*Original Research Article*

Enhancing Milk Production through Milk Collection Centers in Tanga region of Tanzania: A Case of Uwama Milk Collection Centre at Amani Division in Muheza District

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ABSTRACT

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| This study aimed to evaluate the impact of milk collection centers on dairy farming practices and productivity in the Amani division at Muheza of the Tanga region, Tanzania. Utilizing a descriptive survey, demographic data were collected and analyzed to reveal the characteristics of livestock keepers, including gender, age, marital status, and education, and how these factors influenced their perceptions and practices in dairy farming. Key findings indicated that milk collection centers function as vital cooperatives that enhance milk production, provide guaranteed market access, and ensure timely payments to farmers. Additionally, these centers contributed to improved feeding strategies, resulting in increased milk yields and quality. However, several challenges, including water shortages, poor road conditions, and a lack of skilled labor, significantly impeded productivity and market access. Despite these obstacles, farmers generally held a positive view of the centers, recognizing their contributions to income generation and social networking. Concerns regarding exploitation and low pricing, however, highlighted the need for equitable pricing mechanisms. The study emphasized the importance of addressing infrastructure deficiencies and enhancing communication channels between farmers and collection centers to foster trust and participation. Overall, the research concluded that milk collection centers are pivotal to the development of the dairy industry, effectively linking rural producers with urban markets and facilitating the growth of smallholder milk production in Tanzania. Recommendations for improving the effectiveness of these centers include establishing reliable market connections, promoting higher-quality milk production, and addressing logistical challenges to bolster overall dairy productivity. |

*Keywords: Smallholder farmers, Dairy farming, Farmers’ cooperatives, Market access, Rural development*

1. INTRODUCTION

This study investigated the factors influencing milk productivity in Amani Division, Muheza District, Tanga Region, Tanzania, with a specific focus on the role of milk collection centers (MCCs). The Tanzanian livestock sector, while a significant contributor to agricultural production, remains below its full economic potential despite a large national herd and ample grazing land [1; 2]. This is largely due to the predominantly smallholder nature of the sector, with over 80% of Tanzanians engaged in subsistence farming [3], and 99% of livestock owned by smallholders operating within pastoral and agro-pastoral systems [4].

However, increasing demand for livestock products, driven by population growth, urbanization, and rising incomes, presents a significant opportunity [5; 6; 7]. Milk production in Tanzania is characterized by two main systems: traditional and dairy. The traditional system, using indigenous cattle primarily in central, northern, and western Tanzania [8], is characterized by low productivity but low production costs. Challenges include remoteness, poor infrastructure, and limited market access, leading to substantial milk being consumed locally or wasted [9]. Some producers near urban areas overcome these challenges through direct sales.

The dairy system, using improved breeds (Friesian, Jersey, Ayrshire crosses with TSHZ), is further divided into smallholder, urban/peri-urban, and large-scale operations. Tanga Region, with a significant cattle population (322, 351 in 2010, [10]) and numerous organizations involved in dairy production (100,103 in 2007, [11]), exemplifies both the challenges and opportunities within the sector. The high nutritional value of milk [12; 13] highlights its importance, especially for rural communities.

Optimal milk production relies on appropriate breeds; crossbred cows with 50-75% *Bos taurus* genetics balance productivity and disease resistance [14]. However, production varies widely (2-28 kg/cow/day, Tanga Regional Livestock [11], influenced by management and genetics. Farming practices range from zero-grazing to pastoralism [15], with challenges including land scarcity and limited grazing areas. Tanzania's poor transportation infrastructure, low milk prices, inadequate marketing, limited promotion of dairy products, and a shortage of dairy technologists hinder formal sector development [14]. The prevalence of informal trade, coupled with weak quality control, increases disease risks. The lack of quality-based pricing further limits market supply.

The dairy value chain (production, collection, processing, distribution, marketing; [16]) faces numerous challenges: low-producing local breeds, poor-quality feed, water scarcity, and limited animal health services all negatively impact milk production [16]. Efficient milk collection is crucial. MCCs are vital, especially in developing countries connecting smallholders to markets [17]. While individual cow productivity is low, the collective output from many smallholders is significant [14] emphasizing the need for efficient collection and marketing. Government initiatives, including policy reforms (ASDPII, 2017-2022) and promotion of group farming and crossbred cattle [14], aim to improve market access. Milk collection centers (MCCs) play a crucial role in dairy development, particularly in regions with surplus milk beyond local demand [18]. These centers, often operated by farmer groups, processors, or traders, connect rural producers to peri-urban and urban markets. Farmers typically choose between supplying an MCC or selling directly to urban consumers or households as raw milk. Maintaining milk quality necessitates a cold chain from farm to processing plant; while large-scale dairy operations in developed countries utilize on-farm cooling, this is often financially unfeasible for smallholders in developing countries [16].

