



## Economic supply chain analysis of Hilsa Fish Landing Centers (Maach Ghats) in Bangladesh: Operational insights and strategies

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Received: January 2024

Accepted: April 2024

### Abstract

The Chandar Khal Puran Bery Hilsa Fish Landing Center in Raipur Upazila, Laxmipur District, Bangladesh is vital to the local fishing economy, as revealed by a comprehensive economic supply chain analysis conducted from January to December 2019. This study, employing a mixed-methods approach, integrates qualitative and quantitative data gathered through focus group discussions, semi-structured interviews, direct observations, and surveys with key stakeholders including fishers, traders, and other fisheries-dependent professionals. The research uncovered significant infrastructural challenges at the landing center, including inadequate facilities, substandard hygiene conditions, and limited storage and preservation capabilities. Despite these obstacles, the center serves a vibrant fishing community of over 2,400 individuals, primarily engaged in hilsa fishing. Hilsa constitutes an impressive 90% of total fish landings, with peak season yields reaching up to 2.0 tons per day. The research cataloged nine types of fishing gear and three types of craft, with mechanized kusha boats predominating. Hilsa pricing and distribution are influenced by size, weight, and market dynamics, with distinct supply chains for local and distant markets. The study delves into the complex interactions among fishers, mahajons, arotgars, and paikers, highlighting their interdependent roles in credit flow, fish distribution, and profit-sharing. To address the identified challenges, including environmental concerns and market inequities, the study recommends constructing cold storage facilities, enhancing market infrastructure, and implementing policy reforms. These recommendations aim to improve operational efficiency, product quality, and sustainability, guiding stakeholders toward supporting the long-term viability of the hilsa supply chain while fostering sustainable practices and economic growth in the region.

**Keywords:** Distribution Channel, Economic Supply Chain, Hilsa Fish, Landing Center (Maach Ghat) and Stakeholder Dynamics.

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## Introduction

Hilsa shad (*Tenualosa ilisha*, Hamilton 1822), locally known as 'ilish' in Bangladesh, stands as a cornerstone of the nation's fisheries industry, embodying both cultural heritage and economic significance (Islam *et al.*, 2017). Renowned for its rich nutritional profile, including high protein, essential amino acids, and beneficial fatty acids, Hilsa is the most esteemed fish species, contributing 12% to total fish production and 1.0% to the national GDP (Gross Domestic Product) (Mamun *et al.*, 2024). Bangladesh leads the world in hilsa catch, contributing 86% of the global total, with India and Myanmar accounting for 8% and 4%, respectively (Rahman *et al.*, 2018). The implementation of the Hilsa Fisheries Management Action Plan (HFMAP) has driven production to remarkable heights, reaching 517,198 tons in 2017-18 (Islam *et al.*, 2020). Beyond its economic impact, the Hilsa sector provides direct employment to over 0.50 million fishers and supports millions more in ancillary industries (Beveridge *et al.*, 2013; Islam *et al.*, 2016; Mamun *et al.*, 2024).

This study focuses on the Chandar Khal Puran Bery Maach Ghat, a prominent fish landing center along the Meghna River embankment in Raipur upazila, Laxmipur district. Fish landing centers, or 'Maach Ghats', serve as crucial nodes in the economic supply chain, facilitating the processing, sorting, and distribution of fish (NOAA, 2006). The Meghna River, with its vast estuary covering 35,000 km<sup>2</sup> (FAO, 2011), plays a vital role in Hilsa

migration and the livelihoods of fishing communities (Roy and Habib, 2013).

Our research endeavors to conduct a comprehensive economic supply chain analysis of the Chandar Khal Puran Bery Hilsa Fish Landing Center, with a focus on its procurement, transportation, processing, storage, and distribution processes. Located in the Laxmipur district, a region that significantly contributes to Bangladesh's Hilsa production, the center plays a crucial role in the national fisheries sector. This study aims to evaluate the operational efficiency and economic impact of the center, providing valuable insights for policymakers, fisheries managers, and stakeholders.

The analysis will explore the center's integration into the region's socioeconomic fabric, identifying opportunities to enhance its contribution to local livelihoods and the national economy. By building on existing literature (Islam *et al.*, 2017; Mamun *et al.*, 2024; Chowdhury, 2012; Banglapedia, 2023), this research offers a critical examination of a key component in Bangladesh's fisheries industry. The findings will present a detailed perspective on the economic dynamics of Hilsa fish landing centers and their broader implications for national development and community well-being.

