productivity (Adams & Jumpah, 2021).

Climate change poses substantial challenges to dual-purpose cattle farming, particularly in the form of altered environmental conditions. Changes in rainfall patterns and rising temperatures affect the availability of grazing land and water resources for cattle, impacting their overall well-being and productivity (Rojas-Downing et al., 2017). These adverse effects of climate change negatively correlate with household welfare, as

reduced cattle productivity directly impacts income and food security (Hanley-Cook et al., 2020). Conversely, studies have indicated that climate-resilient farming practices can mitigate the impact of climate change on dual-purpose cattle production, potentially leading to enhanced household welfare (Adams & Jumpah, 2021).

Dual-purpose cattle farming is a vital component of rural economies, significantly contributing to household welfare. However, challenges related to limited market access, inadequate access to finance and credit, and the impacts of climate change pose obstacles to maximizing the economic benefits of this production system. Addressing these challenges through targeted interventions and policies is essential to enhance household welfare and promote sustainable dual-purpose cattle farming in Sembabule District, Central Uganda.

2.5 Efficiency of Dual-Purpose Cattle Production and household welfare

The economic contribution of dual-purpose cattle production systems to household welfare is a vital topic, particularly in regions where agriculture remains a significant pillar of the economy. In many developing countries, including

Uganda, cattle play a central role in the livelihoods of rural households. Dual-purpose cattle production, involving the utilization of cattle for both meat and milk, presents a potential avenue to enhance household welfare through increased income generation and improved nutrition (Rangel et al., 2020). Studies have demonstrated a positive correlation between milk production efficiency and household welfare. Higher average milk yield per cow leads to increased income and better nutritional intake for households (Kabunga et al., 2017). In Uganda, research by Atube et al. (2021)

emphasized that efficient milk production enhances household food security and boosts income levels, contributing positively to overall welfare.

Efficient meat production in dual-purpose cattle farming significantly influences household welfare. Faster weight gain in cattle indicates better utilization of resources and higher meat yield, positively impacting household income and food security (Letelier et al., 2022). In Brazil, studies by Francisco Marques Cardozo et al. (2016) highlighted the association between improved meat production efficiency and enhanced household welfare, emphasizing the importance of efficient meat production in dual-purpose cattle systems.

The cost of production in dual-purpose cattle farming is a crucial factor influencing household welfare. Studies suggest that a lower cost of production, achieved through efficient feed utilization and management, can lead to increased income and improved welfare for households (Rolando Rojo Rubio et al., 2008). Research conducted in Uganda by Kugonza et al. (2013) emphasized the need for cost-effective feeding strategies to enhance household welfare through reduced production expenses.

Consumer demand for dual-purpose cattle products, influenced by milk and meat quality, has a direct impact on household welfare. High market demand for quality milk and meat drives up the prices, consequently improving income for farming households (Zanon et al., 2020). Studies by Tebug et al. (2016) in Uganda revealed that aligning production with consumer preferences is essential to meet market demands and enhance household welfare (Ge et al., 2020).

Dual-purpose cattle production systems have a notable economic contribution to household welfare in regions like Sembabule District, Central Uganda. Efficient milk and meat production, cost-effective strategies, and meeting market demand based on consumer preferences are key factors influencing household welfare positively. Understanding and optimizing these aspects are crucial for sustainable agricultural practices and improved livelihoods in the study region.

2.6 Summary of literature review

Dual-purpose cattle production, involving both meat and milk, is a vital source of income, food security, and employment for rural households in agricultural-based economies like Uganda. Globally, livestock, including cattle, are recognized for their significant contribution to poverty alleviation and nutrition. In Uganda, dual-purpose cattle production is prevalent and plays a critical role in rural communities, providing food security, income, and integration with crop production for agricultural sustainability.

The economic benefits of this system are multifaceted, ranging from income generation to nutritional improvements within households. Furthermore, the review highlights the influence of socio-economic factors, such as education, employment quality, and access to resources, on household welfare in the context of dual-purpose cattle farming. Challenges faced by farmers, including limited market access, inadequate finance, and climate change impacts, were also discussed. Ultimately, the literature underscores the importance of understanding the economic role of dual-purpose cattle

farming and its potential for enhancing household welfare through improved productivity, market access, and sustainable practices.

In dual-purpose cattle production, both men and women play crucial roles. Here are some activities typically associated with each gender:

Women's activities, Calf care, Feeding, monitoring, and providing health care to calves, Milk processing, Milking, processing, and marketing dairy products, Herd management, Overseeing breeding, calving, and animal health, Feed preparation: Preparing feed for cattle, including harvesting and storing fodder, Marketing, Selling dairy products, meat, or live animals, Record keeping: Maintaining records of cattle health, breeding, and production, Farm maintenance, Assisting with farm repairs, fencing, and infrastructure
Men's activities, Breeding and selection, Selecting breeding stock, managing bull selection, and breeding programs, Pasture management: Managing grazing, pasture rotation, and forage production, Herd health, Providing veterinary care, vaccinations, and parasite control. Cattle handling: Assisting with cattle movement, handling, and restraint, Equipment maintenance, maintaining farm equipment, tools, and machinery, Fencing and infrastructure, Building and repairing fences, water points, and other infrastructure, Marketing and sales, negotiating sales, transporting animals, and marketing products.

Shared activities, Decision making: Collaborating on farm decisions, such as breeding, marketing, and resource allocation Labor sharing, assisting each other with tasks, especially during peak periods, Knowledge sharing, Exchanging information on best practices, new technologies, and market trends.

In Uganda, dual-purpose cattle products are consumed in various ways Dairy products, Raw milk, Consumed directly or used to make tea, coffee, and other beverages, Fermented milk (kwete), Used as a sour milk product, similar to yogurt, Ghee (clarified butter), Used for cooking and as a source of fat, Cheese (local varieties like "kasinga" and "kikomera"), Consumed fresh or dried, Butter, Used for cooking and as a spread Meat products, Fresh meat, Sold in markets or consumed at home, Dried meat (bitooke), Preserved through smoking or sun-drying, Smoked meat: Smoked to preserve

and add flavor. Groundnuts (peanuts) and beef mix, A popular snack. Meat broths and soups, Used as a nutritious and flavorful base.

Other products, Hide and skin products: Used for leather, shoes, and other crafts. Bone and blood meal, Used as fertilizer or animal feed. Manure, Valued as organic fertilizer.

Cultural and social significance: Milk and meat are important symbols of wealth and prosperity. Cattle products are used in traditional ceremonies and celebrations. Sharing milk and meat is a sign of hospitality and friendship Regional variations, Different regions have unique consumption patterns and preferences. Urban areas tend to have more diverse and processed products. Rural areas rely more on raw and traditional products.

CHAPTER III

RESEARCH METHODOLOGY

3.1 Research design

To investigate the economic contribution of dual-purpose cattle production systems on household welfare in Sembabule District, Central Uganda, the study will use cross sectional and mixed-methods research design. This research design will involve the use of both qualitative and quantitative approaches to provide a comprehensive understanding of the subject.

The quantitative aspect shall involve structured surveys conducted among a representative sample of households within the district, focusing on aspects such as

income generated from dual-purpose cattle production, household consumption patterns, and overall economic impact. Additionally, qualitative methods such as interviews and focus group discussions with cattle farmers, agricultural extension officers, and local community leaders can provide valuable insights into the social and cultural aspects affecting dual-purpose cattle production and its influence on household welfare (Memon, 2020).

This mixed-methods approach will allow for a thorough analysis of the economic contributions of dual-purpose cattle production and its implications for household welfare, considering both quantitative data for statistical analysis and qualitative insights for a deeper understanding of the context.

3.2 Target Population

The target population of the study will be the households practicing dual cattle production in Lwebitakuli subcounty, Ssembabule District Uganda

3.3 Sources of Data

The study will use primary data which shall be sourced in Lwebitakuli subcounty, Ssembabule District. The researcher will then use observations and questionnaires that shall be administered to dual cattle household producers (Ajayi, 2017). Secondary will also be to accompany with the study findings.

3.4 Sampling and sample size determination

A sample is a portion of the population, where the population is defined as all the people who have "some common observable traits" (Kiugu et al., 2021). It is essential to make every effort to obtain a sizable sample in order to draw one that is representative of the population. Any sample with more than 30 elements is regarded as large

statistically. The magnitude of sampling mistakes is reduced by choosing a large sample (Kiugu et al., 2021). Greater understanding of the demographic features and wider generalizations of the results are both possible with larger samples.

A report from the Subcounty Agricultural office of Lwebitakuli, Ssembabule District, 2020 registered 2,435 of cattle production systems households in four villages. A population of 820 dual producers will be considered in the study. Simple random sampling will be used to select sample elements at random from each village.

Table 1 : The table showing cattle production households in Lwebitakuli subcounty

Villages	Milk Producing households	Beef Producing households	Dual Producing households	Total of Number of households (N)	Percentages
Kabaale	180	123	130	433	17.8
Lwebitakuli	340	162	280	782	32.1
Nassenyi	325	154	241	720	29.6
Kasambya	240	91	169	500	20.5
TOTAL	1085	530	820	2435	100

Source; 2020 Agricultural report, Lwebitakuli sub county, Ssembabule district

3.4.1 Sample size determination of the households in the four villages practicing dual purpose cattle.

According to Memon, he revealed that a sample greater than and equal to 50 is good for a simple regression analysis (Memon, 2020). A population size of 820 households from four parishes practicing dual purpose cattle will be used to determine the sample size using Cochran, (Cochran, 1963).

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

Where; n = sample size N = Total Population size of dual households under study area,
e= margin of error set at 5%

$$n = 820 / [1 + 820(0.05)^2] = 268.852 \approx 269 \text{ households}$$

3.5 Sampling techniques

The simple random sampling, stratified and purposeful random sampling procedures, which are described below, will be both used in the study. When determining the components for a probability sample, some type of random selection is used. Greater confidence can be placed in our sample as typical of probability sampling, enabling one to draw robust statistical conclusions about the entire group. Each unit of the population has an equal and independent chance of being chosen into the sample. Non-probability sampling entails non-random selection based on practicality or other factors that make it simple to gather data, (Cochran, 1963).

3.5.1 Purposive sampling

Purposeful sampling is where units/ respondents will be selected basing on certain norm. A subset of the study's respondents which included villages, farmers/households,

diary inspectors, education officers, and village cattle committee members, will be selected basing a selective sample technique in Sembabule District (Creswell & Clark, 2011). This method is recommended so as to obtain information from respondents who are very experienced and have a wealth of expertise with the dual-purpose cattle production systems.