MCCs are vital for dairy industry growth, facilitating the transfer and transformation of milk from rural production areas to urban consumers or milk-deficient regions [14]. They ensure quality and safety by enabling cold chain storage, providing a guaranteed market and stable income for farmers. MCCs offer technical, economic, and social support to farmers, with input supply identified as a particularly significant aspect [19]. Several factors constrain the effectiveness of milk collection centers (MCCs). Poor road conditions significantly increase transportation costs; [20] reported a 27% price increase per litre due to this issue in Tanzania. The widespread use of indigenous cattle in remote areas with limited infrastructure, including electricity [21], further hinders efficient milk collection and adds to processing costs. Challenges throughout the dairy value chain – from production to marketing – impact MCCs [16], particularly at the farm and collection levels.

Accessibility to veterinary services, secondary markets, primary markets, and water points significantly impacts farmers. A substantial percentage of households (approximately 70%) are located 15km or more from veterinary clinics, highlighting the limitations in animal health support [11]. [22] identified internal challenges for dairy cooperatives, such as a lack of processing facilities, poor member awareness, and limited member involvement in decision-making. External constraints include high crossbred cow costs, animal diseases, and low local breed productivity. Farmers frequently cite poor animal breeds (92%) and low milk supply (88%) as major constraints [23]. MCCs require technical support in packaging, record-keeping, financial management, quality control, marketing, and cooperative administration [23], with over 65% of farmers willing to pay for these services. Poor infrastructure remains a significant obstacle to efficient milk collection and processing. Farmer perceptions of milk collection centers (MCCs) are largely positive, particularly regarding increased social networks, improved income, and savings opportunities [22]. A study in Ethiopia using a relative importance index found that farmers valued these aspects of dairy cooperatives. However, addressing farmers' concerns and improving cooperative functioning are crucial for enhancing participation.

Another study [24] compared villages with and without MCCs in Egypt. Villages with MCCs showed increased forage cultivation, a preference for buffalo (due to consumer preference for their milk), improved animal feeding practices (concentrates and silage), cleaner milk production (machine milking in designated areas), and ultimately, higher milk productivity, prices, and income. These findings highlight the potential of MCCs to improve dairy production and farm income, suggesting a need for wider MCC implementation. Despite existing research on MCCs and milk production [25; 13], this study addresses a knowledge gap by focusing on the specific impact of MCCs on milk productivity in Amani Division, Tanga region.

2. methodology

Research design

This study employed a descriptive survey design, collecting data at a single point in time to minimize costs and time constraints given limited resources [26; 27]. This approach is efficient and cost-effective, particularly where resource availability could influence results.

Study area

This study was conducted in Amani Division, Muheza district, Tanga Region, Tanzania. Muheza district, located in the northeast corner of Tanga Region, is bordered by Tanga, Pangani, Korogwe, Lushoto, Kenya, and the Indian Ocean. Its district headquarters are situated just 36 kilometers from Tanga City. Muheza, covering 4,922 square kilometers, is Tanga Region's largest district after Handeni [28]. The region's diverse geography includes coastal plains, mountains, and the Indian Ocean, rich in biodiversity [14]. The Pangani, Zigi, and Mkulumuzi rivers flow into the Indian Ocean. The climate varies from hot and humid on the coast to temperate in the mountains (Muheza district socio-economic profile, [29]. Amani division was purposefully selected due to the absence of prior similar research in the area. This division is known for dairy production and milk collection services within Tanga Region. Therefore, Amani division provided a suitable location for investigating the potentials and constraints of milk collection centers on milk productivity.