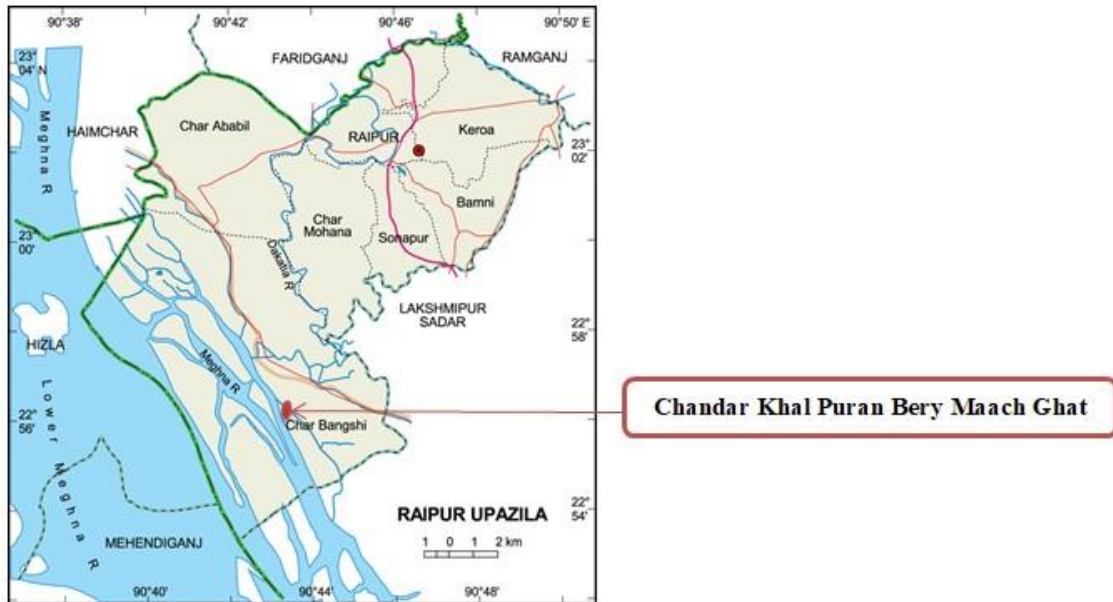
## Research methodology

### *Study area and time frame*

This study was conducted at the Chandar Khal Puran Bery Maach Ghat, located in

Char Gashia, 2no Uttor Char Bongshi, Raipur Upazila, Laxmipur District, Bangladesh (N 22° 56.718', E 090° 49.142') (Fig. 1a and b). The research

spanned from January to December 2019.



**Figure 1(a): Map showing the location of Chandar Khal Puran Bery Maach Ghat under Raipur Upazila of Bangladesh.**



**Figure 1(b): Map displaying the study location with precise GPS coordinates.**

### *Research design*

A mixed-methods approach was employed, combining qualitative and quantitative techniques to comprehensively analyze the economic

supply chain of the hilsa fish landing center.

### *Data collection*

Data were collected through focus group discussions (FGDs), semi-structured

interviews, direct observations, surveys, and key informant interviews. Participants included various fisheries-related stakeholders, such as fishermen, landing station traders, and other fisheries-dependent professionals.

#### *Data analysis*

Both qualitative and quantitative data were analyzed to assess river fish diversity, fishing community characteristics, fishing gear and craft composition, fish landing quantities, pricing systems and structures, wharf transaction systems, fish distribution channels, stakeholder relations, infrastructure quality, and manpower efficiency.

#### *Research activities*

The study encompassed key activities such as profiling the fish landing center, identifying associated fishing communities, analyzing fishing craft and gear composition, quantifying fish landings, monitoring fish selling and pricing systems, identifying operational challenges, analyzing stakeholder dynamics, mapping the economic supply chain, and investigating hilsa distribution systems.

#### *Recommendation formulation*

Based on the research findings, strategies were developed to address infrastructural inadequacies, manpower shortages, operational inefficiencies, market diversification needs, and economic performance enhancement.

#### *Limitations*

The study acknowledges potential variations in results due to factors such as geographical location, seasonal changes, economic fluctuations, data collection timing, the number of landing stations, fishery policy changes, and river tides. These variables should be considered when interpreting the results and in future studies.

#### **Result**

##### *General profile of the chandar khal puran bery Maach Ghat*

The Chandar Khal Puran Bery Maach Ghat exemplifies the underdeveloped state of many fish landing centers in Bangladesh. Spanning approximately 20 decimals, this center operates with minimal infrastructure, highlighting the challenges faced by the local fishing industry.

##### *Infrastructure and facilities*

The center features a basic 8-foot-high tin roof structure with partial walls, covering a soil floor. Notably absent are essential amenities such as office space and electricity. Ten arotdars (fish traders) conduct their business from designated areas equipped with rudimentary tables for transactions. The lack of specialized areas for critical activities such as fish landing, grading, cleaning, and packing underscores the center's limited development. Focus group discussions reveal that during peak fishing periods, grading sometimes occurs on boats before landing, while at other times, it takes place on auction

tables based on paikers' (wholesalers') demands.

#### *Hygiene and sanitation*

Hygiene standards at the center are suboptimal. The absence of clean water sources forces reliance on river water for fish cleaning and other purposes. Sanitation is a low priority, evidenced by the lack of a proper drainage system. This deficiency results in muddy, difficult-to-navigate conditions during trading hours. Common hygienic practices, such as the use of sterilizing chemicals or thorough cleaning of fish and containers, are notably absent.

#### *Storage and preservation*

Storage facilities at the center are inadequate, primarily due to insufficient ice supply and the absence of nearby ice factories. The center relies on a single ice supplier who transports ice from Chandpur district by boat. Arotdars typically store fish for one day in cocksheets boxes with ice. The center possesses only two insulated metal boxes, each measuring 5 feet by 2.5 feet by 3 feet, capable of preserving up to 5 Mon (200 kg) of hilsa fish for 5-7 days. These boxes are lined with white polythene sheets and utilize a 1:1 ratio of fish to ground ice for preservation.

