MILKING THE GAP: AN ANALYSIS OF THE INCOME DIFFERENCES AMONG DAIRY BUFFALO FARMERS IN SAN AGUSTIN, ISABELA, PHILIPPINES

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10.15408/saj.v6i2.54152

Received September 22, 2026; 1st Revised November 3, 2026; 2nd Revised November 6, 2026; Accepted November 7, 2026.

ABSTRACT

This study explores income differences among dairy buffalo farmers in San Agustin, Isabela, Philippines, identifying influencing factors and offering recommendations to enhance participation in milk production. A survey among 132 dairy buffalo farmers indicated that only 23 (17%) supply milk to a cooperative while 109 (do not engage in milk marketing. Mann-Whitney U test results showed that farmers who supply milk had significantly higher household incomes than non-suppliers, though no notable differences existed in age or farming experience, suggesting that market access, technical assistance, and institutional support, may be more critical income determinants.The findings highlight a significant income gap and emphasize the importance of targeted interventions that strengthen institutional support systems, improve market linkages, and promote wider participation in the milk supply chains. By addressing these barriers, local government units, cooperatives, and development agencies, can help unlock the full potential of dairy buffalo farming as a sustainable and inclusive livelihood source in rural communities.

Keywords: dairy-buffalo; income-difference; cooperative

INTRODUCTION

The dairy buffalo industry in the Philippines plays a vital role in sustaining rural livelihoods. It provides not only milk, but also meat and draft power, making it a key contributor to food security and economic

development in the countryside (Philippine Carabao Center, 2014). Despite its importance, the industry continues to face major challenges. These include low milk production, limited access to markets, and a strong dependence on imported dairy products, which currently make up 95 percent of the country's milk supply (PSA, 2023). These issues limit the industry's potential to support rural income growth and national self-sufficiency in dairy production.

To address these concerns, government agencies and development institutions have introduced various programs aimed at helping farmers and improving local milk production. In San Agustin, Isabela, one such initiative is the Carabao-based Enterprise Development (CBED) Program. This program promotes crossbred dairy buffalo farming as a strategy to increase milk yield and improve the economic conditions of farming households (Del Barrio et al., 2020). While some farmers have benefited from these interventions, many remain disengaged from milk production, resulting in notable income disparities between those who supply milk and those who are not engaged in milk marketing.

Market participation theory provides the theoretical basis for the income disparity. Using this lens, previous studies have shown that involvement in formal milk supply chains and cooperative systems can significantly improve the incomes of smallholder dairy farmers (Lantican et al., 2017). Theoretically, farmers who decide not to market their milk are performing lower-return activities. Empirical studies support this, indicating that access to education, training, and well-functioning markets are essential for increasing productivity and profitability in the dairy sector (Dizon & Mercado, 2020; Tullao & De Guzman, 2019). Nevertheless, many farmers still face barriers to entering formal markets, which continues to limit the potential benefits of dairy buffalo farming.

This study intends to quantify the income disparities between milk-supplying and independent dairy buffalo farmers in San Agustin, Isabela. By examining socio-demographic and economic data through the theoretical framework of market participation, the research aims to identify actionable strategies to encourage more farmers to participate in formal milk markets. The findings aim to inform policymakers, cooperatives, and development agencies on how to strengthen support systems –such as training, technology adoption, and market linkages– to bridge the income gap and ensure the sustainability of the dairy buffalo sector.

REVIEW OF RELATED LITERATURE

The research conducted by Cazzuffi (2013) investigated the coexistence of cooperative and private milk processors in Trento, Piacenza, and Bologna, Italy and its effects on dairy farmers' outcomes. Using primary data collected through farmer surveys, the study employed both descriptive and econometric methods, including non-experimental evaluation techniques, to assess how geography, farm size, and socio-economic factors influence cooperative membership and farmer benefits. The analysis found that cooperatives are more prevalent in remote areas with smaller-scale farms and higher transportation costs, where they often serve as the sole buyer.

