

Women's Participation in Livestock Management and Value Chains: Implications for Rural Household Income in NYAGATARE District, Rwanda

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ABSTRACT: This study assesses the contribution of women's engagement in livestock management and value chains to rural household income in Nyagatare District, Rwanda (2019–2025). The objectives were to identify women's roles in Livestock management and Value Chains management, determine the extent to which their participation enhances household income, and examine the moderating effect of support mechanisms on this relationship. Using a mixed-methods approach, questionnaires, interviews, and focus group discussions data were collected from 400 respondents representing varied socio-economic backgrounds. Findings show that rural women play a central, multidimensional role across the entire livestock value chain. Over 92% of respondents personally participate in livestock management, with 64.3% involved in feeding, watering, and breeding. Women also dominate value addition, with 84.5% processing products such as milk, meat, and manure into yogurt, cheese, dried meat, and organic fertilizer, while 85.5% engage in marketing through cooperatives, local markets, and home sales. These roles demonstrate women's strong contribution to value addition and commercialization, significantly enhancing household economic stability. Regression results reveal a strong positive relationship between women's engagement and household income ($R^2 = 0.613$, $p < 0.001$), and when support mechanisms, including government programs, training, credit, veterinary care, and infrastructure, are integrated, explanatory power rises markedly ($R^2 = 0.983$), underscoring the importance of enabling systems. Despite these contributions, several constraints limit women's full potential: financial challenges affect 36.8%, limited market information affects 18%, cultural barriers affect 7.8%, and 27.3% have restricted or no access to credit. Additionally, 20% cite inadequate follow-up training and resource limitations. Overall, the study concludes that women are key drivers of livestock production, processing, and marketing in Nyagatare, substantially improving household income, food security, and welfare. Strengthening support mechanisms and addressing persistent constraints, especially credit access, land rights, market linkages, and continuous training, is essential for sustaining gains and promoting inclusive rural development.

KEY WORDS: Livestock management, Value Chain, Household Income, Rural Development, Support Mechanisms, Nyagatare District, Economic Resilience

I. BACKGROUND TO THE STUDY

The livestock sector is a cornerstone of rural economies in developing countries, contributing to poverty reduction, food security, and livelihoods, particularly for women (FAO, 2021; ILRI, 2022). Livestock represents both past capital and future productive assets, requiring investments often financed through savings or borrowing, with ongoing working capital needed for production expenses (FAO, 2022; World Bank, 2023; IFAD, 2021). Livestock is widely raised in rural and peri-urban areas to generate income and meet nutritional needs (Smith & Kifle, 2023). Managing livestock is labor-intensive, requiring full-time participation from both sexes; however, women undertake the majority of routine tasks, such as feeding, milking, cleaning, and processing, often without remuneration (Tadesse et al., 2020; UN Women, 2021; Osei-Akoto & Mensah, 2021). Globally, women contribute significantly to livestock management, handling about 70–90% of livestock duties in Asia and Sub-Saharan Africa, while men focus on marketing, slaughtering, and farm infrastructure (Khan et

al., 2022; Kabir & Asfaw, 2020). Women's involvement spans both small and large ruminants, including goats, sheep, poultry, and cattle, providing financial security, income from product sales, and improved household nutrition (Habte et al., 2023; Mugisha & Tumusiime, 2022). Manure management by women further enhances soil fertility, promoting crop productivity (Girma & Dube, 2021). Increased responsibility in livestock management enhances women's decision-making power and empowerment within households (Ayele & Tadesse, 2024; Nkurunziza et al., 2020).

Empowering women through control over livestock income, access to markets, mobility, financial autonomy, and gender-sensitive training significantly improves household nutrition and child health outcomes (World Bank, 2023; Zewdu & Alemayehu, 2022; Kassahun & Mekonnen, 2021; Berhanu & Tsegaye, 2023; Thapa & Gurung, 2020). In mixed farming systems, women comprise approximately 75% of the labor force, contributing around 30% to national agricultural production (IFAD, 2021), and are major participants in the dairy sector, dedicating 12–14 hours daily to livestock-related work (WFP, 2024). Livestock serves multifunctional purposes: supporting farming operations, generating high returns, providing food, and acting as a financial buffer during crises (OECD, 2021; ILO, 2020; UN Women, 2023). Ownership of small livestock is often more accessible to women than land or financial assets, helping reduce gendered asset inequality (Mutoni & Uwase, 2021; Chirwa & Phiri, 2023).

In Rwanda, livestock farming is crucial to household livelihoods, particularly for women (Alobo Loison et al., 2022; Kristjanson et al., 2021; Smith & Johnson, 2018). Traditionally male-dominated, livestock rearing has seen increased female participation due to gender-inclusive programs such as One Cow per Poor Family (Wambugu, 2021; Kigama & Tetteh, 2022). In 2020, over 70% of rural women were active in agriculture, many managing livestock for milk, poultry, and small ruminants (National Institute of Statistics, 2020; World Bank, 2020; Thompson & Ellis, 2021). Livestock management has improved women's economic empowerment, household income, food security, and decision-making power (Bates & Harris, 2021; Miller & Thompson, 2019; Foster & Young, 2020; Karanja, 2020; Simmons & Reed, 2021).