#### *Associated fishing community in this landing center*

According to respondent data, the landing center is associated with a total of 2,402 people across various stakeholder groups. These include

Fishers from four primary Hilsa fishing villages (Char Gashia, Char Induria, Char Bongshi, and Char Jalia), as well as those involved in fish trade services and input supply (Table 2). Additionally, fishers from the Barisal and Chandpur regions occasionally sell their catches at this center. In 2018, an estimated 250 tons of Hilsa and 30 tons of other fish species were landed here, providing employment for approximately 2,000 fishers. The fishing villages primarily deliver their catch to designated arotdars; however, due to access restrictions imposed by dadons (loans), fishers often receive suboptimal prices for their catch.

#### *Associated fishing craft and gear at the landing center*

##### *Fishing craft*

The study identified three types of fishing craft at the landing center: kusha, holi, and anniwala fishing boats. All fishing boats are mechanized, with engines ranging from 16 to 32 HP, except for a few kusha nouka. Of the 285 fishing crafts observed, 235 were motorized, while 50 were non-motorized. Mechanized kusha nouka (28-32 HP) represented the highest percentage at 76%, followed by non-mechanized kusha nouka at 17%, mechanized holi nouka at 6%, and mechanized anniwala boats at 1% (Fig. 2).

##### *Fishing gear*

The research identified nine types of fishing gear in the study area, with current jal comprising the highest percentage at 37%, followed by thela jal

at 25%, jhaki jal at 12%, chewa jal at 8%, moia jal at 6%, poa/baua jal at 4%, and chor gora/net jal and kona/gulti jal both at 3%. Chandhi/ilish jal accounted for 2% of the fishing gear observed (Fig. 3). The most popular gear used includes large and small mesh gillnets, with small

meshed gillnets (current jal) primarily deployed in wider areas due to the migratory nature of hilsa, while others target specific species.

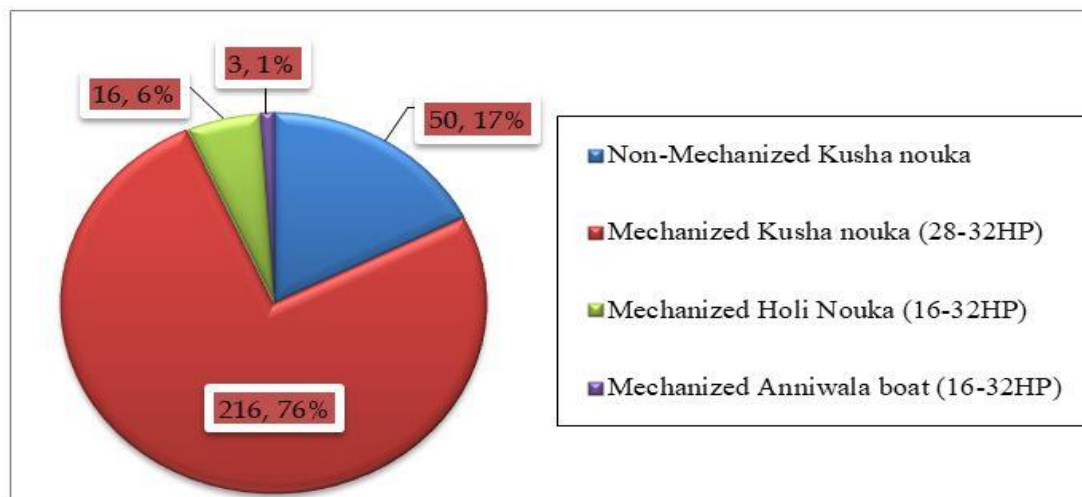


Figure 2: Composition of Fishing Craft .

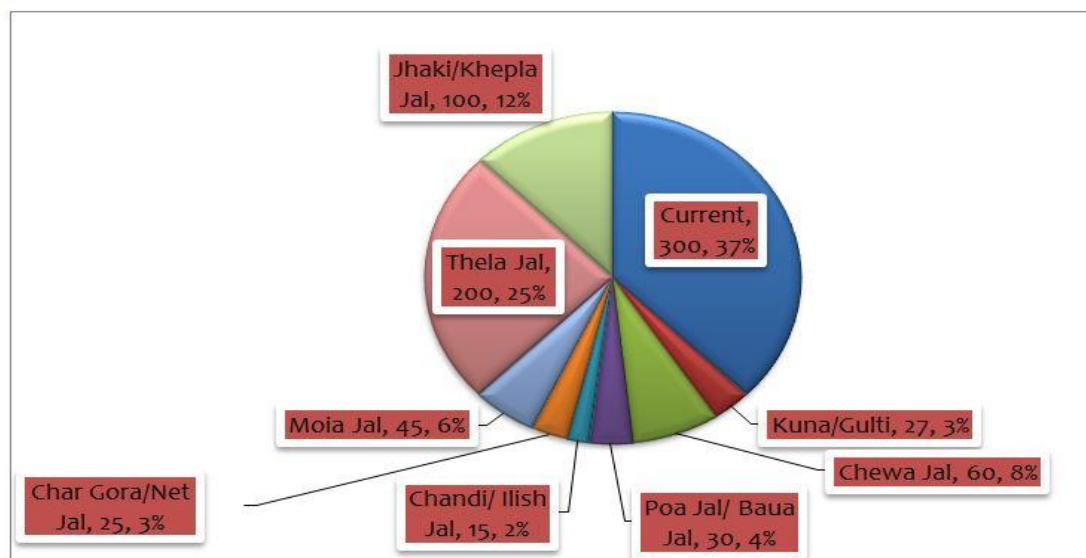


Figure 3: Composition of Fishing Craft.