The paper of Alemu and Adesina (2015) also determined the effects of marketing cooperatives and buyer-driven contracts on dairy production and household income among smallholder farmers in Northern Ethiopia. A structured survey was conducted among 415 dairy farmers across four districts in Tigray, focusing on those involved in a small-scale dairy extension package. Results show that cooperative membership is positively associated with higher milk production, better cow productivity, and increased household income compared to reliance on the spot market. Cooperatives were also found to provide valuable services such as milk cooling and storage, access to feed, veterinary care, credit, and hybrid cows, all of which contribute to productivity improvements.

Sharma (2015) analyzed how smallholder milk producers in India respond to evolving dairy market structures, focusing on their choice of traditional, cooperative, or private organized channels and the resulting effects on income and technology adoption. Based on a survey of 374 households, the study used stratified random sampling and a two-stage econometric analysis. Findings revealed that while modern channels are expanding, traditional markets still dominate, handling about 70% of marketed milk. Larger farmers with better infrastructure access tended to engage with private channels, while smaller producers relied on cooperatives or informal markets. Factors such as education, cooperative membership, and veterinary access positively influenced income, though traditional sellers received higher prices per unit but earned less overall due to lower productivity.

The study by Chagwiza et al. (2016) explores the impact of cooperative membership on the livelihoods and dairy production of smallholder farmers in Selale, Ethiopia. Using data from 384 farmers (192 members and 192 non-members), it examined ten indicators, including proportion of

dairy income to total household income, total dairy income, proportion of crossbreed cows to the total number of cows in the herd, amount of feed bought, milk production, milk productivity, commercialization, price per liter of milk, price per kg of butter and the share of milk production that is processed at the household level. To ensure accurate comparison, the study applied Propensity Score Matching using both nearest neighbor and kernel matching techniques. Results indicate that cooperative members achieved higher productivity, greater adoption of improved technologies, and stronger market participation, though no significant difference was found in milk or butter prices. Membership was more common among older, more educated farmers with larger households and smaller landholdings, especially those closer to milk collection centers.

Mahida et al. (2018) presented the determinants of technical efficiency among dairy farmers, with emphasis on the role of cooperative membership in Gujarat, India. The study used primary data collected from 180 farmers across three districts, Anand, Bharuch, and Tapi. Multiple regression analysis and regression tree methods were employed to assess the influence of socio-economic and institutional factors. The results revealed that cooperative member farmers exhibited higher technical efficiency. Key variables found to significantly influence efficiency included cooperative membership, access to non-farm income, access to information, and herd size. Notably, while cooperative membership, off-farm income, and information access had a positive effect, herd size was negatively associated with efficiency, which implies potential management challenges with larger herds. The regression tree analysis further highlighted the importance of proximity to dairy cooperatives and access to institutional support in improving efficiency. The study also indicated that dairy cooperatives play a critical role in enhancing farm-level performance by facilitating access to technical inputs, veterinary services, and advisory support.

In an effort to understand how cooperatives can support long-term sustainability in Bangladesh's dairy sector, Sultana et al. (2019) performed a study in Sirajgonj district, an area known for its established dairy cooperative infrastructure. A case study approach was used which gathered data from 95 dairy farmers, both cooperative members and non-members, through semi-structured interviews. By applying descriptive analysis, the study compared production practices, income levels, and access to services between the two groups. It was discovered that members of the cooperative enjoyed clear advantages: access to veterinary care at no

cost, regular training and advice on better dairy practices, and most importantly, a secure market for their milk at a stable price. These factors not only increased farmers' incomes but also encouraged more consistent production.

On the other hand, the paper by Onyango et al. (2023), conducted in Nyamira and Homa Bay Counties in Kenya, aimed to examine the impact of cooperative market participation on smallholder dairy farmers' incomes. Data from 277 farmers was collected through semi-structured questionnaires. Findings from the study revealed that cooperative participation increased farmers' income by approximately 10 percent. Additionally, education, access to off-farm income, extension services, and herd size were found to significantly influence income levels. Generally, smaller and more resource-constrained farmers benefit from cooperative membership, particularly when cooperatives provide timely payments and access to support services. The findings support policies that promote awareness of cooperative benefits, improve access to dairy services, and enhance farmer participation to boost household income in Kenya's dairy sector.

METHODOLOGY

The study was conducted in San Agustin, Isabela in the Philippines. It is known as the crossbred capital of the country due to its significant population of crossbred buffaloes. The municipality of San Agustin is situated in the southernmost region of Isabela and encompasses a land area of 27,840 hectares. It is comprised of 23 barangays and shares borders with the municipality of Jones to the west, and the south and southeast areas are adjacent to Quirino Province.