Nevertheless, women face structural barriers limiting the full potential of livestock-based livelihoods, including restricted access to land, finance, training, and cultural norms that constrain participation in commercial aspects of the value chain (Namboka & Mwaura, 2020; Githinji & Omari, 2021; Robinson & Keller, 2021; Amin & Gupta, 2020; Smith, 2018). Policy initiatives and support programs such as the National Gender Policy, Girinka, veterinary services, and financial services aim to empower women, enhance participation, and promote gender equity (Wambugu, 2021; Kigama & Tetteh, 2022; Mutoni, 2020; Karanja & Moorthy, 2020; Parker & Martinez, 2021). Despite these efforts, challenges remain, highlighting the need for targeted strategies to maximize women's economic contribution through livestock (Galiè et al., 2020; Choudhury et al., 2021). Rural women constitute approximately two-thirds of the 600 million impoverished livestock keepers worldwide, yet their roles and the benefits they could gain from livestock-focused initiatives remain inadequately understood (Yami & Mude, 2021). While research on women in small-scale crop agriculture is extensive, quantitative data on their livestock engagement, particularly in mixed crop-livestock systems, is limited (Lopez & Ndiritu, 2023; Tibebe et al., 2022). This knowledge gap complicates the design of interventions to enhance women's economic empowerment and household welfare, as livestock serves multiple purposes in poor households, and its management impacts nutrition, income, and long-term asset accumulation (Mwangi & Atieno, 2022).

The current study is confined to Nyagatare District in Rwanda's Eastern Province, an agriculturally rich area where livestock farming is central to rural livelihoods and poverty alleviation. Focus is on rural households, where women actively engage in raising cattle, goats, sheep, and poultry (MINAGRI, 2022; NISR, 2023). Government initiatives, such as one cow per poor family (Girinka, provide cows) for milk production and support small livestock management (MINAGRI, 2020). Nyagatare's strategic location near Uganda and Tanzania expands market access for livestock products like milk, meat, and eggs (Nyagatare District, 2020). Women are also involved in value chain activities, including processing and selling livestock products, supported by training in husbandry, veterinary care, and marketing strategies (NISR, 2023). The district's combination of diverse livestock practices, government support, market access, and women's active participation positions it as a model for empowering women in livestock farming across Rwanda (MINAGRI, 2022).

The study focuses on the period 2019–2025, capturing a crucial phase of livestock program implementation and integration into value chains in Nyagatare District. This allows assessment of household income changes, livelihood patterns, and women's roles in livestock management over time. During this period, the district experienced growth in dairy production, with daily output rising from 75,000 to 80,000 liters, supported by the Rwanda Dairy Development Project (RDDP) with Rwf 65 billion invested in training and practices (MINAGRI, 2022). Modern infrastructure, including slaughterhouses and abattoirs worth Rwf 1.2 billion, enhanced meat production for local and regional markets (All Africa, 2023; Food Business Africa, 2023). Programs such as Poultry Farming for Development (POFADE) empowered women and boosted egg

production (Rwanda Development Board, 2023). Water availability remains a challenge, with 25% of valley dams non-operational, though rehabilitation efforts are ongoing (Rwanda Environmental Journal, 2023).

The primary objective of this study is to investigate the impact of women's participation in livestock management and value chains on rural household income in Rwanda, specifically:

- i. To examine the roles played by women in Livestock management and value chains in Nyagatare District.
- ii. To assess the contribution of women's participation in Livestock management and value chains to household income generation in Nyagatare District.
- iii. To evaluate the moderating effect of support mechanisms on the relationship between women's engagement in Livestock management and value chains and rural household income in Nyagatare District.

II. LITERATURE REVIEW

2.1 Theoretical review

The engagement of women in livestock management in Nyagatare District can be understood through several interconnected theoretical perspectives. The Gender and Development (GAD) Theory frames gender as a socially constructed system that shapes access to power and resources, highlighting the gendered division of labor and women's exclusion from decision-making and markets (Kabeer, 2021; Moser, 2019). Complementing this, the Sustainable Livelihoods Framework (SLF) explains how households mobilize human, social, financial, physical, and natural assets to sustain livelihoods under vulnerability, linking women's participation in livestock to income generation and resilience while emphasizing the importance of supportive policies and institutions (Scoones, 2022). The Value Chain Theory further analyzes production and distribution stages, identifying where women are often engaged in low-value segments and the constraints they face, thereby guiding strategies to enhance their benefits (Adekunle, 2020; Pietrobelli & Saliola, 2018; Fatunbi, 2020). In tandem, the Empowerment Theory highlights how women's involvement fosters economic empowerment, decision-making power, and agency despite structural barriers (Zimmerman, 2020; Warschausky, 2020), while the Social Capital Theory underscores the role of networks, norms, and trust in enabling cooperation, collective marketing, credit access, and resilience through social groups and cooperatives (Van-Bakel, 2024; Horak, 2024). Together, these frameworks provide a comprehensive lens for understanding and enhancing women's roles and benefits in Livestock management and Value Chains management.

2.2 Empirical Studies (Summary)

Empirical studies on "*Women's Engagement in Livestock Management and Value Chains as a Strategy for Enhancing Rural Household Income in Nyagatare District, Rwanda (2019–2025)*" highlight women's crucial yet often undervalued roles in livestock production, their contribution to household income, and support mechanisms. These studies combine both quantitative and qualitative approaches to examine women's participation, socio-economic outcomes, and barriers within livestock systems.

2.2.1 Roles of Women in Livestock Management and Value Chains

Studies by Kristjanson et al. (2010), Njuki et al. (2011), Dossa et al. (2015), FAO (2013), and Galiè et al. (2017) reveal that women play key roles in small livestock rearing, feeding, milking, and primary processing. Yet, they remain excluded from marketing, ownership, and decision-making. Evidence across East Africa, including Rwanda, shows that cultural norms and gendered divisions of labor restrict women's participation in profitable stages of the value chain. Cooperative membership and gender-responsive interventions were found to enhance women's agency, improve market access, and increase their economic visibility.

