Moving beyond Least Developed Country status: Challenges to diversifying Bangladesh's seafood exports

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Abstract:

Bangladesh is due to graduate from Least Developed Country status, resulting in the loss of preferential market access for textiles and ready-made-garments in key import markets. The paper examines the opportunities and constraints for developing a stronger export market orientation in the Bangladesh fish and seafood sector. We discuss the role of public and private standards in food safety and quality, as well as empirical evidence for their effect on fish and seafood value chains. We assess the factors limiting diversification into fish and seafood exports and constraints to value chain enhancement. The experience of export-oriented shrimp value chains provides lessons for the aquaculture sector. High costs of compliance with public and private standards and inability to meet traceability requirements for food safety and quality present a significant challenge. In diversifying beyond domestic markets for fish and seafood, the policy challenge lies in striking an appropriate balance between intervention and guidance.

Keywords: Diversification; aquaculture; seafood; food safety; standards

1. Introduction

Bangladesh has natural comparative advantages in marine coastal and inland water resources, but its exports of seafood accounted for less than 1 per cent of total exports by value in 2019 (FAO, 2018 OEC, 2021). Fish and seafood (which includes live, fresh/chilled, frozen or prepared fish and

crustaceans) is Bangladesh's main agri-food export sector, but exports are concentrated in a few product categories, such as frozen shrimp that accounts for 35 per cent of the sector's exports. Studies examining the agri-food sector, in particular fish and seafood, suggest that a potential pathway for sustainable growth in Bangladesh is to diversify into the agri-food sector (Sarker, 2018).[1] While the focus of policy dialogues has been primarily on the selection of sectors for export diversification, a discussion on how to address the fragmented agri-food supply chains and enhance the ability of exporters to meet public and private standards of importing countries is largely missing (Bangladesh Planning Commission, 2014). This paper discusses Bangladesh's aquaculture sector value chains and explores the opportunities and constraints for developing fish and seafood exports.[2]

The aims of this paper are twofold. First, the paper examines the role of public and private standards in food safety and quality and the implications of standards for fish and seafood value chains in Bangladesh. Second, the factors limiting Bangladesh's diversification into fish and seafood exports are assessed and major constraints that hamper value chain enhancement and affect the competitiveness of exporters are identified. Drawing on the experience of the shrimp sector, which has traditionally been more export-oriented, unlike fish aquaculture that has primarily supplied the domestic market, this paper comments on how the successes and failures in shrimp value chains provide lessons for the fresh and frozen fish aquaculture sector in diversifying

[1] Bangladesh is heavily reliant on ready-made garments (RMG) exports, which accounted for more than 84 per cent of total exports by value in 2018–2019 (OEC, 2021).

[2] Literature substantiates that countries can achieve sustainable growth through export diversification (Hausmann et al., 2007; Dunusinghe, 2009; World Bank, 2009; Sarker, 2018). Export concentration increases vulnerability and creates detrimental long-term effects, hence diversification is essential for economic growth (Sattar, 2015; Sumi & Reaz, 2020; World Bank, 2020). Export diversification can be achieved by either adding new products to the existing portfolio of exports or accessing new markets, or by a combination of the two.

into export markets. Limited ability to meet public and private standards poses a challenge for exporters. Further, improving export performance is dependent upon several interrelated factors, both specific to the agri-food sector and cross-sectoral, such as lack of skilled labour, resource depletion and overfishing, fragmented supply chains, and lack of supply chain connectivity.

The paper is organised as follows: Section 2 explains the implications for Bangladesh of graduation from Least Development Country (LDC) status and provides a brief overview of Bangladesh's export profile and the concentration into select products. Section 3 provides background on the growth of the commercial fish and seafood sector in Bangladesh, and explains the distinct types of supply chains in the sector and the efforts to improve food safety standards to facilitate export market access. Section 4 discusses the role of public and private standards in food safety and quality, summarising empirical evidence for the effect of standards on seafood exports. Section 5 lists the resource and supply chain challenges for the fish sector and lessons to be learned from the shrimp sector. Section 6 concludes with a consideration of policy implications for Bangladesh.

