Portraying the Bangladesh Shrimp Industry: A SWOT Analysis

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Abstract: The Bangladesh shrimp industry plays a vital role in the country’s economy by exhibiting a complex interplay of strengths, weaknesses, opportunities, and threats. A significant strength is the extensive coastal region which provides a natural habitat conducive to shrimp cultivation. It gains a competitive edge globally with a skilled workforce and low production costs. The industry benefits from geographical indication certification, accredited labs, upgraded facilities, and financial support, highlighting its robust strengths. However, intrinsic weaknesses such as inadequate infrastructure, limited technological integration, and susceptibility to disease outbreaks impede its full potential. To amplify its reach, the industry should consider adopting advanced aquaculture methods, expanding its value-added goods, optimizing supply chains, and acquiring international certifications. However, the industry faces challenges owing to climate-induced disruptions, diseases, trade barriers, and market fluctuations. By investing comprehensively in infrastructure, technology, disease control, and regulatory compliance, Bangladesh’s shrimp industry can solidify its position as a robust, ethical, and competitive player in the global seafood market.

Keywords: shrimp; aquaculture practices; market access; climate change impacts; supply chain improvements

1. Introduction

The global seafood industry plays an indispensable role in meeting the ever-growing demand for high-quality protein and contributes significantly to the economies of countries that participate in this dynamic sector. Within this industry, the shrimp sector holds a prominent position, characterized by its rapid growth, export potential, and vital contribution to the livelihoods of millions.

Bangladesh’s favorable geographical features, such as its extensive coastline of over 700 km, mangrove forests, and nutrient-rich river deltas, provide an ideal environment for shrimp cultivation [1]. As a result, shrimp farming has become a significant driver of the country’s economic growth, contributing substantially to export earnings, employment generation, and rural development, and thus, Bangladesh has emerged as a significant player in the global shrimp market [2].

Initially, shrimp farming was rudimentary and limited to traditional methods. However, recognizing the potential of this industry, the government and private sector gradually invested in research, infrastructure, and technology to modernize and expand shrimp farming practices. The Bangladesh shrimp industry encompasses a diverse range of stakeholders, from small-scale farmers in rural areas to large vertically integrated enterprises [3].

The predominant species which have evolved significantly over the years are the black tiger shrimp (Peneaus monodon), locally called bagda, which constitutes 50% of the overall production, followed by the giant freshwater prawn (Macrobrachium rosenbergii), locally called galda, accounting for 42%. The remaining 8% comprises various wild shrimp species [4]. Major shrimp-producing districts include Khulna, Satkhira, Bagerhat, and Cox’s Bazar. Bangladesh’s shrimp industry has witnessed remarkable expansion since its inception in the late 1970s, when shrimp farming commenced on a small scale in the southwestern coastal region of Bangladesh.
The industry experienced rapid growth during the 1980s and 1990s, driven by increased demand in international markets. Bangladesh became one of the top shrimp-exporting countries globally, with exports reaching their peak in the early 2000s [3,5]. However, this success came at a cost, as unsustainable practices and environmental issues started to surface, posing significant challenges to the industry’s long-term sustainability.

The importance of the shrimp industry in Bangladesh’s economic landscape cannot be overstated. The sector has played a pivotal role in the country’s transition from a primarily agrarian economy to one driven by exports and manufacturing. The shrimp industry accounted for nearly 1.24% of the country’s total exports in 2020–2021, generating substantial foreign exchange earnings and contributing to employment for millions of people, particularly in rural coastal areas [6]. It also holds tremendous promise for further growth and development, aligning with Bangladesh’s ambitions to become a middle-income country by 2040.

The global shrimp industry has experienced exponential growth in recent decades, with rising consumer demand, increased health consciousness, and changing dietary preferences fueling its expansion. As of the latest available data, the global shrimp market was valued at approximately USD 46.94 billion in 2022, and it is expected to be USD 69.35 billion by 2028 [7]. According to recent statistics, Bangladesh produced 251,964 metric tons of shrimp in 2020–2021, with a total export volume of 30,571 metric tons and a value exceeding USD 407.25 million in 2021–2022 [1,6]. The United States, the European Union, and Japan are among the major importers of shrimp, and Bangladesh has positioned itself as a key supplier to these lucrative markets.

The Bangladesh shrimp industry has experienced remarkable growth and transformation over the past few decades, positioning itself as a significant player in the global seafood market. This industry has emerged as a vital contributor to the country’s economic development, employment generation, and foreign exchange earnings. However, this industry’s success story is marked by volatility, sustainability concerns, and challenges that have the potential to disrupt its growth trajectory. Therefore, it is imperative to conduct a comprehensive analysis of the shrimp industry in Bangladesh through the lens of the SWOT (strengths, weaknesses, opportunities, and threats) framework. A SWOT analysis provides a valuable theoretical framework for assessing the Bangladesh shrimp industry’s strategic landscape. By examining its strengths, weaknesses, opportunities, and threats, stakeholders can gain insights into internal and external factors shaping the industry.