2.2.2 Livestock Keeping and Household Income Generation

Empirical findings (Smith et al., 2021; Kumar & Njeru, 2022; Munyaneza & Habimana, 2023; Jones et al., 2020; Habumugisha & Tuyishime, 2024) consistently demonstrate that women's livestock management substantially improves household income. Across East Africa, women's participation contributes between 25% and 40% to household earnings, mainly through dairy, poultry, and small ruminant production. The Studies show that when women gain access to veterinary services, credit, and training, productivity and household welfare improve significantly. Furthermore, empowerment through livestock ownership enhances women's decision-making power, food security, and resilience.

2.2.3 Support Mechanisms for Women in Livestock management and value chains

Research (Nguyen et al., 2020; Bekele & Alemu, 2021; Mwikali & Kamau, 2023; Garcia & Martinez, 2023; Nguyen et al., 2024) emphasizes that effective support mechanisms such as microfinance, capacity-building programs, cooperative societies, market linkages, and digital platforms are essential for strengthening women's involvement in livestock enterprises. Access to credit boosts investment in better breeds and feed; training improves knowledge and productivity; and cooperative membership encourages collective marketing

and bargaining power. Similarly, digital platforms and extension services enhance women’s access to market information and veterinary support. Studies indicate that integrated interventions that combine financial, technical, and institutional support produce the most sustainable outcomes for women’s empowerment and income growth.

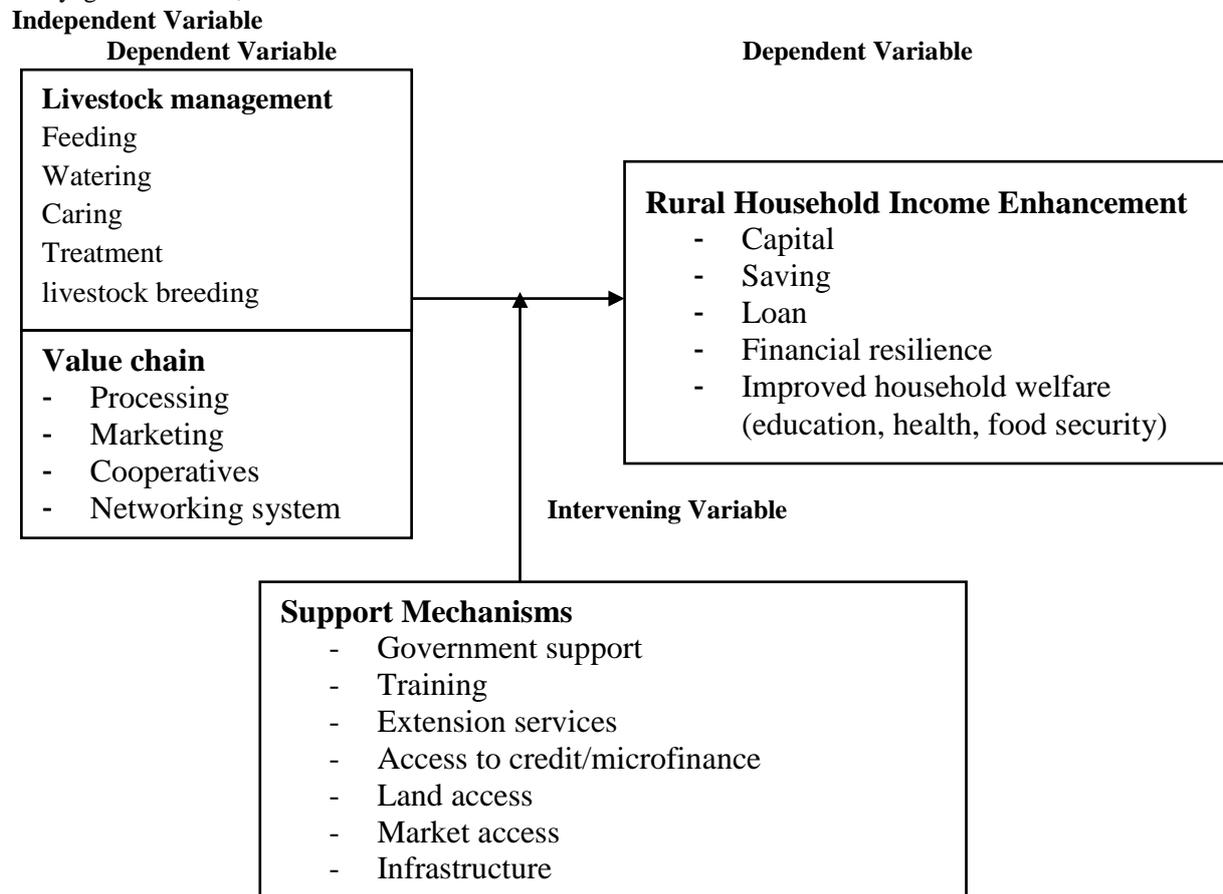
2.3 Research gap

Women play critical roles in livestock management, particularly in small livestock care, processing, and retailing, yet they remain largely excluded from marketing, ownership, and decision-making (Kristjanson et al., 2010; Njuki et al., 2011; Kabahenda & Akinyi, 2009). Institutional and cultural barriers further limit their control over livestock resources, though cooperative membership has been suggested as a pathway to empowerment (Dossa et al., 2015; FAO, 2013; Mpyisi et al., 2003; Galiè et al., 2017). While women’s livestock activities contribute substantially (25–40%) to household income and enhance decision-making and empowerment (Smith et al., 2021; Kumar & Njeru, 2022; Munyaneza & Habimana, 2023; Jones et al., 2020; Alamu & Adesina, 2024; Habumugisha & Tuyishime, 2024), gaps remain in understanding intra-household income control, long-term welfare effects, and variations by age or education.

Access to credit, training, markets, and digital platforms improves productivity and income (Nguyen et al., 2020; Bekele & Alemu, 2021; Mwikali & Kamau, 2023; Garcia & Martinez, 2023; Nguyen et al., 2024), yet the quality, inclusiveness, and sustainability of these support mechanisms, as well as their combined effects on women’s outcomes, are rarely evaluated.

