Enhancing Milk Production through Establishment of 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 2024 study assessed the contribution of milk collection centers on dairy farming in Amani division, Muheza District, Tanga region, Tanzania. Data were collected via a descriptive survey using questionnaires administered to a sample of 30 respondents (men and women). Key parameters examined included demographic data (gender, age in years, marital status, years of education), milk production (liters/day), milk quality, feeding practices (type and quantity of feed), monthly income (Tanzanian Shillings), and access to essential services (water availability, road condition assessment). Findings revealed that milk collection centers significantly enhanced milk production, guaranteed market access, and ensured timely payments, leading to improved feeding strategies and increased milk yields. Despite boosting farmer income and community ties, the success of milk collection centers was hindered by significant infrastructure challenges. Water shortages, poor road conditions, and a lack of skilled workers limited productivity and market reach. While farmers largely supported the centers, worries about fair prices and potential exploitation underscore the urgent need for equitable pricing mechanisms and infrastructure improvements. The study underscores the critical role of milk collection centers in linking rural producers to urban markets, but emphasizes the need for enhanced communication and infrastructure development to maximize their effectiveness and foster sustainable growth in Tanzania's smallholder dairy sector. |

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

1. INTRODUCTION

This study examines the multifaceted factors influencing milk productivity within Amani Division, Muheza District, Tanga Region, Tanzania, with a particular emphasis on the role of milk collection centers (MCCs). Tanzania's livestock sector, while possessing a substantial national herd and extensive grazing land, significantly underperforms its economic potential [1, 2]. This underperformance stems largely from the sector's predominantly smallholder structure, where over 80% of Tanzanians engage in subsistence farming [3], and a staggering 99% of livestock are owned by smallholders operating within pastoral and agro-pastoral systems [4]. However, the burgeoning demand for livestock products, fueled by population growth, urbanization, and rising incomes, presents a considerable opportunity for expansion and economic growth [5, 6, 7].

Tanzania's milk production is characterized by two primary systems: traditional and commercial dairy. The traditional system, prevalent in central, northern, and western Tanzania, utilizes indigenous cattle breeds [8]. While characterized by low production costs, this system suffers from low productivity, hampered by remoteness, poor infrastructure, and limited market access, resulting in substantial milk loss through local consumption or wastage [9]. In contrast, the dairy system employs improved breeds (Friesian, Jersey, Ayrshire crosses with Tanzania Short-Horned Zebu), encompassing smallholder, urban/peri-urban, and large-scale operations.

The Tanga Region, with its substantial cattle population (322,351 in 2010 [10]) and numerous organizations involved in dairy production (100,103 in 2007 [11]), serves as a microcosm of the Tanzanian dairy sector, highlighting both its challenges and opportunities. The high nutritional value of milk [12, 13] underscores its importance, particularly for rural communities' nutritional security.

Optimal milk production hinges on several interconnected factors. Appropriate breeds are crucial; crossbred cows with 50-75% *Bos taurus* genetics offer a balance between productivity and disease resistance [14, 42]. However, milk production varies considerably (2-28 kg/cow/day [11]), influenced by both genetic factors and management practices. Farming practices range from zero-grazing to pastoralism [15], with challenges including land scarcity and limited grazing areas. Furthermore, Tanzania's inadequate transportation infrastructure, low milk prices, ineffective marketing strategies, limited promotion of dairy products, and a shortage of dairy technologists hinder the formal sector's development [14]. The prevalence of informal trade, coupled with weak quality control, exacerbates disease risks. The absence of quality-based pricing further restricts market supply.

The entire dairy value chain—encompassing production, collection, processing, distribution, and marketing [16]—faces numerous obstacles. Low-producing local breeds, poor-quality feed, water scarcity, and limited animal health services all negatively impact milk production [16]. Efficient milk collection is paramount. MCCs are particularly vital in developing countries, serving as a crucial link between smallholder farmers and markets [17]. While individual cow productivity may be low, the collective output from numerous smallholders is substantial [14], emphasizing the need for efficient collection and marketing systems. Government initiatives, including policy reforms (ASDPII, 2017-2022) and the promotion of group farming and crossbred cattle [14], aim to improve market access and overall productivity. Milk collection centers (MCCs) play a pivotal role, especially in regions with milk surpluses exceeding local demand [18]. These centers, often managed by farmer groups, processors, or traders, connect rural producers to peri-urban and urban markets. Farmers typically choose between supplying an MCC or direct sales to urban consumers or households. Maintaining milk quality requires a robust cold chain from farm to processing plant; while large-scale operations in developed countries utilize on-farm cooling, this is often financially prohibitive for smallholders in developing countries [16]. Therefore, the role and effectiveness of MCCs in overcoming these challenges are central to this study.

**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 in 2024. 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 having a production record of 7,595,605 litres of milk from 2017 – 2023 (data adopted from Uwama Milk Collection Centre at Amani Division in Muheza District, Tanga Region, Tanzania). 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) were selected to gather information on milk collection centers and milk productivity. This sample size was selected based on convenience sampling 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 the collected data, providing frequency and percentages tables 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 and percentages) 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% |

**Table 5: Milk Production Trend: Uwama Milk Collection Center**

|  |  |  |
| --- | --- | --- |
| Time Period | Year | Milk Production (Litres) |
| Pre-Establishment | <1990 | Data unavailable |
| Post-Establishment (Center established 28/05/1991) | 2017 | 988,154 |
| 2018 | 1,214,940 |
| 2019 | 1,357,256 |
| 2020 | 1,199,693 |
| 2021 | 1,079,886 |
| 2022 | 877,790 |
| 2023 | 877,886 |

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.

**Disclaimer (Artificial intelligence)**

Author(s) hereby declare that no generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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