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Socio-Economic Status and Relational Analysis among the Factors of Cattle Farming at Jhenaidah District in Bangladesh

Md. Rezaul Islam

Abstract

The study investigated the socio-economic status and relationships among factors of cattle farming in four villages spanning two upazilas of the Jhenaidah district in Bangladesh. Data were collected from 60 cattle farmers engaged in cattle farming. For this purpose, a set of questionnaires was administered, covering the socio-economic features of the farmers, the costs and income from cattle, and the relational variables associated with cattle production. The results revealed that the average family size, percentage of males and females, and age were all significant. The average monthly income and expenditure were estimated at 17,558 and 21,175 thousand BDT, respectively. Most farmers were smallholders, with an average of only 81.91 decimal land for cultivation. Furthermore, the study found that male respondents predominantly participated in decision-making processes, accounting for 87.76% of decisions. The coefficient of yearly family income, age of the respondents, yearly family labor used in cattle farms, land used in primary food production, and family education level suggest that a one-unit increase might contribute to a 0.144, 1.953, 0.412, 0.903 unit increase in income from cattle production in the study area, respectively. However, the coefficients of the number of family members, respondents' traditional experience, land used in agriculture, and herd size of the farm indicate a negative relationship with income from cattle farming. This implies that a one-unit increase resulted in a 1.894, 1.442, 0.017, and 2.092 unit decrease in income, with all other variables held constant. Currently, there is a crying need to address the issues that cattle farmers face, and for that, the authority should propose several initiatives to attain sustainability and functionality.

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1. Introduction:

Cattle farming is an emerging sub-sector of livestock in Bangladesh's agricultural economy, emphasizing profitability in terms of costs and revenue. This sector holds high potential, particularly as the country's traditional agriculture relies on cattle for various activities such as cultivation and transportation of crops to feed its population of 169.1 million people (Ministry of Finance, 2022). With over 65.7% of the population residing in rural areas, Bangladesh's agricultural system is finely attuned to its tropical monsoon climate (Bangladesh Bureau of Statistics, 2022). Consequently, livestock, particularly cattle, plays a crucial role in the country's rural economy.

Cattle, among other livestock species in Bangladesh, are the most versatile component of the existing integrated agricultural farming system (Talukder et al., 2013). Livestock serves various functions such as providing food, nutrition, savings, income generation, draft power, fuel, manure, transport, and contributing to foreign currency earnings through the export of meat, skin, and related products (Al Mamun et al., 2018). Cattle undertake various roles in the production area, including fattening for beef meat, dairying for milk, and as draft animals for transporting agricultural goods, making them essential to the livestock sector. Their feeding habits vary based on factors like time, location, and breed. Traditionally, cattle feed on a variety of natural foods such as green grass, water, rice straw, leaves of different trees, paddy, wheat bran, maize, banana trees, and other solid foods available in agricultural fields and markets. Research by Battese, Malik, & Gill (1996) has shown that the chemical treatment of straw is the most effective and economical method for improving its quality, contributing significantly to the fibrous part of beef cattle diets.

The Directorate of Livestock Services (DLS, 2022) of the Government of Bangladesh has initiated beef-fattening programs to generate income for rural poor farmers. According to DLS reports (2022), the livestock sector contributes 1.47% to the Gross Domestic Product (GDP) and has a GDP growth rate of 3.47%, with approximately 20% of the population directly involved in the industry (Ministry of Finance, 2013). In 2014, there were 787,411 cattle in Sadar Upazila and 853,235 in Sailkupa Upazila, with an average growth rate of 3.32 in Sadar Upazila and 2.3 in Sailkupa Upazila in Jhenaidah District. This indicates higher cattle production in Sadar Upazila than in Sailkupa Upazila. Draught power and manure obtained from animals enhance meat and milk productivity and improve land fertility deficient in organic matter, notwithstanding methane production (Jhenaidah District Livestock Services, 2014).

Traditionally, farmers rear cows for higher profits during the Muslim holy day of Eid-ul-Azha, but modern methods now allow for cattle sales throughout the year, with 50% rearing beef cattle for Eid-ul-Azha. About 28% of farmers believe that the prices of meat and milk do not significantly differ based on selling time, while 22% sell their cattle seasonally. Currently, male farmers contribute more to cattle farming due to modern technology, commercial cow rearing, and women's lesser interest in cow shed tasks. However, over 90% of women believe that they contribute to wealth, economic progress, social awareness, education, and the sustainable management of resources through cattle rearing (Jhenaidah District Livestock Services, 2014).

Primary challenges faced by farmers include high feed costs, inadequate credit options, disease outbreaks, market uncertainties, illicit use of human medications for cattle fattening, fluctuating cattle product prices, and insufficient extension services. Policy and research should focus on manufacturing affordable feeds for fattening, training farmers in feed preparation to reduce costs, and improving access to feeds for maximum efficiency (Moller et al., 2023; Uddin et al., 2012; Baset et al., 2003).