3.6 Collection of data procedures

The researcher will present a written document to the heads of parishes and villagers, households, inspectors of cattle, education officers and village dairy committee members a letter of introduction from the Universitas Diponegoro. The heads of Lwebitakuli subcounty and or parishes will be asked to endorse a stamp and a note of acceptance to officially allow the researcher to carry out his Study. The researcher will train the research assistants who will helped in distributing the surveys questionnaires. The researcher will conduct interviews in person so as to obtain first-hand information from the respondents (Creswell & Clark, 2011).

3.7 Measurement of variables

Table 2: Table showing how variable measurement, objectives and specific features in the study

S/N	Type of variable	Objective	Features used	Measurement scale
1	Background variables		Age, family size, marital status	ratio, nominal
2.	Dependent			
	Household welfare		Household welfare measured as 1=Yes (dual production improved household welfare), 0=No (dual production did not	Nominal

		improve household welfare)	
3	Independent		
1.	Economic contributions of dual-purpose cattle production	<ul style="list-style-type: none"> • Productivity and Output • Improvement in Food Security • Welfare Indicators (household income generated from the sales of cattle productions) 	Nominal, ratio
2.	Socio-economic factors influencing the choice of dual-purpose cattle farming	<ul style="list-style-type: none"> • Education Level (in years and at levels) • Employment and Livelihoods (yes or no) • Access to Resources (land) 	Ordinal, nominal
3	Challenges faced by farmers in dual-purpose cattle production	<ul style="list-style-type: none"> • Market Access (yes or no) • Access to Finance and Credit (yes or no) • Climate Change Impacts 	Likert, nominal
4	The efficiency of Dual-Purpose Cattle Production	<ul style="list-style-type: none"> • Milk Production Efficiency (in liters) • Meat Production Efficiency (in kgs) • Cost of Production (in US dollars) • Market Demand/Consumer Preference (yes or no) 	Likert, ratio, nominal

3.8 Data collection methods and tools

- a) Household interviews: eight hundred and twenty (820) households will be randomly selected for the study, and face to face guided interviews shall be conducted using semi-structured questionnaires. This is deemed because guided interviews provide the opportunity to break-ground; establish trust and iteration of responses when dealing with respondents with low levels of formal education. (Phellas *et al.*, 2011; Abafita and Kim, 2014). A household in this study is defined based on the Uganda Bureau of Statistics Operational definitions; a group of people living and eating together (UBOS, 2003).
- b) Key Informant Interviews (KIIs): Key informants like parish chiefs, district veterinary officers, animal officers, district and sub county extension officers, village leaders and knowledgeable persons will be identified by local assistants and the community chiefs who will further provide more information on cattle production, their sources and various breeds kept and the welfare to households.
- c) Direct observation: will be used to compare what shall be said and that on the actual ground hence validating information from questionnaires and key informants.

3.8.1 Data collection tools

- a) Structured questionnaires: The semi-structured questionnaire will have used to capture data on cattle species, consumption patterns, dual purpose products and marketing patterns. It will further capture data on breeds kept and source of the breeds kept.
- b) Interview guides: These will be used to elicit information from key technical persons within the study area. They will be open ended to capture all qualitative

information to be triangulated with quantitative information from the household surveys.

- c) Observation checklist: This will be used intuitively by the researcher to observe the methods used in animal rearing, various animals commonly kept. Also, generation the daily income earnings of the farmers

3.9 Data quality control

Validity and reliability of the research instruments will be measured as follows.

3.9.1 Validity of Instruments

Validity is the extent to which the instruments used during the study measure the issues they are intended to measure (Amin, 2005). To ensure validity of instruments; the instruments will be developed under close guidance of the supervisor. After the questions are designed, they will be pre-tested to a tenth of the respondent's sample. This will help to identify ambiguous questions in the instruments and be able to re-align them to the objectives.

3.9.2 Reliability of Instruments

Reliability is the extent to which the measuring instrument will produce consistent scores when the same groups of individuals are repeatedly measured under the same conditions (Amin, 2005). The study will administer one type of questionnaire to the respondents and using Cronbach credibility test, Alpha values of 0.7 will be sustained,

3.10 Ethical issues

At the onset of data collection, the researcher will seek permission of the municipal production officer who will introduce the researcher to the parish committees and later the village leadership. In addition, each questionnaire will contain an opening introductory letter requesting for the respondents' cooperation in providing the required

information for the study. The respondents will be further assured of confidentiality of the information provided and that the findings will be used for academic purposes only. Respondents will be further assured of their personal protection and that they will have authority to either refuse or terminate the interview even if in the middle.

3.11 Data analysis

All the returned questionnaires will be edited, coded and entered using EXCEL and STATA version 15 computer software. Analysis will involve descriptive summary of the study variables using frequency tables, graphs and descriptive statistics.

Identification of breeds of cattle kept by households will be analysed using descriptive statistical analysis where ranks, frequencies, and percentages shall be generated on preferred breeds or species of animals including their reasons for preference. To determine the most preferred animal species, preference ranking approach will be used. The ranks will be computed and one with highest frequency will be considered to be most preferred species in study area accompanied by the reasons for its preference. Descriptive statistical analysis will further be used to generate percentages of marketing animals' products and consumption patterns of cattle products as well as determine whether there is significant association to the welfare of famers and their income.

It will also involve univariate analysis, correlation analysis and regression analysis.

3.11.1 Univariate Analysis.

Descriptive and summary statistics was used to analyze the variables under study i.e., economic contribution, socioeconomic factors, challenges faced by farmers, efficiency of dual-purpose cattle production and background variables of respondents.

3.11.2 Correlation Analysis

Simple correlation analysis of some variables will be used to derive insights and relationships between economic contribution, socioeconomic factors, challenges faced by farmers, role of dual-purpose cattle production on household welfare respectively.

3.11.3 Multivariate regression Analysis.

Logistic Regression analysis will be used to measure the effectiveness and combined contribution of economic contribution, socioeconomic factors, challenges faced by farmers, role of dual-purpose cattle production on household welfare from some selected variable features and background variables.

Model 1: Logistic model.

$$L_i = \frac{1}{1+e^{-(\alpha_1+\alpha_2X_i)}} \dots\dots\dots(a)$$

$$L_i = \alpha_0 + \alpha_1A_i + \alpha_2F_i + \alpha_3W_{Ci} + \alpha_4E_i + \alpha_5EM_i + \alpha_6R_i + \alpha_7M + \alpha_8X_i + \alpha_9C_i + \alpha_{10}D_i + \alpha_{11}Z_i + u_i \dots\dots\dots (1)$$

Where;

L_i = Household welfare measured as 1=Yes (dual production improved household welfare), 0=No (dual production did not improve household welfare)

α_{is} = are slope coefficients of respective features

$A_i, F_i, W_{Ci}, E_i, EM_i, R_i, M, X_i, C_i, D_i, Z_i$ = Age of the respondent, family size, welfare indicators (income generated from the sale of cattle products and activities), Education Level (in years), Employment and Livelihoods (1=Full, 0=Part-time), Access to Resources (1=Yes, 0=No), Milk Production Efficiency (in Liters), Meat Production Efficiency (in KGs), Cost of Production (in UGX), Market Demand and Consumer Preference (1=Yes, 0=No), and access to Finance and Credit (1=Yes, 0=No) respectively.

u_i = error term accounting for other factors

CHAPTER IV

RESULT AND DISCUSSION

4.0 Introduction

This chapter presents facts findings, analysis and discussions which were obtained from questionnaires given to the respondents. The analysis and study findings involved demographic analysis of collected data followed by empirical findings. The Logistic regression is performed to measure the economic contribution of dual-purpose cattle production systems on household welfare. It presents the results from the analysis and discusses the major findings of the study according to the research objectives.

4.1 Presentation of findings

Demographic characteristics of the respondents were of importance in the study where by a total of 269 respondents were selected to participate in the study. These include; sex, education level, family size, marital status and summary statistics of some of the selected variables of the respondents. This is shown in Table 4.1, Table 4.2, Table 4.3.

4.1.1 Sex of respondent

Table 3 Descriptive statistics of sex of respondents

Gender	Frequency	Percentage (%)
Male	164	60.97
Female	105	39.03
Total	269	100

Source: Primary data, 2023

Results in Table 3 shows that 164 males representing 60.97 percent of the male household farmers and 105 females representing 39.03 percent female household farmers practiced dual cattle production systems implying that more male farmers participated in dual cattle production than their female counter parts by the time the study was carried out.

4.1.2 Marital status of respondents

Table 4: Descriptive statistics of Marital status of respondents

Marital Status	Frequency	Percentage (%)
Divorced/separated	25	9.29
Married	130	48.33
Single	74	27.51
Widower/widowed	40	14.87
Total	269	100.00

Source: Primary data, 2023

Table 4 reveals that, 48.33 percent of the respondents/household farmers were married (130 married), 27.51 percent of the respondents/household farmers were single (74 single), 14.87 percent of the respondents/household farmers that is 40 were Widower/widowed and only 9.29 percent (25) were divorced/separated. This implies that most of the dual cattle production activities were carried out by the married household farmers which means that they had various family obligations to attend to, followed by the single and few of the widower/widowed and divorced/separated respectively.

4.1.3 Education level

A pie Chart showing education level of respondents

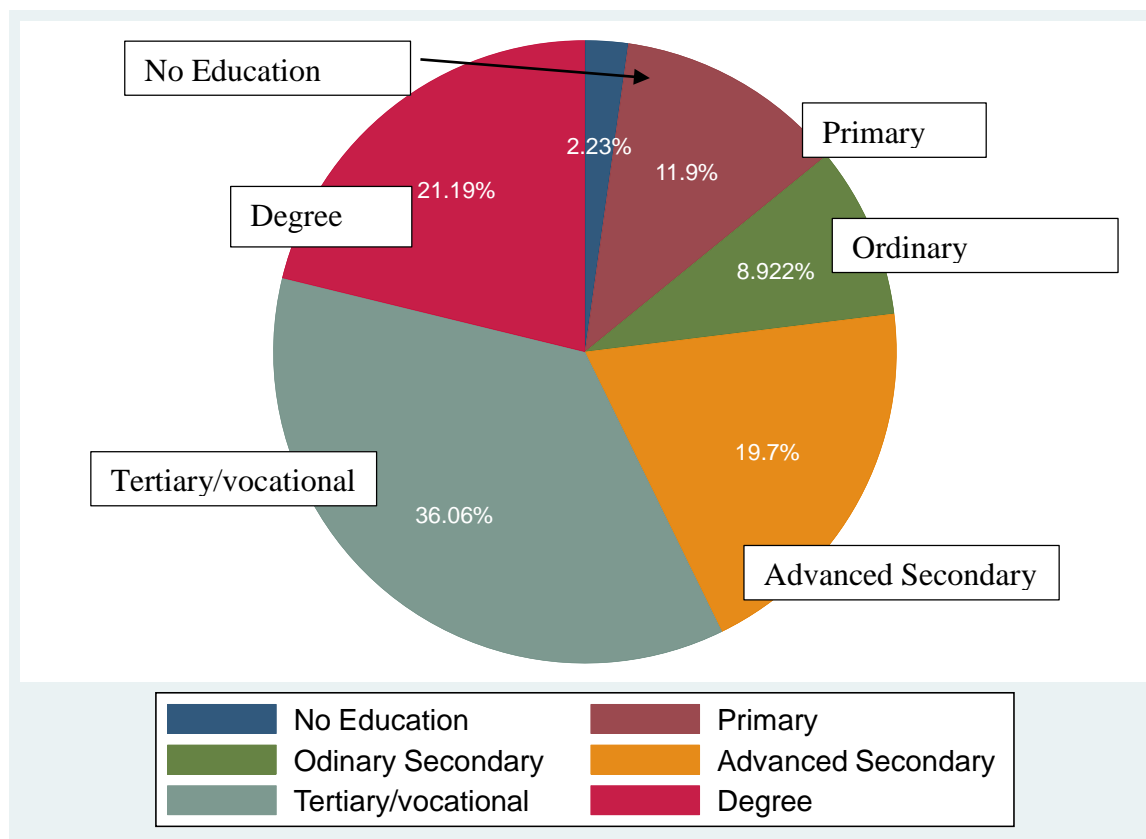


Figure 1 shows distribution of education level of respondents/household farmers

Figure 1 shows that 36.06 percent household farmers had attained tertiary/vocational level, 21.19 percent of household farmers had attended degree level,