#### Quantity of fish landing

Fishers come to the landing center to sell their catches from the Meghna River, gathered from various locations. Among

the fishes landed at this center, Hilsa takes the crown, constituting a whopping 90% of the total catch. In comparison, other species like Prawn, Bata, Bele,

Chewa/Siring, Poa, Topshi, Shilong, Koral, Shol, and Air make up the remaining 10% collectively. This breakdown underscores the significant dominance of Hilsa in the catch, making it the primary and most regularly landed

species (Fig. 4). During peak season, approximately 2.0 tons/day of Hilsa are landed, followed by 0.75 ton/day during semi-peak and 0.25 ton/day during off-peak seasons. (Fig. 5).

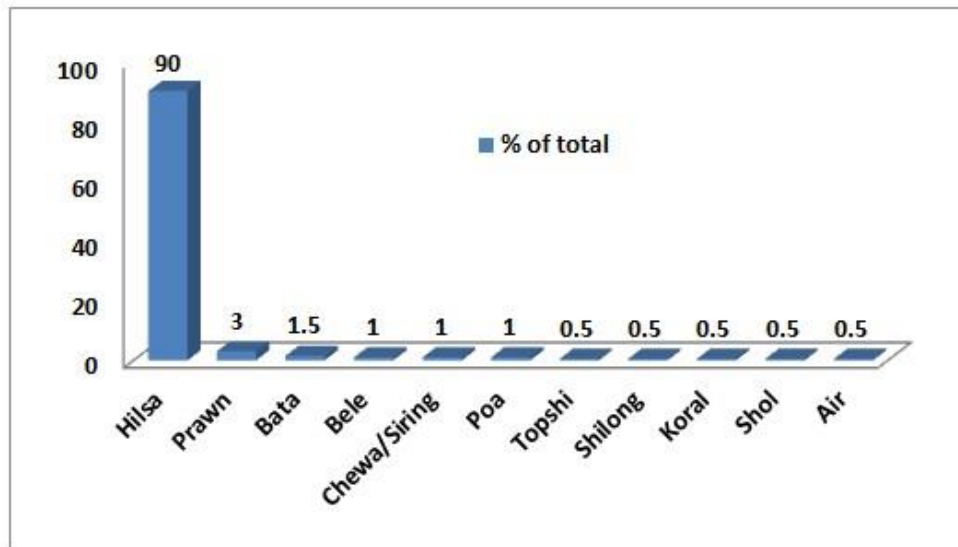


Figure 4: Percentage (%) of total Capture Fish.

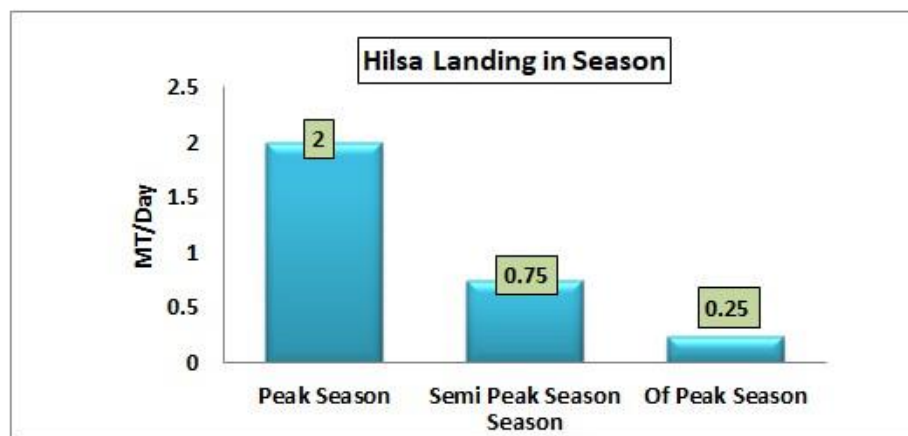


Figure 5: Season wise Hilsa landing in this landing center.

#### *Selling system of fish*

According to study, the fish market operates twice a day, with specific trading hours (from 6 am to 11 am and 2 pm to 4 pm depending on high-tide). The fish are categorized based on species, size, and quality. Hilsa fish are sold in units of hali (4 pieces), while other types

of fish are sold in bulk. Fishes are sold by fishers through the name of mahajon to paikers with the engagement of arotdars (commission agents). The arotdars play a key role in facilitating the sale of the fish, charging a commission rate of 5-8% (which is varied on the amount of dadon) and also sometimes

intentionally retains a small quantity of fish from Fishers.

### *Pricing of Hilsa*

The pricing of Hilsa fish follows a structured system, primarily determined through open auctions conducted by arottdars and paikers. Within this framework, prices are established via competitive bidding, ensuring a fair and

transparent process. The highest bidder secures the allotment of fish and completes the transaction with full cash payment. Wholesale prices of Hilsa vary based on several factors such as quality, size, weight, season, market dynamics, and supply-demand dynamics. This variability is reflected in the Table 1 provided.