Jhenaidah District in Bangladesh is renowned for its alluvial land, folk culture, and numerous heroes. It is a dominant district in cattle production, with farmers well aware of small-scale beef cattle fattening programs (Jhenaidah District Livestock Services, 2014). The district's primary crops such as paddy, betel leaf, banana, various Robi crops, and oilseeds serve as essential cattle feed. Banana plants have become an important alternative fodder for cattle rearing in the region, while paddy straw remains a favored feed. Farmers in Jhenaidah benefit from increased income from Aus paddy straw, improving their socio-economic status and offsetting losses from paddy farming in recent years, fetching 10,000-12,000 Taka per bigha of land (Kabir, 2020). The rising demand for cattle production has increased the need for cattle feed, particularly straw, reflecting the growing demand for cow rearing. Overall, the cattle farming sector in Bangladesh presents significant opportunities for economic growth and rural development, but it also faces challenges that require strategic interventions and policy support to realize its full potential.

2. Literature review/ Related work:

Many research works were available on various aspects related to the present study in different countries of the world including Bangladesh. The visited study analyzes different sides from different perspectives. However, literature about the financial status and relation among the factors is limited in Bangladesh.

Cattle production in Bangladesh is a vital component of the country's agricultural landscape, supporting the livelihoods of numerous farmers and contributing to the nation's food security. Several studies have been conducted to understand different aspects of beef cattle production systems, including production practices, technological innovations, environmental sustainability, and resilience to natural disasters. Islam et al. (2022) conducted a baseline survey to investigate the beef cattle production scenario in Bangladesh, providing insights into various factors such as demographic information, capital sources for fattening, herd size, duration of fattening, production systems, and feeding systems across different divisions of the country. Their findings highlighted significant variations in these aspects among different regions, underscoring the need for tailored interventions to address specific challenges faced by beef cattle farmers. Kamal et al. (2019) focused on assessing the cattle fattening system in selected regions of Bangladesh, shedding light on the prevalent practices, including the use of mixed feeds, feed ingredients, and growth promoters. Their study revealed the widespread use of steroids as growth promoters, driven largely by factors such as lack of knowledge among farmers and influence from middlemen and feed dealers. The findings underscored the importance of education and training to mitigate the adverse effects of such practices on public health and livestock welfare. Nur-E-alam et al. (2020) addressed the impact of the COVID-19 pandemic on cattle farming in rural areas of Bangladesh and proposed an optimization approach for off-grid hybrid power generation systems to enhance the resilience of livestock farming. By designing and optimizing thin-film coating-assisted hybrid power systems, the study aimed to provide sustainable energy solutions to small- and medium-scale cattle farmers, thereby mitigating the economic challenges posed by the pandemic and other natural disasters. Ruhul Amin et al. (2021) investigated the effects of climate change and natural disasters on cattle farming in selected areas of Bangladesh, emphasizing the vulnerability of livestock rearing to environmental risks. Their study highlighted the need for adaptive strategies to mitigate the adverse impacts of climate change on cattle production and enhance the resilience of farming communities against natural disasters. Sarker et al. (2021) developed a farming system typology to understand the factors influencing technology adoption among farmers in Bangladesh. Their study identified four main farm types based on resource endowment and livelihood orientation, providing valuable insights for policymakers and extension services to tailor interventions that cater to the diverse needs of farming communities. Sarkar and Uddin (2020) explored the

potential of multilayer cattle farming as a sustainable approach to waste management and environmental sustainability in Bangladesh. By implementing two-storied sheds for cattle rearing and integrating biogas plants for waste disposal, their study demonstrated the feasibility of multilayer farming in reducing pollution, promoting sustainable development, and improving economic returns for farmers. In addition to these studies, Akber et al. (2022) highlighted the importance of crop diversification in southwest coastal Bangladesh as a strategy to enhance agricultural resilience and mitigate the adverse effects of land use changes on food security and environmental sustainability. Their findings underscored the critical role of diversified farming systems in promoting economic and environmental sustainability in coastal regions.

Previous research also has delved into the multifaceted roles of livestock, encompassing functions such as food provision, nutrition, savings, income generation, draft power, fuel, manure, transportation, and the generation of foreign currency through meat, skin, and related by-products exportation. Herrero et al. (2013) underscore the importance of livestock in developing countries for income generation, employment, and social safety nets. They advocate for curbing growth to mitigate environmental costs and comprehend its repercussions. Sarma, Raha, and Jorgensen (2014) scrutinized the socioeconomic aspects of cattle farming, revealing that cattle fattening addresses the escalating demand for high-protein foods, thereby enhancing food security and providing avenues for employment, income, investment, and sustainable agricultural practices. Additionally, they identified the profit margin of cattle at BDT 13,350.84 per head, with a benefit-cost ratio of 0.5. Hossain et al. (2016) found that farmers employed cultivated fodder, grass, and vitamin-mineral supplementation, alongside practices like vaccination, deworming, grooming, and the use of hormones, antibiotics, and growth promoters. Md. Quddus et al. (2017) noted demographic, capital, herd size, duration, production, and feeding system disparities among divisions, with most farmers initiating their ventures with personal capital and a minority resorting to NGO and bank loans. Jobirov, Yuejie, & Kibona (2022) identified education, family size, farming experience, and access to farm credits as influential factors in beef meat output, citing cattle population, yield, and slaughtered cattle as key determinants. Rahman (2020) highlighted the varied feed sources utilized by cattle farmers, including rice straw, green grass, and kitchen waste, alongside knowledge of feeding technologies and high-quality fodder cultivation during dry seasons. However, a significant proportion of cattle farmers face feed shortages, lack credit, and incur high costs, prompting the suggestion of reducing feed costs as a viable solution. Datta et al. (2019) examined smallholder farms in Bangladesh, revealing high milk productivity with crossbred cows yielding a substantial net return per cow. Major challenges identified by Sarma, Raha, and Jorgensen (2014) include high feed costs, inadequate credit facilities, disease outbreaks, illicit drug use, price volatility, and insufficient extension services. Belachew (2019) explored analogous challenges in Ethiopia's cattle industry, encompassing feed, working capital, disease outbreaks, and land scarcity. Ahmed et al. (2021) elaborated on challenges faced by farmers, including high feed costs, susceptibility to natural disasters, inadequate credit, disease outbreaks, price fluctuations, insufficient green grass supply, and deficient extension services. Jobirov, Yuejie, & Kibona (2022) identified barriers hindering industry progression, such as human resource shortages, poor pasture governance, feed scarcity in colder seasons, environmental degradation, and limited access to nutritious forages.