Strengths lie in abundant shrimp resources and a growing global demand. Weaknesses encompass environmental concerns, regulatory challenges, and infrastructural limitations. Opportunities include expanding international markets and technological advancements in aquaculture. Threats involve potential disease outbreaks, price fluctuations, and climate change impacts. By systematically analyzing these factors, stakeholders can make informed decisions, formulate strategic plans, and address vulnerabilities. The theoretical contribution of the SWOT analysis to the Bangladesh shrimp industry lies in its ability to foster resilience, capitalize on strengths, and navigate challenges for sustainable growth.

In this article, we embark on a journey to explore the intricacies of the Bangladesh shrimp industry, employing the SWOT analysis as our guiding framework. By examining the current state of the industry, the dynamic global context, and the latest available data, we aim to provide an up-to-date assessment of the factors that influence the industry’s performance and its potential trajectories. The introduction section sets the context, highlighting the industry’s economic significance and global positioning. It explores existing studies on shrimp farming, both in Bangladesh and globally. The methodology outlines the research design and data sources used for the SWOT analysis. The findings are presented systematically, delving into the internal strengths and weaknesses of the industry, followed by external opportunities and threats. The discussion section analyses the interplay of these factors and their implications for the industry’s future. This paper concludes with strategic recommendations based on the SWOT analysis, offering insights for stakeholders, policymakers, and practitioners involved in Bangladesh’s shrimp industry.
2. Material and Methods

The methodology for conducting a SWOT analysis in the shrimp industry is a structured approach that combines qualitative and quantitative data from a thorough literature review. This process serves as a strategic planning tool to gain insights into the internal and external factors affecting the industry’s performance.

To initiate the SWOT analysis, the first step is to comprehensively review the existing literature on the shrimp industry. This involves studying academic research, industry reports, government publications, relevant journals, and empirical studies collected between December 2022 and June 2023. The objective is to gather historical data and insights regarding the industry’s strengths and weaknesses, which were determined through a comprehensive assessment of factors such as production efficiency, technological capabilities, market positioning, resource allocation, and regulatory frameworks.

The next phase of the methodology involves identifying external factors that present opportunities and threats to the shrimp industry. This entails a thorough examination of market trends, global economic conditions, environmental factors, consumer preferences, and competition. This literature review provides valuable context to discern opportunities, such as emerging markets or sustainable seafood certifications, and threats like disease outbreaks, climate change, or trade restrictions.

After compiling this data, a SWOT matrix is constructed, categorizing the findings into four quadrants: strengths, weaknesses, opportunities, and threats (Table 1). Each aspect is analyzed in terms of its impact on the industry’s performance, likelihood, and potential mitigation strategies. Stakeholder input and expert opinions are also considered to validate the findings from the literature review.

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<td>1. What is the firm’s competitive advantage?</td>
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<td>3. What consumer trends threaten business?</td>
<td>3. What new market niches can be explored?</td>
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Finally, this methodology enables industry stakeholders to gain a holistic understanding of their current position and prospects, facilitating strategic decision making. Additionally, it allows for the formulation of strategies that leverage strengths to exploit opportunities and mitigate weaknesses against potential threats, ultimately enhancing the sustainability and competitiveness of the shrimp industry.

3. Results

The SWOT analysis conducted on the Bangladesh shrimp industry unveils a comprehensive understanding of its internal strengths and weaknesses, as well as external opportunities and threats. This in-depth analysis not only offers a keen awareness of the industry’s existing positioning but also serves as a guiding compass toward uncharted pathways of strategic development and enhancement.

3.1. Strengths

3.1.1. Geographical Indication Certificate

In the year 2022, a significant milestone was achieved for the Bangladesh shrimp (Penaeus monodon) as it was bestowed with a geographical indication (GI) registration certificate, officially recognizing it as the “Bagda shrimp of Bangladesh” [8]. This prestigious recognition not only underscores the distinctiveness of this crustacean but also cements it as
a distinctive form of intellectual property intrinsically linked to Bangladesh’s rich tapestry of environment, culture, geography, heritage, and traditional customs. This commendable acknowledgment is conferred by the Department of Patents, Designs, and Trademarks of the Bangladesh Government, a process that adheres to the criteria set forth by the World Intellectual Property Organization.

Renowned for its natural production approach, distinctive color, rich flavor, and impeccable quality, the Bangladeshi shrimp has earned a distinguished reputation on the global stage. The acquisition of a GI designation bestows upon the Bangladeshi shrimp the potential for heightened prominence in the European market, enabling it to command premium prices that set it apart from comparable products originating from other regions. The iconic black tiger shrimp leads the country’s seafood exports, constituting a substantial 80% share, with a noteworthy 59% finding its way to discerning European consumers [1].

3.1.2. Regulatory Frameworks

Bangladesh has established an array of acts, rules, guidelines, and statutory orders to oversee the operations of the shrimp industry. The legal hierarchy places acts as the top, as they are laws passed by the national parliament. Acts serve as the primary legal authority and have the highest legal status. Rules are secondary to acts and are framed to provide detailed regulations or procedures for implementing acts. Guidelines, on the other hand, offer non-binding recommendations and serve as reference materials. Statutory orders hold a lower status, typically issued by government authorities to address specific administrative matters. These regulatory frameworks collectively provide a comprehensive suite of standards, as well as legal and administrative protocols, aimed at fostering optimal management practices for shrimp production within the country. Encompassing an extensive scope, the regulatory framework addresses all facets of the shrimp industry’s evolution, ranging from production and quality control to marketing, exports, and even environmental and societal considerations. The following are the main pieces of legislation that govern Bangladesh’s shrimp sector.