2.4 Conceptual framework

Figure 1: Women's engagement in livestock management and value chains to enhance rural household income in Nyagatare District, Rwanda



III. METHODOLOGY

This chapter outlines the materials and methods used in the study, including research design, population, sampling, data collection, and analysis procedures. A mixed-methods design combining quantitative and qualitative approaches was adopted to comprehensively examine women’s roles in Livestock management and value chains (LMVC) in Nyagatare District (Schoonenboom & Johnson, 2017; Creswell, 2019). Quantitative surveys measured trends and relationships related to women’s participation and household income, while qualitative interviews and focus group discussions explored experiences, roles, and challenges (Magliocca et al., 2019; Kuvenda et al., 2024). The target population comprised 327,965 women across 14 sectors of Nyagatare District (NISR, 2022). Using Yamane’s formula (1967) with a 5% error margin, a sample of 400

women was selected through proportional stratified random sampling, ensuring fair representation across sectors (Kordestani, 2008; Zhang & Li, 2022). Primary data were gathered through questionnaires, interviews, and FGDs, while secondary data were obtained from reports and statistical documents (FAO, 2021; UNDP, 2022). Ethical protocols such as informed consent, confidentiality, and voluntary participation were strictly followed (Creswell & Poth, 2018). A pilot test involving 15 participants assessed the validity and reliability of the questionnaire (Teijlingen et al., 2001; Taherdoost, 2016). Data were analyzed using descriptive and inferential statistics, including correlation and regression, to test relationships and hypotheses (Tabachnick & Fidell, 2019; Johnson & Lee, 2022). Hypothesis testing determined the significance of women's engagement, income contribution, moderating support mechanisms, and challenges faced in LMVC (Creswell & Creswell, 2023).

IV. RESULTS

a. Roles of rural women in Livestock management and Value Chains management

4.1.1 Duration of involvement in Livestock Activities

Items	n	Percent
1-3 years	76	19.0
10 years and above	125	31.3
4-6 years	124	31.0
7-9 years	75	18.8
Total	400	100.0

Source: Primary data, 2025

The study shows that women in Nyagatare District have varying levels of experience in Livestock management and Value Chains management, which affects their skills, knowledge, and contributions to household income. The largest group (31.3%) has over 10 years of experience, demonstrating strong expertise and stable market participation that boost household livelihoods. Another 31.0% have 4–6 years of experience, indicating moderate skills and growth potential that could be improved through training and financial support. About 18.8% have 7–9 years of experience, reflecting gradual skill development but limited access to wider networks and capital. The smallest group (19.0%) includes women with 1–3 years of experience, mostly recent entrants influenced by initiatives like Girinka Munyarwanda (One Cow per Poor Family). Although their current impact is limited, they have future potential for economic empowerment. Overall, the findings reveal that longer involvement in livestock activities improves women's experience, productivity, and income, while newer participants need capacity-building support to achieve similar benefits.

4.1.2 Primary Livestock Management Responsibilities

Items	n	Percent
Feeding, watering, Caring, breeding	55	13.7
Feeding, watering, Caring, breeding, mating/birthing	121	30.2
Feeding, watering, Caring, breeding, mating/birthing, and Treatment	224	56.0
Total	400	100.0

Source: Primary data, 2025

The largest proportion of respondents (56.0%) is responsible for all major livestock management tasks, including feeding, watering, caring, breeding, mating/birthing, and treatment. This indicates that more than half of the women have full-spectrum responsibilities, which require extensive knowledge, skills, and time commitment. Their involvement covers both routine husbandry (feeding, watering, caring) and more specialized tasks (breeding, mating/birthing, and treatment), demonstrating a high level of competency in managing livestock enterprises. About 30.2% of women manage tasks including feeding, watering, caring, breeding, and mating/birthing, but exclude treatment. This group shows substantial engagement in livestock reproduction and general care, suggesting they are experienced in routine and reproductive management but may lack direct involvement in veterinary care or disease management. The exclusion of treatment responsibilities could be due to limited technical knowledge, lack of access to veterinary services, or delegation of treatment tasks to trained personnel. A smaller proportion (13.7%) handles feeding, watering, caring, and breeding only. These women participate in essential livestock activities but are not involved in reproductive management beyond breeding, mating/birthing, or treatment. This indicates entry-level or partial engagement in livestock management, which may reflect new entrants into livestock farming, smaller-scale operations, or households with shared responsibilities.

4.1.3 Frequency of Participation in Livestock Activities

Items	n	Percent
Daily	276	69.0

Occasionally	42	10.5
Weekly	82	20.5
Total	400	100.0

The findings indicate that women in Nyagatare District are heavily involved in livestock activities, with 69.0% participating daily. This high level of engagement reflects the labor-intensive nature of livestock management and underscores women's central role in ensuring animal health, productivity, and household food security. Daily tasks typically include feeding, watering, cleaning, breeding, and occasionally marketing livestock products, highlighting livestock farming as a core livelihood strategy with direct impact on household income and welfare. About 20.5% of women engage in livestock activities weekly, likely handling less frequent or supervisory tasks such as marketing, feed collection, or organizing veterinary services. Their participation may also reflect shared household responsibilities. A smaller proportion (10.5%) participates occasionally, often due to competing economic or domestic duties, limited access to livestock, or involvement in less labor-intensive enterprises like poultry or rabbit rearing. While their contribution to household income is lower, occasional engagement still supports income diversification and food production.