Policy and research initiatives should prioritize affordable feed production and educate stakeholders on local feed formulation to enhance efficiency and reduce costs. Belachew (2019) suggested political reforms, diplomatic relations, improved agro-processing, establishment of sugar factories, investment in agricultural research institutes, and adoption of mobile drone technology to optimize fattening practices and augment production capacity. Datta et al. (2019)

proposed policy implications related to modernization and breed management for rural poverty alleviation, employment generation, and household nutrition. Mostak Ahmed et al. (2021) advocated for education on credit access, river erosion control initiatives, beef fattening training, seasonal credit assistance, and the establishment of meat processing enterprises linked with char areas and farmer associations for collaborative beef cattle agribusiness. Kibona, Yuejie, & Tian (2022) recommended Tanzania's policymakers adopt balanced policies for beef farmers to spur development, mitigate poverty, bolster food security, and foster economic growth.

In summary, these studies offer invaluable insights into diverse aspects of beef cattle production in Bangladesh, emphasizing the imperative for integrated approaches to tackle sustainability, resilience, and technological innovation challenges in the livestock sector.

3. Materials and Methods:

3.1. Study Area, sample size

The study was conducted on Sailkupa and Jhenaidah Sadar Upazila in the Jhenaidah district of Bangladesh, where the farmers primarily raise cattle for profit. 60 cattle farmers of meat and milk production were purposively selected to form a final list.

Table 1. Distribution of respondent's number

Upazila	Name of Villages	Number of Respondents
Sailkupa	Dudhsar	10
	Vatai	20
Jhenaidah Sadar	Durgapur	10
	Dukbangla	20

There were 39 beef cattle for meat production and 21 dairy cattle for milk production. 'Face-to-face' interviews with the rural farmers were used to gather data between October 2023 and December 2023. Information was taken from the villages where local, foreign, and cross-breeding cattle were raised. Socio-economic data were collected from the cattle farmers and farm owners providing concentration to cattle farming. Moreover, secondary data on cattle farming were collected from both the Upazila offices. A profit function was used to determine the profitability of the meat and milk market and a regression function to determine the relationship of factors affecting the profitability of beef cattle. The software Microsoft Excel 2010 and IBM SPSS version 25 were used to estimate the relationship among the variables through statistical analysis.

3.2. Profitability Measurement:

The following analytical techniques were used to achieve the objectives of the study. The benefit-cost analysis is a useful tool in determining the profitability of beef and dairy cattle farming.

The formula for estimating profit margin is given as:

$$NP=TR-TC \quad \text{----------(1)}$$

Where, NP=Net Profit, TR=Total Revenue, TC= Total Cost,

Again, TC= TVC+ TFC ----------(2)

TVC= Total Variable Cost and TFC=Total Fixed Cost

3.3. Functional Analysis (Stochastic Frontier Model)

The Cobb-Douglas technical efficiency approach was used, to study the input-output relationship in the production of cattle. The following model was used, to determine the contribution of the most significant variables in the production process of cattle farming in the studied area:

$$Y = \beta_0 x_1^{\beta_1} x_2^{\beta_2} x_3^{\beta_3} x_4^{\beta_4} x_5^{\beta_5} x_6^{\beta_6} X_7^{\beta_7} U_7 \quad \text{----------} \quad (3)$$

The Cobb-Douglas production function was transformed into the following logarithmic form so that the parameter could be solved by applying the Ordinary Least Square Method (OLS). The equation (3) can be written as:

$$\ln Y = (\ln\beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + \beta_7 \ln X_7) + (v_i - u_i) \text{-------} (4)$$

Where,
Y= amount of meat produced
β_0 = constant
X_1= purchasing cost of cattle,
X_2=feed cost on green grass, straw, etc.
X_3= veterinary costs such as cost of treatment, medicine, etc.,
X_4= salary of workers/labor charges of household labor,
X_5= housing purposes cost,
X_6= electricity and others
V_i = error term approach to zero
Ui = error term approach to minimum value but not to zero

4. Results and Discussion:

4.1. Socio-Economic Status of Cattle Farmers in Selected Areas of Bangladesh:

Table 1 represents the holding reports, number of cows, and number of cows per holding of the selected two upazilas.