- Fish Hatchery Act, 2010.
- Fish Feed and Animal Feed Act, 2010.
- Fish Quarantine Act, 2018.
- Fish and Fish Products (Inspection and Quality Control) Act, 2020.

The 2020 Fish and Fish Products (Inspection and Quality Control) Act safeguards and boosts the export of Bangladeshi fish products while ensuring local market quality. License revocation can occur for false information, non-renewal for three years, or license transfer. Unhygienic conditions or substandard processing during inspections may result in penalties, including imprisonment for up to five years, 500,000 taka (USD 4500) fine, or both [9].

The Fish Hatchery Act of 2010 and Fish Hatchery Rules of 2011 oversee fish hatchery and nursery operations in Bangladesh. These regulations emphasize generating premium fish seeds while preventing inbreeding and crossbreeding issues. Hatchery owners must adhere to guidelines concerning water quality, fish health, and genetic diversity [10].

The 2010 Fish Feed and Animal Feed Act, along with the Fish Feed Rules of 2011, safeguard the quality of feed products in Bangladesh. These regulations empower the directors-general of Fisheries and Livestock Services for licensing and encompass various aspects from production to distribution. These measures aim to uphold elevated quality and safety standards in locally produced fish and animal feed [11].

The 2018 Fish Quarantine Act oversees fish, fish products, and probiotics import to Bangladesh, preventing risks to health and environment. The Department of Fisheries (DOF) and export–import authorities monitor and control imports, prohibiting harmful substances under the Imports and Exports Act, 1950. Importers must acquire a DOF license prior to importing fish or products [12].
3.1.3. Policy Framework

The 1998 National Fisheries Policy guides Bangladesh’s fisheries sector. Shrimp farming, a vital export, forms 42% of volume and 74% of value in exports [13,14]. To boost shrimp production and exports, the policy suggests better coordination between shrimp and paddy farming, modernizing practices, private sector involvement, hatcheries, sustainable fry collection, and infrastructure development.

The shrimp farming industry in Bangladesh is influenced by various sectoral policies, including the National Water Policy, National Environment Policy, National Land Use Policy, National Agriculture Policy, Export Policy, Shrimp Mohal Management Policy, and Coastal Zone Policy. The 1998 National Water Policy, vital for shrimp, promotes balanced water resource development for economic growth, poverty reduction, food self-sufficiency, health, ecology, and biodiversity preservation.

The 2014 National Shrimp Policy aims at eco-friendly shrimp farming, involving private investment and semi-intensive methods. It prohibits mangrove destruction and risky practices. The plan prioritizes sustainable integrated shrimp farming, crop diversity, job creation, poverty reduction, exports, and nutrition fulfillment, aligning with ecological and economic goals [15].

The 2005 Coastal Zone Policy emphasizes local resource-driven growth and recognizes shrimp farming as a coastal livelihood [16]. It underlines safeguarding communities through cyclone shelters, roads, embankments, warning systems, and coastal tree planting to counter climate change and erosion.

3.1.4. Recognition of the Competent Authority

The Department of Fisheries is the primary government agency responsible for regulating the fishery industry. Following the ratification of Decision 98/147/EC, the DOF has been designated as the competent authority for verifying and certifying the compliance of fishery and aquaculture products intended for export with European Union (EU) directives [17]. Bangladesh is classified as a “List 1 Country” by the EU, which signifies that its laws and enforcement policies for health safety standards meet the EU’s requirements for exporting fish and fishery products to the EU [18]. Additionally, Bangladesh has been categorized as a “Country in the First Group” by the Food and Agriculture Organization (FAO) for adhering to HACCP standards.

3.1.5. Accredited Laboratories

The Department of Fisheries operates three quality control laboratories in Dhaka, Chattogram, and Khulna, all of which are accredited with ISO 17025 [19]. Each laboratory is staffed by qualified technical personnel and is equipped with advanced analytical instruments such as LC-MS-MS (liquid chromatography–mass spectrometry), ELISA (enzyme-linked immuno sorbent assay), GC-MS/TOF (gas chromatography–mass spectrometry/time-of-flight), UPLC (ultra-performance liquid chromatography), AAS (atomic absorption spectrophotometer), and HPLC (high-performance liquid chromatography) [5]. These facilities have the task of analyzing a range of fish and fish products, as well as ice, swabs, fish feed, and its components. Moreover, the laboratories regularly conduct examinations to guarantee the microbial quality of the specimens and to identify any harmful chemical remains, like prohibited antibiotics, dyes, and anthelmintics, in seafood products.

The advanced analytical technique of LC-MS-MS is utilized to detect the presence of various substances in fishery products, including chloramphenicol, nitrofurin metabolites (AMOZ, AOZ, AHD, and SEM), metronidazole, malachite green, leuco-malachite green, crystal violet, leuco-crystal violet, and anthelmintics (flubendazole, fenbendazole, and mebendazole).