4.1.4 Types of Livestock Products Processed or Value-Added

Items	Frequency	Percent
Manure	91	26.9
Meat	57	16.9
Meat and Manure	9	2.7
Meat and Skins/Hides	8	2.4
Milk	24	7.1
Milk and Manure	91	26.9
Milk, Meat, and Manure	7	2.1
Milk, Meat, and Skins/Hides	8	2.4
Milk, Skins/Hides, and Manure	14	4.1
Others (eggs, bees...)	29	8.6
Total		100.0

Source: Primary data, 2025

The data indicate that manure processing is a major activity among women in Nyagatare District. About 26.9% of women process manure alone, while an equal proportion (26.9%) process it in combination with milk. This highlights the importance of manure as organic fertilizer or compost for household agriculture and demonstrates women's role in integrating livestock management with crop production, reflecting a sustainable and holistic farming approach. Milk processing is central to women's value addition activities, whether done alone (7.1%) or in combination with manure, meat, or skins/hides. Milk is highly versatile, providing essential nutrition for households and generating income through products such as yogurt, cheese, butter, and fermented milk. The frequent appearance of milk in multiple product combinations underscores its economic and nutritional significance. Meat processing accounts for 16.9% when processed alone, with smaller proportions involved in combinations with manure (2.7%) or skins/hides (2.4%). This demonstrates women's contribution to adding value to livestock beyond primary production, enabling preservation, market participation, and increased household income. Skins and hides appear mostly in combination with milk or meat, representing smaller proportions (2.4%–4.1%). This suggests that processing skins and hides is a specialized activity requiring specific skills or access to niche markets for leather and craft products. A further 8.6% of respondents engage in other livestock products, such as eggs, honey, or artisanal items. This reflects women's innovation and adaptability in exploring niche opportunities for income diversification.

4.1.5 Sales Channels for Livestock Products

Items	Frequency	Percent
Cooperative	184	48.5
Exporting	0	0.0
Home-based sales	87	22.5
Local market	111	27.7
Not involved in sales	18	2.3
Total		100.0

Source: Primary data, 2025

The data shows that nearly half of the women (48.5%) sell their livestock products through cooperatives, highlighting the importance of collective organizations in facilitating market access, improving

bargaining power, and achieving better prices. Cooperatives often provide technical support, storage facilities, and links to larger buyers, helping women increase the profitability of their livestock enterprises. Participation in cooperatives also reflects women's organization and networking, which is crucial for sustainable engagement in the Livestock management and Value Chains and for leveraging group-based empowerment initiatives. About 22.5% of women sell products from home, while 27.7% use local markets. Home-based sales offer flexibility and convenience, particularly for women balancing household duties with economic activities, while local markets provide access to a wider customer base but require mobility and negotiation skills. Both approaches contribute to household income and reinforce women's role in linking livestock production with cash revenue generation. The study reports that no one is engaged in exporting livestock products, indicating the absence of opportunities for women to access regional and international markets. Only 2.3% reported not being involved in sales, suggesting a few rely on family members or cooperatives to handle marketing or focus solely on production and processing. Overall, the findings show that women in Nyagatare District primarily use cooperatives and local channels to market livestock products, reflecting the combined importance of collective action and individual entrepreneurship. Strengthening access to formal markets, providing business and marketing training, and improving logistics could further enhance household income and empower women within the livestock value chain.

4.1.6 Women's Decision-Making in Livestock Sales and Income Use

Items	n	Percent
Fully involved (main decision-maker)	176	44.0
Very involved	52	13.0
Moderately involved	105	26.3
Slightly involved	45	11.3
Not at all involved	22	5.5
Total	400	100.0

Source: Primary data, 2025

The findings reveal that a substantial proportion of women in Nyagatare District (44.0%) are fully involved as the main decision-makers regarding the sale of livestock and the allocation of income generated from livestock activities. This demonstrates significant empowerment, as these women not only manage production and processing but also exercise control over financial resources. Being the primary decision-maker enables women to prioritize household needs, invest in education, healthcare, and other livelihood activities, and reinvest strategically in livestock or other productive ventures, thereby enhancing overall household welfare. An additional 13.0% of women reported being very involved, while 26.3% are moderately involved in decision-making. These figures indicate that the majority of women participate actively in financial and sales decisions, even if responsibility is shared with spouses or other family members. Shared decision-making can foster collaboration and balanced resource allocation, although it may also reflect cultural or social norms that influence women's autonomy in economic matters. A smaller proportion of women, 11.3%, are slightly involved, and 5.5% are not involved at all in decisions regarding livestock sales or income use. These women likely face limitations in bargaining power, ownership rights, or social constraints that restrict their participation, which could affect household resource allocation, limit economic empowerment, and constrain their influence over income strategies.

Overall, the data highlights that most women in Nyagatare District are actively engaged in decision-making related to livestock sales and income allocation, reflecting considerable empowerment within the livestock value chain. Strengthening women's capacity through financial literacy, business training, and awareness of legal rights could further enhance their decision-making power, improve household income management, and contribute to sustainable economic growth. Women's autonomy in financial decisions is not only crucial for individual empowerment but also for broader household welfare and rural economic development.

