

# Economic Analysis and Supply Chain of Backyard Pig Rearing in Tribal Households of Rangamati District, Bangladesh

## Abstract

This study investigates the economic analysis of pig farming on the livelihoods of tribal women at the Belaichhari Upazila of Rangamati district. The study aims to assess how pig rearing improves the economic status of tribal women and enhances their knowledge of pig husbandry practices. Data were collected through a structured questionnaire using a purposive sampling technique. The research employs descriptive and econometric statistical analysis to evaluate the socio-economic characteristics and the profitability of pig farmers. The findings reveal most of the farmers are from the Chakma community (66%) and 22% and 12% are from Tanchangya and Marma community, respectively. 72% of pig farmers are from age range of 21-30 and 31-40 which indicates participation young population in pig farming. The study shows that net return and gross margin were 4836.8 BDT and 19332.12 BDT, respectively indicating profit of the farm. A benefit-cost ratio (BCR) of 3.14 for full costs and 3.09 for cash costs basis, indicating that pig farming is economically profitable and sustainable in the region. Additionally, the study reveals six marketing channels for pig and pork, highlighting inefficiencies that reduce farmer profits, despite 40% using direct sales for better returns. Besides the study highlights the significant challenges faced by farmers, which could hinder the growth and sustainability of pig farming. The study concludes that pig farming plays an important role in improving the livelihoods of tribal women. Govt and non govt agencies should take further support for development and, enhance this sector sustainable and profitable.

**Keywords:** Tribal, Socio-economic, Pig farming, profitability

## 1. Introduction

Bangladesh is among the world's most densely inhabited nations and its primary industry is agriculture. Along with, livestock is also a crucial industry for Bangladesh in producing animal sourced protein, reducing unemployment, poverty, and generating empowerment [3]. In the tribal and underprivileged sections of society, one of the most significant livestock that contributes to raising the socioeconomic standing is pig [11]. Pigs are known for their quick growth and exceptional reproductive ability among livestock breeds [2,12]. They are genetically better than ruminants in turning feed into meat. They are said to be twice as efficient as ruminants [11]. For pork consumers, pigs are considered the most affordable and abundant source of animal protein [6,11].

Even with their remarkable qualities, pigs in Bangladesh have not received much attention up to this point [1]. There hasn't been much focus on pigs because cultural and religious taboos have an impact on pig production in Bangladesh. As a consequence, pig farming in Bangladesh is predominantly practiced by non-Muslim minority communities [7]. Pig rearing is primarily carried out by underprivileged individuals in the districts of Rangamati and Khagrachari who lack the resources and know how to increase production [6]. The socio-economic status of farmers in hilly regions is a significant topic for research, as they face complex, varied, and high-risk living conditions. Their reliance on traditional agricultural and livestock practices often results in low productivity [5]. The most common way to rear pig in those areas is by backyard farming which is unhygienic and not socially supportive. The production and profit from the pig rearing is unnoticed and less reported. For tribal communities, pig farming holds

a vital role in their farming practices, serving as a key element in their efforts to sustain their livelihoods [11]. Pigs do not contribute to the loss of pasture land, thus they can be raised in enclosures their entire lives [11]. So, every ethnic group raises one or two pigs for domestic purposes [4].