19.7 percent of farmers had attended advanced secondary, 8.922 percent of farmers had attended ordinary secondary, 11.9 percent of farmers attended primary school whereas only 2.23 percent of household farmers had no education respectively. Thus, majority of the dual cattle production systems household farmers had acquired education. This implies that dual cattle production activities are under go well arranged programs, quality book keeping, marketing and market demands and maintenance.

4.1.4 Age and family size of the respondent

Table 5: Age and family size of the respondent

Variable	Mean	Std. Dev.	Min	Max
Age in years	37.84015	11.36408	21	73
Family size	6.245353	3.907421	1	19

Source: Primary data, 2023

Results in table 5 reveals that the minimum and maximum age that participated in dual cattle production systems were 21 and 73 respectively. The average age was 38 with a standard deviation of 11.36408. Whereas the minimum size of the respondent's family was 1 and the maximum was 19 with an average of 6.24533 people and standard deviation of 3.907421 respectively.

4.2 Univariate Analysis

This includes mean, kurtosis, minimum etc. it is only for quantitative / continuous variables whereas Frequency distribution table It is used for categorical features of each objective.

4.2.1 Economic contributions made by dual-purpose cattle production

These features include Productivity and Output, Food Security, Welfare Indicators (household income generated from the sales of cattle productions)

Table 6: Descriptive statistics for Economic contributions

Variable	Mean	Std. Dev.	Min	Max
Quantity of Milk produced and sold	124.4535	168.5555	2	800
Quantity of Meat produced and sold	104.3086	109.6652	3	520
Cost of Production	1040372	1039091	15000	5000000
Number of cows	25.84015	11.36408	9	61
Household income	1512842	1379021	40000	5800000

Source: Primary data, 2023

Table 6 presents the descriptive statistics for economic contributions made by dual-purpose cattle production systems on household welfare. The mean quantity of milk produced and sold is 124.4535 liters, with a standard deviation of 168.5555 liters. The mean quantity of meat produced and sold is 104.3086 kgs, with a standard deviation of 109.6652 kgs. The mean cost of production is 1,040,372 UGX, with a standard deviation of 1,039,091 UGX. The average number of cows per household is reported to be approximately 26 cows with a standard deviation of 11.36408, the maximum and minimum number of cows were 61 and 9 respectively. The mean household income generated from the sales of cattle productions is 1,512,842 UGX, with a standard deviation of 1,379,021 UGX. These results suggest that dual-purpose cattle production systems can contribute significantly to household welfare, as indicated by the mean household income generated from the sales of cattle products.

Table 7: Frequency distribution of Improvement in Food security

Improvement in Food security	Frequency	Percentage (%)
No	34	12.64
Yes	235	87.36
Total	269	100.00

Source: Primary data, 2023

The frequency distribution of improvement in food security shows that out of the 269 respondents, 87.36% (235), reported that dual-purpose cattle production led to an improvement in food security, while 12.64% (34) did not report an improvement. This indicates that the majority of the respondents perceived a positive impact of dual-purpose cattle production on food security, which is an important outcome in the context of household welfare and agricultural sustainability.

4.2.2 Socio-economic factors

These features include; Education Level (in years and at levels), Employment and Livelihoods (yes or no), Access to Resources, years of dual cattle engagement

Table 8: Summary statistics of education level

Education level	Frequency	Percentage (%)
No Education	6	2.23
Primary	32	11.90
Ordinary Secondary	24	8.92
Advanced Secondary	53	19.70
Tertiary/vocational	97	36.06
Degree	57	21.19
Total	269	100.00

Source: Primary data, 2023

Results in table 8 indicates that a significant proportion of the household farmers engaged in dual-purpose cattle production had attained higher levels of

education, with 36.06% (97) having reached a tertiary/vocational level and 21.19% (57), 19.70% (53) having obtained a degree, advanced secondary level respectively. This suggests that the majority of the farmers involved in dual-purpose cattle production had a relatively high level of education, which could potentially contribute to better management practices, market understanding, and overall agricultural decision-making.

A bar graph showing respondent’s Education level on household welfare

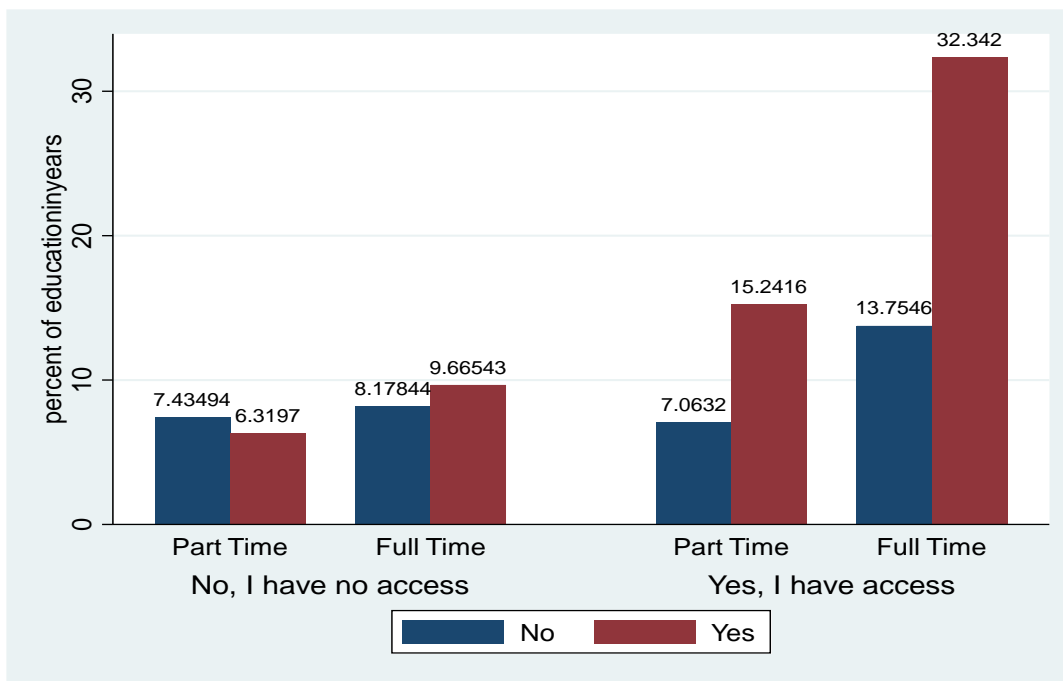


Figure 2 shows distribution of respondent’s education level ,on household welfare

Results in figure 3 shows that 32.342 percent of respondents who spent years in education were in full time employment, had access to resources e.g., Land and said dual cattle production systems improved their household welfare. Whereas 13.7546 percent of respondents who spent years in education were in full time employment, had access to resources e.g., Land and said dual cattle production systems did not improve their household welfare.

Figure 3 also reveals that 15.2416 percent of respondents who spent years in education were in part time employment, had access to resources e.g., Land and said dual cattle production systems improved their household welfare. Whereas 7.0632 percent of respondents who spent years in education were in part time employment, had access to resources e.g., Land and said dual cattle production systems did not improve their household welfare.

Results in figure 3 shows that 9.66943 percent of respondents who spent years in education were in full time employment, had no access to resources e.g., Land and said dual cattle production systems improved their household welfare. Whereas 8.17844 percent of respondents who spent years in education were in full time employment, had no access to resources e.g., Land and said dual cattle production systems did not improve their household welfare.

Figure 3 also shows that 6.3197 percent of respondents who spent years in education were in part time employment, had no access to resources e.g., Land and said dual cattle production systems improved their household welfare. Whereas 7.43494 percent of respondents who spent years in education were in part time employment, had no access to resources e.g., Land and said dual cattle production systems did not improve their household welfare.

Table 9: Frequency distribution table for Years of dual cattle engagement

Years of engagement	Frequency	Percentage (%)
Less than 1 year	71	26.39
1-5 years	99	36.80
5-10 years	48	17.84
More than 10 years	51	18.96
Total	269	100.00

Source: Primary data, 2023

Results in Table 4.7 reveals that, the majority of the respondents (99 respondents) have been engaged in dual cattle production for 1-5 years, followed by those (71 respondents) engaged for less than 1 year, more than 10 years (51), and 5-10 years (48), in descending order. This suggests that dual cattle production is a relatively new venture for many of the respondents, with a significant proportion having been engaged for less than 5 years.

4.2.3 Challenges faced by farmers in dual-purpose

Challenges faced by farmers during dual-purpose production activities include; Market Access (yes or no), Access to Finance and Credit (yes or no), Climate Change Impacts.

Table 10: Frequency distribution table for market access

Market access	Frequency	Percentage (%)
No	52	19.33
Yes	217	80.67
Total	269	100.00

Source: Primary data, 2023

Table 4.8 reveals that 19.33 percent (52) of the household dual cattle farmers had no access to the market whereas 80.67 percent (217) had access to the markets. This implies increased dual cattle production activities were carried out.