4.2 Women's Participation in Livestock management and Value Chains Activities on Household Income and Financial Stability

Statement	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Participation in livestock marketing has a positive impact on the financial stability of my household.	273 (68.3%)	85 (21.3%)	34 (8.5%)	4 (1.0%)	4 (1.0%)
The income I generate from Livestock management and Value Chains activities helps to meet my family's daily household	271 (67.8%)	93 (23.3%)	30 (7.5%)	2 (0.5%)	4 (1.0%)

expenses.					
Participation in livestock management and value chains has enabled our household to invest in other income-generating activities.	144 (36.0%)	116 (29.0%)	61 (15.3%)	52 (13.0%)	27 (6.8%)
The income I earn from livestock activities enables me to consistently provide for my children's education, healthcare, nutrition, and clothing.	298 (74.5%)	70 (17.5%)	22 (5.5%)	8 (2.0%)	2 (0.5%)
Involvement in livestock rearing has significantly boosted my household income by enabling effective savings.	88 (22.0%)	168 (42.0%)	62 (15.5%)	60 (15.0%)	22 (5.5%)
Participation in livestock rearing has markedly improved my ability to access loans from financial institutions.	43 (10.8%)	190 (47.5%)	45 (11.3%)	30 (7.5%)	43 (10.8%)
Livestock rearing has significantly strengthened my ability to repay loans acquired from financial institutions and various other lenders.	97 (24.3%)	198 (49.5%)	42 (10.5%)	19 (4.8%)	44 (11.0%)

Source: Primary data, 2025

The findings reveal that a large majority of women in Nyagatare District perceive their participation in the Livestock management and Value Chains as positively impacting household financial stability. Specifically, 68.3% strongly agree and 21.3% agree that their involvement in livestock marketing improves their household's economic standing. This demonstrates that women recognize the direct link between daily livestock activities, rearing, processing, and selling, and maintaining household financial stability.

Livestock marketing thus emerges as a vital avenue for generating cash flow and reducing vulnerability to economic shocks. Women also overwhelmingly agree that income from livestock activities helps meet daily household expenses, with 67.8% strongly agreeing and 23.3% agreeing. This highlights livestock production and marketing as a primary source of funds for essential household needs, including food, utilities, and small household investments, emphasizing women's critical role in supporting household consumption and well-being. When asked whether livestock income enables households to invest in other income-generating activities, responses were more varied: 36.0% strongly agree and 29.0% agree, while 15.3% remained neutral and 19.8% disagreed. This indicates that although livestock income can be reinvested to diversify household economic activities, resource constraints or competing financial priorities may limit the capacity to do so consistently, with income often addressing immediate household needs rather than long-term investments. Regarding children's welfare, including education, healthcare, nutrition, and clothing, 74.5% strongly agree and 17.5% agree that livestock income allows them to provide consistently, demonstrating that women's engagement in the Livestock management and Value Chains directly supports household human capital development. Analysis of household savings, access to loans, and repayment capacity shows more variability. About 22.0% strongly agree and 42.0% agree that livestock has boosted household income for savings, while 35.5% are neutral or disagree. Similarly, 10.8% strongly agree and 47.5% agree that livestock activities improved access to loans, though 18.3% disagree or strongly disagree. For loan repayment capacity, 24.3% strongly agree and 49.5% agree, with 15.8% in disagreement.

4.3 Moderating effect of support mechanisms on the relationship between women's engagement in livestock management and value chains and rural household income in Nyagatare district.

Support Mechanism	Answer	n	Percent (%)
Government Support	Very Satisfied	126	31.5
	Satisfied	170	42.5
	Neutral	72	18.0
	Dissatisfied	12	3.0
	Very Dissatisfied	20	5.0
	Total	400	100.0
Training	Strongly Agree	203	50.7
	Agree	68	17.0
	Neutral	50	12.5
	Disagree	40	10.0

Support Mechanism	Answer	n	Percent (%)
Microfinance Access	Strongly Disagree	39	9.8
	Total	400	100.0
	Always	67	16.8
	Often	109	27.3
	Sometimes	115	28.7
	Rarely	38	9.5
Land Access	Never	71	17.8
	Total	400	100.0
	Always	266	66.5
	Often	112	28.0
	Sometimes	18	4.5
	Rarely	2	0.5
Infrastructure Quality	Never	2	0.5
	Total	400	100.0
	Excellent	210	52.5
	Good	123	30.8
	Average	45	11.3
	Poor	20	5.0
	Very Poor	2	0.5
	Total	400	100.0

Source: Primary data, 2025

A majority of women (74.0% combining “very satisfied” and “satisfied”) expressed satisfaction with government initiatives such as the One Cow Per poor family (Girinka program) extension services, and cooperative development. These interventions enhance women’s engagement in livestock production, processing, and marketing, thereby increasing productivity and household income. However, 8.0% of women were dissatisfied, indicating gaps in policy implementation and the need for targeted support for underserved groups. Over two-thirds of women (67.7% combining “strongly agree” and “agree”) reported that training improved their livestock management practices. Training enhances technical skills in feeding, breeding, disease control, and productivity, directly contributing to higher yields and income. Yet, about 20% indicated limited impact, suggesting that practical support, follow-up, and context-specific training are necessary to maximize benefits. Access to financial services was moderately available, with 72.8% of women able to secure credit “always,” “often,” or “sometimes.” Access to finance enables investments in feed, equipment, and livestock expansion, thus enhancing household income. Nevertheless, 27.3% faced difficulties due to collateral requirements, limited financial literacy, or institutional barriers, highlighting the need for tailored microfinance solutions. An overwhelming 94.5% of women agreed that access to land improves their ability to expand livestock businesses. Land is critical for scaling production, rearing larger herds, producing fodder, and building infrastructure, directly influencing household income and livelihood security. Limited land access remains a barrier due to cultural norms and inheritance laws, underscoring the importance of policies securing women’s land rights. Most women (83.3% combining “excellent” and “good”) reported that infrastructure, including roads, markets, and storage facilities, supports efficient livestock marketing. Adequate infrastructure reduces post-harvest losses, facilitates timely transport to markets, and enhances profitability. Areas with poor infrastructure (5.5%) still face challenges that may limit income potential.