**Table 1: Pricing of Hilsa.**

<b>Fish Size</b>	<b>Weight Range</b>	<b>Price Range* (BDT (Bangladeshi Taka))</b>	<b>Selling System</b>	<b>Destination Selling Place</b>	<b>Consumer Level</b>
Small	100-200	150-100	Hali basis (4 pieces)	Local Place Street Selling	Local and poor people
Semi Small	200-300	150-250	Hali basis (4 pieces)	Local Market	Local and Poor people
Medium	300-500	250-600	Hali basis (4 pieces)	District and Divisional Market	Local and Middle class people
Semi Large	500-650	500-700	Hali basis (4 pieces)	District and Divisional Market	Local (Top/Middle class) people
large	700- 1000	700-1000 700-1200	Hali basis (4 pieces)	District and Divisional Market	Local (Top/Middle class) people and Supplying for Foreigner People

\*Changeable

### *Distribution of Hilsa*

In the distribution of Hilsa, two major supply chains exist at this landing center. These supply chains illustrate the different pathways through which Hilsa reaches consumers, with Channel 1 primarily catering to distant markets and Channel 2 focusing on local markets.

Channel 1: Fisher - Mahajon - Arottdar – Large Paiker - Arottdar - Retailer - Consumer (Distant Market)

Channel 2: Fisher - Mahajon - Arottdar - Paiker - Retailer - Consumer (Local Market)

### *Stakeholder dynamics*

Understanding the intricate dynamics among stakeholders within the fish landing center ecosystem is paramount for effective governance and sustainable development. From Fishers and buyers to service providers and institutional actors, each stakeholder group contributes to shaping the functioning of the fishery. Here, we delve into the roles, interests, and interactions of these stakeholders, drawing insights from the diverse array of actors at Chandar Khal Puran Bery Maach Ghat (Table 2).



**Table 2: Summary of Actor's Roles and Responsibilities.**

<b>Actors</b>	<b>Role and Responsibilities</b>	<b>Demand (Interest)</b>	<b>Total Number</b>
Fishers (Vagee)	- Wage laborer for fishing. - Works under a labor contract. - Part of an informal group called 'Vagee'.	Single share of the 50% net profit	1500
Fishers (Sub/Nim Majhee)	- 2nd Leader of a fishing team. - Wage laborer for fishing. - Works under a labor contract. - Sometimes acts as an engine operator.	1.5 shares of the 50% net profit	285
Fishers (Head Majhee)	- Leader and director of a fishing team. - Experienced and skilled fisher. - Expert aquatic laborer. -Some also serve as engine operators.	Majhee = 2 x Vagee Double share of the 50% net profit. Additional half share if acting as an engine operator. 50% of net profit if majhee is a mahajon.	200
Mahajon (Boat and Net Owner)	-Arranges workers and other variable factors for capture. -Sometimes acts as a commission agent.	Direct influence on the fishing team. Interest in investment (50% of net profit)	200
Arotdar (Dadondar)	-Invests capital. -Provides loans (dadon) to Mahajon. -Ascertains the value of the catch. -Facilitates landing and marketing. -Ensures sales and supply of captured fish.	Negotiates between buyers and sellers of fish and assists them. Interest in invested money Loyalty of Fishers	10
Wholesaler (Large Paiker)	- Participates in auctions. - Collects and distributes fish. -Provides credit supplies to middlemen.	Receives Hilsa Fish from target arotdar. Incentive from purchased Hilsa fish	11
Retailer (Small Paiker)	- Participates in auctions. -Collects and distributes fish within the district.	Receives Hilsa Fish from target arotdar. Incentive from purchased Hilsa fish	125
Ancillary participants	- Provides manpower services.	Provides services to target arot	50
Motor engine service provider	-Provides expertise services for boats.	Provides services to target Mahajons' boat	2
Fishing gear & equipment supplier	-Supplies fishing gear & equipment.	Supplies fishing gear & equipment to target Fishers	5
Ice providers	- Supplies ice to middlemen and Paikers. - Provides credit supplies.	Supplies ice to target arot/landing center	1
Salt suppliers	- Supplies fuel. - Provides credit supplies.	Supplies salt to target fishing boat	3
Fuel supplier	- Supplies fuel. - Provides credit supplies.	Supplies fuel to target fishing boat	2
Fishing boat maker or repair	- Provides expertise services.	Provides services to target Mahajons	8
<b>In Total (number)</b>			<b>2402</b>

According to the focus group discussions (FGDs), the community has provided insights into the performance of various institutions related to fisheries management, as outlined in Table 3. These insights highlight significant issues such as inadequate services,

limited access to financial resources, and exploitation by powerful entities. Addressing these concerns is crucial for improving institutional effectiveness and meeting the needs of fishers.