The study sample consisted of 132 dairy buffalo farmers, selected using convenience sampling. The sample included 23 milk suppliers of Sadaco Multipurpose Cooperative (17%), and 109 non-milk suppliers of Sadaco Multipurpose Cooperative (83%). They do not sell any milk from their buffaloes because of the belief that the offspring will lack milk. The sample size was determined based on the availability of active dairy buffalo farmers in the area, with representation from different barangays where the CBED Program was implemented.

Primary data was collected through structured face-to-face interviews using a pre-tested questionnaire. The survey covered socio-demographic characteristics of the dairy buffalo farmers, economic factors (their annual household income and income from dairy farming), and institutional factors (membership in dairy associations and membership in the

cooperative).The dairy buffalo farmers were interviewed at their homes, at their farms or during cooperative meetings to secure complete and detailed responses.

The study aimed to document key socio-demographic features and income differences between two groups of dairy buffalo farmers: those who supply or sell their milk to a cooperative and those who do not sell milk, in San Agustin, Isabela. To achieve this, descriptive statistics (mean, frequency, percentage) summarized the socio-demographic profile of respondents and the Mann-Whitney U test was employed to compare annual household income and age and years of farming experience between milk suppliers and non-suppliers. Statistical significance level was set at alpha equal to 5%, with analysis performed using JASP 0.19.3, an open-source statistical software by the University of Amsterdam.

The study followed ethical guidelines for conducting research with human subjects. Informed consent was obtained from all respondents before data collection. The researchers made sure that the dairy buffalo farmers were aware of the purpose of the study and their right to confidentiality and voluntary participation. The privacy of the survey participants was also protected. The study protocal was approved by the University of the Philippines Research Ethics Board (UPLB REB 2024-01520.

RESULTS AND DISCUSSION

Sociodemographic Characteristics of Respondents

Age

The mean age of the respondents is 53 years which is 4 years younger than the national average of 57 years (PSA CAF 2021). The youngest age was 22 while the oldest was 82 years. Thirty one percent (31%) of the respondents was in the age bracket 51-60 years old and 24% belonged in the age bracket of 61-70 years old (Table 1). Survey results indicated an aging dairy farming population in San Agustin, Isabela. This is consistent across studies at the national level based on the Census of Agriculture and Fisheries Report 2021.

The aging of the country's dairy buffalo farmer population may be considered a threat to the sector, citing PSA data showing that farmers are getting older and that older farmers do not encourage their children to be involved in agriculture-related activities.

Educational Attainment

Sixteen percent (16%) of the respondents reached college level, fourteen percent (14%) are college graduates, and another 14% finished a vocational course. These results revealed that dairy buffalo farmers from San Agustin, Isabela are more educated than the typical Filipino farmers who have relatively low formal education, with most not reaching beyond elementary level (PSA CAF 2021).

Table 1. Characteristics of Dairy Buffalo Farmers

Characteristics	Frequency (n=132)	Percentage (%)
Age (years)		
20-30	3	2
31-40	21	16
41-50	31	24
51-60	41	31
61-70	32	24
>70	4	3
Minimum	22	
Maximum	82	
Mean	53	
Educational Attainment		
Pre-elementary level	1	-
Elementary level	6	4
Elementary Graduate	9	7
High school level	18	14
High school Graduate	41	31
College level	21	16
College Graduate	18	14
Vocational	18	14
Sex		
Male	116	88
Female	16	12
Milk Supplier of Sadaco Multipurpose Coop.		
Yes	23	17
No	109	83

Sex

Majority of the respondents were male (88%) and only 12% were female. This aligns with the Philippine national data of male dominance in farming as Filipino women in general prioritize household duties over

formal market roles. In addition, in the Philippines, farming is considered physically intensive which is perceived to be the men's responsibility. There is a gendered division of labor according to the Food and Agriculture Organization's (FAO) Philippine Fact Sheet: men take care of land clearing and large-scale farming, and in livestock farming, men usually manage cattle and water buffalo while women are into poultry and pig-raising.