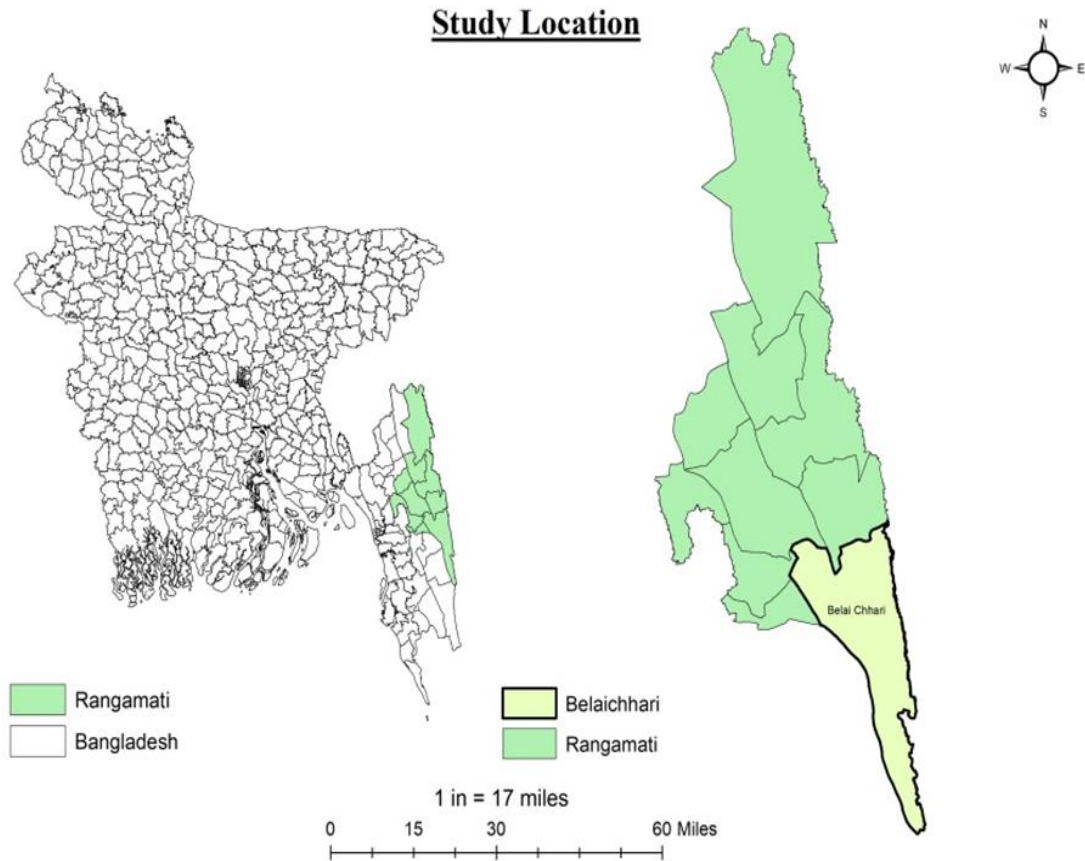
According to some studies, raising pigs was mostly done to generate emergency funds or provide food for domestic consumption [11]. In Bangladesh, the productivity of domestic pig breeds is low, as they are often reared on garbage, kitchen waste, and human excreta, which negatively affects production. Due to their high growth rates, exotic breeds, especially Yorkshire, Landrace, Hampshire, and Poland China, are gaining popularity day by day [8]. There is little information available about pig farming in rural areas, including housing, feeding, breeding, disease management, vaccination, biosecurity and marketing. Due to the lack of balanced feed and limited access to veterinary care, piglets often died, and pigs struggled with different health issues [15]. Despite facing problems with raising pigs, still some people choose to raise pig and earn supportive income from the selling of animals and mostly from their products which can be used in different sectors such as invest in farm assets, pay for school fees and medical treatments.

Notably, a government-operated pig farm is located in the Rangamati Hill District, while wild relatives of indigenous pigs have been observed in forested regions (Rangamati and Hill Tracts). In the context of Rangamati, pig farming holds potential for enhancing social empowerment through improved livelihoods [14]. Due to the conventional production structure, there is still a significant imbalance between the supply and demand for pork [11]. By focusing on sustainable pork farming and processing, this approach can empower women while also enhancing food security and promoting gender equality. There was no study yet to assess the profitability of tribal women through pig rearing in Rangamati district. So, this research aims to measure the profitability of pig rearing of tribal women and marketing channel of pig in the Rangamati district. So, the current approach was conducted to evaluate the socio-economic characteristics, assess the profitability of pig farmers in the study areas. Also find out pig and pork marketing channel lastly identify the problems faced by tribal women during pig rearing, diagnosis and long-term care.

## **2. Materials and Method**

### **2.1 Study Area and Duration**

The study was conducted in the Belaichhari Upazila of Rangamati district and it was carried out in the month of May, 2024. This area is purposely chosen on the basis of availability of pig farming in every households.



**Figure 1.**Study area of Belaichhari Upazilla, Rangamati District

## **2.2 Selection of Sample**

Fifty tribal households were selected on a random process depending on the presence of pigs and each household rear at least three pigs in the study area. The respondents are basically tribal women.

## **2.3 Questionnaire Preparation**

The questionnaire was designed to gather information about the pig production system in accordance with the study's objectives. The socioeconomic characteristics of pig owners were the focus of its material, which included housing, feeding, breeding, marketing, and a crucial challenge with pigs' production, along with further data..

## **2.4 Collection of Data**

All associated data were obtained using a pre-tested questionnaire when visiting the households of pig farmers in the study. The farmers enthusiastically gave all the relevant data as they were given a brief idea of importance and the purpose of the study before interviewing

## **2.5 Data entry and analysis**

Following data collection, the questionnaire was reviewed and entered into an MS-Excel spreadsheet and then transferred to STATA program (Stata,14, Statistical software) for analysis.

## 2.6 Statistical Analysis

A descriptive method was used to identify socio-economic traits and production challenges, and farm profitability was assessed through specific equations.

### 2.6.1 Cost estimation

- i. Total Cost (TC) = Total variable cost (TVC) + Total fixed cost (TFC).
- ii. Total operating cost (TOC) = (Feed cost + Purchase cost (piglet) + Veterinary cost + Labor cost + Miscellaneous cost).

iii) Total variable cost (TVC) = TOC + Interest on OC (where interest rate 7%      (1)

1. Variable cost (TVC): Variable costs refer to expenses directly tied to production activities. These include feed, veterinary care, labor, and other miscellaneous expenses necessary to sustain operations.

a. Feed cost: Feed expenses are measured by the amount of feed the pig consumes, multiplied by the market price of the feed.

b. Veterinary cost: It represents the cost related to animal health like vaccination, medication.

c. Labor cost: In the analysis, family labor was regarded as an opportunity cost.

d. Miscellaneous cost: These include electricity cost, water and other cost.