Study population and sample size

This study defined its population as Amani livestock cooperative members in Amani Division, Muheza district, possessing relevant knowledge on milk production and collection [30; 31; 32; 33]. Both men and women were included as they both contribute to milk production and transportation. A sample of 30 respondents (men and women) was selected to gather information on milk collection centers and milk productivity. This sample size aimed to represent the larger population [34; 35]. Individual-level sampling was employed. Simple random sampling was used to select the 30 respondents from the cooperative's membership list. This probability sampling technique ensured each member had an equal chance of selection. The small sample size was chosen to represent the study area's population while mitigating bias. The sample comprised the sampling frame for the study. The selected respondents were expected to provide accurate and reliable information.

Data collection, processing and analysis

Data analysis employed a mixed-methods approach. Quantitative data were analyzed using descriptive statistics in IBM SPSS Statistics version 20. This software facilitated efficient analysis of large datasets, providing frequency tables, graphs, percentages, means, and charts to summarize data categorized by gender, age, marital status, and education level [31]. Results were presented to reflect demographic characteristics. Qualitative data were analyzed using Excel. Data processing involved editing, coding, classifying, and tabulating the collected data to prepare them for analysis [31]. Descriptive statistics (frequencies, percentages and means) were used to draw conclusions and compare variables.

Primary data collection involved questionnaires and face-to-face interviews with 30 dairy farmers selected using simple random sampling. This approach was chosen to gather first-hand information on the potentials and constraints of milk collection centers on milk productivity [31]. Both open-ended and closed-ended questions were used. Open-ended questions allowed for richer responses, while closed-ended questions ensured efficient data collection and analysis [36]. The mixed-methods approach combined the strengths of both quantitative and qualitative data analysis techniques to provide a comprehensive understanding of the research problem.

3. results and discussion

Farmers’ demographics

A demographic study of 30 livestock keepers in Amani division revealed key characteristics influencing dairy farming practices. The sample demonstrated a significant gender imbalance, with males comprising 60% of respondents. Ages ranged from 19 to 85 years, with the largest age cohort (39.9%) between 36 and 55 years old. Educational attainment was predominantly primary school level (63.3%), suggesting a reliance on traditional farming knowledge. Marital status showed a high percentage of married respondents (80%), indicating a focus on family income generation. Most participants (90%) engaged in mixed farming, combining livestock keeping with crop cultivation. A smaller subset (10%) focused exclusively on livestock, often supplementing their income through off-farm employment. This diversity in occupational strategies impacted resource allocation and time management within farming operations. The demographic data provided a crucial foundation for analyzing the effects of milk collection centers on milk productivity. These findings highlight both the potential and constraints within the Amani dairy farming sector, providing valuable insights for designing effective interventions targeted at this specific population (see Table 1).

Potential of milk collection centre on milk productivity

This study's primary objective was to assess the perceived benefits of milk collection centers on milk productivity. The results (Table 2) indicated unanimous agreement (100%) among respondents that these centers positively impact milk production, the overall dairy production system, and farmer income. Key benefits identified included guaranteed market access, enabling consistent milk sales. Respondents further reported that increased income from milk sales was allocated towards food security (40%), children's education (20%), household expenses (33.3%), and the purchase of cattle feed supplements (6.6%) to further enhance milk production.

The constraints of milk collection centre on milk productivity

The study identified several key constraints impacting both milk collection center operations and overall milk production. These included inadequate skilled labor, water scarcity, unreliable electricity supply, and deficient infrastructure, particularly poor road conditions (Table 3). While water shortages (33.3%), electricity outages (6.6%), and a lack of skilled labor (10%) presented challenges, poor road networks emerged as the most significant constraint (50%). This severely hampered not only efficient milk collection and delivery but also broader economic development in the rural areas. The perishable nature of milk necessitates daily access to markets and reliable transportation, making the poor road conditions a major impediment to both milk marketing and processing activities.

Farmer’s perceptions toward milk collection centre

Milk collection centers are largely viewed favorably by farmers, primarily due to increased income, strengthened social networks, and reliable savings mechanisms. The consistent income stream significantly improves farmers' financial stability and social standing, enhancing their overall resilience. This underscores the centers' potential for fostering profitable smallholder dairy farming. However, opinions diverge regarding potential exploitation by these centers; a notable minority holds this view, although the majority disagree. Farmer cooperatives associated with the centers are generally viewed positively, facilitating collaboration, market access, and timely payments. Payment security is a highly valued aspect of the centers for most farmers. Contrary to common assumptions, high milk production is not considered a prerequisite for utilizing the centers by a significant number of farmers. Similarly, the majority disagree with the notion that these centers are unimportant for boosting milk production. While some find the offered milk prices acceptable, many perceive them as too low, especially considering transportation costs. Despite this, the majority recognize the centers' crucial role in providing access to markets and ensuring reliable payment. While strong farmer-center relationships are important, they aren't the sole determinant of success. Finally, the establishment of these centers is not solely driven by the promise of high milk prices.