A pie chart showing impact of climate changes on dual cattle production systems

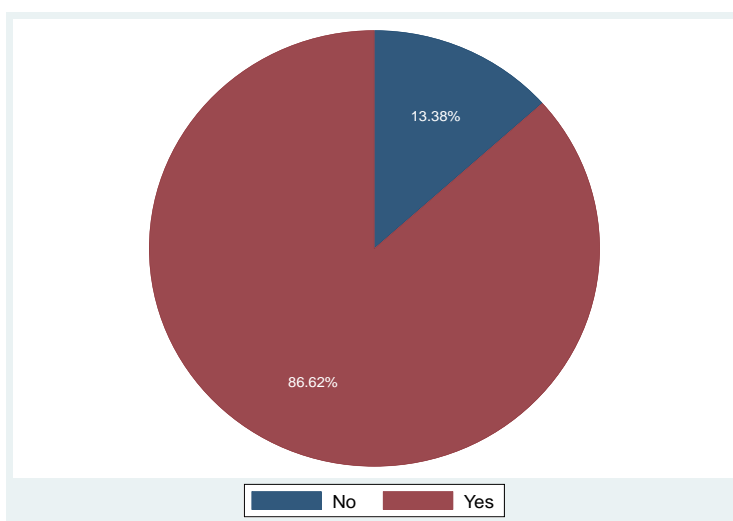


Figure 3 shows distribution of climate impacts on dual production activities

Figure 3 reveals that 13.36 percent of the household dual cattle farmers reported that climate changes does not affect their dual production activities whereas 86.62 percent said climate changes does affect their dual production activities.

Table 11: Frequency distribution for credit and financial challenges

Credit and financial challenges	Freq.	Percentage (%)
No	62	23.05
Yes	207	76.95
Total	269	100.00

Source: Primary data, 2023

Table 4.8 reveals that 23.05 percent (62) of the household dual cattle farmers reported that they had no challenges in obtaining financial credit whereas 76.95 percent constituting 207 respondents had challenges in obtaining financial credit. This implies dual cattle production activities were either supported by incomes generated from cattle activities and also doing some part time employment.

4.2.4 Efficiency of dual-purpose cattle production systems

For dual cattle production efficiency, the features include; Milk Production Efficiency (in liters), Meat Production Efficiency (in kgs), Cost of Production (in UGX dollars), Market Demand/Consumer Preference (yes or no).

Table 12: descriptive statistics for cost of production

Variable	Mean	Std. Dev.	Min	Max
Cost of production	1,040,372	1,039,091	15,000	5,000,000

Source: Primary data, 2023

The table presents the mean, standard deviation, minimum, and maximum values for the cost of production. The mean cost of production is 1,040,372 UGX (=USD 281.18), with a standard deviation of 1,039,091 UGX (=USD 280.84). The minimum cost of production is 15,000 UGX (=USD 4.05), and the maximum cost is 5,000,000 UGX (=USD 1,351.35). This indicates that the average cost of production is around 1,040,372 UGX (=USD 281.18), with a considerable variation indicated by the standard deviation. The range between the minimum and maximum values shows the spread of the cost of production data.

Table 13: Frequency distribution for Milk Production Efficiency

Milk production Efficiency	Frequency	Percentage (%)
High efficiency	63	23.42
Moderate efficiency	123	45.72
Low efficiency	73	27.14
Not sure	10	3.72
Total	269	100.00

Source: Primary data, 2023

Table 4.11 presents the frequency distribution for Milk Production Efficiency. The table shows the number of respondents who reported high, moderate, and low efficiency in milk production, as well as those who were not sure. The results

indicate that 23.42% (63) of the respondents reported high efficiency in milk production, while 45.72% (123) reported moderate efficiency, and 27.14% (73) reported low efficiency. Only 3.72% (10) of the respondents were not sure about their milk production efficiency.

Table 14: Frequency distribution for Meat Production Efficiency

Meat production Efficiency	Frequency	Percentage (%)
High efficiency	41	15.24
Moderate efficiency	117	43.49
Low efficiency	78	29.00
Not sure	33	12.27
Total	269	100.00

Source: Primary data, 2023

Table 14 presents the frequency distribution for Meat Production Efficiency. The table shows the number of respondents who reported high, moderate, and low efficiency in meat production, as well as those who were not sure. The results indicate that 15.24% (41) of the respondents reported high efficiency in meat production, while 43.49% (117) reported moderate efficiency, and 29.00% (78) reported low efficiency. 12.27% (33) of the respondents were not sure about their meat production efficiency

Table 15: Frequency distribution for Market demand/customer preference

Market demand	Frequency	Percentage (%)
No	82	30.48
Yes	187	69.52
Total	269	100.00

Source: Primary data, 2023

Table 15 presents the frequency distribution for Market demand/customer preference. The table shows the number of respondents who reported yes or no to

market demand/customer preference. The results indicate that 69.52% (187) of the respondents reported yes to market demand/customer preference, while 30.48% (82) reported no.

The frequency distribution tables above provided an overview of the efficiency of dual-purpose cattle production systems in terms of milk and meat production, as well as the market demand/customer preference. The results suggest that a significant proportion of the respondents reported moderate to low efficiency in milk and meat production. However, the majority of the respondents reported yes to market demand/customer preference, indicating a potential market for dual-purpose cattle production.

These results suggest that there is potential for improving the efficiency of dual-purpose cattle production systems, especially in milk and meat production. Additionally, the majority of the respondents reported yes to market demand/customer preference, indicating a potential market for dual-purpose cattle production. However, the challenges faced by farmers in dual-purpose cattle production, such as access to finance and credit, market access, and climate change impacts, need to be addressed to improve the efficiency and sustainability of dual-purpose cattle production systems.

4.3 Bivariate Analysis

The researcher performed cross tabulation and chi square tests in a bid to understand the dependency of various categorical features on household welfare. Correlation analysis was also carried out.

4.3.1 Chi square test and cross tabulations for improvement in food security and household welfare

H₀; household welfare does not depend on improvement in food security

Ha; household welfare depends on improvement in food security

Table 16: Chi square test and cross tabulations for improvement in food security and household welfare

Household welfare	Improvement in Food security		Total
	Yes	No	
Yes	21	77	98
	7.81	28.62	36.43
No	13	158	171
	4.83	58.71	63.57
Total	34	235	269
	12.64	87.36	100.00

Pearson chi2(1) = 10.7854 Pr = 0.001

Source: Primary data, 2023

Table 16 presents the results of a chi-square test and cross-tabulation for improvement in food security and household welfare. The null hypothesis (H0) is that household welfare does not depend on improvement in food security, while the alternative hypothesis (Ha) is that household welfare depends on improvement in food security. The table shows that out of 269 respondents, 36.43% (98) reported improvement in food security and household welfare, while 63.57% (171) reported no improvement. The chi-square test statistic is 10.7854 with a p-value of 0.001, which is less than the level of significance (alpha) of 0.05. Therefore, we reject the null hypothesis and conclude that there is a significant relationship between improvement in food security and household welfare. This suggests that dual-purpose cattle production can contribute to household welfare by improving food security.

4.3.2 Chi square test and cross tabulations for respondent's education level and household welfare

H0; household welfare does not depend on respondent's education level

Ha; household welfare depends on respondent's education level.

Table 17: Chi square test and cross tabulations for respondent's education level and household welfare

Household welfare	Education level						Total
	No Education	Primary	Ordinary secondary	Advanced Secondary	Tertiary/	Degree	
No	2 0.74	16 5.95	9 3.35	21 7.81	30 11.15	20 7.43	98 36.43
Yes	4 1.49	16 5.95	15 5.58	32 11.90	67 24.91	37 13.75	171 63.57
Total	6 2.23	32 11.90	24 8.92	53 19.70	97 36.06	57 21.19	269 100.0

Pearson chi2(5) = 4.1268 Pr = 0.531

Source: Primary data, 2023

The provided table 4.15 presents the results of the chi-square test and cross-tabulations for respondent's education level and household welfare. The table includes the relative percentages for each education level category as follows;

0.74% (2) of the respondents who had no education, reported that dual cattle production systems did not improve on their household welfare. 5.95% (16), 3.35% (9), 7.81% (21), 11.15% (30), and 7.43% (20), of the respondents who had primary, Ordinary secondary, advanced secondary, tertiary/vocational and degree education respectively also reported that dual cattle production systems did not improve on their household welfare.

Table 4.15 still reveals that 1.49% (4) of the respondents who had no education, reported that dual cattle production systems improved on their household welfare. 5.95% (16), 5.58% (15), 11.90% (53), 24.91% (97), and 13.75% (57), of the respondents who had primary, Ordinary secondary, advanced secondary, tertiary/vocational and degree

education respectively also reported that dual cattle production systems improved on their household welfare.

The chi-square test statistic is 4.1268 with a p-value of 0.531, which is greater than the level of significance (alpha) of 0.05. Therefore, we fail to reject the null hypothesis and conclude that there is no significant relationship between household welfare and respondent’s education level. This suggests that household welfare does not depend on the respondent’s education level.

4.3.3 Chi square test and cross tabulations for access to resources and household welfare

H0; household welfare does not depend on access to resources

Ha; household welfare depends on access to resources

Table 18: Chi square test and cross tabulations for access to resources and household welfare

Household welfare	Access to resources		Total
	No, I have no access	Yes, I have access	
No	42	56	98
	15.61	20.82	36.43
Yes	43	128	171
	15.99	47.58	63.57
Total	85	184	269
	31.60	68.40	100.00

Pearson chi2(1) = 9.0411 Pr = 0.003

Source: Primary data, 2023

Results in table 18 shows that 15.61 percent (42) of the respondents who said they have no access to resources e.g., land said dual cattle production systems did not improve

on their welfare whereas those who said they had access to resources said dual cattle production systems improved on their welfare. The results also reveal that 15.99 percent (85) of the respondents who said they have no access to resources e.g., land also mentioned that dual cattle production systems improved on their welfare whereas those who said they had access to resources said dual cattle production systems improved on their welfare. Access to resources have a significant impact on household welfare since the chi square probability (0.003) is less than 5 percent level ($P < 0.05$).

4.3.4 Chi square test and cross tabulations for market demand of dual cattle products and household welfare

H₀; household welfare does not depend on market demand of dual cattle products

H_a; household welfare depends on market demand of dual cattle products

Table 19: Chi square test and cross tabulations for market demand of dual cattle products and household welfare

Household welfare	Market demand of dual cattle products		Total
	No	Yes	
No	38	60	98
	14.13	22.30	36.43
Yes	44	127	171
	16.36	47.21	63.57
Total	82	187	269
	30.48	69.52	100.00
Pearson chi2(1) = 5.0024 Pr = 0.025			

Source: Primary data, 2023

Table 19 presents the chi-square test and cross-tabulations for market demand of dual cattle products and household welfare. The table shows that out of the 269

respondents, 14.13% (38) reported that they had no difficulties in market demand/customer preference of dual cattle products hence said dual cattle production did not improve on their household welfare whereas 22.30% (60) reported that they had difficulties in market demand/customer preference of dual cattle products thus said dual cattle production did not improve on their household welfare.