2. Fixed cost (TFC): Housing and equipment depreciation are components of fixed costs.

a. Depreciation of housing and equipment. It was calculated on the basis of straight-line method. The formula is as follow:

$$\text{Depreciation} = (\text{Original value} - \text{Salvage value}) / (\text{Life of the house or equipment})$$

### 2.6.2 Estimation of return

$$\pi = \text{TR} - \text{TC}$$

$$= \text{QP} - (\text{TVC} + \text{TFC}) = \text{NR} \quad (2)$$

$$\text{GM} = \text{TR} - \text{TVC} \quad (3)$$

$$\text{BCR (full cost basis)} = \text{TR} / \text{TC} \quad (4)$$

$$\text{BCR (cash cost basis)} = \text{TR} / \text{TVC} \quad (5)$$

Where,

$\pi$  = Profit

Q= Output (pig) P=Sale Price NR = Net return

TVC = Total Variable cost TC = Total cost

TR = Total return GM = Gross margin

BCR = Benefit cost Ratio

### 2.6.3 Marketing Channel of pig and pork

Marketing channel of pig refers to the group of people, organizations, and actions that work together to move pig and pork products from producers to the consumers

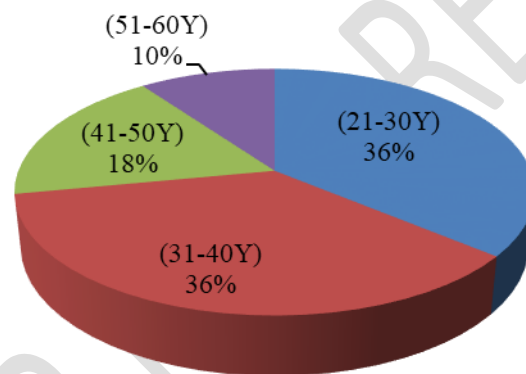
## 3. Results

### 3.1 Socio-economic characteristics of the farmer

Several socio-economic statuses of the farmers such as age, education, occupation, experience, training, family size, monthly income etc. were calculated and presented below:

#### 1. Age (years):

The age distribution of farmer's shows that 36% are in the 21-30 and 31-40 age groups, indicating young farmer in pig production. Only 18% are aged group 41-50, and a smaller percentage (10%) falls into the 51-60 age group.



**Figure 2:** Age group (%) of the pig farmers.

#### 2. Marital Status

A significant majority (84%) of women are married, while 16% are unmarried, suggesting that farming is predominantly a family-oriented occupation in this area.

**Table 1 : Marital Status of pig farmers**

Marital status	Frequency(n=50)	Percentages
Unmarried	8	16
Married	42	84
Total	50	100

### 3. Occupation

The primary occupation of the farmers includes housewives (40%) and farmers (30%), with a few engaged in other occupations such as labor, shop keeping, and tailoring, reflecting a diverse economic engagement.

**Table 2 : Occupation status of pig farmers**

Occupation	Frequency	%
Farmer	15	30
Housewife	20	40
Labor	3	6
Shopkeeper	5	10
Student	3	6
NGO Job	1	2
Tailor	1	2
Politician	1	2
Cleaner	1	2
Total	50	100

### 4. Other Household Income:

The table also lists other sources of household income, with agriculture being the most common occupation (40%), followed by labor (30%) and shop keeping (10%).

**Table 3. Other household income of the pig farmers.**

Other Household Income	Frequency	%
Agriculture	20	40
Shopkeeper	5	10
Day Labor	15	30
Driver	5	10
Institutional Cook	1	2
Other Livestock	4	8
Total	50	100

### 3.1.1 Other Socio-economic characteristics of pig farmers in the study region

**Table 4. Other Socio-economic characteristics of pig farmers in the study area**

Parameter	Category	Frequency	Percentage	Mean
Year of schooling	0 to 4	29	58	4.81
	5 to 10	16	32	
	11 to 16	4	8	
	17 to above	1	2	
Income of women	1000-5000	48	96	3270
	6000-10000	1	2	
	11000-12000	1	2	
Family size	1 to 5	35	70	4.5
	6 to 10	15	30	

The table 4 presents following socio-economic parameters of the pig farmers in-volved in the study:

#### 1. Year of Schooling:

The educational background reveals that 58% of farmers have completed 0 to 4 years of schooling, while 32% have 5 to 10 years. Only a small fraction (10%) has more than 10 years of schooling, indicating limited educational attainment among the farmers.