Table 2: Upazila Basis Comparison of Cattle Production:

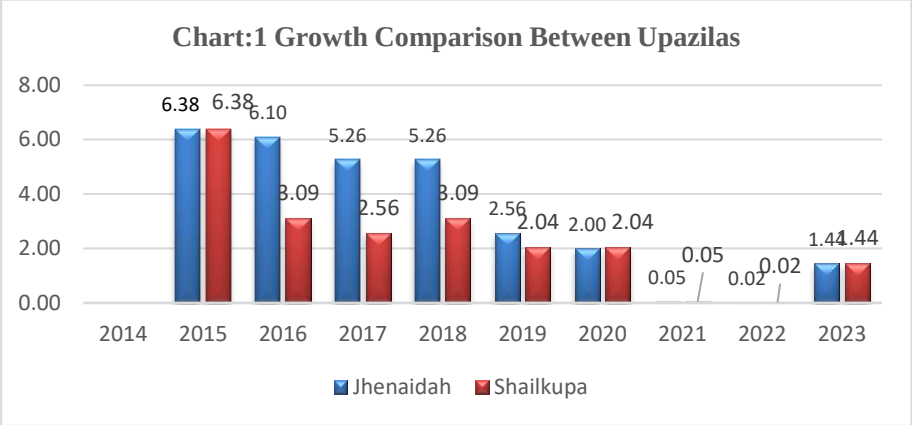
	Jhenaidah Sadar (%)	Sailkupa (%)
Holding reporting	49	51
Number of cows	50	50
No. of cows per holding	48	52

Source: Agriculture Census 2019.

From Table 1 it can be determined that the percentage holdings of Jhenaidah Upazila is less than that of Sailkupa Upazila, the number of cows is the same as Sailkupa, and in the case of the number of cows per holding in Sailkupa is in advance comparing with that of Jhenaidah Sadar upazila. The number of cows per holding in Sailkupa is greater than that of Jhenaidah Sadar Upazila although the holding report is less in Jhenaidah Sadar. This can be interpreted that the cattle farmers in Sailkupa are more influenced in cattle farming and they are more facilitated.

4.2. Comparative Analysis of Cattle Production of Both the Upazilas:

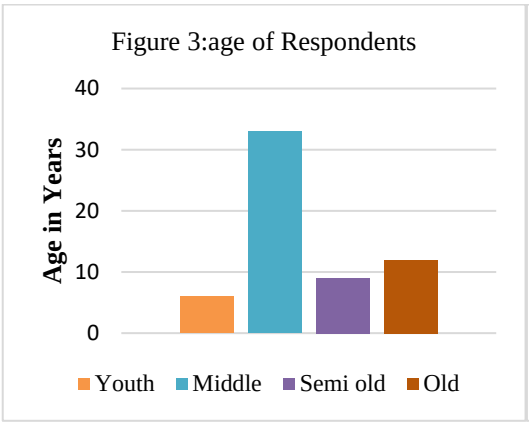
The following chart 1 shows the growth rate of cattle in Jhenaidah Sadar and Shailkupa Upazila in Jhenaidah district. In 2015 the growth rate of meat in both the Upazillas is the same. But since then the growth rate of both the upazilas started to fall. This falling rate of Sailkupa is faster than that of Jhenaidah Sadar in 2020. After 2020 it is seen that the rate grows up and in 2023 the growth rate of Shailkupa is 2.44 which is greater than that of Sadar Upazila, Jhenaidah.

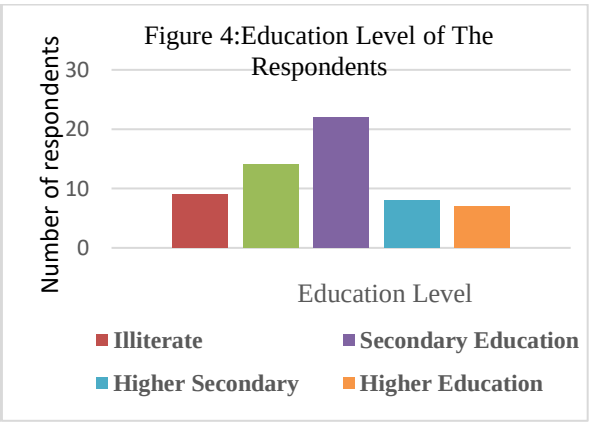


Source: Agriculture Census 2019.

The study categorized farmers into four age groups as youth-aged, middle-aged, semi-older, and old-aged. The majority (55%) were middle-aged, with 25% in the young age group, 16.7% in the semi-elderly, and 3.3% in the old age group.