The Food and Veterinary Office audit report of the European Union has affirmed the Department of Fisheries laboratories’ analytical capacity. This affirmation is grounded in their commendable laboratory work performance, laboratory accreditation, and validation.
of analytical methods. The competent authority expresses unwavering confidence in the dependability of the generated analytical results [20].

Furthermore, three distinguished government research institutions—BCSIR, AERE, and ICDDRB—serve as reference laboratories for an array of chemical and other testing purposes [20]. In alignment with EU standards, endorsed processing facilities have instituted their own laboratory setups, overseen by proficient professionals, to carry out self-assessments on fishery and aquaculture products. These assessments encompass organoleptic, microbiological, water, and swab testing. Periodically, processing factories forward samples to the reference laboratories for targeted examinations.

3.1.6. Upgraded Production Facilities

Driven by stringent EU and global standards, the processing sector has undergone a significant overhaul, reconfiguring manufacturing systems and integrating novel technologies. Semiautomatic processing technology was embraced to reduce human contamination risk and expedite cycles. Freezing methods have evolved, including doorless plate freezers (1000 kg/h) and advanced individually quick frozen (IQF) machines with water coolers, air handling systems, and spiral freezers (800 kg/h) [21]. Companies have broadened product arrays and elevated quality through steam cooking and other innovations. Responding to international demand, processors introduced IQF, cooked, and ready-to-eat items, amplifying product value. Structural enhancements, cutting-edge equipment, labs, upgraded packaging, training, HACCP plans, and hygiene facilities have elevated operations [21].

Shrimp farmers enhance quality by adopting modern methods. They switch to plastic crates for shrimp transportation and upgrade farm floors. The government enforces hygiene, relocating latrines, and demolishing peeling sheds. Depots seeking DOF licenses elevate cleanliness and sanitation, introducing flowing water systems, concrete structures, stainless steel grading tables, handwashing basins, and more. Additionally, the government constructed 21 advanced shrimp landing and service centers to ensure post-harvest quality and safety [3].

3.1.7. Production Capacity

Bangladesh’s shrimp farming thrives on expansive tidal lands, enabling natural water circulation via tides. Notably, Bangladeshi shrimp stands out for its pesticide-free, hormone-free, and natural ecosystem-reliant production, yielding superior taste despite limited output.

In Bangladesh, shrimp production is derived from various sources, including maritime capture fisheries, brackish water aquaculture, freshwater aquaculture, and inland capture fisheries. In the years 2020–2021, these sources collectively produced 251,964 metric tons of shrimp [1]. The majority of the output (60%) came from farming of brackish water black tiger shrimp (Penaeus monodon) on 191,964 hectares of coastal land, with an average yield of 358 kg/ha [1]. The second-highest production was from the giant freshwater prawn (Macrobrachium rosenbergii), which has rapidly grown over the last ten years. This species accounted for 31% of the production on 71,062 hectares of low-lying floodplain areas, mostly in the southwest region, with an average yield of 714 kg/ha, and is quickly expanding to other regions. Around 25% of the overall production comes from maritime sources, while the remaining 9% is derived from inland capture fisheries [1].

Currently, there are 24 fully operational fish processing facilities in Bangladesh, out of the 105 with a yearly capacity of approximately 400,000 metric tons. Of these, 73 have obtained licenses from the European Union, and 8 have permits from Russia [22]. The closure of most processing plants has been attributed to factors such as declining monodon species, quality compliance concerns, reduced profit margins, increased input costs, and underutilized capacity. In 2020–2021, there were 77 public and private hatcheries in Bangladesh that produced about 7.2 billion shrimp and prawn post-larvae (PL). If all hatcheries operate at full capacity, they possess the capability of producing more than 10 billion shrimp and prawn PL [1]. Among these, 44 shrimp hatcheries obtain around
200,000 pieces of mother shrimp [23] to produce nearly 8 billion shrimp PL, while the remaining 33 prawn hatcheries produce almost 2 billion prawn PL [1].

3.1.8. Retaining Global Market Access

Bangladesh shrimp, once the second-highest export, slipped to seventh since 2014–2015. Yet, recent data bring hope. After 8 years of decline, Bangladesh shrimp exports have surged by 39% in volume, valued at USD 407.25 million in 2021–2022 [24] (Figure 1). Currently, Bangladesh contributes 1.76% of global shrimp exports [23].

![Figure 1. Export volume and value of Bangladesh shrimp products.](image)

During 2020–2021, the EU held the majority share of shrimp exports by value, comprising 59% and totaling more than USD 186 million among key exporting nations [1]. The remaining portion was distributed among the United States (US) (10%), Japan (6%), and other countries (25%) (Figure 2).