#### 2. Income of Women:

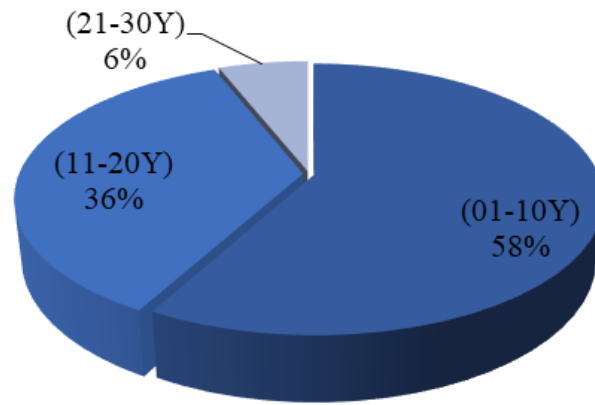
The income data shows that a vast majority (96%) of women earn between 1000-5000, with very few earning higher amounts, indicating a low-income level among women in the community.

#### 3. Family Size:

Most families (70%) have a size of 1 to 5 members, while 30% have 6 to 10 members, suggesting a relatively small family structure.

### 3.1.2 Experience of the pig farmers:

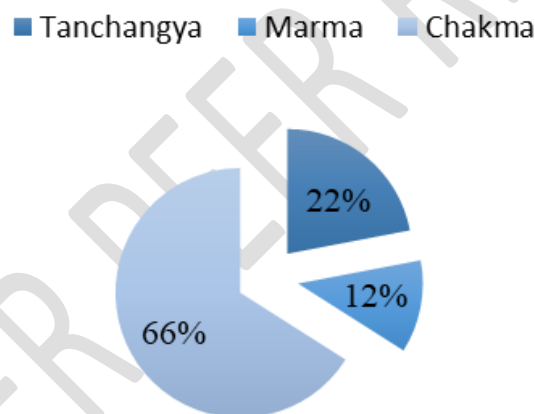
Experience in farming is predominantly between 1 to 10 years (58%), with fewer farmers having more extensive experience (11 to 20 years at 36% and 21 to 30 years at 6%).



**Figure 3.** Experience of farming (%) of the farmers.

### 3.1.2 Tribal affiliation of the pig farmers

Figure 4. Indicate that majority of the pig farmers are from Chakma community (66%), while 22% and 12% are from Tanchangya and Marma community, respectively.



**Figure 4.** Tribal affiliation (%) of the sample farmers

**Table 5: Cost analysis of per pig**

Cost items	Mean $\pm$ SD (BDT)	Min. (BDT)	Max. (BDT)
Piglet cost	4906 $\pm$ 227.15	4000	5000
Labour cost	101.25 $\pm$ 30.64	62.5	125
Feed cost	3017 $\pm$ 493.8	2100	4200
Medicine cost	332 $\pm$ 56.93	200	500



Miscellaneous cost	118.4 ± 15.95	100	150
Total operating cost	8474.65 ± 557.2	7125	9825
Interest on operating cost	593.23 ± 39.004	498.75	687.75
<b>Total variable cost (TVC)</b>	<b>9067.88 ± 596.2</b>	<b>7623.8</b>	<b>10512.8</b>
Housing cost	85 ± 18.52	33.3	116.7
Equipment cost	30.16 ± 6.74	22	50
<b>Total fixed cost (TFC)</b>	<b>115.2 ± 6.74</b>	<b>65.3</b>	<b>152.67</b>
<b>Total cost (TVC+TFC)</b>	<b>9183.04 ± 595.4</b>	<b>7770.42</b>	<b>10638.8</b>

### 3.2 Cost analysis of per pig

The cost analysis of pig farming is crucial for understanding the economic viability of farming management. The cost structure in pig farming typically includes various components such as piglet cost, feed cost, housing cost, veterinary care, and labor cost. These costs can significantly impact the overall profitability of pig farmers in the study region

#### 1. Piglet cost

Among the costs piglet cost is the major cost where average cost is 4906 BDT per piglet. The lowest cost recorded is 4000 BDT, and the highest is 5000 BDT as shown in Table 5. This indicates that purchasing piglets is a significant expense, and the costs are relatively stable since the SD is small.

#### 2. Labour cost

Average labour cost per pig is 101.25 BDT with a standard deviation of 30.64 BDT. This shows that the labour cost is low, as family labor was considered as an opportunity cost in this study.

#### 3. Feed cost

Feed is often the largest expense in pig farming. Pigs require a balanced diet to grow efficiently, and the cost of feed can fluctuate based on market prices and availability. This aspect is particularly important as pigs are noted to be more efficient FCR (Feed Conversion Ratio) than ruminants, which can influence overall costs and returns. Here in table 5. Average cost for feed per pig is 3017 BDT with a standard deviation of 493.8 BDT.