The average age of farmers was 46.7 years. The farmers of the majority middle-age group are more technical than the respondents of other groups and they know the production and treatment system of cattle. They expected young and particularly middle-aged farmers (about 76%) to be more active, energetic, enthusiastic, well-experienced, and more acquainted with performing beef fattening (Rahman, 2017). Younger farmers were also sincere and knowledgeable about modern cattle production and treatment techniques. The respondents of the old age group 60+ have traditional knowledge which can be the cause of damaging cattle population.





Most respondents had 4-5 (55%) members, with a few having 8+ members. Large families are essential for cattle farming, as they can establish medium-sized farms and share labor for profitability. The average family size was 4.48 which can be compared to Rahman, (2021) as it was 4.23. Male respondents (90.83 %) and female respondents (9.17%), in responding, showed more male farmers' attendance in the area and answered the questions frequently. Despite this gap between male and female participants, it was seen that a good number of women took part in sharing in the cattle farms and even they were to work more consciously than male farmers. However, the women respondents were seen as smarter in delivering data about cattle raising. Even some female participants demand that the amount of work done in the household be more than that of male respondents. Some of them even orally argued with the interviewers about the amount of work they do on the cattle farms. Categorically, more than 86% of respondents do not have facilities in cattle farm-related training, 90% in

marketing, and 95% in transporting and communication. It can be stated that a great number of farmers are deprived of production-related facilities.

Table 3. Distribution of respondents according to Relational Factors

Variables	Category		Frequencies	Percentage
Gender	Male		55	90.83
	Female		5	9.17
Age(Year)	Up to 30	Youth	6	10
	31 to 50	Middle	33	55
	51 to 60	Semi old	9	15
	>60	Old	12	20
Family Size (Per household members)	Small Family (2-3)		15	25
	Medium Family (4-5)		33	55
	Semi Large Family (6-7)		10	16.7
	Large Family(7^{+})		2	3.3
Education	Illiterate		9	15
	Primary Education		14	23.33
	Secondary Education		22	36.67
	Higher Secondary		8	13.33
	Higher Education		7	11.67
Occupation (Main)	Agriculture		58	96.67
	Industry		0	0
	Business		2	3.33
	Service		0	0
	Cattle Farming		0	0
Occupation (optional)	Agriculture		0	0
	Industry		0	0
	Business		0	0
	Service		5	8.33
	Cattle Farming		55	91.67
Access to Training Facilities	Yes		8	13.33
	No		52	86.67
Access to Credit Facilities	Yes		6	10
	No		54	90
Access to marketing facilities	Yes		5	8.33
	No		55	91.67
Access to transport and communication facilities	Yes		57	95
	No		3	5
Access to Veterinary Facilities	Yes		53	88.33
	No		7	11.67

Source: Field survey

Table 3 demonstrates the number and percentage distribution of respondents by farmers' sex, age, family size, education level, occupation (main and optional), and some categorical variables such as access to training facilities, access to credit facilities, and access to veterinary facilities. Figure 2 shows that among the respondents, 15% were illiterate and they could neither read nor write. 23.33% of respondents who could read and write as well. They completed primary education by any means. Some 36.67% passed SSC and 13.33% HSC. The rest 11.67% obtained higher education from different universities. The higher educated people were not seen as quite serious in rearing cattle though they were knowledgeable about cattle farming. From Table 1, it was visible that only 13.33% of people had access to training facilities, 10% loan facilities, and 8.33% veterinary facilities which are hindrances to the progress of this sector. However, the online communication system was better as 95% of respondents opined.

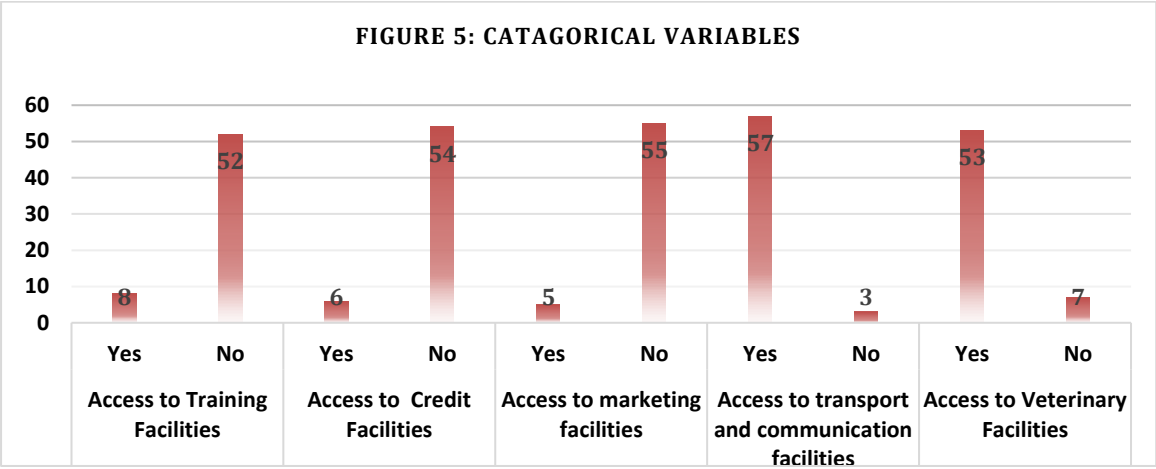
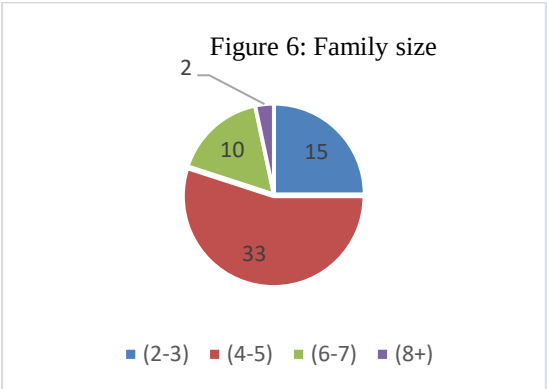
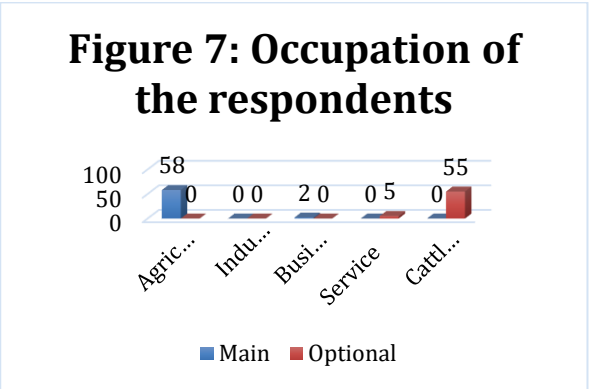