2. Bangladesh's graduation from LDC status and the challenges of export concentration

Bangladesh was included in the LDC list in 1975. It met the LDC graduation threshold in 2018 and the graduation criterion at the United Nations (UN) triennial review in 2021.[3] In June 2021, the UN Committee for Development Policy (CDP) recognised that the COVID-19 pandemic posed a threat to a sustainable graduation pathway out of LDC status and extended the preparatory period for Bangladesh from three years to five years, that is 2026 (UN, 2021). Countries graduate from the LDC list when they demonstrate an improvement in two of the three graduation dimensions,

[3] Bangladesh had per capita income of US$1827 (against the threshold of US$1230 for a country to be classified as a developing country) and HAI of 75.4 (against the threshold of 66 or above). Bangladesh's EVI score was 27.3 points; this must be below 32 points for an LDC.

namely per capita income criterion, the Human Assets Index (HAI), and the Economic Vulnerability Index (EVI), for two consecutive triennial reviews. The list of LDCs is reviewed every three years by the CDP.

Once it transitions away from LDC status, Bangladesh will lose the benefits from duty-free, quota-free (DFQF) imports under the non-reciprocal preferences allowed by high-income countries,[4] including the Everything but Arms (EBA) initiative of the EU. Following graduation in 2026, Bangladesh would be given a three-year transition before it loses DFQF access in the EU. Bangladesh's largest export market in 2017–2018 was the EU-28, followed by the United States (US), Canada, and Japan. Under the EU's EBA scheme, countries enjoy favourable EU Rules of Origin (RoO) requirements, which was a contributing factor in Bangladesh's phenomenal ready-made garments (RMG) export growth. Over 50 per cent of Bangladesh's knitwear exports and almost 40 per cent of its woven garment exports went to the EU in 2018 (UNDESA, 2020). Graduating LDCs can apply to the EU's Special Arrangement for Sustainable Development and Good Governance (General Scheme of Preferences plus (GSP+)), which grants duty-free access to 66 per cent of EU tariff lines. However, as it currently stands, Bangladesh may not qualify for the EU GSP+ scheme (UNDESA, 2020). First, the share of EU GSP-covered items sourced from Bangladesh must be below 6.5 per cent, but was 17 per cent in 2018. Second, Bangladesh has not ratified the International Labour Organization's (ILO) Convention concerning Minimum Age for Admission to Employment (No. 138, 1973), which is a prerequisite for EU GSP+. Should

[4] Developed (high-income) countries offer 'special and differential treatment' to developing (low- and middle-income) countries in the form of non-reciprocal trade preferences. Preferences schemes were established in the early 1970s and are founded on the idea of granting non-reciprocal and non-discriminatory preferential market access to developing countries, with the objective of increasing their export earnings, promoting their industrialisation, and accelerating their rates of economic growth.

Bangladesh be ineligible for GSP+ it will have access to the standard EU GSP schemes which include stringent RoO and higher than zero tariffs (Table 1).

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Literature lacks optimism on market access opportunities for Bangladesh after the loss of its LDC status. UNCTAD (2017) estimates that the reduction of exports could be in the range of 5 to 7 per cent, although this does not model EU-specific scenarios. Rahman and Bari (2018) estimate that additional tariffs of 6.7 per cent after graduation would result in export losses of US$2.7 billion, equivalent to 8.7 per cent of Bangladesh's total exports in 2014–2015. Razzaque (2018) reports that more than 92 per cent of Bangladesh exports to the EU will face an average tariff rate of 8 to 9.9 per cent after graduation. Further, stricter RoO, which determine what proportion of a product must be made from domestically sourced inputs, will impact Bangladesh's exports as the EU's general threshold for LDCs of non-originating materials is 70 per cent, in contrast to 50 per cent for EU GSP beneficiaries. Bangladesh relies heavily on imported inputs, especially for production of woven garments, and these will not be eligible for flexible RoO (with GSP or GSP+) but will be made worse when higher tariffs apply after graduation.

While the development of Bangladesh's RMG sector boosted manufacturing that led to its impressive economic and export growth, its RMG product mix has remained static, eschewing higher value and fashion garments to instead derive export growth from increasing volumes (World Bank, 2018; Sumi & Reaz, 2020). Further, the RMG sector is characterised by low product complexity with limited ability to diversify into new, more complex or value-added products (Sattar, 2015; World Bank, 2018; Sumi & Reaz, 2020). Bangladesh has implemented export

promotion policies to increase agricultural exports but these have been largely ineffective (World Bank, 2020).[5]

As Bangladesh prepares for graduation in 2026, strategies are required to enhance its competitiveness and diversify the economy and exports beyond textiles. The agri-food sector (including fish and seafood) is an important source of employment and rural livelihoods. The sector is evolving, moving beyond subsistence production to commercially oriented value chains, which reflects overall economic development progress in Bangladesh. One component of this progress is the potential for export market development in commodities for which Bangladesh has a potential comparative advantage, such as fish and seafood.