#### 4. Medicine cost

Another crucial cost is veterinary care and medication cost where Average cost is 332 BDT with a standard deviation is 56.83 BDT explains that pig farmers gives a very little attention to pig health. So, it can be said that Veterinary cost is not very significant in this study.

## 5. Housing and equipment cost

Proper housing is essential for pig farming to ensure the health and productivity of the animals. But in Table 5. Shows a very low housing cost as pig farmer's rear pig in backyard in free ranging system.

In summary, a comprehensive cost analysis is essential for pig farmers to enhance their profitability and improve their economic conditions, especially in the context of the socio-economic challenges faced by underprivileged communities.

### 3.3 Profitability Analysis

The profitability of pig farming in Belaichhari Upazila was estimated by calculating gross margin, net return and benefit cost ratio.

**Table 6: Profitability of per pig production**

Parameters	Mean $\pm$ SD (BDT)	Min. (BDT)	Max. (BDT)
Total cost (TC)	9183.04 $\pm$ 595.4	7770.42	10638.8
Total return (TR)	28400 $\pm$ 4956.96	20000	40000
Gross margin (GM)	19332.12 $\pm$ 4836.8	10503.8	30677.63
Net return (NR)	19216.96 $\pm$ 4824.75	10367.8	30527.63
BCR (Full)	3.09 $\pm$ 0.52	2.08	4.2
BCR (Cash)	3.14 $\pm$ 0.53	2.1	4.3

For sustainable farming, measuring profitability is essential. Profitability of a farm can be estimated by calculation gross margin, net return and BCR. In Table 6 it shows that Net return and gross margin were 4836.8 BDT and 19332.12 BDT, respectively indicating profit of the farm.

#### 3.3.1 Benefit Cost Ratio Analysis (BCR)

BCR is the ratio of total return and total cost. Figure 5. Represents BCR (cash cost) and BCR (full cost) basis for per pig.

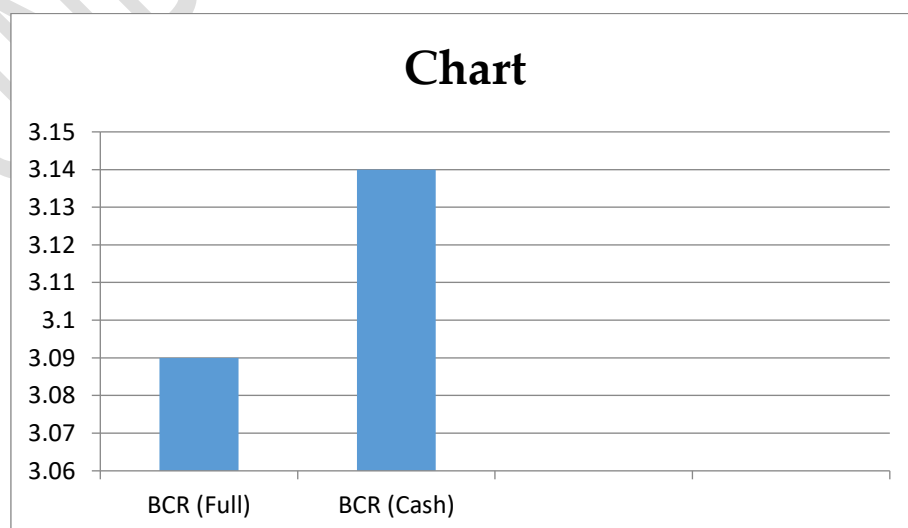


Figure 5. Comparison of Benefit Cost Ratio.