Figure 5 shows the number of respondents who had access to training facilities, credit facilities, marketing facilities, transport and communication facilities, and, veterinary facilities. This implies that all the sources of facilities for the cattle farmers are very low except the marketing facility. Anyone can at present enter the cattle market easily with a mobile phoning system. Even it is not difficult to visit the market as the transport system is easier than before. By using the internet through mobile and other different devices, they can learn everything about the condition of the cattle market. Hence, uncourtly to improve this sector of development, the authority should facilitate the farmers as per the policy of the government. In this study, four sources of capital were available in the money market for cattle farming such as credit from banks, non-governmental organizations (NGOs), relatives, and money investors. According to the capital source regarding cattle farming, 10% of respondents (6 people out of 60) took loan facilities from different sources. Among them, 50% were from different NGOs like BRAC, Ashah, and Jagoroni Chacro, and the rest 50% took credit from the Bank. The rest of the cattle farmers (90%) used their capital for fattening purposes. Credit from other sources of capital was seen as zero. The results of this study are nearer to Sarker, A. K., et al. (2017)[40] who reported that 57% used their capital, 10% used bank loans, and 33% from other sources such as NGO loans and lending for fattening purposes. Technological knowledge significantly aids in cattle rearing with cattle farming-based training.

It significantly improves knowledge and skills in various agricultural technology areas. Among all other cattle farmers, only 13.33% of farmers took short time training. 82.67% did not train in cattle farming. This study shows that cattle farmers experienced on short time training usually in different government and non-government organizations (NGO), and commented 50% as 'very good', 37.5% as good, 0% as 'not sufficient', and 12.5% as 'moderate'. 36% of farmers had expertise in feeding technology and making high-quality animal feed.





They applied cattle feeding technology and obtained satisfactory results. 24% of respondents did not know about food processing, mixing, making molasses, etc. Even they still applied the traditional system in their cattle farms.

4.3 Profitability analysis for cattle fattening: An analysis of cattle farming results showed that the costs associated with different inputs, such as cattle purchasing cost, feed cost on green grass, straw, etc., veterinary costs such as cost of treatment, medicine, etc., the salary of workers and labor charges of household labor, electricity, maintenance cost, and others are considered as the variable cost of cattle farming. Conversely, depreciation on fixed capital and equipment such as cow sheds including its boundary wall, floor, roof, sturdy drinkers, spades, wheelbarrows, buckets, and rakes, were the fixed cost of cattle farms. The following Tables 2 and 3 show the profit of beef and Dairy production:

Table 4. Cost and income from beef cattle fattening

Return from cattle farming		Expenditure for cattle farming	
Earning Items	Amount in thousand BDT	Expending Items	Amount in thousand BDT
Cattle Selling	166.231	Initially purchasing cost (PC)	75.846
Cow dung is used as household fuel	.717	Feed Cost (FC)	28.752
Cow dung is used as organic fertilizer in self-land	.558	Veterinary Cost (VC)	2.286
Cow dung sold as fuel and fertilizer	.561	Labor cost LC)	9.257
Others		Fixed Cost (FxC)	.532
		Electricity, Mosquito coil, Management, etc. Cost (EMMC)	1.477
Total	168.067	Total	118.15
So Profit = TR-TC= 49.917		BCR=1.42	