Conversely, 16.36% (44) reported that they had no difficulties in market demand/customer preference of dual cattle products hence dual cattle production improved on their household welfare whereas 47.21% (127) reported that they had difficulties in market demand/customer preference of dual cattle products thus said that dual cattle production improved on their household welfare.

The chi-square test statistic is 16.667 with a p-value of 0.000, which is less than the level of significance (alpha) of 0.05. Therefore, we reject the null hypothesis and conclude that there is a significant dependency between market demand of dual cattle products and household welfare. This suggests that market demand plays a crucial role in determining the economic contributions of dual-purpose cattle production systems to household welfare. The results indicate that farmers who have access to a market for their dual cattle products are more likely to report an improvement in household welfare than those who do not have access to a market.

The results of the chi-square test and cross-tabulations for market demand of dual cattle products and household welfare suggest that market demand plays a significant role in determining the economic contributions of dual-purpose cattle production systems to household welfare. Farmers who have access to a market for their dual cattle products are more likely to report an improvement in household welfare than those who do not have access to a market. These findings have important implications for policymakers

and stakeholders in the agricultural sector, as they highlight the need to support farmers in accessing markets for their dual cattle products to improve their economic well-being.

4.3.5 Chi square test and cross tabulations for impacts of climate change and household welfare

H0; household welfare does not depend on Impacts of climate change

Ha; household welfare depends on Impacts of climate change

Table 20: Chi square test and cross tabulations for impacts of climate change and household welfare

Household welfare	Impacts of climate change		Total
	No	Yes	
No	15	83	98
	5.58	30.86	36.43
Yes	21	150	171
	7.81	55.76	63.57
Total	36	233	269
	13.28	86.62	100.00
Pearson chi2(1) = 0.4919 P = 0.483			

Source: Primary data, 2023

Table 20 presents the results of the chi-square test and cross-tabulations for impacts of climate change and household welfare. The table shows the frequency distribution of household welfare and impacts of climate change. Out of the 269 respondents, 5.58% (15) reported that they never experienced impacts of climate change while carrying out dual cattle production activities hence said dual cattle production did

not improve on their household welfare whereas 30.86% (83) reported that they never experienced impacts of climate change while carrying out dual cattle production activities thus said dual cattle production did not improve on their household welfare.

Conversely, 7.81% (21) reported that they never experienced impacts of climate change while carrying out dual cattle production activities hence dual cattle production improved on their household welfare whereas 55.76% (150) reported that they never experienced impacts of climate change while carrying out dual cattle production activities thus said that dual cattle production improved on their household welfare. The chi-square test statistic is 0.4919 with a p-value of 0.483, which is greater than the level of significance (alpha) of 0.05. Therefore, we fail to reject the null hypothesis and conclude that climate change impacts do not significantly depend on household welfare.

4.3.6 Chi square test and cross tabulations for Milk Production Efficiency and household welfare

H₀; household welfare does not depend on Milk Production Efficiency

H_a; household welfare depends on Milk Production Efficiency

Table 21: Chi square test and cross tabulations for Milk Production Efficiency and household welfare

Household welfare	Milk production Efficiency			Not sure	Total
	High efficiency	Moderate efficiency	Low efficiency		
No	19 7.06	39 14.50	33 12.27	7 2.60	98 36.43
Yes	44 16.36	84 31.23	40 14.87	3 1.12	171 63.57

Total	63	123	73	10	269
	23.42	45.72	27.14	3.72	100.00
	Pearson chi2(3) = 9.5480 Pr = 0.023				

Source: Primary data, 2023

The provided table 21 presents the results of the chi-square test and cross-tabulations for milk production efficiency and household welfare. The table includes the relative percentages for each milk production efficiency category as follows; 7.06% (19) of the respondents with high milk production efficiency, reported that dual cattle production systems did not improve their household welfare. 14.50% (39), 12.27% (33), 2.60%(7), of the respondents with moderate milk production efficiency, low milk production efficiency and those who were not sure respectively also reported that dual cattle production systems did not improve on their household welfare.

Table 4.19 continues to reveal that 16.36% (44) of the respondents with high milk production efficiency, reported that dual cattle production systems improved their household welfare. 31.23%(84), 14.87%(40), 1.12%(3), of the respondents with moderate milk production efficiency, low milk production efficiency and those who were not sure respectively also reported that dual cattle production system improved on their household welfare.

The chi-square test statistic is 9.5480 with a p-value of 0.023, which is less than the level of significance (alpha) of 0.05. Therefore, we reject the null hypothesis and conclude that there is a significant effect of milk production efficiency on household welfare.

4.3.7 Chi square test and cross tabulations for Meat Production Efficiency and household welfare

H0; household welfare does not depend on Meat Production Efficiency

Ha; household welfare depends on Meat Production Efficiency

Table 22: Chi square test and cross tabulations for Meat Production Efficiency and household welfare

Household welfare	Meat production Efficiency			Not sure	Total
	High efficiency	Moderate efficiency	Low efficiency		
No	9	33	41	15	98
	3.35	12.27	15.41	5.58	36.43
Yes	32	84	37	18	171
	11.90	31.23	13.75	6.69	63.57
Total	41	117	78	33	269
	15.24	43.49	29.0	12.27	100.00
Pearson $\chi^2(3) = 17.0568$ Pr = 0.001					

Source: Primary data, 2023

The provided table 22 presents the results of the chi-square test and cross-tabulations for meat production efficiency and household welfare. The table includes the relative percentages for each meat production efficiency category as follows;

3.35% (9) of the respondents with high meat production efficiency, reported that dual cattle production systems did not improve their household welfare. 12.27% (33), 15.41%(41), 5.58%(15), of the respondents with moderate meat production efficiency, low meat production efficiency and those who were not sure respectively also reported that dual cattle production systems did not improve on their household welfare.

Table 22 still reveals that 11.90% (32) of the respondents with high meat production efficiency, reported that dual cattle production systems improved their household welfare. 31.23%(84), 13.75%(37), 6.69%(18), of the respondents with moderate meat production efficiency, low meat production efficiency and those who were not sure respectively also reported that dual cattle production system improved on their household welfare.

The chi-square test statistic is 17.0568 with a p-value of 0.001, which is less than the level of significance (alpha) of 0.05. Therefore, we reject the null hypothesis and conclude that there is a significant effect of meat production efficiency on household welfare.

4.4 Milk and Meat production efficiency

The milk and production efficiency of dual-purpose cattle production of household farmers carried out in Ssembabule district are presented below.

Table 23: Efficiency of milk and meat dual cattle production system in terms of UGX

Variable	Mean	Std. Dev.	Min	Max
cost of milk	36189.29	73888.56	428.5714	845000
cost of meat	11887.13	10481.9	1333.333	143846.2
output of milk	54385.56	117736.5	1285.714	1445000
output of meat	19258.6	16632.84	2666.667	184615.4
Total cost of milk	9734920	Total cost of meat	3197638	
Total output of milk	14629716	Total output of meat	5180564	

Milk efficiency	4894796	
Meat efficiency		1982926.2

Source: Primary data, 2023

Table 23 presents the efficiency of milk and meat production in dual-purpose cattle systems among household farmers in Ssembabule district. The mean cost of milk production is UGX 36,189.29 (=USD 9.78), with a standard deviation of UGX 73,888.56 (=USD 19.97), and the cost ranges from UGX 428.57 (=USD 0.12) to UGX 845,000 (=USD 228.38). The mean cost of meat production is UGX 11,887.13 (=USD 3.21), with a standard deviation of UGX 10,481.90 (=USD 2.83), ranging from UGX 1,333.33 (=USD 0.36) to UGX 143,846.20 (=USD 38.88). The mean output of milk is UGX 54,385.56 (=USD 14.69), with a standard deviation of UGX 117,736.50 (=USD 31.82), and the output ranges from UGX 1,285.71 (=USD 0.35) to UGX 1,445,000 (=USD 390.54). The mean output of meat is UGX 19,258.60 (=USD 5.21), with a standard deviation of UGX 16,632.84 (=USD 4.495), ranging from UGX 2,666.67 (=USD 0.72) to UGX 184,615.40 (=USD 49.89).

The total cost of milk production is UGX 9,734,920 (=USD 2,631.06) and the total output is UGX 14,629,716 (=USD 3,953.93), resulting in a milk production efficiency (total output minus total cost) of UGX 4,894,796 (=USD 1,322.92). For meat, the total cost is UGX 3,197,638 (=USD 864.23) and the total output is UGX 5,180,564 (=USD 1,400.15), leading to a meat production efficiency of UGX 1,982,926.20 (=USD 535.93). These efficiency values indicate that dual-purpose cattle farming is highly profitable, with significant returns exceeding the costs of production, thereby contributing positively to household welfare.

4.5 Correlation Analysis of some selected features

The researcher used spearman’s correlation coefficient to observe their significant relationship between some of the selected features from the study objectives on household welfare. It was used because most of the selected variables were in nominal and ordinal scale level.

Table 24: Correlation analysis

	househ~s	educti~l	access~s	foodse~t	market~s	financ~s	climat~s	milkpr~y	meatpr~y	market~d
householdw~s	1.0000									
educationle~l	0.0823 0.1783	1.0000								
access2res~s	0.1833 0.0025	-0.0364 0.5523	1.0000							
foodsecuri~t	0.2002 0.0010	-0.0535 0.3819	0.2709 0.0000	1.0000						
marketchal~s	-0.0185 0.7630	0.0699 0.2529	-0.0492 0.4213	0.2671 0.0000	1.0000					
financecre~s	-0.0475 0.4382	-0.0069 0.9098	-0.1441 0.0180	0.1903 0.0017	0.3580 0.0000	1.0000				
climatecha~s	0.0428 0.4849	0.0613 0.3168	0.0147 0.8107	0.2776 0.0000	0.4712 0.0000	0.2516 0.0000	1.0000			
milkproduc~y	-0.1559 0.0104	0.2120 0.0005	-0.2413 0.0001	-0.3138 0.0000	0.0912 0.1356	0.1173 0.0546	0.0552 0.3671	1.0000		
meatproduc~y	-0.2271 0.0002	0.0189 0.7581	-0.2492 0.0000	-0.0888 0.1466	0.2752 0.0000	0.2380 0.0001	0.0942 0.1234	0.3612 0.0000	1.0000	
marketdema~d	0.1364 0.0253	-0.0585 0.3392	0.1753 0.0039	0.2099 0.0005	-0.1401 0.0215	0.0211 0.7305	0.0006 0.9920	-0.2045 0.0007	-0.3212 0.0000	1.0000

Source: Primary data, 2023

Table 24 shows that some features such as access to resources, improvement in food security, milk production efficiency, meat production efficiency and market demand of dual cattle products had a significant relationship on respondent’s welfare since their p-values 0.0025, 0.0010, 0.0104, 0.0002 and 0.0253 respectively are less than (alpha) of 0.05. Whereas education level, market challenges, credit and financial challenges and impacts of climate change had no significant relationship on household welfare since their p-values 0.1783, 0.7630 and 0.4382 respectively are greater than (alpha) of 0.05.