**Table 3: Community Opinion and Experience on the Performance of Existing Institutions.**

<b>Institution</b>	<b>Opinion/Experience</b>
Landing Center Management	The community reports that the landing center is managed by only 2-3 individuals, resulting in limited visibility of services and unequal accessibility. Maintenance of the premises is deemed unsatisfactory, suggesting a need for improved management and resource allocation.
Financial Institutions	Access to financial resources remains a significant hurdle for fishers. Government banks are largely inaccessible to most fishers due to lack of collateral (land) and past defaults. Similarly, private banks present barriers for poor fishers, indicating a need for more inclusive financial services tailored to the fishing community's unique circumstances.
Operational Support Services	Fishing vessel repair services are reported as ineffective and untimely, potentially impacting the community's ability to maintain their livelihoods. The ice supply, crucial for fish preservation, is characterized by unfair pricing, inadequate quantities, and unreliable availability. The presence of only one ice supplier further exacerbates these issues, suggesting a need for increased competition and improved supply chain management.
Government Oversight	The Department of Fisheries (DoF) faces widespread dissatisfaction from the community. This discontent primarily stems from government-imposed fishing bans during critical periods, such as the prohibition on catching Jatka in sanctuary areas and gravid hilsa during the breeding season. While these measures are designed for conservation, they significantly impact poor fishers who lack alternative livelihood options during ban periods.
Community Organizations	Local fisheries cooperatives, including the Char Gashia Fishers' Cooperative Society and West-Char Gashia Fishers' Cooperative Society, are reported as ineffective. Issues such as exploitation by powerful elements, neglect of small-scale fishers' needs, lack of leadership, poor group management, and internal conflicts hinder their effective operation.
Market Regulation	The absence of a formal arrangement to regulate fish marketing has created an environment where middlemen can exploit the situation, resulting in an inequitable distribution of profits that disadvantages the fishers.

### *Economic supply chain*

The economic supply chain of Chandar Khal Puran Berry Maach Ghat is a sophisticated network that reflects the intricate relationships between various stakeholders in the fishing industry. This system can be analyzed through three key components: flow of credit, flow of

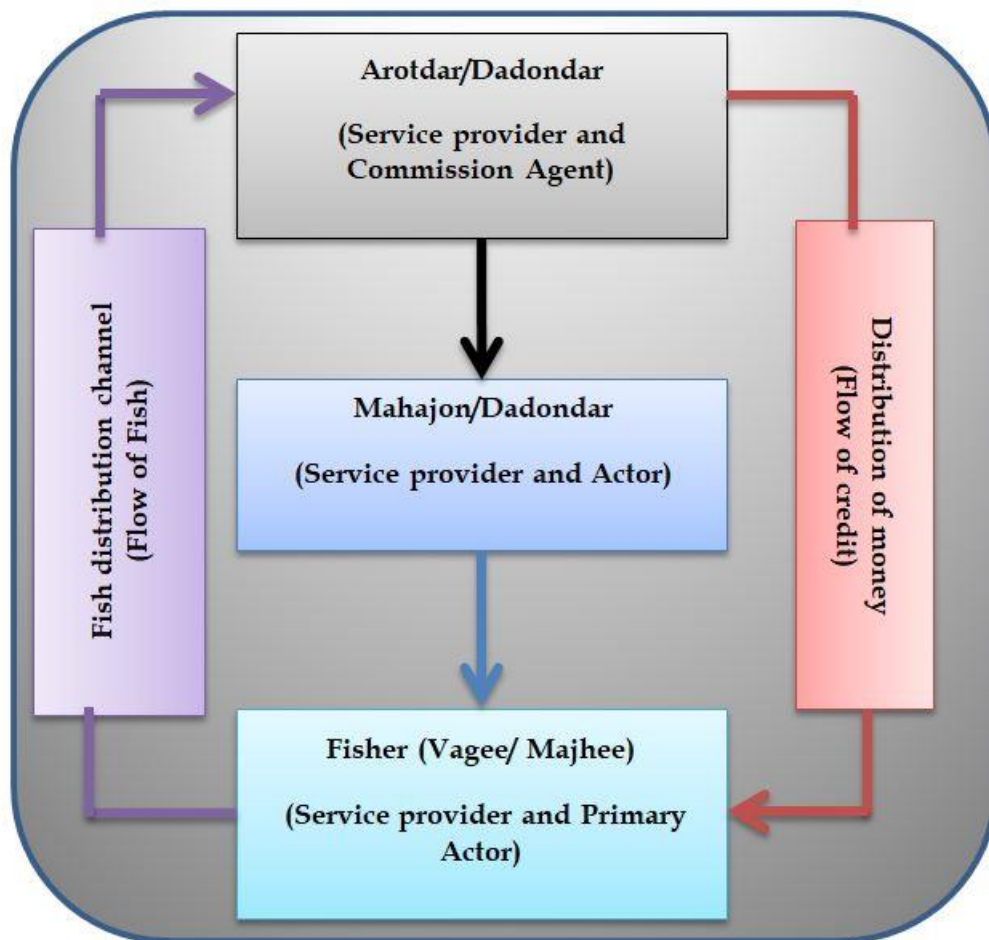
fish, and the profit-sharing system for exploited fish (Fig. 6).

### *Distribution of money (flow of credit)*

The credit system, locally known as *dadon*, is the financial backbone of fishing operations at Chandar Khal Puran Berry Maach Ghat. This hierarchical

lending structure begins with *arotdars*, traditional money lenders, who provide loans to *mahajons*—intermediaries between lenders and fishers. The loan amounts for *mahajons* range from 5,000 to 70,000 BDT (Bangladeshi Taka), depending on the status of their fishing equipment. In turn, *mahajons* distribute these funds to fishers, with loan amounts ranging between 10,000 and 30,000 BDT (Bangladeshi Taka), based on the

fishers' roles and responsibilities. This credit mechanism is vital for maintaining financial liquidity within the fish landing center, enabling necessary investments and sustaining fishing operations. Larger paikers (wholesalers) may also secure *dadon* from *arotdars* in various district markets across the country, further expanding the financial network.