Agri-food[6] exports are Bangladesh's third most important export category, worth US$1.045 billion in 2019, but account for only 2.21 per cent of total exports by value (OEC, 2021). Fish and seafood[7] is Bangladesh's main agri-food export sector, and is concentrated into a few product categories; for example, frozen shrimp accounts for 35 per cent of the sector's exports. Figure 1 shows Bangladesh's top 15 agri-food products exports, which in 2019 accounted for 76 per cent of its total agri-food exports (US$793.7 million), with fish and seafood comprising 64 per cent (US$513.7 million) (OEC, 2021). Fish and seafood is the third largest source of export earnings and the most important agri-food export commodity for Bangladesh (Dey et al., 2010).

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Seafood exports have been dominated by frozen shrimp/prawns (75 per cent), worth US$363 million in 2019, as shown in Table 2 (OEC, 2021). In 2019, frozen shrimp exports were

[5] With the exception of a 10 per cent export subsidy for frozen shrimp (Banrie, 2013).

[6] Comprises animal-based food products including seafood and fish (excluding leather and hides), processed or preserved food products, fruit and vegetables, and animal/vegetable by-products.

[7] Live, fresh/chilled, frozen or prepared fish and crustaceans.

mainly destined for the EU, while China consumed Bangladesh's US$60 million of prepared crab exports (97 per cent) and its live fish exports (95.2 per cent). Whole frozen fish was destined for the UK (28.3 per cent), China (22.5 per cent), Saudi Arabia (16.9 per cent), the US (11.7 per cent) and the United Arab Emirates (UAE) (4.33 per cent) (OEC, 2021). Frozen fish is generally exported in frozen block form with little processing into fillets (Banrie, 2013). In 2019, frozen fish exports were valued at US$24.7 million for a 5 per cent share of all animal-based food products and 2.36 per cent of Bangladesh's top 15 agri-food exports (OEC, 2021).

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3. Development of the fish and seafood sector in Bangladesh

Bangladesh is not alone in the rapid development of its aquaculture sector, a trend reflected across a number of countries (see for example, Asche et al. 2018; Belton et al. 2018; Bush et al. 2018; Garlock et al. 2020; Little et al. 2018). Garlock et al. (2020) track the global 'blue revolution' in the growth of aquaculture across multiple regions and species, noting that it has been the food production technology with the fastest growth rate for several decades. Global trade in seafood continues to increase, both with respect to species and volume, with much of that growth sourced from aquaculture. In this vein, several authors have referred to the 'commoditization' of the global seafood market, with rapid technological advancements, adoption of modern logistics, improvements in storage and preservation technologies, and scale economies in processing and retailing (Anderson et al. 2018; Asche et al. 2018; Belton et al. 2020). As Belton, Bush and Little (2018) note aquaculture makes important contributions to food security in the Global South, with farmed fish produced by commercial and increasingly intensive farms serving poor and middle income consumers in both urban and rural areas. Tracking productivity growth in the salmon aquaculture sector, Ashe et al. (2018) characterize salmon as the world's most efficient seafood

supply chain, with considerable additional potential for product development as a component of value chain development.

Bangladesh's fish and seafood sector has a highly diverse resource base consisting of marine and inland fisheries that practice both capture and aquaculture production. Bangladesh's natural comparative advantages in marine coastal and inland water resources have allowed it to become the world's third largest inland capture, fifth in inland aquaculture, and eleventh in marine fisheries[8] production (FAO, 2018). Inland sources account for the majority of production and, given that more than half of the production is aquaculture, this is the main driver of exports in the sector. Fisheries (both capture and aquaculture) produce 73 per cent of Bangladesh's total animal production (World Bank, 2020) and meet 60 per cent of Bangladesh's demands for animal protein (Banrie, 2013; RVO, 2021).