4.6 Simultaneous Logistic regression

In this case, the researcher considered all the four objectives under study (the independent variables) to find out their effect on household welfare as a result of dual cattle production activities. Each independent variable features were carefully selected that a researcher thought would affect the household welfare (the dependent variable). Moderating variables respondent's age, family size and education level were also included in the model to get the clear picture.

Model 1: Logistic model

$$L_i = \alpha_0 + \alpha_1 A_i + \alpha_2 F_i + \alpha_3 W_{Ci} + \alpha_4 E_i + \alpha_5 EM_i + \alpha_6 R_i + \alpha_7 M + \alpha_8 X_i + \alpha_9 C_i + \alpha_{10} D_i + \alpha_{11} Z_i + u_i \quad \dots\dots\dots \text{Model 1}$$

Where;

L_i = Household welfare measured as 1=Yes (dual production improved household welfare), 0=No (dual production did not improve household welfare)

α_{is} = are slope coefficients of respective features.

$A_i, F_i, W_{Ci}, E_i, EM_i, R_i, M, X_i, C_i, D_i, Z_i$ = Age of the respondent, family size, welfare indicators (income generated from the sale of cattle products and activities), Education Level (in years), Employment and Livelihoods (1=Full, 0=Part-time), Access to Resources (1=Yes, 0=No), Milk Production Efficiency (in Liters), Meat Production Efficiency (in KGs), Cost of Production (in UGX), Market Demand and Consumer Preference (1=Yes, 0=No), and access to Finance and Credit (1=Yes, 0=No) respectively.

u_i = error term accounting for other factors

The logistic regression estimates below are in odds ratio.

Table 25: Logistic regression results

Household welfare	Odds Ratio	Std. Err.	z	P>z	[95% Confidence Interval]	
Age in years	1.000177	.0162484	0.01	0.991	.9688321	1.032535
Family size	1.064507	.0485129	1.37	0.170	.9735459	1.163966
Household income	1.000002	5.84e-07	3.29	0.001	1.000001	1.000003
Education level in years	1.133896	.0570868	2.50	0.013	1.027351	1.251491
Employment status	.7479449	.2422253	-	0.370	.3964644	1.411026
			0.90			
Access to resources	1.839237	.5438131	2.06	0.039	1.030291	3.283335
Quantity of Milk	.9973497	.0013418	-	0.049	.9947232	.9999831
			1.97			
Quantity of Meat	.990379	.0054356	-	0.078	.9797825	1.00109
			1.76			
Cost of production	.9999991	7.29e-07	-	0.235	.9999977	1.000001
			1.19			
Market demand	1.392581	.4241134	1.09	0.277	.7666287	2.529622
Credit and financial Cha	1.030312	.3602747	0.09	0.932	.5191881	2.044622
_cons	.0763988	.0772036	-	0.011	.0105419	.5536754
			2.54			
<hr/>						
Number of obs =	269	LR chi2(11) =	37.86,	Prob > chi2 =	0.0001	
Log likelihood =	-157.49682	Pseudo R2 =	0.1073			

Source: Primary data, 2023

Table 25 presents the results of the logistic regression analysis performed to measure the economic contribution of dual-purpose cattle production systems on household welfare. The table shows the odds ratio estimates for the independent variables, including age in years, family size, quantity of milk produced and sold,

quantity of meat produced and sold, cost of production, market demand, and access to finance and credit. The odds ratio estimates indicate the likelihood of a positive or negative impact of each independent variable on household welfare.

Age in years: The odds ratio estimate is 1.000177, suggesting that for each additional year of age, there is a marginal increase in the odds of dual cattle production influencing household welfare. However, this result is not statistically significant ($p>0.05$).

Family size: The odds ratio estimate is 1.064507, indicating that an increase in family size is associated with a 6.45% increase in the odds of dual cattle production influencing household welfare. However, this result is not statistically significant ($p>0.05$).

Household income: The odds ratio estimate is 1.000002, suggesting that for each unit increase in household income from cattle production, there is an increase in the odds of dual cattle production influencing household welfare. This result is statistically significant ($p<0.05$).

Education level in years: The odds ratio estimate is 1.133896, indicating that for each additional year of education, there is a 13.39% increase in the odds of dual cattle production influencing household welfare. This result is statistically significant ($p<0.05$).

Employment status: The odds ratio estimate is 0.7479449, suggesting that being in full-time employment is associated with a 25.21% decrease in the odds of dual cattle production influencing household welfare. However, this result is not statistically significant ($p>0.05$).

Access to resources: The odds ratio estimate is 1.839237, indicating that having access to resources is associated with an 83.92% increase in the odds of dual cattle production influencing household welfare. This result is statistically significant ($p < 0.05$).

Quantity of Milk: The odds ratio estimate is 0.9973497, suggesting that an increase in milk production efficiency is associated with a marginal decrease in the odds of dual cattle production influencing household welfare. This result is statistically significant ($p < 0.05$).

Quantity of Meat: The odds ratio estimate is 0.990379, indicating that an increase in meat production efficiency is associated with a marginal decrease in the odds of dual cattle production influencing household welfare. However, this result is not statistically significant ($p > 0.05$).

Cost of production: The odds ratio estimate is 0.9999991, suggesting that an increase in the cost of production is associated with a marginal decrease in the odds of dual cattle production influencing household welfare. However, this result is not statistically significant ($p > 0.05$).

Market demand: The odds ratio estimate is 1.392581, indicating that meeting market demand is associated with a 39.26% increase in the odds of dual cattle production influencing household welfare. However, this result is not statistically significant ($p > 0.05$).

Credit and financial challenges: The odds ratio estimate is 1.030312, suggesting that facing credit and financial challenges is associated with a 3.03% increase in the odds of dual cattle production influencing household welfare. However, this result is not statistically significant ($p > 0.05$).

The probability $\text{Prob} > \chi^2 = 0.0001$ indicates that the model has statistical significance. This means that there is a significant relationship between the independent variables and their impact on household welfare in the context of dual-purpose cattle production. The low probability value suggests that the model's findings are unlikely to have occurred by chance, reinforcing the reliability of the relationship between the variables and household welfare.

The logistic regression model as a whole has a pseudo R² value of 0.1073, indicating that approximately 10.73% of the variation in household welfare can be explained by the variables included in the model. Overall, the logistic regression results suggest that there is no significant economic contribution of dual-purpose cattle production in influencing household welfare, as indicated by the lack of statistical significance for most of the independent variable.

4.7 Benefit Analysis of Dual-Purpose Cattle Production

Cattle Earnings and Cost of Production: Earnings from dual-purpose cattle production are derived primarily from the sale of milk and meat. These earnings contribute significantly to household income, providing financial resources for essential needs such as education, healthcare, and daily sustenance. In contrast, the costs of production encompass various expenses, including feed, veterinary care, labor, and other operational costs. This benefit analysis will detail the net benefits by comparing the total earnings against the total costs, providing a clear picture of the economic viability of dual-purpose cattle farming.

4.7.1 Cattle Earnings and Cost of Production

The average income generated from milk and meat sales can be substantial, contributing to the financial well-being of farming households. For instance, milk sales provide a steady cash flow, while meat sales, often occurring at less frequent intervals, provide lump-sum income that can be critical for significant household expenditures.

Maintaining dual-purpose cattle involves several costs, such as purchasing feed, paying for veterinary services, and labor costs for daily care. Feed costs represent a significant portion of the total expenses, especially in regions where grazing land is limited. Veterinary services ensure the health and productivity of the cattle, while labor costs cover the time and effort spent on cattle management.

4.7.2 Net Benefit and Benefit -Cost analysis

To determine the overall benefit of dual-purpose cattle farming, the net benefit is calculated as the difference between total earnings and total costs. This analysis helps in understanding the profitability and sustainability of dual-purpose cattle farming and its role in improving household welfare.

Table 26: Benefit-cost analysis

Variable	Total in UGX	Us dollars
Cost	279900000	7,365.7
Income	407000000	107,105.2
Net Benefit [Total Income-Total Cost]	127100000	3,342.1
Benefit-Cost ratio [Total cost/Total income]	0.687715	0.068770

Source: Primary data, 2023

Table 26 presents a benefit-cost analysis of dual-purpose cattle production, highlighting the economic impact on household welfare. The total cost incurred for cattle production amounts to UGX 279,900,000 (=USD 75,648.65), while the total income generated from milk and meat sales is UGX 407,000,000 (=USD 110,000). This results

in a net benefit of UGX 127,100,000 (=USD 34,351.51), indicating a substantial financial gain from dual-purpose cattle farming. The benefit-cost ratio, calculated as the total cost divided by the total income, is 0.687715. This ratio signifies that the costs represent approximately 68.77% of the total income, meaning the benefits outweigh the costs significantly.

The benefit-cost analysis underscores the significant economic contributions of dual-purpose cattle production to household welfare. With a positive net benefit and a favorable benefit-cost ratio, it is evident that dual-purpose cattle farming is a financially viable and beneficial practice for farmers. This analysis highlights the potential for improving household income and food security, reinforcing the value of promoting and supporting dual-purpose cattle production in the region.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter of the study provides a summary of the study findings by making conclusions and recommendations. The study conclusions and recommendations done are based on the findings from the study objectives. This chapter also presented the areas for further research.

5.1 Summary of findings

The study aimed to analyze the economic contributions of dual-purpose cattle production systems to household welfare in Sembabule District, Central Uganda. The study used both quantitative and qualitative data to provide a comprehensive understanding of the context and factors influencing household welfare. The target population was households practicing dual cattle production in Lwebitakuli subcounty, Sembabule District, Uganda. The study used primary data, which was sourced in Lwebitakuli subcounty, Sembabule District, and secondary data to accompany the study findings.

The study used a sample size of 269 households, selected using simple random sampling, stratified, and purposive random sampling procedures.

The study found that dual-purpose cattle production systems have the potential to significantly contribute to household welfare, particularly in terms of food security and income generation. The mean quantity of milk produced and sold was 124.45 liters, and the mean quantity of meat produced and sold was 104.31 kgs. The mean household income generated from the sales of cattle productions was 1,512,842 UGX (=USD 408.88). The study also found that households with better access to resources have higher odds of improved welfare. The study revealed that a significant proportion of the household farmers engaged in dual-purpose cattle production had attained higher levels of education, with 36.06% having reached a tertiary/vocational level and 21.19%, 19.70% having obtained a degree, advanced secondary level respectively.

The study also identified challenges faced by farmers in dual-purpose cattle production, including market access, access to finance and credit, and climate change impacts. The study found that 80.67% of the household dual cattle farmers had access to the markets, while 19.33% had no access to the market. The study also found that 76.95% of the households faced credit and financial challenges. The study revealed that 86.62% of the household dual cattle farmers said climate changes affect their dual production activities.