**Figure 6: Economic supply chain of Puran Berry Chandar Khal Maach Ghat.**

*Fish distribution channel (flow of fish)*

The fish distribution process follows a structured path from catch to consumer, ensuring efficiency and accountability throughout the supply chain. Fishers generally sell their catch under the

mahajon's name to paikers through *arotdars*, who act as intermediaries. Fishers with outstanding loans are obligated to supply their Hilsa fish to their respective mahajons. If a mahajon has borrowed from *arotdars*, the fish is

directly supplied to the arotadar, who then distributes it to wholesalers or paikers. Retailers subsequently procure the fish from wholesalers and sell it to local consumers. This organized channel facilitates smooth transactions from source to market, benefiting both suppliers and consumers.

#### *Profit-sharing system*

The revenue-sharing model at Chandar Khal Puran Bery Maach Ghat reflects the collaborative nature of fishing operations. After deducting operational costs, the mahajon receives 50% of the total revenue. The remaining 50% is divided among the daily laborers (Vagees) who actively participate in fishing activities. Within this group, specialized roles receive additional compensation: the head majhee is allocated two shares, while sub/nim majhees and engine operators receive 1.5 shares each. This equitable distribution system fosters cooperation and incentivizes participation within the fishing community.

#### *Critical challenges facing the fish landing center*

The fish landing center grapples with a complex array of issues that significantly impact its operations, efficiency, and overall sustainability. These challenges, identified through thorough analysis, highlight the urgent need for comprehensive improvements across various aspects of the center's infrastructure and management.

#### *Infrastructure deficiencies*

The center lacks modern infrastructure, hampering operational efficiency and safety. This deficiency limits the ability to meet growing demands and adhere to contemporary standards in the fishing industry.

#### *Sanitation and monitoring*

Inadequate monitoring systems and poor sanitation practices elevate the risk of contamination and health hazards. This not only jeopardizes the quality of the catch but also poses significant risks to workers and consumers alike.

#### *Environmental concerns*

An insufficient drainage system exacerbates environmental issues, particularly during adverse weather conditions. This inadequacy threatens to disrupt operations and potentially damage equipment and supplies.

#### *Hygiene standards*

The prevalence of unsanitary conditions tarnishes the center's reputation and compromises fish quality and safety. This unhygienic environment undermines consumer confidence and reduces the marketability of the catch.

#### *Preservation challenges*

Limited cold storage facilities and insufficient ice supply hinder the center's ability to preserve perishable goods effectively. These shortcomings lead to potential losses and inefficiencies throughout the supply chain.

### *Market inequities*

The disproportionate influence of affluent stakeholders in market control and money lending perpetuates systemic inequalities. This imbalance restricts access to resources and opportunities for smaller actors, stifling competition and innovation in the sector.

### *Knowledge gap*

A lack of awareness and training in fish preservation and processing techniques undermines quality control efforts. This knowledge deficit limits value-added opportunities for fish traders and hinders potential economic growth in the community.

### *Regulatory vacuum*

The absence of formal regulations and established committees creates an environment of ambiguity and instability. This regulatory gap leaves the center vulnerable to conflicts, exploitation, and operational inefficiencies. Addressing these interconnected challenges requires a multifaceted approach that encompasses infrastructure development, capacity building, and policy reforms. By tackling these issues comprehensively, the fish landing center can enhance its operational efficiency, improve product quality, and foster a more equitable and sustainable fishing industry. Such improvements would not only benefit the immediate stakeholders but also contribute to the broader economic development and food security of the region.

## **Discussion**

This study provides a comprehensive economic analysis of the supply chain at Hilsa fish landing centers (Maach Ghats) in Bangladesh, revealing intricate dynamics and challenges within the sector. The findings align with existing literature while offering new insights into the operational and strategic aspects of the industry.

### *Market structure and exploitation*

The Hilsa fishery operates within a traditional, multi-tiered market structure heavily influenced by intermediaries (Alam *et al.*, 2012; Haque, 2010). Fishermen often face exploitative conditions due to the prevailing dadon (credit) systems, which entrench financial dependency and limit their bargaining power (Islam *et al.*, 2017; Mozumder *et al.*, 2024). The role of intermediaries, particularly aratdars, exacerbates these issues by monopolizing profits and diminishing the fishermen's share of the final consumer price (Coulter and Disney, 1987; Ahmed, 2007; Islam *et al.*, 2020; Porras *et al.*, 2017).

### *Infrastructure challenges and technological landscape*

Infrastructure deficiencies at landing centers, such as the lack of cold storage and proper sanitation, undermine the efficiency of the Hilsa supply chain (Islam *et al.*, 2017; Rahman *et al.*, 2013). These gaps lead to substantial economic losses and reduced profitability. Furthermore, inadequate transportation infrastructure isolates remote fishermen,

compounding their economic difficulties (Islam *et al.*, 2018; Rahman, 2013). Although there is a gradual shift towards mechanized fishing methods, many continue to use traditional techniques, which limit productivity and contribute to environmental degradation (Kibria and Ahmed, 2005; Hasan *et al.*, 2016; Hossain *et al.*, 2021; Siddique *et al.*, 2013; Dipty *et al.*, 2024). Adoption of sustainable technologies could enhance efficiency and mitigate ecological impacts (Hasan *et al.*, 2016; Ahmed *et al.*, 1997; Dewan and Mazid, 1994).