The research also compared the age and the number of years of experience in farming of the suppliers of milk to the cooperative and the non-suppliers of milk as shown in Table 2. The suppliers of milk are younger with an average age of 50 years compared to the non-suppliers' average age equal to 53 years. On the other hand, the average number of years in farming of non-suppliers being equal to 30 is higher compared to the suppliers' number of years in farming being equal to 27.

The high average years of experience (30 years) and the significant proportion of farmers with over 30 years in the agriculture sector suggest an aging workforce in dairy buffalo farming. This raises concerns about succession planning as fewer young farmers are entering the sector. The finding that milk suppliers are younger and have less farming experience imply that newer entrants are more inclined to engage with formal market channels. This aligns with the observation that younger farmers, often with more formal education, are more responsive to market-oriented initiatives and cooperative membership. This also indicates that participation in cooperatives may serve as an entry pathway for younger farmers who lack the agricultural experience and independent market relationships of their older counterparts.

Table 2. Age and Farming Experience of Milk Suppliers and Non-Suppliers

	Age		Years of experience in farming	
	Non-supplier	Supplier	Non-supplier	Supplier
Mode	59.86	38.59	34.14	13.66
Median	54.00	49.00	30.00	27.00
Mean	53.34	49.70	29.62	26.52
Standard Deviation	10.87	14.06	13.90	17.15
Minimum	22.00	27.00	2.00	3.00
Maximum	82.00	69.00	66.00	59.00

Organizational Affiliation of Dairy Buffalo Farmers

The survey revealed that among the 132 dairy buffalo farmers interviewed, 50% (66 farmers) were members of a dairy association, while the remaining 50% were not affiliated with any dairy association in their area. In terms of cooperative membership, only 28% (37 farmers) were members of the Sadaco Multipurpose Cooperative, while a significant portion of the farmers (72%) were not part of the cooperative. The low membership in the cooperative highlights a potential gap in farmer engagement with organized groups that could provide access to resources, training, and market opportunities. This also strongly shows the opportunity for cooperative expansion in San Agustin, Isabela. With these findings, it is interesting to find out why a significant proportion of the dairy farmers remain non-members of the cooperative, whether due to lack of awareness, perceived ineffectiveness of the cooperative, or financial limitations in joining. Addressing these possible concerns could result to higher engagement and improved livelihood of dairy buffalo farmers in San Agustin, Isabela.

Table 3. Organizational Membership Status of Dairy Buffalo Farmers

Characteristic	Frequency (n=132)	Percentage (%)
Membership in dairy association		
Member	66	50
Non-member	66	50
Membership in the cooperative		
Member	37	28
Non-member	95	72

Annual Household Income of Dairy Buffalo Farmers

Survey data on the annual household income of dairy buffalo farmers revealed the large standard deviation and the stark difference between the mode and mean. The mode (most frequent income) was PhP26,198.35 ($448.60) indicating that a significant number of dairy buffalo farmers earn at this lower income level (Table 4). Since the mode represents the most common income level, the fact that it is only P26,198.3 ($37.38) per month suggests that many farmers struggle with poverty-level earnings which limits their ability to invest in better feed, or technology. The mean household income was PhP107,402.11 ($1,893.08), but with a high standard deviation of PhP103,703.46 ($1,775.74), reflecting substantial household

income inequality among respondents while the median household income was Php80,000.00 ($1,360.86), suggesting that half of the dairy buffalo farmers earn below this threshold, while the other half earn more. The median shows that 50% of the dairy buffalo farmers earn less than PhP6,667 ($114.16) per month, which is still below the Philippines' 2023 poverty threshold (around PhP12,030/month for a family of five). In addition, results of the survey showed that the minimum reported household income was PhP36,000.00 ($616.34) while the maximum reached PhP444,000.00 ($7,602.74), further emphasizing the wide income gap.

In the global scene, smallholder dairy farmers in India and Pakistan earn between PhP50,000 and PhP200,000 in a year, similar to this study's range. Meanwhile, in developed countries, dairy farmers earn more because of better productivity, mechanization, and government subsidies.