Three distinct types of supply chain characterise the fish and seafood sector in Bangladesh: marine and inland capture fisheries, aquaculture for domestic consumption, and aquaculture for export. The growth rate in capture fisheries is in decline due to resource degradation, habitat loss, and overfishing, with small-scale fisheries dominating capture fisheries (Alam, 2011; UNCTAD, 2017). The commercial aquaculture sector in Bangladesh and elsewhere has undergone rapid growth and a significant transformation, sometimes characterised as a 'blue revolution' (Rashid & Zhang, 2019; Garlock et al. 2020). The government of Bangladesh has prioritised sustainable development goals (SDGs), of which blue growth in marine resources is important (Islam & Shamsuddoha, 2018), thus aquaculture will play an increasingly greater role compared to capture fisheries.

[8] 'Fisheries' refers to both fish and seafood, including crustaceans. 'Fish' refers to finned fish.

Aquaculture production more than tripled during 2000–2017 and provides 55 per cent of Bangladesh's fish supply (Hernandez et al., 2018; Shamsuzzaman et al., 2020). Inland aquaculture occurs in ponds, ditches, and seasonal water bodies, as well as in pen and cage cultures, to produce carp, tilapia, pangas, and koi, while coastal culture produces shrimp, prawn, and finfish in farms and pens (Shamsuzzaman et al., 2020). Shrimp account for around 70 per cent of agricultural exports from Bangladesh, nevertheless, the export share of farmed shrimp production has been declining steadily in recent years due to quality and infrastructure challenges on shrimp farms and post-harvest (Khan et al., 2022). Primarily located in coastal areas, shrimp aquaculture also remains particularly vulnerable to extreme climate disruptions (cyclones, storm surges) (Kais and Islam, 2018). Investment in processing facilities compliant with Hazard Analysis Critical Control Points (HACCP) has been an important component of export value chains (discussed in section 3.2). Non-shrimp (fish) aquaculture[9] primarily supplies domestic markets, with less than 3 per cent of total fish production exported (Banrie, 2013).

3.1 Fish

Bangladesh's domestic market for fish has undergone rapid development and transformation from subsistence farming to commercial aquaculture for domestic consumption (Hernandez et al., 2018). Over thirty years, domestic demand for farmed fish in Bangladesh has expanded significantly, and instead of subsistence farming, 92 per cent of farmed fish consumers in Bangladesh purchase their fish rather than consume from their own pond. During 2008-2018, the domestic supply chain for farmed fish has tripled in size, with significant growth in the number of fish farmers, feed providers, and wholesalers/traders (Zhang et al., 2019), along with a deepening

[9] Roughly 12 per cent of total fish production is of hilsa, Bangladesh's national fish, which is also a registered geographic indication.

in investment throughout the chain. This increase in activity and investment has been undertaken by thousands of small and medium enterprises (SMEs), from fish farmers to hatcheries, feed mills, transport, and wholesale actors (UNCTAD, 2017; World Bank, 2020; Khan et al., 2021). These investments have diversified the species farmed towards higher yielding, commercially oriented varieties such as tilapia and pangasius (pangus catfish),[10] subsequently reducing fish prices and stimulating demand. Pangasius accounts for a significant portion of farmed fish consumed in major cities such as Dhaka (Belton et al., 2012). The transformation of the aquaculture sector has occurred through private sector activity rather than government and non-governmental organisation (NGO) action or the imposition of standards or contracts (Hernandez et al., 2018, 2019).

But fish is not a major item in Bangladesh's export basket. Government policy in Bangladesh has facilitated investments in infrastructure, created a conducive operating environment, and allowed producers operational freedom in farming choices. Nevertheless, domestically oriented fish value chains with multiple stakeholders suffer from fragmented governance and a lack of coordination. The growing domestic market for farmed fish may have blunted incentives for investing in stronger export capacity. The species with the greatest export potential are the pangasius and the tilapia (Banrie, 2013; Fletcher, 2020), but both have strong domestic demand and provide high returns. Aquaculture and capture fisheries supply chains also lack production and processing capacity, skilled labour, infrastructure, and the necessary quality control to meet the food safety and quality standards of most foreign markets, as discussed in section 5.

3.2 Shrimp

[10] Bangladesh's production of pangasius grew by 17 per cent in 2020 (Fletcher, 2020).