#### *Landing volumes and seasonality*

Hilsa fishing is marked by significant seasonality, with peak catches occurring from July to October. This seasonal concentration puts intense pressure on fish stocks and leads to market saturation, which drives down prices and heightens economic vulnerability for fishermen (Hossain *et al.*, 2022; Hossain *et al.*, 2023; Hossain and Siddiqua, 2024; Mozumder *et al.*, 2019). Effective management of landing volumes and seasonal fluctuations is crucial for ensuring both stock sustainability and economic stability for fishing communities (Rahman *et al.*, 2020; Van Brakel *et al.*, 2018; Hossain *et al.*, 2019; Mozumder *et al.*, 2018).

#### *Pricing, Distribution, and Stakeholder Relations*

The auction-based pricing mechanism in Bangladesh's fish trade largely benefits intermediaries, with fishermen often receiving only a fraction of the final consumer price (Alam *et al.*, 2012;

Hossain *et al.*, 2019). This multi-layered distribution system creates significant economic disparities and highlights the power imbalances within the sector (Khan and Rahman 2020). The journey of Hilsa fish from fishermen to consumers involves numerous intermediaries, including mohajons, baparis, aratdars, faria, wholesalers, and paikers, within complex marketing channels (Roy *et al.*, 2015; Alam *et al.*, 2012). The role of aratdars as commission agents who provide loans exacerbates exploitation and dependency issues (Coulter and Disney, 1987; Ahmed, 2007; Alam *et al.*, 2012; Haque, 2010; Ahmad and Rab, 1993). Research underscores the need for transparency and fairness in pricing and distribution to address these disparities (Rahman *et al.*, 2009; Rahman, 1997; Hossain *et al.*, 2021; Hossain *et al.*, 2018, Hossain *et al.*, 2019; Khan and Rahman 2020; Omar *et al.*, 2013; Ahmed and Ahammed 2006).

#### *Future directions*

To effectively address the challenges faced by Bangladesh's Hilsa fishery, several targeted strategies are essential. First, implementing innovative financing models is crucial to alleviate the reliance on exploitative credit systems (Islam *et al.*, 2020; Khan and Rahman 2020). Sustainable fishing practices should be promoted to ensure the long-term viability of fish stocks (Hossain *et al.*, 2019; Hossain *et al.*, 2021). Additionally, optimizing the supply chain is necessary to streamline processes and increase fishermen's share

of market value (Alam *et al.*, 2012; Uddin *et al.*, 2020). Enhancements in infrastructure and technology are vital to improving post-harvest efficiency and reducing losses (Islam *et al.*, 2018; Ahmed *et al.*, 2021). Finally, adopting co-management approaches can empower communities for more equitable resource management (Islam *et al.*, 2020; Nahiduzzaman *et al.*, 2018). Future research should focus on evaluating the economic impacts of these interventions, exploring the potential for value-added products to boost incomes, and assessing the long-term ecological consequences of current practices on Hilsa populations and the broader ecosystem.

### Conclusion and recommendations

This study of the Chandar Khal Puran Bery Maach Ghat reveals significant challenges facing fish landing centers in Bangladesh. The analysis highlights critical issues including inadequate infrastructure, poor sanitation, insufficient cold storage, and a lack of formal regulations. These factors collectively impede the center's efficiency, product quality, and stakeholder well-being, underscoring the urgent need for comprehensive improvements. Based on our findings, we propose the following recommendations to enhance the fish distribution channel and address the identified constraints:

#### Infrastructure Development:

- Construct cold storage facilities to reduce post-harvest losses and maintain product quality.

- Improve storage, water supply, and drainage systems to ensure a hygienic trading environment.
- Upgrade fish transport and handling facilities to preserve freshness throughout the supply chain.

#### Financial and Regulatory Measures:

- Provide accessible institutional credit to support traders during financial crises.
- Regulate Arottdars' commissions to ensure fair transactions.
- Establish independent legislative measures specific to fish landing and marketing.

#### Market Organization and Efficiency:

- Create designated "Fishers' Corners" for direct sales, reducing intermediary dependence.
- Form market committees with proper constitutions and by-laws to improve management.
- Modernize existing fish market structures to provide a more conducive trading environment.

#### Capacity Building and Research:

- Implement awareness programs and training on fish preservation and processing techniques.
- Conduct further research on socio-economic development and credit systems in the fishing industry.

Implementation of these recommendations can lead to significant improvements in the efficiency, profitability, and sustainability of the hilsa fishing industry. By addressing

infrastructural deficiencies, enhancing regulatory frameworks, and promoting better organization and knowledge dissemination, the fish landing center can better serve its stakeholders and contribute more effectively to the local and national economy.

Future studies should focus on the long-term impacts of these interventions and explore innovative technologies that could further optimize the fish distribution channel. Additionally, efforts should be made to ensure that improvements benefit all stakeholders equitably, with particular attention to small-scale fishers and marginalized groups within the industry.

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