![Figure 2. Major export destination of Bangladesh shrimp (source: LightCastle, 2022).](image)

3.1.9. Financial and Fiscal Support

Different sections of the shrimp supply chain receive financial and fiscal aid through diverse means. Both hatcheries and processors enjoy specific advantageous circumstances and incentives, like convenient loans and lowered tax rates, leading to surplus capacity in both domains [25]. The subsequent benefits are accessible to enterprises in the shrimp sector:

Tax Holiday: Businesses located in Chattogram Division enjoy a 5-year tax holiday, while those in Khulna and Barisal Division are eligible for 7 years. The tax holiday period is
calculated from the month when commercial production starts. Accelerated Depreciation: Businesses in Chattogram Division can avail themselves of an 80% depreciation rate in lieu of a tax holiday, while those in Khulna and Barisal Division can claim 100%. This applies to the actual cost of machinery or plants from the year the business starts commercial production, with a 20% and 0% depreciation rate allowed for the following year for the two respective areas. Advance Income Tax: A 0.25% tax rate is collected on exports, instead of the standard rate of 3%. Shrimp hatcheries and processing plants are completely exempt from advance income tax. Import Duty and Taxes: Shrimp businesses exporting 100% of their products are not subject to any import duty, VAT, or other taxes. A 5% import duty is applicable if a shrimp business fails to export a minimum of 70% of its total production.

3.2. Weaknesses

3.2.1. Policy Conflicts

The governance of the shrimp sector involves diverse policies from various departments and ministries. However, these policies lack coordination, posing implementation challenges. Despite the creation of the National Fisheries Policy and Strategy, introduced in 1998, its effective enforcement through proper laws is incomplete. Conflicting directives worsen the situation. For instance, the Private Fisheries Protection Act of 1899 safeguards landowners against lending their land for shrimp farming, while the Environment Policy seeks to prevent land salinization. Moreover, conflicting aims arise from the Internal Poverty Reduction Strategy Paper and the National Land Use Policy of 2001, which involves local participation in land allocation based on environmental factors such as land topography, tidal inundation, water salinity, and soil quality.

3.2.2. Financial and Fiscal Incentives

Prolonged fiscal support for specific sections of the industry during their initial phases has persisted excessively, causing wasteful resource utilization and distorting local markets. Consequently, the industry confronts several issues: Frequent shutdowns and restarts due to surplus post-larvae from hatcheries. Numerous idle processing plants, indicating surplus processing capacity.

Conversely, essential support for production, post-harvest care, and marketing remains insufficient, hindering the industry’s sustainability and expansion.

3.2.3. Production and Processing Inefficiency

Traditional and extensive shrimp farming suffers from low yields of 300–400 kg/ha. In 2020–2021, 70,477 metric tons of shrimp were produced from 191,964 hectares [1]. The limited production capacity hindered exporters from utilizing the EU’s rules of origin. The shrimp supply shortage led to fierce competition among processors, running factories at just 10–20% capacity. Moreover, 77 fish processing and export units remain closed due to raw material shortages, including shrimp.

3.2.4. Declining Export

The COVID-19 pandemic and ensuing global economic downturn caused a substantial drop in Bangladesh’s frozen shrimp exports in 2020. This led to the cancellation of 290 shrimp purchase orders by EU and US buyers, resulting in a loss of BDT 460 crores (USD 41,988,340) [26]. The decline in exports can be traced to competing countries’ surge in whiteleg shrimp (Penaeus vannamei) production. Nations like Argentina, Ecuador, India, Thailand, and Vietnam adopted intensive farming methods for Vannamei species, propelling their shrimp exports. To stay competitive, Bangladesh’s government recently permitted trial cultivations of Vannamei.
The challenges faced by Bangladesh’s shrimp exports extend beyond the expansion of Vannamei species and the subsequent decline in prices. The nation’s supply chain grapples with transparency gaps, traceability issues, insufficient certifications meeting global standards, weight manipulation, and product mislabeling. Another contributor to this scenario is the rise in giant freshwater prawn (GFP) production. The GFP output surged from 30,868 metric tons in 2010 to 51,571 metric tons in 2018 [1], mainly driven by local demand spikes in Dhaka city and tourist destinations like Chattogram, Sylhet, and Cox’s Bazar due to increased consumer purchasing power from economic growth [27,28].

3.3. Opportunities

The expansion of the worldwide gross national income and purchasing power has resulted in a heightened need for food options rich in nutrients. Shrimp products present numerous advantages for health, given their minimal fat content and abundant protein, omega-3 fatty acids, and astaxanthin antioxidants [29].

3.3.1. Production Potential

The potential for expanding and enhancing shrimp production lies within the realm of shrimp farming, achieved through the adoption of advanced cultivation techniques. The harvesting from marine sources has reached a stable point and is unlikely to experience significant growth in the immediate future. However, the realm of freshwater shrimp farming holds substantial promise for extending its horizontal reach, offering the prime opportunity for boosting shrimp production in Bangladesh [1].

By elevating production levels in the farm stage, there is a chance to optimize the utilization of processing capacity within the processing plants. These processors could fully exploit their capacity if the government were to permit the export of frog legs, small-sized shrimp (<61/70), and prawns (<51/60), items that faced export restrictions nearly twenty years ago [3]. Furthermore, Bangladesh could potentially export surplus shrimp post-larvae to its neighboring countries.

In recent years, there has been a significant rise in demand for GFP within Bangladesh’s domestic fishery trade. Currently, domestic consumption takes precedence over exports due to the high local demand and favorable retail prices. Approximately 75% of the country’s annual GFP production, amounting to around 45,000–46,000 tons, is consumed within the domestic market [1]. This trend is projected to continue growing due to the expanding middle and affluent classes in urban areas of Bangladesh.