The study revealed that some features such as access to resources, improvement in food security, milk production efficiency, meat production efficiency and market demand of dual cattle products had a significant relationship on respondent's welfare since their p-values 0.0025, 0.0010, 0.0104, 0.0002 and 0.0253 respectively are less than (alpha) of 0.05. Whereas education level, market challenges, credit and finance

challenges had no significant relationship on household welfare since their p-values 0.1783, 0.7630 and 0.4382 respectively are greater than (alpha) of 0.05.

The logistic regression estimates in the study provide valuable insights into the factors influencing the economic contributions of dual-purpose cattle production systems to household welfare. The odds ratio and associated statistics offer a deeper understanding of the relationships between the variables. Here are the key interpretations of the model estimates:

Age and Family Size: The odds ratio for age in years is 1.000177, indicating that age has a minimal effect on household welfare. Similarly, the odds ratio for family size is 1.064507, suggesting that family size has a limited impact on household welfare. These variables may not be significant predictors of the welfare impact of dual-purpose cattle production.

Household Income and Education Level: The odds ratio for household income is 1.000002, implying that for every unit increase in household income, the odds of improved household welfare increase by a factor of 1.000002. This suggests that household income has a positive and significant influence on household welfare. The odds ratio for education level in years is 1.133896, indicating that higher education levels are associated with increased odds of improved household welfare. This highlights the importance of education and income in enhancing household welfare through dual-purpose cattle production.

Access to Resources: The odds ratio for access to resources is 1.839237, suggesting that households with better access to resources have higher odds of improved welfare. This variable appears to be a significant predictor of the welfare impact of dual-

purpose cattle production, emphasizing the importance of resource access in enhancing household welfare.

The study's findings, combined with the model estimates, contribute to a comprehensive understanding of the economic contributions of dual-purpose cattle production systems to household welfare in Sembabule District, Central Uganda. The study highlights the importance of household income, education, and access to resources in enhancing household welfare through dual-purpose cattle production systems. The study also identifies challenges faced by farmers in dual-purpose cattle production, which can inform policymakers and stakeholders in the agricultural sector to design appropriate interventions and support programs that cater to the needs of farmers engaged in dual cattle production.

5.2 Discussion of Findings

The study "Economic Contribution of Dual-Purpose Cattle Production Systems to Household Welfare in Sembabule District, Central Uganda" utilized a mixed-methods research design, combining both qualitative and quantitative methods to provide a comprehensive understanding of the economic contributions of dual-purpose cattle production systems. The study's findings support the hypotheses, rejecting the **null** hypotheses and confirming the significant economic contributions, socio-economic factors, challenges, and efficiency of dual-purpose cattle production on household welfare. The study also used logistic regression analysis to measure the effectiveness and combined contribution of economic contribution, socio-economic factors, challenges faced by farmers, and the role of dual-purpose cattle production on household welfare

from some selected variable features and background variables. The following are the features used to achieve each objective and their impact on household welfare.

Objective 1: The economic contributions of dual-purpose cattle production on household income were measured using productivity and output (Quantity of milk and meat produced), improvement in food security, and welfare indicators such as income generated from the sale of cattle productions. The study found that dual-purpose cattle production significantly contributes to household welfare, where food security and income generation have low positive relationship on improving household welfare. With household income and welfare generated from productivity and output (Quantity of milk and meat produced), the study findings reveal that although household dual cattle farmers reported high average milk and meat productivity and output significantly, they were decreasing in marginal terms thus low improved household welfare.

These findings are not tandem with Eula Regina Carrara et al (2022) and Kabunga (2014) who said that milk and meat productivity and output positively impacted an improvement on household farmers' welfare and income (Regina Carrara et al, 2022; Kabunga 2014). Therefore, the hypothesis H1, which stated that there is no significant economic contribution of dual-purpose cattle production on household welfare, was rejected. hence there is a significant relationship between economic contribution of dual-purpose cattle production on household welfare.

Objective 2: The socio-economic factors influencing the choice of dual-purpose cattle farming on household welfare were analyzed using education level, employment and livelihoods, and access to resources. The study found that education enhances farmers' awareness of modern agricultural practices with there is a 13.39% increase in

the odds of dual cattle production on household welfare, leading to improved productivity and income. This is in line with what Rashidin et al., 2020 said that educated farmers tend will be innovative, hence increasing on their productivity and income from cattle farming (Rashidin et al., 2020).

Findings on full time employment suggests that full time employment does not significantly contribute to the household improvement as indicated by 25.21% decrease in the odds of dual cattle production on household welfare. These findings are not tandem with what Krueger et al., 2020 noted that Quality employment, particularly full-time engagement, positively impacts household welfare (Krueger et al., 2020). Access to resources such as Land was found to be significant with an 83.92% increase in the odds of dual cattle production on household welfare. These results are in support since adequate access to resources, including land, capital, and technological advancements, plays a crucial role in enhancing farming efficiency and household income (Rashidin et al., 2020).

Therefore, the hypothesis H2, which stated that there is no significant socio-economic factor influencing the choice of dual-purpose cattle farming among households, was rejected hence there is a significant relationship between socio-economic factor influencing the choice of dual-purpose cattle farming on household welfare.

Objective 3: The challenges faced by farmers in dual-purpose cattle production, including market access, healthcare, and environmental factors, were assessed using market access, access to finance and credit, and climate change impacts. The study found that 80.67 percent had access to the markets. This implies increased dual cattle

production activities were carried out. Although the study found Majority of the households having access to the market, there are still limited cases of access to markets for cattle and cattle products which poses a considerable challenge for dual-purpose cattle farmers. This restriction affects the sale of cattle and associated products, directly impacting household income (Rangel et al., 2020). Whereas access to finance and credit, and climate change impacts had insignificant impact on household welfare and income respectively, they don't affect household welfare.

The hypothesis H3, which stated that there is no significant challenge faced by farmers in dual-purpose cattle production on household welfare, was not rejected hence there are no significant challenges faced by farmers in dual-purpose cattle production on household welfare.

Objective 4: The efficiency of dual-purpose cattle production on household welfare was evaluated using milk production efficiency, meat production efficiency, cost of production, and market demand and consumer preference. The study found that milk and meat production efficiency enhance household food security, boosts income levels, and significantly impacts overall welfare.

The study is in agreement with what Atube et al. (2021) and Letelier et al., (2022) reported and concluded in their findings that milk and meat production efficiency positively impact the overall household welfare boosting in their income levels and food security. The study also found that market demand/consumer preferences positively and significantly improve on the household welfare. This is in agreement with Zanon et al. (2020) who noted and concluded that high market demand for quality milk and meat drives up the prices, consequently improving income for farming households (Zanon et

al., 2020). Additionally, the study reveals that the cost of production has no significant impact on household welfare. This is because an increase in the production costs, decreases on the house welfare.

Therefore, the hypothesis H4, which stated that there is no significant efficiency of dual-purpose cattle production in influencing household welfare, was rejected hence there is a significant impact of dual cattle production efficiency on household welfare.

5.3 Conclusion

Based on the discussion of findings in the study "Economic Contribution of Dual-Purpose Cattle Production Systems to Household Welfare in Sembabule District, Central Uganda," with each objective had a mix of significant and not significant findings. The economic contributions of dual-purpose cattle production were found to significantly impact household welfare through enhancing food security and generating income. However, the productivity and output of milk and meat showed a low positive relationship with improving household welfare. Socio-economic factors such as education level and access to resources were significant influencers of the choice of dual-purpose cattle farming on household welfare, while full-time employment was not.

Challenges faced by farmers, particularly limited market access, proved to significantly affect household welfare, whereas access to finance and credit, as well as climate change impacts, did not exhibit significant relationships. The efficiency of dual-purpose cattle production, including milk and meat production efficiency, market demand, and consumer preference, was found to be significant for household welfare, although the cost of production did not show a significant relationship. These findings

underscore the complex interplay between various factors in dual-purpose cattle farming and their impact on household welfare in Sembabule District, Central Uganda.

5.4 Recommendations

Based on the research conducted on the "Economic Contribution of Dual-Purpose Cattle Production Systems to Household Welfare in Sembabule District, Central Uganda," the following recommendations can be made:

Enhanced Market Access: Address the limited access to markets for cattle and cattle products by implementing interventions that improve market linkages, provide market information, and support the development of local market infrastructure. This can positively impact income generation for farmers and contribute to improved household welfare.

Access to Finance and Credit: Introduce programs that enhance access to finance and credit for dual-purpose cattle farmers. This can include the provision of financial literacy training, the establishment of cooperative credit schemes, and the facilitation of access to formal financial institutions. Improved access to finance and credit can enable farmers to expand their cattle operations, invest in technology and infrastructure, and ultimately improve productivity and income generation.

Climate Change Resilience: Develop and promote climate-resilient farming practices to mitigate the impact of climate change on dual-purpose cattle production. This can include the adoption of sustainable land management techniques, the implementation

of water conservation measures, and the promotion of climate-smart livestock management practices. Climate-resilient farming practices can contribute to enhanced household welfare by reducing the vulnerability of cattle farming to climate change and its adverse effects on productivity and income.

Efficiency Improvement: Provide training and extension services to farmers to enhance the efficiency of dual-purpose cattle production. This can involve the dissemination of best practices in milk and meat production, cost-effective feeding strategies, and the adoption of technologies that improve production efficiency. By optimizing the efficiency of milk and meat production, farmers can enhance household food security, boost income levels, and positively impact overall welfare.

Education and Training: Implement programs that promote education and training for farmers engaged in dual-purpose cattle production. This can include the provision of training in modern agricultural practices, the dissemination of information on improved cattle breeding techniques, and the facilitation of access to extension services. Education and training can enhance farmers' awareness of best practices and quality full time employment lead to improved productivity and income, and ultimately contribute to enhanced household welfare.

5.5 Limitations of the study and future research

5.5.1 Limitations of the study

Despite the valuable insights provided by the study, there are some limitations that need to be acknowledged. Firstly, the study was conducted in a specific geographical area, and the findings may not be generalizable to other regions with different socio-economic and environmental contexts. Secondly, the study relied on self-reported data

from the respondents, which may be subject to recall bias and social desirability bias. Thirdly, the study did not consider the impact of cultural and traditional practices on dual-purpose cattle production systems, which may influence the economic contributions and welfare outcomes. Fourthly, the study did not explore the potential environmental impacts of dual-purpose cattle production systems, such as land degradation and water pollution. Finally, the study did not consider the potential gendered impacts of dual-purpose cattle production systems on household welfare, which may differ between male and female-headed households.