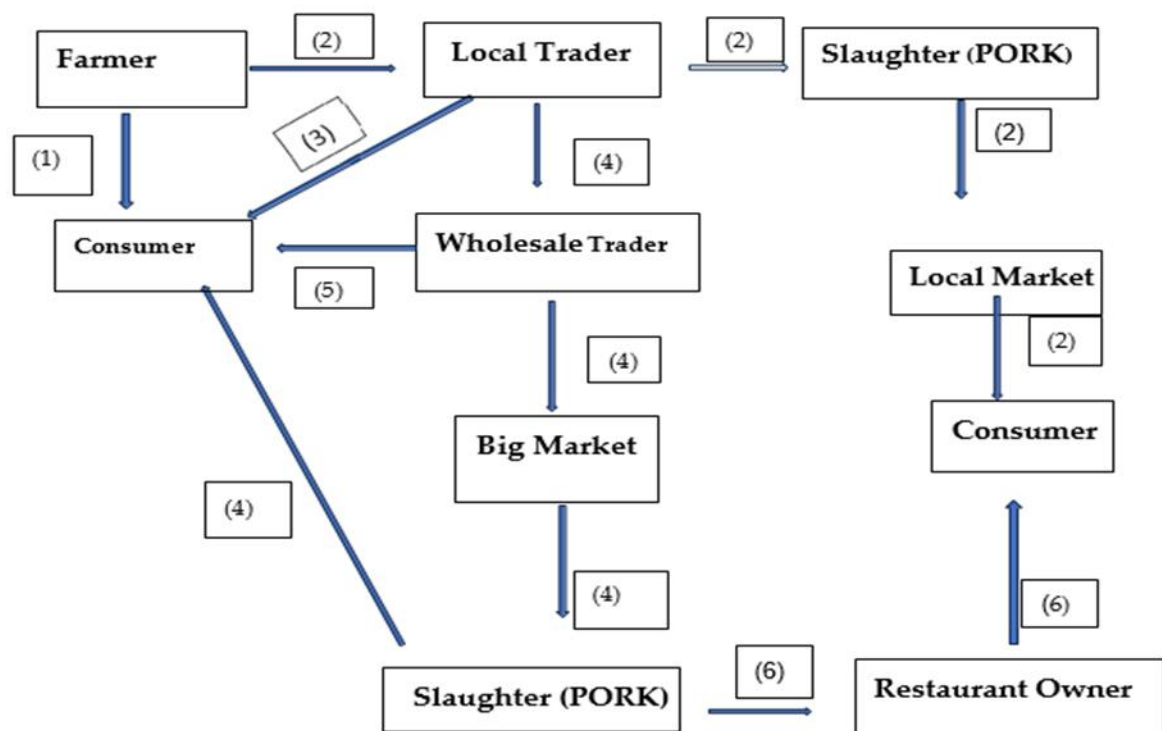
The benefit-cost ratio indicates the return on investment. BCR is greater than 1 indicates that the benefits outweigh the costs. From Table 6. Benefit cost ratio (cash cost basis) and Benefit cost ratio (full cost basis) were 3.14 and 3.09, respectively. Both BCR suggest that the operation is generating a reasonable return on investment. However, BCR 3.14 and 3.09 indicates that pig farming is economically profitable and sustainable in the study area.

### 3.4 Marketing channel

Marketing channel refers to the channel in which products are supplied from producers to the consumers.

In the study area six marketing channels were found for pig and pork marketing. The marketing channels are following:

1. Farmer → Consumer
2. Farmer → Local trader → Slaughter → Local market → Consumer
3. Farmer → Local trader → Consumer
4. Farmer → Local trader → wholesale trader → big market → Slaughter → Consumer
5. Farmer → Local trader → wholesale trader → Consumer
6. Farmer → Local trader → wholesale trader → big market → Slaughter → Restaurant owner → Consumer



**Figure 6:** pig and pork marketing channel in the study area

Channel 1 is a direct marketing channel which is directly from the producers to the consumers. Here, the most important marketing channel is the local trader who act as the middlemen in three ways: firstly supplying pork in the local market (Local Trader also can act as the slaughterer), secondly by supplying directly to the consumers and thirdly by introducing wholesale trader in the marketing channel. Wholesale trader contributes his role by supplying pig in the big market and also directly to the consumers. From big market it gets supplied to the consumers directly or by restaurant owners after being slaughtered. This scenario of the marketing channel of pig and pork was found in the study location (Figure 7).

### 3.5 Problems faced by farmers

**Table 7. Problems faced by the farmers in the study area.**

Problems	Frequency	%
Lack of land	48	96
Lack of capital	40	80
Feed cost	39	78
Lack of veterinary service	50	100
Demand fluctuations	43	86
Disease outbreaks	24	48
Climate related issues	48	96
Predation	48	96

The provided table highlights the significant challenges which have faced by the farmer in the study location. The most prevalent problems include:

- **Lack of land:** This is the most pressing issue, affecting 96% of the farmers. Limited land availability restricts their ability to expand their operations and increase production.
- **Lack of capital:** 80% of farmers identified this as a problem, suggesting that access to financial resources is limited, hindering their ability to invest in inputs, equipment, or expansion.
- **Feed cost:** 78% of farmers cited feed costs as a challenge, indicating that the cost of feed is a significant burden on their operations.
- **Every respondent :** (100%) reported that the absence of veterinary services is a critical issue. This means they cannot get help for sick animals, which can lead to larger problems.

Other significant problems include demand fluctuations, disease outbreaks, climate-related issues, and predation. Addressing these problems is crucial for improving the livelihoods of farmers and ensuring the sustainability of agricultural production in the region. Potential solutions could include land reforms, access to credit facilities, subsidies for feed, improved

veterinary services, market information systems, disease control programs, climate-resilient agricultural practices, and predator management strategies.