Table 4. Annual Household Income Characteristics of Dairy Buffalo Farmers

	Annual Household Income (PhP)
Mode	26,198.35
Median	80,000.00
Mean	107,402.10
Standard Deviation	103,703.46
Minimum	36,000.00
Maximum	444,000.00

The wide income range (PhP36,000 ($616.44) to PhP444,000.00 ($7,602.74)) suggests that some dairy buffalo farmers have other sources of income (e.g., corn, rice, banana, cassava, and livestock farming), while others rely on dairy buffalo farming alone.

The average annual income of smallholder farmers in the Philippines is approximately PhP 100,000 ($1,712.00)-PhP 150,000 ($2,568.49), aligning with the mean household income of the dairy buffalo farmers in this study. However, the low modal income highlights that many dairy buffalo farmers earn far less than the national average for agriculture.

In the global context, in India and Pakistan, small-scale dairy farmers earn between PhP 50,000 ($856.16) to PhP 200,000 ($3,424.66) annually, similar to this study's range. However, in developed countries (e.g., US and EU), dairy farmers earn significantly more due to higher productivity, mechanization, and government subsidies.

Net Income from Dairy Farming

The mean net income amounts to PhP12,377.50 ($211.94) which indicates that, on the average, dairy farming contributes modestly to household income. However, the high standard deviation of PhP38, 332.06 ($656.37) reflects great variability, with some dairy buffalo farmers earning substantially more or less than the average. The minimum net income is very low at PhP2,022.00 ($34.62) while the maximum is at PhP168,000.00 ($2,876.71), showing big disparities in profitability even among those who are cooperative members.

Table 5. Net Income of Dairy Buffalo Farmers from Dairy Farming

	Net income (PhP)
Mean	12,377.50
Standard deviation	38,332.06
Minimum	2022.00
Maximum	168,000.00

There is a significant disparity between the annual household incomes of dairy buffalo farmers who supply milk to the cooperative with those who do not sell their buffalo milk. The mode income for non-suppliers is only PhP20,126.77 ($344.64), while cooperative suppliers exhibit a substantially higher mode of PhP138,395.30 ($2,369.78) – nearly 7 times greater (Table 6). This indicates that the most common income level among cooperative suppliers of milk is significantly higher than independent farmers (those not affiliated with the cooperative). This suggests that cooperative participation may help stabilize earnings at a more sustainable level.

Table 6. Annual Household Income of Suppliers and Non-Suppliers of Milk

	Annual Income	
	Non-suppliers of milk	Suppliers of milk
Mode	20,126.77	138,395.30
Median	67,800.00	180,000.00
Mean	86,681.05	210,092.17
Standard deviation	84,596.37	125,529.32
Minimum	36,000.00	120,000.00
Maximum	336,500.00	444,000.00

The median income for non-suppliers of milk is P67,800.00, while the median income for those supplying their milk to the cooperative is P180,000.00. This confirms that half of the cooperative suppliers earn above P180,000.00, whereas half of the non-suppliers earn below P67,800.00, reinforcing the economic advantage of cooperative membership/participation. In terms of mean income, for the non-suppliers of milk, their mean income is P86,681.05 while mean income for the cooperative milk suppliers is 2.4 times higher at P210,092.17. The higher mean income for suppliers suggests that, on average, cooperative membership/participation correlates with greater household earnings. However, the large standard deviation of P84,596.37 for non-milk suppliers versus P125,529.32 for cooperative milk suppliers indicate income variability in both groups of dairy buffalo farmers.

The income range for non milk suppliers is PhP 36,000-PhP 336,500 while the income range for the cooperative milk suppliers is PhP120,000-PhP444,000. The minimum income of cooperative suppliers of milk (PhP 120,000) is 3.3 times higher than the minimum income of non-suppliers of milk while the maximum income gap is narrower (PhP444,000 vs. PhP336,500). This implies that dairy farmers will indeed benefit from cooperative membership/participation

H_1: Milk suppliers' annual income is higher compared to the annual income of non-milk suppliers

The difference in annual income level of the two groups of dairy buffalo farmers: non-suppliers of milk and milk suppliers to the cooperative was tested using Mann-Whitney U test. With a p-value less than 0.001, it can be concluded that a significant income difference level exists between milk suppliers and non-suppliers of milk group at 5% significance level. The value of "W" or the sum of the groups' ranks for non-parametric test and p-value showed that a significant difference exists between the two groups and therefore one group tends to be higher compared to the other group. Given these findings, we reject the null hypothesis and accept the alternative hypothesis (hypothesis 1), that the income level of milk suppliers is greater than the income of non-milk suppliers.