4.4 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.783 ^a	.613	.612	.24659
2	.879 ^b	.773	.772	.18886
3	.991 ^c	.983	.982	.05242

a. Predictors: (Constant), Women’s Engagement in the livestock value chain

b. Predictors: (Constant), Women’s Engagement in livestock value chain, Support Mechanisms

c. Predictors: (Constant), Women’s Engagement in livestock value chain, Support Mechanisms, Interaction

The analysis shows a strong positive relationship between women's engagement in the Livestock management and Value Chains and rural household income. In Model 1, women's participation alone explains 61.3% of the variation in household income, highlighting their substantial direct contribution. When support mechanisms such as government programs, training, cooperatives, access to credit, and infrastructure are included in Model 2, the explanatory power rises to 77.3%, indicating that these mechanisms significantly enhance the impact of women's engagement. Model 3, incorporating the interaction between engagement and support mechanisms, explains 98.3% of income variation, demonstrating that the synergistic effect of active participation and enabling support is critical for maximizing household income. Overall, the findings underscore that while women's engagement is vital, its full economic potential is realized when combined with structured support, emphasizing the need for holistic interventions that integrate empowerment, resources, and infrastructure to improve rural livelihoods in Nyagatare District.

4.5 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38.301	1	38.301	629.876	.000 ^b
	Residual	24.201	398	.061		
	Total	62.502	399			
2	Regression	48.341	2	24.171	677.626	.000 ^c
	Residual	14.161	397	.036		
	Total	62.502	399			
3	Regression	61.414	3	20.471	7448.847	.000 ^d
	Residual	1.088	396	.003		
	Total	62.502	399			

a. Dependent Variable: Household Income

b. Predictors: (Constant), Women's Engagement in the livestock value chain

c. Predictors: (Constant), Women's Engagement in livestock value chain, Support Mechanisms

d. Predictors: (Constant), Women's Engagement in livestock value chain, Support Mechanisms, Interaction

The ANOVA analysis confirms that all three models predicting household income based on women's engagement in the Livestock management and Value Chains and support mechanisms are highly statistically significant ($p = 0.000$). In Model 1, women's engagement alone significantly predicts household income ($F = 629.876$), demonstrating their direct positive impact on rural economic welfare. Model 2, which adds support mechanisms, shows increased significance ($F = 677.626$) and reduced residual variation, highlighting the moderating role of training, credit, cooperatives, and infrastructure in enhancing income outcomes. Model 3, incorporating the interaction between engagement and support mechanisms, is extremely significant ($F = 7448.847$) with minimal residual variation, indicating that the synergistic effect of active participation and enabling support almost entirely explains household income variation. The ANOVA results reinforce that women's engagement, when coupled with targeted interventions and structural support, is a critical driver of household income and rural socioeconomic development in Nyagatare District.

4.6 Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.244	.123		10.113	.000
	Women's Engagement in Livestock Value Chain	.725	.029	.783	25.097	.000
2	(Constant)	.230	.112		2.052	.041
	Women's Engagement in Livestock Value Chain	.424	.028	.458	14.886	.000
	Support Mechanisms	.536	.032	.516	16.777	.000
3	(Constant)	4.025	.063		63.689	.000
	Women's Engagement in Livestock Value Chain	-1.061	.023	-1.146	-46.262	.000

Support Mechanisms	.072	.011	.069	6.473	.000
Interaction	.243	.004	1.971	68.969	.000

a. Dependent Variable: Household Income

The regression coefficients reveal the magnitude and direction of the relationship between women's engagement, support mechanisms, and household income. In Model 1, women's engagement alone strongly and positively influences household income ($B = 0.725$, $Beta = 0.783$, $p = 0.000$), indicating that active participation in livestock activities directly boosts household earnings. In Model 2, both women's engagement ($B = 0.424$, $Beta = 0.458$) and support mechanisms ($B = 0.536$, $Beta = 0.516$) are significant positive predictors, showing that training, credit, cooperatives, and infrastructure amplify the income impact of women's engagement. Model 3 highlights a synergistic effect: the interaction between engagement and support mechanisms has a strong positive effect ($B = 0.243$, $Beta = 1.971$, $p = 0.000$), while engagement alone shows a negative coefficient, emphasizing that support systems are essential for maximizing the economic benefits of women's participation. Overall, the coefficients confirm that women's engagement is a critical driver of household income, with its full impact realized when combined with institutional, financial, and infrastructural support, underscoring the importance of holistic empowerment strategies in Nyagatare District.

V. DISCUSSION OF RESULTS

The findings of this study clearly demonstrate that women in Nyagatare District are central actors across multiple stages of Livestock management and Value Chains management, and their role is both quantitatively significant and qualitatively transformative. Over 92% of respondents confirmed personal involvement in livestock management, showing that women's participation is foundational to rural livestock economies. This is consistent with global research, which, according to Khan et al. (2022), indicates that women perform 70–90% of livestock-related tasks in Sub-Saharan Africa. Similarly, as highlighted by Habumugisha and Tuyishime (2024), women in East Africa dominate routine livestock operations, a pattern mirrored in the present study. A deeper analysis of experience levels shows that 31.3% of women have over 10 years of livestock experience, while another 31.0% have been involved for 4–6 years, suggesting strong accumulated knowledge and practice. This finding aligns with Kristjanson et al. (2021), who argue that long-term involvement in livestock significantly enhances productivity and household stability in rural agricultural systems. In terms of daily workload, 69.0% of women engage in livestock activities every day, underscoring that livestock is a core, not supplementary, livelihood activity. Furthermore, 56.0% of women manage the full range of husbandry tasks, including feeding, breeding, and treatment. This pattern reflects broader regional evidence, as observed by Mugisha and Tumusiime (2022), who found that women carry the most continuous and labor-intensive responsibilities in livestock households.