#### 4. Discussion

This study highlights the economic viability and socio-economic impact of pig farming among tribal households in the Belaichhari Upazila of the Rangamati district. The findings revealed a high Benefit-Cost-Ratio (BCR) exceeding 3.0 emphasizing the profitability of backyard pig farming in this region which corroborate those of [5,11], who observed that pig farming significantly contributes to the livelihoods of marginalized communities. The net return per pig (19,216.96 BDT) further reinforces the economic potential of this activity. The Benefit-Cost Ratio (BCR) exceeding 3.0 indicates that pig farming in the study area is highly profitable, aligning with similar profitability studies in rural Tanzania and Botswana [9,10]. However, feed costs, which accounted for a significant proportion of total variable costs, emerged as a critical constraint for farmers. As observed in [5], feed price volatility often reduces farmers' profitability. To address this, interventions such as feed subsidies or the introduction of alternative, locally available feed sources could mitigate costs and stabilize earnings.

According to [13], most of the respondents were marginal farmers (59.11%), followed by small farmers (19.01%), landless farmers (16.41%), and large farmers (5.47%). Nearly all the farmland (94.80%) was unirrigated, with only a small portion (5.20%) being irrigated. In contrast, the farmers in this study all own their land. Similar to V. Ramesh et al.'s findings, all the farmers in their study raised desi pigs mainly for fattening rather than breeding, a practice that aligns with the observations in our study.

In many countries, studies on rural pig farming have highlighted the low education levels among pig farmers. For example, study [10] reported that in Botswana, only 25% of pig farmers had completed secondary education. Similarly, studies [11] found that in Tanzania, just 14.6% of pig farmers had reached secondary school. In Bangladesh, [6] observed a slightly higher figure, with 20.8% of farmers attaining secondary or higher education. The findings from the current study align with these observations, revealing that 58% of pig farmers in the study area had no more than four years of schooling. This underscores the pressing need for accessible educational programs and support tailored to the needs of rural farmers.

Most of the numbers of pig farmers in this research were women, indicating the gendered nature of pig farming in tribal communities. This finding is consistent with observations by [14], who highlighted the role of women in managing small-scale live-stock farms in marginalized groups. The participation of younger farmers (72% under 40 years) in this study diverges from patterns in other regions, such as Botswana [10], where older individuals predominated in pig farming. This demographic shift presents an opportunity for targeted interventions focusing on youth capacity building and skill development, which could enhance the long-term sustainability of the sector.

Several challenges were identified, including limited access to veterinary services (100% of respondents), lack of land (96%), and climate-related issues (96%). The absence of veterinary support is particularly concerning, as it increases susceptibility to disease outbreaks and mortality [9]. Similar constraints were noted by [6] in rural Bangladesh. Addressing this issue through mobile veterinary clinics or community health workers could significantly improve animal health and farm productivity. Disease management programs, including mobile veterinary units and vaccination drives, could significantly improve herd health and reduce losses. The lack of dedicated land for pig farming forces many farmers to rely on backyard spaces, which may not be optimal for growth or hygiene. This finding aligns with [6], who

observed similar constraints among tribal pig farmers in Bangladesh. Innovative solutions, such as community farming models or government-leased land, could alleviate these constraints.

The findings highlight the need for targeted policy interventions to address the systemic challenges faced by pig farmers. Programs promoting low-interest loans, feed subsidies, and access to veterinary care are critical for scaling up production. Similar initiatives in Tanzania [9] and India [11] have demonstrated success in empowering smallholder pig farmers and improving their livelihoods. Collaboration between government bodies, NGOs, and local communities could ensure the effective implementation of such policies. The significant involvement of women in pig farming underscores its potential as a tool for gender empowerment. As noted by [14], livestock farming often provides women with direct income and decision-making authority, which can enhance their socio-economic status. Tailored training programs for women in pig husbandry, entrepreneurship, and financial management could amplify these benefits, fostering greater gender equity in tribal communities.

In the study area, six marketing channels were identified for pig and pork distribution, showing how products move from farmers to consumers. The fragmented marketing channels identified in the study suggest inefficiencies that limit farmers' profits. Channel 1 is the simplest, where farmers sell directly to consumers without any intermediaries. Direct-to-consumer channels (used by 40% of farmers) provide better returns but are less scalable.

In the other channels, local traders play a crucial role. They act as middlemen in three main ways: supplying pork to local markets (sometimes also serving as the slaughterers), selling directly to consumers, and introducing wholesale traders into the process. Wholesale traders further distribute pigs to larger markets or sell them directly to consumers. From the larger markets, pork either reaches consumers directly or is purchased by restaurant owners, who process it for their customers after slaughtering. This structure highlights the diverse roles of local traders and wholesale traders in connecting farmers to consumers; ensuring pork is available at both local and large-scale markets. Establishing cooperative models or market linkages could help farmers negotiate better prices and access larger markets. Similar studies in Botswana reported lower economic returns and higher educational requirements for success [9,10]. The higher profitability in Rangamati suggests that the region has unique advantages, such as traditional knowledge and community-driven practices that can be further leveraged.