3.3.2. Prospects in Shrimp/Crop Diversification

Coastal aquaculture is a vital contributor to Bangladesh’s foreign exchange reserves, primarily centered around shrimp monoculture. Yet, the vulnerability of these coastal regions to natural calamities, diseases, and swift environmental shifts poses considerable challenges. Despite these obstacles, the local populace has showcased resilience and inventive adaptations to uphold their livelihoods [30]. Notable strategies include employing salinity-resistant rice varieties, mixed shrimp cultivation, and elevated horticulture [31–33].

In recent times, integrated multi-trophic aquaculture (IMTA) has garnered growing interest as a sustainable avenue for expanding aquaculture while concurrently advancing socio-economic progress and safeguarding ecological balance. IMTA entails cultivating aquatic species from diverse trophic levels in a manner that harmonizes ecosystem functions. This permits the conversion of leftovers and waste from one species into resources for others, capitalizing on synergistic interactions [34]. Furthermore, IMTA is viewed as an ecosystem-centered adaptation approach to climate change. Widespread IMTA adoption could alleviate the ecological strain of shrimp farming on the Sundarbans mangrove forest and alleviate the burden on capture fisheries.
3.3.3. Organic Shrimp Farming

Organic shrimp farming in Bangladesh offers notable benefits, such as a favorable climate, expansive export potential, and superior yields compared to traditional methods. Yet, challenges stem from limited knowledge of organic techniques and disease risks [35]. Still, Bangladeshi farmers are progressively shifting to organic practices for sustainable livelihood and asset growth [36]. Global demand, especially in Japan, Hong Kong, Singapore, the European Union, and the United States, underscores the appeal of organic shrimp. These traits foster customer trust, premium pricing abroad, and sectoral advancement.

3.3.4. Increase in Value-Added Products

The global markets exhibit rising interest in value-added items, which yield 15–20% higher prices than frozen products. Among 59 EU-approved export plants in Bangladesh, 35 generate 30–35% value-added goods [21]. By elevating this to 50%, the shrimp sector’s export value might reach USD 500 million, given investments in advanced machinery.

3.3.5. Market Promotion

Until the mid-1990s, Japan was the primary importer of black tiger shrimp (70%) from Bangladesh. Later, Japan turned to importing processed shrimp from other nations, reducing Bangladesh’s exports to 10%. Yet, recent years have seen a rise in Bangladeshi shrimp exports to Japan. To thrive in global trade, Bangladesh must target new markets like Australia and the Middle East. This entails setting up marketing hubs in major cities of importing nations, aiding in market insight gathering, spotting prospects, and building a robust market presence.

3.3.6. Polymerase Chain Reaction (PCR)-Tested PL

PCR is a molecular biology technique used to amplify and analyze deoxyribonucleic acid (DNA) segment. PCR is crucial in various applications, including genetic research, diagnostics, and forensics. In the context of shrimp testing, PCR is employed to detect and identify specific pathogens, viruses, or genetic markers, aiding in the assessment of shrimp health and quality. White spot syndrome virus (WSSV) has become endemic and poses a significant threat to the sustainability and further expansion of the shrimp industry in Bangladesh. Small-scale shrimp farmers can benefit from adopting good quality seeds. Ensuring access to WSSV-free PL combined with implementing core best management practices at the farm level can help reduce disease risks and stimulate investment, leading to improved shrimp production and livelihood for farmers. Coordination among the government, industry, and research institutions is essential to develop and disseminate effective disease management strategies and improve the overall health and sustainability of the shrimp industry.

3.4. Threats

3.4.1. Scarcity of Broodstock Shrimp

The shrimp hatchery operators in Bangladesh have historically benefited from a large quantity of mother shrimp available from the nearby Bay of Bengal. However, due to inadequate enforcement and insufficient marine patrols, many fishing boats violate regulations and catch mother shrimp indiscriminately [3]. This practice may result in acute scarcity of broodstock shrimp in the future, which could impact the production capacity of hatcheries and the overall shrimp industry. It is necessary to strengthen regulation and enforcement measures to prevent overfishing and ensure the sustainable use of broodstock shrimp resources.

3.4.2. Natural Calamities

Bangladesh faces multiple climatic threats like cyclones, droughts, tidal surges, sea-level rise, and salinity. These disasters have had a severe impact on the shrimp farming industry. For instance, cyclone Sidr, which hit in 2007, destroyed around 54,000 shrimp
farms and hatcheries in the coastal districts [37]. Similarly, cyclone Aila in 2009 caused damage to approximately 38,900 hectares of shrimp farms in southwestern Bangladesh [38]. Floods caused by cyclone Amphan in 2020 severely damaged around 3000 shrimp and crab farms [39], while cyclone Yass in 2021 washed away 6500 shrimp enclosures, causing damage of BDT 9.5 crores.

These calamities not only inflict physical devastation but also impact shrimp producers’ financial capacity to ready their fields, procure PL, and acquire necessary inputs for the shrimp production cycle [40]. Consequently, households grappling with reconstructing homes and vital infrastructure face obstacles in investing in shrimp cultivation. By 2050, predictions signal that sea level rise and cyclones may extend coastal soil and groundwater salinity to affect two million hectares [41], accentuating coastal salinity. These challenges underline the urgent need for resilient strategies in the shrimp sector to navigate the escalating climatic risks.