The study investigated multifaceted impact of milk collection centers on dairy farming practices and productivity in Amani division at Muheza district in Tanga region of Tanzania. The analysis incorporated demographic data to provide a comprehensive understanding of respondent characteristics and their influence on perceptions and practices. Understanding the demographic characteristics of respondents—gender, age, marital status, and education level—is crucial for interpreting survey results. These factors significantly influenced respondents' maturity, experiences, and perspectives on dairy farming. Analyzing these characteristics allowed for the identification of disparities in views, perceptions, knowledge, skills, and experiences related to dairy farming activities. This approach ensured the validity and reliability of the collected data, providing a nuanced picture of the respondent population [37]. This aligned with [38], who highlighted the value of demographic data in gaining a comprehensive understanding of respondents based on age, work experience, and educational qualifications. The inclusion of such data enhances the researcher's awareness of the respondent group's nature and context.

Milk collection centers play a pivotal role in improving dairy farming practices and outcomes. They function as farmer cooperatives, enhancing milk production, guaranteeing market access, ensuring secure and timely payments, and fostering trust [17]. The presence of these centers significantly influences farming practices. Farmers in areas with collection centers demonstrate improved feeding strategies, including increased use of concentrates and silage, resulting in higher milk yields and better milk quality [24]. This improved productivity and higher milk prices contribute to increased income, supporting the expansion of milk collection centers to enhance the overall dairy production system and farmer livelihoods. A key function of these centers is maintaining the quality and safety of raw milk through cold chain management, ensuring product quality from milking to processing [19]. They provide farmers with crucial technical, economic, and social support, with input supply emerging as a particularly significant factor [19]. [23] emphasizes that a secure and profitable market, minimizing farmer risk, is the primary incentive for dairy farming investment and diversification. Milk collection centers effectively achieve this by providing a reliable market outlet and facilitating the efficient exploitation of local milk production potential. These centers are vital to the development of the dairy industry, acting as a crucial link between rural producers and urban consumers or milk-deficient areas [14].

Despite their benefits, milk collection centers face significant constraints that impact milk productivity. These include water shortages (33.3%), electricity shortages (6.6%), poor road conditions (50%), and inadequate skilled labor (10%). The perishable nature of milk necessitates daily access to markets and reliable delivery services, making poor road conditions a particularly critical constraint [14]. This is further compounded by high ambient temperatures, which increase the risk of spoilage during transport to processing plants (e.g., Tanga Fresh). This aligns with [20], who demonstrated a 27% price increase per liter due to poor road conditions in Tanzania. Remoteness and inadequate infrastructure pose major bottlenecks to milk collection and marketing. Addressing this requires infrastructure improvements, which can be justified by the potential for growth in smallholder milk production [39]. Furthermore, Tanzania's poor transportation system generally hampers the delivery of goods to markets [16]. Low milk prices, poor marketing, limited promotion of dairy products, and a shortage of dairy technologists hinder the formal sector's development. The resulting informal trade in raw milk, coupled with inadequate quality control, increases the risk of zoonotic diseases [11]. Accessibility to veterinary clinics, secondary markets, primary markets, and water points are also major challenges, with a significant percentage of households located far from these essential services [40]. Internal challenges for dairy cooperatives (milk collection centers) include a lack of processing facilities, poor member awareness, and limited member involvement in decision-making. External constraints include high costs associated with crossbreed cows, animal diseases, and low productivity of local breeds [22].