*Source: Survey data

According to Table 4 the purchase value of the beef cattle (n_2=39) was the highest unevenly, with operational expenses making up roughly 64.19% of variable costs and only .45% of fixed production costs. The most crucial input utilized in the fattening procedure, and the 2nd largest cost component, is feeder cattle which cost 28.752 thousand BDT at the time while studying. The average profit margin in the table is 49.917 thousand BDT and BCR is 1.42 which is greater than 1. This implies that this sector of production is efficient for the farms and the farms' owners can invest in this sector of the agriculture economy. The second highest cost for cattle farming is feed cost which is 24.33% of total cost. Per cattle cost averages 28.752 thousand BDT per year for feed only. The minimum household labor cost is 9.257 thousand BDT which is included. The table 5 given below examined the returns from dairy farms (n_1=21) focusing on small and medium dairy farmers in the study area. Farmers sold raw milk to various consumers, bazaars, sweet shops, wholesalers, and neighbors at various price levels. They also sold milk to the company of milk product producers such as Milk Vita etc. on an irregular basis. The average amount of milk per cow per day was 6.143 liters, with a money value of 368.580 BDT. Md. Ariful Alam et al. (2022) reported that the production of milk per cow per day is 12.5 liters which is more than that of the present study. The reason is that Md. Ariful Alam et al (2022) studied the study area Dhaka and data were based on large farms, and the dairy farms were almost based on foreign species such as Holstein Friesian milking cows. Net return per cow per year from Holstein Friesian milking cows is much more than generally raised local or cross-breeding cows.

Table 5. Cost and income of dairy cattle farmers:

Return from cattle farming		Expenditure for cattle farming	
Earning Items	Amount in BDT ('000)	Expanding Items	Amount in BDT ('000)
Cattle Selling	178.428	Initially purchasing cost (PC)	111.857
Cow dung is used as a household fuel	.717	Feed Cost (FC)	28.694
Cow dung is used as organic fertilizer in self-land	.558	Veterinary Cost (VC)	2.286
Cow dung sold as fuel and fertilizer	.561	Labor cost (VC)	7.551
Household milk selling	55.286	Fixed Cost (FxC)	.822
Household Milk consumption	10.571	Electricity, Mosquito coil, Management, etc. Cost (EMMC)	1.957
Total Revenue(TR)	246.121	Total Cost (TC)	153.167
So Profit = TR-TC= 92.954		BCR=1.61	

**Source: Survey data,

Net average returns from our respondents' dairy cows were measured at Tk. 92.954 thousand BDT per cow per year. This implies that dairy milk production was a profitable enterprise for small and medium dairy farmers and the result is nearer to line with the findings of Alam et al. (2022). The average fixed cost per cow per year was .822 thousand BDT which includes the cost of house building and maintenance costs for cattle farming. The average variable cost is greater than the fixed cost. This study estimated the financial efficiency of dairy milk production using NPM (Net Profit Margin) and BCR (Benefit-Cost Ratio) and found BCR equals 1.61 which is suggested to have a higher return on investment than previous studies. Therefore, dairy farming was found to be a more profitable enterprise than beef cattle farming in the study area.

5. Determinants of participation in Cattle Farming in the study area:

To investigate the determinants of cattle production, linear regression analysis was applied and the relation among the variables related to cattle production was produced, provided in Table 4 and Table 5. Both the table shows the relationship between the dependent variable and independent variables which are explained below:

5.1. Analysis of Regression for Effectiveness of Factors:

The average revenue per cattle production was 195.385 thousand BDT whereas the NPM of beef cattle fattening was 49.917 thousand BDT. Sarma P.K., et al. (2014) estimated average NPM of beef cattle was 13.351 thousand BDT. The price of meat, milk, and cattle by-products has increased by these time tremendously. Moreover, in 2013-2014, Bangladeshi cattle farmers did not use technical equipment in cattle farming.

Table 6. Results of regression analysis: Descriptive Statistics of Total Revenue from Cattle Farming

Descriptive Statistics			
	Mean	Std. Deviation	N
Average revenue	195.39	83.58	60
Yearly average family income	254.10	177.48	60
The average age of the respondents	46.07	12.23	60
Average Number of family members	4.48	1.83	60
Average labor used yearly	7.67	4.79	60
Average experience of the respondents	22.27	12.23	60
Average land used in agriculture in decimal	141.07	178.38	60
Average land for primary food production	16.97	28.28	60
Ave. education level	1.83	1.20	60
Ave. hard size of the farm	6.17	4.11	60

** Ave-Average,

They did not raise improved cross-breeding and species of foreign cattle like Holstein Friesian. However, the internal demand for beef meat increased and the supply failed to fill the gap. Probably the fact was that there was a ban on cattle exporting from India, and Myanmar in the fiscal year 2013-2014. Before this fiscal year, a huge number of cattle were imported into Bangladesh crossing the India and Bangladesh border legally or illegally. As a result, the price of meat increased. The farmer increased their investment and the production increased. The average age of the respondents is 46.07 years according to Table 6. P.K Sharma et al., (2014)[43] showed that the average age of the respondents was 45.00 years which is nearly equal to that of the present study.

5.2. Effect of Explanatory Variables on Total Income from Cattle Farming

To calculate the effect of explanatory variables on the annual revenue from cattle farming, a linear regression model was fitted. Six explanatory factors were related to the average annual income from cattle farming.