3.4.3. Prevalence of Diseases

Disease outbreaks have been identified as the biggest obstacle to the development of shrimp aquaculture in Bangladesh. Viral diseases are a major problem for shrimp farmers globally, causing severe economic losses. For example, the WSSV caused losses of nearly USD 7 billion in the Asian and American aquaculture industries in the 1990s [42]. In Bangladesh, the shrimp sector has suffered significant financial losses, ranging from 832 to 3928 USD/ha/year [43]. Other viral diseases affecting shrimp farmers include infectious hypodermal and hematopoietic necrosis virus, Taura syndrome virus, yellow head disease, and infectious myonecrosis virus.

Shrimp farmers in Bangladesh have also reported physical deformities, nutritional deficiencies, and unknown diseases, indicating poor health of their stock. To maintain productivity, they are increasingly using a range of substances, including a high dependency on prophylactic products [44]. Addressing shrimp diseases is critical for the sustainable growth and success of the shrimp aquaculture industry in Bangladesh.

3.4.4. COVID-19 Impact

The global and local demand for shrimp has been significantly affected by the COVID-19 pandemic that originated in 2020. Bangladesh, the world’s largest exporter of monodon shrimp, has encountered numerous challenges due to the pandemic, resulting in detrimental effects on its production and export endeavors.

The pandemic’s impact on the Bangladeshi shrimp industry has been multifaceted. Prolonged lockdowns, travel restrictions, and social distancing measures have led to disruptions and workforce shortages across hatcheries, farms, and processing units. Consequently, there has been a notable decrease in the production of PL, along with reduced distribution and procurement by farmers.

The transportation sector, a pivotal component of the shrimp supply chain, has suffered severe setbacks due to the pandemic. Lockdowns have resulted in fewer operational commercial vehicles, which faced heightened scrutiny from law enforcement agencies. Moreover, the availability of shrimp seed stock has dwindled, leading to supply shortages and a staggering 200–300% surge in seed stock prices [45].

The pandemic prompted many farmers to prematurely harvest their shrimp. However, shrimp processing businesses encountered difficulties in procuring the harvested shrimp due to order cancellations, purchase delays, potential factory closures, and the return of migrant workers to their hometowns. Overseas demand for processed shrimp has also witnessed a sharp decline, with 290 export orders amounting to BDT 4.6 million (USD 420,000) already being canceled [46].

3.4.5. Export Competition

During 2005–2006, Bangladesh achieved a substantial revenue of more than USD 400 million from shrimp exports, establishing it as the second-largest contributor to the nation’s exports [24].
Despite this, the country’s presence in the global shrimp market remains modest, constituting less than 3% of the market share. Intense rivalry characterizes the realm of shrimp production, with numerous nations vying for dominance.

Bangladesh possesses favorable geographic conditions for successful shrimp cultivation. However, the sector faces challenges stemming from limited raw materials, technological disparities, exchange rate unpredictability, and volatile market prices. These impediments have hindered the country’s ability to establish a competitive edge comparable to shrimp-producing counterparts like India, Indonesia, the Philippines, Thailand, and Vietnam.

3.4.6. Consignment Rejection

When it comes to international trade, ensuring food safety is a significant concern. Regulatory bodies such as the Food and Drug Administration, the Rapid Alert System for Food and Feed, and the Ministry of Health, Labour and Welfare in the US, EU member states, and Japan closely monitor imports to their respective countries.

Cato and Santos [47] examined the immediate financial effects of the EU’s short-term ban on Bangladeshi shrimp imports. Simulation exercises projected a cost of roughly USD 65.1 million. However, some farms and exporters managed to redirect a substantial portion of their intended shipments to Japan and the US, thereby reducing the net loss to around USD 14.7 million.

The national inspection services of EU countries are responsible for sampling and examining imported products, rejecting those that do not meet the required standards. Rejected lots are either destroyed, particularly by Germany and the Netherlands, or returned/re-exported to other markets. The destruction of products can result in substantial economic losses for exporters from developing countries as well as European importers. The European Commission operates a “rapid alert system” that facilitates the sharing of information on encountered problems among countries, and this information is also disseminated to the private sector through national inspection services [48].

The EU notified the Bangladesh government regarding the presence of harmful chemicals, nitrofurans and metabolites, in 22 consignments from 13 shrimp processing plants [48]. In response, the government has taken action by temporarily revoking the export licenses of four shrimp processing factories after conducting necessary investigations to address the issue of harmful chemicals in shrimp.

3.4.7. Food and Veterinary Office (FVO) Inspection Mission Report

The FVO plays a vital role in ensuring adherence to European Union food quality and safety regulations through inspections conducted in EU member states as well as in countries exporting to the EU. The recommendations provided by the FVO to address any identified deficiencies can have implications for the import of food from specific countries or products [20].

Hence, in order to optimize productivity within the shrimp sector, it is essential to focus on increasing productivity at the farm level, addressing issues related to land use policies and ownership, promoting the use of appropriate inputs such as PL, fry, feed, and broodstock, and improving access to financial resources. These measures are key to maximizing output and ensuring the sector’s growth and success.