In summary, while pig farming presents significant opportunities for economic empowerment, particularly for tribal women, the associated challenges must be addressed through targeted interventions. Future studies should explore the environmental impacts of pig farming and the role of government policies in supporting this sector. While this study provides valuable insights, it also identifies areas for further research. Longitudinal studies evaluating the long-term socio-economic and environmental impacts of backyard pig farming could provide a more comprehensive understanding.

## **5. Conclusions**

The study on pig farming in the Bilaichari Upazila of Rangamati district provides valuable insights into this agricultural activity's economic viability and social impact. The findings demonstrate that pig farming is a profitable enterprise, with a benefit-cost ratio exceeding 3.0, indicating a significant return on investment. Moreover, the study highlights the positive impact of pig farming on the livelihoods of farmers, particularly tribal women, who have benefited from increased income and improved knowledge of husbandry practices. However, the study also identifies several challenges faced by pig farmers, including limited access to veterinary services, fluctuations in demand, and disease outbreaks. Addressing these challenges is crucial for ensuring the long-term sustainability of pig farming in the region.

Overall, the study concludes that pig farming is a promising economic activity in the Bilaichari Upazila, capable of contributing to improved livelihoods and economic development. By addressing the identified challenges and providing appropriate support to farmers, the potential of pig farming can be fully realized, leading to a more prosperous and sustainable future for the local community.

## References

1. Anower, A. K. M., Ahmed, M., Rahman, M. M., Hasan, A., Islam, M. A., & Rahman, L. (2017). Hygienic farming system improved pig-rearers' livelihood status in South-West region of Bangladesh. *International Journal of Avian and Wildlife Biology*, 2(3), 91–97.
2. Phookan, A. P., Laskar, S., Aziz, A., & Goswami, R. N. (2006). Reproductive performance of indigenous pigs of the Brahmaputra Valley of Assam. *Indian Journal of Animal Science*, 78.
3. Cole, D., Todd, L., & Wing, S. (2000). Concentrated swine feeding operations and public health: A review of occupational and community health effects. *Environmental Health Perspectives*, 108(8), 685–699.
4. Dey, T. R., Dey, A. R., Begum, N., Akther, S., & Barmon, B. C. (2014). Prevalence of endoparasites of pigs at Mymensingh, Bangladesh. *IOSR Journal of Agriculture and Veterinary Science*, 7(1), 31–38.
5. Gcumisa, S. T. (2013). The untold story of the pig farming sector of rural KwaZulu-Natal: A case study of Uthukela District. *Doctoral Thesis, University of South Africa, South Africa*.
6. Hossain, M. E., Chakma, S., Khatun, M. M., Hasanuzzaman, M., Miah, M. Y., & Biswas, M. A. A. (2011). Production systems of swine in the rural areas of Rangamati and Khagrachari districts of Bangladesh. *Bangladesh Journal of Animal Science*, 40(1), 28–33.
7. Islam, A., Trisha, A. A., Safiul, M., Sardar, A., Akbor, M., Al Mamun, A., & Nahar, Z. (2021). Pig raising practices by unprivileged, ethnic people in Bangladesh. *Age*, 15(1), 35.
8. Johnson, A. K., Morrow-Tesch, J. L., & McGlone, J. J. (2001). Behavior and performance of lactating sows and piglets reared indoors or outdoors. *Journal of Animal Science*, 79(10), 2571–2579.
9. Karimuribo, E., Chenyambuga, S., Makene, V., & Mathias, S. (2014). Characteristics and production constraints of rural-based small-scale pig farming in Iringa region, Tanzania. *Age*, 1(1), 3–10.
10. Nsoso, S. J., Mannathoko, G. G., & Modise, K. G. (2006). Monitoring production, health, and marketing of indigenous Tswana pigs in Ramotswa village of Botswana. *Journal of Animal Health*.
11. Patr, M. K., Begum, S., & Deka, B. C. (2014). Problems and prospects of traditional pig farming for tribal livelihood in Nagaland. *Indian Research Journal of Extension Education*, 14(2), 6–11.
12. Prakash, M. G., Ravi, A., Punya Kumari, B., & Srinivasa Rao, D. (2008). Reproductive and productive performance of crossbred pigs. *Indian Journal of Animal Science*, 78(11), 1291–1296.
13. Ramesh, V., Vigneshwaran, S., Sivakumar, K., Singh, D., Ramakrishnan, S., & Chinnamani, K. (2018). Analysis of socio-economic status of tribals and pig husbandry

practices in Kolli Hills, Namakkal District of Tamil Nadu, India. *Indian Journal of Veterinary Science and Biotechnology*, 13.

14. Ritchil, C. H., Faruque, M. O., Tabassum, F., Hossain, M. M., & Bhuiyan, A. K. F. H. (2013). Socio-economic status of pig rearers and management system of native pigs in Bangladesh. *Indian Journal of Animal Science*, 83.
15. Safranski, T. (1999). Outdoor pig farming. *Journal of Animal Health and Wealth*, 11(1), 1–6.

UNDER PEER REVIEW