Farmers generally hold positive views of milk collection centers, appreciating their role in expanding social networks, increasing income, and providing savings opportunities [22]. However, perceptions regarding exploitation vary. While a significant portion disagrees, a considerable number believe they are exploited by these centers. The majority of farmers (56.7% agree, 16.7% strongly agree) recognize the importance of milk collection centers for increasing milk production, market access, and payment security. Farmers in areas with collection centers often increase forage cultivation, favor buffaloes due to their milk fat content, and improve feeding practices [24; 41]. They also adopt cleaner milking practices, leading to higher productivity and milk prices [42]. The case study of Mr. Said, a dairy farmer since 2002, highlights the transformative impact of milk collection centers on his livelihood, demonstrating significant income growth and improved living standards [17]. However, a significant portion of farmers disagree with the assertion that collection centers provide good prices, citing the price paid by Tanga Fresh and transport costs as insufficient (40% disagree).

**Table 1: Respondent Demographics in Amani Division Dairy Sector (n=30)**

|  |  |
| --- | --- |
| Characteristic | Percentage (%) |
| Sex |  |
| Male | 60 |
| Female | 40 |
| Age Group (years) |  |
| 19-35 | 13.5 |
| 36-55 | 39.9 |
| 56-75 | 3.3 |
| 76-85 | 16.6 |
| Education Level |  |
| Primary | 63.3 |
| Secondary | 33.3 |
| Advanced | 3.3 |
| Marital Status |  |
| Married | 80 |
| Single | 20 |
| Primary Occupation |  |
| Livestock & Crops | 90 |
| Livestock Only | 10 |

**Table 2: Potentials of milk collection centre on milk productivity**

|  |  |  |  |
| --- | --- | --- | --- |
| Farmers’ participation | Frequency | Percentage (%) | |
| Farmers responsibilities in milk production |  |  | |
| male | 18 | 60.0 | |
| female | 12 | 40.0 | |
| All | 0 | 0.0 | |
| Total | **30** | 100.0 | |
| Benefit from milk production |  |  | |
| Yes | 30 | 100.0 | |
| No | 0 | 0.0 | |
| Total | **30** | 100.0 | |
| Reasons for beneficiaries |  |  | |
| Food | 12 | 40.0 | |
| School fees | 6 | 20.0 | |
| Covering home costs needs | 10 | 33.3 | |
| Buying cattle supplements | 2 | 6.6 | |
|  |  |  | |
| Total | 30 |  | 100 |

**Table 3: Constraints of milk collection centre**

|  |  |  |
| --- | --- | --- |
| Constraints of milk collection | Frequency | Percentage (%) |
| Shortage of water | 10 | 33.3 |
| Poor infrastructure( Roads) | 15 | 50 |
| Shortage of electricity | 2 | 6.6 |
| lack of skills labour | 3 | 10 |
| Total | 30 | 100.0 |

**Table 4: Farmer’s perceptions toward milk collection centre**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Attitudinal Statement | Strong Disagree | Disagree | Undecided | Agree | Strong Agree |
| Collection centers exploit farmers | 33.3% | 23.3% | 10.0% | 16.7% | 16.7% |
| Collection centers provide good prices for farmers | 16.7% | 40.0% | 6.7% | 26.7% | 10.0% |
| Collection centers are important for market insurance | 10.0% | 10.0% | 6.7% | 56.7% | 16.7% |
| Collection centers are not important for increased milk production | 30.0% | 33.3% | 6.7% | 26.7% | 3.3% |
| High milk production is not essential for center use | 20.0% | 26.7% | 6.7% | 23.3% | 23.3% |
| No need for collection centers in your area | 43.3% | 20.0% | 10.0% | 16.7% | 10.0% |
| Center performance not determined by farmer linkage | 20.0% | 26.7% | 13.3% | 23.3% | 16.7% |
| Having centers is less determined by good milk prices | 13.3% | 20.0% | 30.0% | 23.3% | 13.3% |

4. Conclusion

To enhance the effectiveness of milk collection centers, several strategies are recommended. A fair pricing mechanism that rewards farmers who organize into formal groups is crucial. This incentivizes group formation, potentially leading to cooperatives and improved relationships. Paying premiums for higher-quality milk can further motivate farmers to increase production. Building trust and commitment through reliable milk supply and incentive schemes, such as bonuses or profit sharing, can create a stable production system. The centers should actively facilitate market linkages between farmer groups, collection centers, and processors, fostering long-term supply contracts. Addressing infrastructure challenges, particularly road conditions, is paramount to ensuring timely and efficient milk delivery. Finally, enhancing communication and transparency between farmers and collection centers can improve trust and participation.

Ethical approval

Research Ethical Clearance was obtained from the Tanzania Livestock Research Institute (TALIRI).

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