Value addition is another domain where women demonstrate significant involvement. The study shows that 84.5% engage in processing activities, with manure (26.9%), milk–manure combinations (26.9%), and meat (16.9%) being the most common. This finding aligns with earlier research in which Girma and Dube (2021) and Harper and Wilson (2021) note that women frequently dominate post-production processing due to their expertise in traditional preservation techniques and organic fertilizer preparation. As aligned with these scholars, such activities in Nyagatare contribute to diversified household income and strengthened food security. Women also exhibit growing influence in livestock marketing. The results indicate that 48.5% sell products through cooperatives, 22.5% from home, and 20.5% in local markets. This trend is consistent with Garcia and Martinez (2023), who argue that cooperative membership enhances women's bargaining power and market access. Furthermore, the finding that 44.0% of women are the primary decision-makers on livestock income aligns with Habte et al. (2023), who emphasize that livestock income control is a critical indicator of women's empowerment and household welfare improvement. The contribution of livestock to household income is strongly supported by respondent perceptions: 68.3% strongly agree and 21.3% agree that livestock marketing improves financial stability. Additionally, 74.5% strongly agree that livestock income supports children's nutrition, education, healthcare, and clothing.

These results reinforce global evidence, as reported by the World Bank (2023) and Zewdu and Alemayehu (2022), both of whom highlight livestock income as a key driver of household resilience and welfare in rural economies. Financial empowerment emerges as a significant outcome. According to Mwikali and Kamau (2023), livestock often serves as liquidity and collateral alternatives for women excluded from formal finance. This is reflected in the present study, where 22.0% strongly agree and 42.0% agree that livestock boosts savings, and 49.5% agree that it improves loan repayment capacity. The inferential analysis provides robust support for these findings. Women's participation alone explains 61.3% of household income variation ($R^2 = 0.613$). When support mechanisms; training, credit access, veterinary services, and government programs are included, predictive power increases dramatically to 98.3% ($R^2 = 0.983$). This strong explanatory power aligns with Hayes (2022) and Nguyen et al. (2024), who emphasize that structured institutional support produces transformative economic outcomes in agricultural value chains. Nevertheless, challenges persist. Financial constraints affect

36.8% of women, while 27.3% have limited or no access to credit. Additional barriers such as insufficient training (20%), poor market information (18%), and constraining cultural norms (7.8%) hinder full potential.

These challenges are consistent with earlier findings by Namboka and Mwaura (2020) and Githinji and Omari (2021), who argue that structural gender inequities continue to limit women's optimal participation in livestock economies. Support mechanisms present a mixed picture. While 74.0% of respondents express satisfaction with government interventions such as Girinka and cooperative support, gaps remain particularly in credit access, where 18% of women have never accessed formal loans. These inconsistencies align with studies by Choudhury et al. (2021) and Galiè et al. (2020), who highlight that despite supportive policies, implementation gaps often prevent women from fully benefiting from available programs. Overall, the findings depict a promising yet constrained landscape. Women in Nyagatare District demonstrate extensive participation, economic significance, and growing empowerment in livestock value chains. However, as aligned with recent gender and agricultural development scholarship, unlocking their full potential requires sustained institutional support, broader financial inclusion, expanded market access, and strengthened training and extension services. The results ultimately reinforce that enhancing women's participation in livestock systems is not merely a gender priority; it is a strategic driver of rural economic growth, household welfare, and long-term community resilience.

VI. CONCLUSION

Ho1: Women in Nyagatare District do not play significant roles in Livestock management and Value Chains.

Findings show that over 92% of women personally engage in livestock management, 64.3% participate in feeding, watering, caring, and breeding, 84.5% are involved in processing, and 85.5% participate in marketing. These high proportions provide strong empirical evidence that women play significant and multidimensional roles across the entire livestock value chain. Therefore, **Ho1 is rejected.**

Ho2: Women's participation in Livestock management and value chains does not significantly contribute to household income generation in Nyagatare District.

Regression analysis indicates a strong and statistically significant relationship between women's participation in Livestock management and Value Chains activities and household income, with $R^2 = 0.613$ ($p < 0.001$). This shows that women's engagement in production, processing, and marketing significantly increases household financial stability, savings, and loan repayment capacity. Therefore, **Ho2 is rejected.**

Ho3: Support mechanisms do not significantly moderate the relationship between women's engagement in Livestock management and value chains and rural household income in Nyagatare District.

When support mechanisms such as training, the One Cow Per Poor Family Program (Girinka), access to microfinance, veterinary services, and infrastructure are incorporated, the explanatory power increases dramatically from $R^2 = 0.613$ to $R^2 = 0.983$. This substantial improvement demonstrates that support mechanisms have a strong and significant moderating effect on the relationship between women's engagement and household income. Therefore, **Ho3 is rejected.**

VII. RECOMMENDATIONS

Based on the findings, the study recommends that policymakers, development partners, and local institutions strengthen women's productivity by expanding targeted credit schemes tailored to rural livestock keepers, improving access to timely veterinary and extension services, and providing continuous hands-on training focused on modern livestock technologies and value addition. Cooperative structures should be strengthened to enhance women's bargaining power and market access, while local government authorities should intensify gender-responsive programs, such as the One Cow per Poor Family (Girinka) program, by ensuring equitable distribution, technical follow-up, and post-support monitoring. To overcome structural barriers, culturally sensitive community awareness campaigns should be implemented to promote joint household decision-making and reduce gender-based limitations. Finally, investment in rural infrastructure, particularly water points, milk collection centers, and feeder roads, should be prioritized to directly improve women's efficiency and income generation within the livestock value chain.

VIII. DECLARATION OF INTEREST

The authors declare that there are no known financial, professional, or personal conflicts of interest that could have influenced the development, analysis, or presentation of this study. All findings, interpretations, and conclusions presented in this work are the result of independent academic inquiry and are not directed by any

external organization, funding body, or individual. The authors affirm that the research was conducted objectively and that no competing interests exist that could compromise the integrity or impartiality of the study.

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