Bangladesh is the world's twelfth largest farmed shrimp producer (Ferdous & Ikeda, 2018). In the 1970s, a US Food and Drug Administration (FDA) ban of Bangladesh's seafood exports over safety concerns prompted the government of Bangladesh to implement standards, regulations, and inspections in the seafood processing industry, with assistance from the UN Food and Agriculture Organization (FAO). In the late 1990s, the FAO provided assistance in preparing an HACCP-compliant quality and safety programme for shrimp and fish processing in Bangladesh, including training for processors, information on regulations in importing markets, and promotion of value-added exports. While the focus of the processing facilities is shrimp for export, they are multi-purpose seafood facilities capable of processing freshwater prawn, shrimp, white fish, and other marine species (Ferdous & Ikeda, 2018).

In 1997, the EU instituted a ban on seafood from Bangladesh due to quality control and hygiene issues. This ban spurred Bangladesh's government and exporters to undertake improvements in processing and laboratory infrastructure, implement further employee training, and update regulations to facilitate meeting HACCP and sanitary and phytosanitary (SPS) requirements. Subsequently, some processing facilities obtained licences to export fish products to the EU. Periodic bans and alerts have occurred since, resulting in Bangladesh taking action to improve testing capacity. Consequently, Bangladesh is currently a rare case of an LDC approved to export some varieties of fish and seafood to the EU, with the regulatory system governing these products harmonised with that of the EU (Dey et al., 2010; UNCTAD, 2017). Nevertheless, the ability of the sector to meet international standards (both public and private) remains a potential source of vulnerability.

4. Meeting public and private standards: challenges for seafood exporters

As Bangladesh seeks to diversify exports into a broader range of fish and seafood products, several challenges are apparent, including inconsistent food safety and quality, the inability to meet public and private standards of importing countries and firms, fragmented supply chains, and high transaction costs. This section examines the role of public and private standards in assuring food safety and quality, along with existing empirical evidence for the effect of these standards on seafood exports and global competitiveness.

4.1 Public standards

Public standards are mandatory requirements put in place by governments or regulatory agencies, entailing a legal obligation for compliance. Examples include food safety standards, minimum residue limits for chemical inputs, environmental protection regulations, and regulations protecting the health and welfare of workers (Hobbs, 2010). Agricultural commodity grading systems and national organic standards also define and signal quality, enabling credible quality signals within supply chains and facilitating trade over time and distance.

While public standards are typically enacted to achieve a legitimate domestic policy goal, they create compliance and monitoring costs within supply chains, particularly in an international trade context if different countries enact different regulatory standards. The World Trade Organization (WTO) distinguishes between SPS measures (related to food safety and animal and plant health) and technical barriers to trade (TBT) (related to non-SPS measures, such as labelling and packaging). Gourdon and Nicita (2012) report that SPS measures affect 60 per cent of trade in food-related products. Orden et al. (2021) find that 38 per cent of notifications to the WTO TBT committee concerned measures related to agri-food products.

A growing body of empirical literature has examined the effect of public standards on trade in agriculture and food products, with a particular focus on food safety and quality standards. This

literature recognises that standards may inhibit trade due to increased costs of compliance, particularly for low- and middle-income countries (standards as barriers), but may also facilitate trade by improving information flows, thereby increasing demand, and create an incentive for countries to modernise their export sectors and strengthen domestic food safety standards (standards as catalysts) (Anders & Caswell, 2009; Medin, 2018). While non-tariff measures (NTMs) are subject to abuse through their imposition as trade barriers, most SPS measures protect human, animal, or plant health, even if agreement is sometimes lacking on the appropriate scientific basis for these barriers (Hobbs et al., 2014). Disdier and Marette (2010) find that the adoption by the US, EU, Canada, and Japan of a standard limiting antibiotic residues (chloramphenicol) in crustaceans had a negative impact on crustacean imports, yet generated welfare gains domestically and internationally.