Table 7: Results of Regression Co-efficient of cattle fattening in the study area:

Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	57.748	49.375		1.170	.248
	Yearly family income	.144	.056	.307	2.587	.013
	Age of the respondents	1.935	.909	.283	2.130	.038
	Number of family members	-1.894	5.080	-.041	-.373	.711
	Labor used yearly	.412	1.946	.024	.212	.833
	Experience of the respondents	-1.442	.979	-.211	-1.474	.147
	Land used in agriculture in decimal	-.017	.077	-.036	-.216	.830
	Land for primary food production	.903	.498	.306	1.813	.076
	Education level	26.823	9.090	.384	2.951	.005
	The herd size of the farm	-2.092	3.018	-.103	-.693	.492

a. Dependent Variable: Total Revenue from the Cattle Farming

Education as one of the explanatory variables was statistically significant among all others estimated. However, the result was statistically insignificant, while there was a favorable correlation between age, family members, farming experiences, land use in crop production, and cattle farming. From Table 5, the coefficient of age of the respondents reveals that it was positively related to the income from cattle farming in the study area of Bangladesh. This can also be interpreted as every one-unit increase in age might contribute to a 1.935-unit increase in cattle farm income. Moreover, one unit increase in each land used for primary food production, labor used yearly, yearly family income and education level of the respondents might provide respectively 0.903, 0.412, .144, and 26.823 unit increase in income from cattle farming. This means that these factors are contributing positively in the case of cattle meat and milk production in the study area. On the other hand, the coefficient of family members, experience of the respondents, land used for agriculture crops production of the respondents, and herd size of the farms are negatively related to the yearly income from the cattle farms. These factors showed the adverse relation of the explanatory variables with the income from cattle farming.

Conclusion:

The findings of this study shed light on the socio-economic dynamics and key factors influencing cattle farming in the Jhenaidah district of Bangladesh. The significant relationships identified between various socio-economic variables and income from cattle production underscore the complexity of this sector and the multifaceted nature of rural livelihoods. Notably, factors such as family income, respondent age, labor input, land use patterns, and education level emerged as crucial determinants of income generation in cattle farming. However, the study also revealed

challenges faced by cattle farmers, including limited land holdings, gender disparities in decision-making processes, and negative associations with certain socio-economic factors such as family size, traditional experience, agricultural land use, and herd size. These findings highlight the need for targeted interventions aimed at addressing these challenges and promoting sustainable livelihoods among rural farming communities. To mitigate the obstacles identified in this study, it is imperative for authorities and stakeholders to implement initiatives that enhance access to resources, provide training and capacity-building opportunities, and improve market linkages for cattle farmers. Additionally, efforts should be made to promote gender equality and inclusive decision-making processes within the cattle farming sector, ensuring that all members of the community have a voice in shaping their livelihoods. Overall, addressing the issues identified in this study will require a collaborative and multi-dimensional approach involving government agencies, non-governmental organizations, community-based institutions, and other relevant stakeholders. By prioritizing the needs of cattle farmers and implementing targeted interventions, it is possible to foster sustainable development, improve rural livelihoods, and enhance the functionality of the cattle farming sector in Bangladesh.

Applications

The findings of this study have practical implications for various stakeholders involved in the cattle farming sector in the Jhenaidah district of Bangladesh. The applications derived from the research are outlined below:

Policy Formulation: The identified socio-economic factors influencing income from cattle farming can inform the development of targeted policies. Policymakers can use this information to design interventions that address specific challenges faced by cattle farmers, such as providing financial support, training programs, and access to technology.

Capacity Building Programs: Based on the study's results, there is a need for capacity-building initiatives targeting farmers. Training programs can focus on improving traditional practices, introducing modern technologies, and enhancing financial literacy. These programs can empower farmers to adopt more efficient and sustainable practices, thereby increasing their income.

Gender-Inclusive Decision-Making: The study highlights the dominance of male respondents in decision-making processes. To promote gender inclusivity, interventions should be designed to encourage the active participation of women in decision-making related to cattle farming. This could involve awareness campaigns, training, and support for women in assuming leadership roles.

Resource Allocation: Understanding the factors influencing income in cattle farming allows for more targeted resource allocation. Government agencies, NGOs, and other stakeholders can direct resources to areas that need the most support, whether it be in providing financial assistance, improving veterinary services, or facilitating access to markets.

Community Development Initiatives: The study emphasizes the importance of addressing challenges faced by smallholder farmers. Community development initiatives can be tailored to enhance infrastructure, access to credit, and veterinary services in areas with limited resources. This can contribute to the overall well-being of the community.

Research and Extension Services: The findings can guide future research in cattle farming by identifying areas that require further exploration. Extension services can use this information to disseminate knowledge and best practices among farmers, promoting the adoption of improved techniques and technologies.

Market Interventions: Understanding the socio-economic dynamics influencing income is crucial for market interventions. Efforts can be made to stabilize market prices, establish fair trade practices, and create market linkages for cattle farmers. This can contribute to a more equitable and profitable cattle farming sector.

In summary, the applications derived from this study provide actionable insights for policymakers, development practitioners, and community leaders to formulate strategies and interventions that enhance the socio-economic conditions of cattle farmers in the Jhenaidah district of Bangladesh.

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