These findings give empirical evidence for market participation theory, which suggests that integration into formal value chains provides smallholders with access to stable markets, better prices, and essential

support services, thereby resulting to higher incomes (Lantican, et al., 2017).

Table 7. Result of the Independent Samples' Mann-Whitney U Test (one-tailed) for Annual Income

	W	p-value
Annual Income	516.000	< .001

H_2: Age of the members of the two groups of dairy buffalo farmers is not the same

H_3: Number of years in farming of the two groups of dairy buffalo farmers is not the same

Using the Mann-Whitney U-test, the difference in the age and the number of years in farming of the two groups dairy buffalo farmers: milk suppliers and non-milk suppliers were tested. The results of the "W" statistic values and p-values being greater than 0.05 mean that there is no statistical difference existing between the two groups in terms of their age and number of years in farming. Therefore, we accept both the null hypotheses and reject the alternative hypotheses (hypotheses 2 and 3).

Table 8. Result of the Independent Samples' Mann-Whitney U Test (two-tailed) for Age and Number of Years in Farming

	W	p-value
Age	1430.000	0.291
Number of Years in Farming	1430.000	0.290

CONCLUSION AND RECOMMENDATIONS

This study provides empirical evidence on the critical role of institutional support in shaping the dairy buffalo farming enterprises in San Agustin, Isabela, Philippines. The analysis of 132 dairy buffalo farmers reveals a sector at a crossroads, characterized by a duality of opportunity and vulnerability.

The most compelling finding is the transformative economic impact of cooperative integration. Membership in the Sadaco Multipurpose Cooperative is not merely correlated with but is a primary driver of positive economic outcomes. Dairy buffalo farmers who supplied milk to the cooperative exhibited a sevenfold higher modal income (PhP138,395 vs. PhP20,127) and a 2.4-fold higher mean household income (PhP210,092

vs. PhP86,681), a disparity confirmed as statistically robust. The guaranteed market and stable pricing provided by the cooperative establish a vital economic floor, as evidenced by a minimum income for milk suppliers 3.3 times greater than that of non-suppliers (PhP120,000 vs. PhP36,000). This model demonstrates a proven pathway for poverty alleviation and income stabilization.

The highly skewed income distribution – with a mode at PhP26,198 juxtaposed against a mean of PhP107,402 – underscores the deep economic disparities and the urgent need for targeted interventions.

The failure to detect statistically significant differences in age and farming experience between suppliers and non-suppliers is a finding in itself. It indicates that the income disparity shown in H1 is due to the institutional mechanism of cooperative participation rather than to demographic differences between the groups of farmers. This supports the case that cooperative integration results to income outcomes.

Based on these findings, the following recommendations are proposed:

1. Prioritize Cooperative Expansion and Development: Local Government Units (LGUs) and development agencies should actively promote and facilitate cooperative membership. -added production (e.g., cheese, yogurt) to increase profit margins for all members.
2. To address the aging workforce, two initiatives are critical:a) A Formalized Knowledge Transfer Program**:** Create structured mentorship programs that pair experienced older farmers with youth, documenting and preserving indigenous knowledge; b) Next-Generation Incentives: Develop and fund attractive loan schemes, training packages, and starter kits specifically targeted at encouraging youth entry into dairy buffalo farming.
3. Enhance Support for Non-Supplier Farmers: For the 72% of farmers not in cooperatives, immediate efforts should focus on bridging the resource gap.
4. Based on the findings of this study, the following research studies are recommended: a) longitudinal studies on cooperative impact; b) qualitative research on barriers to cooperative membership; c) comparative studies across cooperatives and regions; d) market linkage analysis; and e) assessment of youth engagement and succession interventions.

In conclusion, the sustainability of the dairy buffalo industry in San Agustin, Isabela hinges on strategic institutional intervention. By

leveraging the proven success of the cooperative model while simultaneously addressing the demographic and structural vulnerabilities, stakeholders can transform a struggling supplemental activity into a robust, equitable, and sustainable engine for rural development.

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