Despite these limitations, the study provides valuable insights into the economic contributions of dual-purpose cattle production systems to household welfare in the study area. The findings can inform policy and programmatic interventions aimed at promoting sustainable agricultural practices and improving the welfare of households engaged in dual-purpose cattle production in similar contexts.

5.5.2 Areas of future research

Based on the research conducted on the "Economic Contribution of Dual-Purpose Cattle Production Systems to Household Welfare in Sembabule District, Central Uganda," there are several areas for further research.

Firstly, future research can explore the potential gendered impacts of dual-purpose cattle production systems on household welfare, which may differ between male and female-headed households.

Secondly, further research can investigate the potential environmental impacts of dual-purpose cattle production systems, such as land degradation and water pollution.

Thirdly, future research can explore the potential impact of cultural and traditional practices on dual-purpose cattle production systems, which may influence the economic contributions and welfare outcomes.

Fourthly, future research can investigate the potential impact of dual-purpose cattle production systems on the wider economy, including the creation of employment opportunities and the contribution to local economic development.

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APPENDICES

Appendix 1: Location of the Study Area

Sembabule District is bordered by Mubende District to the north, Gomba District to the northeast, Bukomansimbi District to the east, Lwengo District to the south, Lyantonde District to the southwest, and Kiruhura District to the northwest. The town of Sembabule is approximately 48 kilometers (30 mi), by road, northwest of Masaka, the largest town in the sub-region. Agriculture is the mainstay of the district economy. Agriculture involves both crop and animal husbandry. Because of the relatively dry climate, cattle ranching for beef and dairy farming are the most important economic activities in the district

Appendix 2: Ssembabule District Map

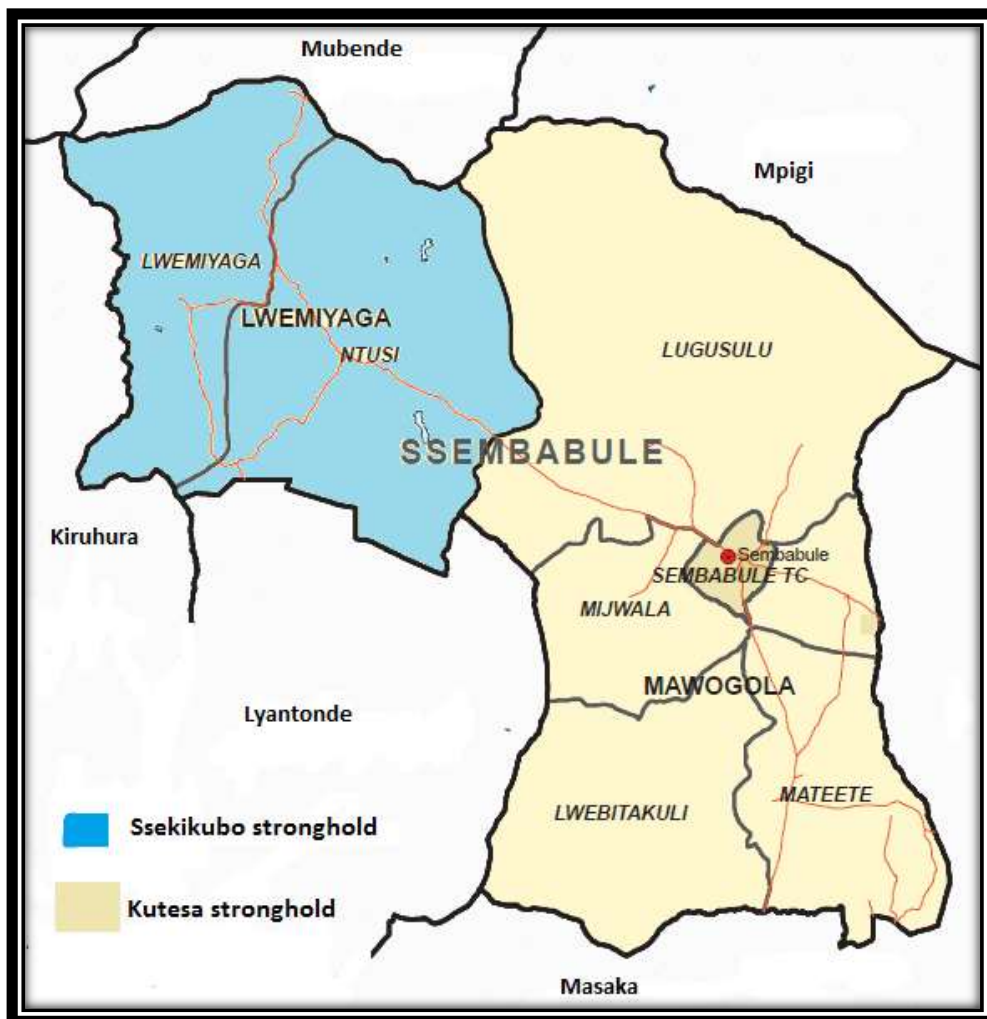


Figure 4 Map showing Ssembabule district in Uganda

Appendix 3: Introductory Letter and Questionnaires

Dear Respondent,

I hope this letter finds you well. My name is Naturinda Movadi a degree of masters of agri-business in the faculty of agriculture and animal science in university of Diponegoro, and i am a student currently pursuing a research project focused on the economic contributions of dual-purpose cattle production systems on household welfare in Sembabule District, Central Uganda. I am writing to seek your valuable support and cooperation for this research endeavor.

The aim of this research is to gain a comprehensive understanding of how dual-purpose cattle production impacts the income and livelihoods of households in Sembabule District. This study will help shed light on the challenges faced by farmers, the socio-economic factors influencing their choice of cattle farming, and the efficiency of dual-purpose cattle production. Additionally, we aim to explore the relationship between cattle farming and food security and, ultimately, its influence on overall household welfare.

Your participation in this research is crucial for its success. I kindly request your cooperation in the following ways:

1. **Participation in Interviews:** I would appreciate the opportunity to conduct interviews with you and other cattle farmers in the Sembabule District. These interviews will focus on your experiences, challenges, and the benefits you have observed from engaging in dual-purpose cattle farming.

2. **Sharing of Information:** Your insights into the socio-economic factors affecting your decision to engage in cattle farming, the challenges you face, and the efficiency of your cattle production will be invaluable.

3. **Access to Data:** If available, access to data related to your cattle farming practices, such as milk production, meat production, costs, and income, will be highly appreciated.

I understand that your time and resources are valuable, and I assure you that all information and data provided will be kept confidential and used solely for research purposes. Your participation will significantly contribute to the success of this study, benefiting both the academic community and the local farming community in Sembabule District.

QUESTIONNAIRE; ON THE ECONOMIC CONTRIBUTIONS OF DUAL-PURPOSE CATTLE PRODUCTION SYSTEMS ON HOUSEHOLD WELFARE IN SEMBABULE DISTRICT, CENTRAL UGANDA

Instructions: Please tick in the appropriate box and also fill in the blank spaces provided for those questions where elaborate answers are required.

Demographic Information:

1. Age: _____ years

2. Marital Status:
 - a) Single

 - b) Married

 - c) Divorced

 - d) Widowed

3. Family Size: _____ members

Objective 1: To assess the economic contributions of dual-purpose cattle production on household income and food security.

Feature 1: Income and Food Security

1.1. How long have you been engaged in dual-purpose cattle farming?

- a) Less than 1 year
- b) 1-5 years
- c) 5-10 years
- d) More than 10 years

1.2. Has your involvement in dual-purpose cattle farming increased your household income significantly?

- a) Yes
- b) No

1.3. Have you noticed an improvement in your household's food security (e.g., access to milk and meat) since you started cattle farming?

- a) Yes
- b) No

1.4. Can you estimate the quantity of milk and meat cattle products produced that can meet your household's food needs and improve welfare

Milk.....in liters

Meat.....kgs

Objective 2: To analyze the socio-economic factors influencing the choice of dual-purpose cattle farming on household welfare.

Feature 2: Socio-Economic Factors

2.1. What is your highest level of education completed?

- a) No formal education
- b) Primary school
- c) Ordinary Secondary school
- d) Advanced secondary school
- d) Vocational training
- e) University education

2.2. Which employment status are you in when carrying out dual cattle activities?

- a) Full-time
- b) Part-time

2.3. Besides cattle farming, are you engaged in other employment or livelihood activities?

- c) Yes
- d) No

2.3. Do you have access to resources such as land, capital, and technological tools for cattle farming?

- a) Yes, I have access

b) No, I have no access

Objective 3: To assess the challenges faced by farmers in dual-purpose cattle production, including market access, healthcare, and environmental factors on household welfare.

Feature 3: Challenges in Dual-Purpose Cattle Farming

3.1. Have you encountered challenges related to market access for selling cattle products (milk and meat)?

a) Yes

b) No

3.2. Have you faced challenges in accessing finance and credit for your cattle farming activities (e.g., loans or grants)?

a) Yes

b) No

3.3. Have you observed any impacts of climate change on your dual-purpose cattle production, such as changes in rainfall patterns or grazing land availability?

a) Yes

b) No

Objective 4: To evaluate the efficiency of Dual-Purpose Cattle Production on household welfare.

Feature 4: Efficiency of Dual-Purpose Cattle Production

4.1. How would you rate the efficiency of your cattle in milk production?

a) High efficiency

b) Moderate efficiency

c) Low efficiency

d) Not sure

4.2. How would you rate the efficiency of your cattle in meat production (e.g., weight gain)?

a) High efficiency

b) Moderate efficiency

c) Low efficiency

d) Not sure

4.3. Can you estimate the cost of production for your cattle in terms of feed expenses relative to the output of milk and meat?

Cost of production.....Ugx

4.4. Are you aware of the market demand for dual-purpose cattle products, and do you consider consumer preferences in your cattle production practices?

a) Yes

b) No

Objective 5: To assess the economic contributions of dual-purpose cattle production on household income and food security, and how this impacts overall household welfare.

Feature 5: Household welfare

5.1. Please, can you estimate how much do you earn from dual purpose cattle activities and from the sale of cattle products in Ugx for a single day?

Income.....Ugx

5.2. Have you seen an increase in access to healthcare, education, or improvements in your living standards (welfare) as a result of dual-purpose cattle production?

a) Yes

b) No

*******THANK YOU FOR YOUR TIME AND REPOSSES*******

BIBIOGRAPHY OF THE AUTHOR

NATURINDA MOVADI was born on **23/12/1986 in Kibaale district**, Uganda. He entered at DIPONEGORO UNIVERSITY, SEMARANG since September 2022 in Master Program of Agribusiness. He attended Makerere university in 2012 to 2015 nad he attained a degree in agriculture science double main, he attained his diploma and Kyambogo university in Uganda in 2009. He is married to Madinah Namayanja and he is a Moslem by faith. He taught in Ugandan secondary schools and he is currently working with the ministry of education, science and sports.