4. Discussion

The Bangladesh shrimp sector has played a pivotal role in the country’s economy, contributing significantly to exports and providing livelihoods for numerous coastal communities. The sector, while exhibiting strengths, also faces certain weaknesses that necessitate strategic interventions for sustainable development.

One of the major challenges faced by the Bangladesh shrimp sector is the recurring threat of disease outbreaks. This outbreak leads to massive losses, impacting both production and export revenues. There is a need for continuous research and development
to enhance disease-resistant shrimp breeds. Collaborations with international research institutions and investing in advanced biosecurity measures can play a crucial role in preventing and mitigating the impact of disease outbreaks.

The shrimp industry often faces criticism for its environmental impact. Unsustainable farming practices can lead to habitat destruction and water pollution. Implementing sustainable and eco-friendly practices, such as IMTA and responsible land use planning, can help minimize environmental degradation. Engaging with environmental organizations and regulatory bodies to establish and enforce stringent environmental standards will contribute to a more sustainable shrimp industry.

Furthermore, the shrimp sector faces challenges in market diversification and value addition. To address this, the industry can explore new markets, invest in branding and marketing strategies, and develop high-value shrimp products. Strengthening linkages between shrimp producers and processors can enhance value chains and ensure better returns for stakeholders.

The shrimp sector in Bangladesh has faced criticism for labor rights violations, including poor working conditions and low wages. Addressing these social issues is essential for the industry’s long-term sustainability and ethical practices. Implementing and enforcing fair labor standards, promoting worker empowerment, and fostering community engagement can help build a positive image for the Bangladesh shrimp sector. Certification programs that verify adherence to ethical and social responsibility standards can enhance market access and consumer trust.

The socio-economic aspect of the shrimp sector also requires attention. Small-scale farmers often lack access to financial resources, technical knowledge, and market information. Implementing capacity-building programs, providing affordable credit facilities, and establishing farmer cooperatives can empower small-scale farmers, improving their livelihoods and contributing to inclusive growth.

In terms of future development directions, enhancing infrastructure and logistics is crucial. Improving transportation, cold storage facilities, and processing units will reduce post-harvest losses and ensure the quality of shrimp exports. Government support plays a pivotal role in addressing weaknesses and steering the shrimp sector toward sustainable development. Policies that encourage responsible aquaculture, provide financial incentives for adopting eco-friendly practices, and facilitate international collaborations will contribute to the long-term success of the Bangladesh shrimp industry.

The Bangladesh shrimp industry, among the world’s largest, primarily relies on farmed tiger shrimp. Recognizing the distinctive taste and texture of tiger shrimp, establishing a robust brand identity in international markets, and promoting it as a sustainable product are essential steps to ensure the secure future of tiger shrimp. Bangladesh has made substantial strides in recent years to ensure the long-term viability of its shrimp farming, with a particular focus on preserving its iconic tiger shrimp. The country’s national action plan focuses on improving productivity, profitability, transparency, and sustainability across the shrimp sector, thereby enhancing its global reputation.

While Vannamei shrimp has gained prominence in the world market, Bangladesh, as the third-largest producer and exporter of monodon shrimp globally, aims to revitalize and promote its monodon shrimp through modernization and adopting a business model that integrates social, environmental, and food safety sustainability practices throughout the shrimp supply chain.

To support this endeavor, the government of Bangladesh has devised an action plan to increase annual black tiger shrimp production from approximately 60,000 to 200,000 metric tons. The World Bank is providing a USD 248 million fund to facilitate the establishment of over 20 SPF black tiger shrimp hatcheries and broodstock centers [49].

One of the primary goals of the “Bangladesh Action Plan for Branding Black Tiger Shrimp” is to establish a distinct brand identity for Bangladeshi black tiger shrimp, renowned for its organic attributes, in the international market. The action plan emphasizes the implementation of improved management practices at all stages of the supply
5. Conclusions

The SWOT analysis is a widely used qualitative research method employed by decision makers to assess the strengths, weaknesses, opportunities, and threats associated with a business venture in the present context. In order to increase the marketing and export of shrimp, Bangladesh should prioritize the production of high-quality shrimp. The ability to target high-value niche markets for shrimp requires proper coordination and collaboration among all stakeholders in the value chain, including fishery managers, regulators, growers, processors, and distributors. The industry must focus on producing differentiated food products that consistently meet consumer demands and preferences in terms of quality and quantity.

While the shrimp industry in Bangladesh has witnessed consistent growth in recent years, there is still considerable room for improvement in both technical and commercial aspects to ensure its sustainability, foster innovation, and enhance competitiveness. Key areas for improvement include enhancing the quality of fish and shrimp breeding, implementing effective disease control measures and animal health management practices, ensuring the availability of high-quality feed, optimizing post-harvest practices, promoting the development of a robust cold chain, and streamlining supply chain interdependencies.

To meet the demand and supply equilibrium, Bangladesh should explore new market opportunities in regions such as the Middle East, Hong Kong, Singapore, and Australia. It is crucial to address the issues of middlemen and commissions, who often exploit profits, in order to foster industry growth and development. Eliminating or regulating these practices would contribute to the overall improvement in the industry and position Bangladesh as a leader in sustainable and competitive shrimp production on the global stage.

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