Asian countries account for a significant share of world production and trade in crustaceans; however, heavy use of pesticides, harmful drugs, and antibiotics such as chloramphenicol to address bacterial infections in aquaculture production is harmful to human health (Disdier & Marette, 2010). A series of problems with imports of shrimps from China, India, Pakistan, and South East Asian countries led to repeated bans and testing requirements by the EU, the US, Canada, Japan, and other major importers. The imposition of a cap on chloramphenicol residues by major importers (including the EU) impacted trade. Seafood import border rejection cases due to chloramphenicol cases rose from zero per cent of EU border cases in 2000 (prior to the standard) to 36 per cent of border cases in 2002 (Disdier & Marette, 2010). The standard spurred a change in production practices among export-dependent shrimp producers in Asia, including selection of different shrimp varieties and adopting HACCP programmes. Thus, the maximum residue limit (MRL) standard acted as a catalyst for change. Disdier and Marette (2010)

show that the adoption of the MRL by the US, Canada, and the EU resulted in a loss to foreign exporters, but (in most cases) this loss was offset by welfare gains which accrued to domestic consumers and producers.

Examining the effect on US seafood imports of the 1997 US mandatory HACCP food safety standard, Anders and Caswell (2009) find the effect was positive for high-income country exporters, but negative (overall) for low- and middle-income countries. Drilling down to country-specific effects, the story is more nuanced with larger, more established seafood exporting countries (regardless of development status) gaining increased trade with the US at the expense of smaller low- and middle-income country exporters.

The empirical literature on the effect of public standards on trade finds heterogeneous effects across products and across types of standard. Chen et al. (2008) examine the effect of standards imposed by high-income countries on 17 low- and middle-income countries; they report that quality standards tended to increase exports, while certification requirements reduced exports. Medin (2018) cites evidence of a high incidence of NTMs for seafood (both SPS and TBT notifications). Using firm-level data, Medin examines the effect of SPS standards on trade in seafood at both the extensive margin (the number of firms exporting a particular product to a particular country) and intensive margin (firms' average exports), finding that standards have a negative effect on both margins of trade. Nevertheless, the negative effect for fresh seafood products is offset by a counteracting positive effect due to increased demand for products utilising enhanced food safety measures. The differences across products (e.g. frozen versus fresh) have important implications for seafood exporters such as Bangladesh who have tended to focus on lower quality (frozen) exports.

Fatema and Islam (2020) use a gravity model and a multi-country panel data set to examine the driving forces behind marine fisheries and seafood exports by Bangladesh in 1990–2011 (marine fisheries) and 2005–2011 (seafood). They find that the adoption of HACCP standards by importers significantly reduced exports from Bangladesh, while regional trade agreements had mixed effects. Gravity modelling by Nguyen and Wilson (2009) presents empirical evidence of a significant negative effect of changing food safety regulations in the EU, the US, and Japan on world trade in seafood over 1992–2005. Their analysis suggests that the Japanese food safety standard had the largest effect, with lower value products least affected. While Anders and Caswell (2009) find that the negative effect of food safety standards on trade dissipates over time, Nguyen and Wilson (2009) find the opposite effect when focusing on just low- and middle-income countries. Their analysis confirms differential impacts across products, with shrimp being the most sensitive and fish the least sensitive to changing food safety policies.

Asche et al. (2015) examine seafood trade flows between high-income and low- and middle-income countries, focusing on prices, quantities, and quality. They find evidence of quality exchange, with low- and middle-income countries exporting high-quality seafood to high-income countries in exchange for imports of low-quality seafood, arguing that this is driven largely by an income effect: people with higher incomes substitute away from cheaper food.

Differences in consumer demand, in part driven by differences in income, also explain incentives to adopt stricter public standards. As Hoffman et al. (2019) note, many factors contribute to food safety problems in low- and middle-income countries, from limited consumer awareness and ability to pay for food safety, and lack of market incentives to invest in food safety along the supply chain (beyond the farm), to inadequate enforcement due to weak public institutions. These problems are particularly acute for domestically oriented supply chains, while

the incentives to adopt stronger, enforceable standards in export-oriented supply chains are considerably stronger. In the Bangladesh context, the use of HACCP food safety management systems in the export-oriented shrimp sector stands in stark contrast to the primarily domestic-oriented fish aquaculture sector.

When tighter food safety regulations result in food import refusals, the blocked products may instead be exported to other countries with less restrictive import regimes. Seafood products are prone to food safety violations and receive the most import refusals by the EU and US (Buzby et al., 2008). Baylis et al. (2011) examine the trade effects of seafood import refusals by the EU, finding evidence for significant trade deflection in the case of less health-threatening violations, suggesting these products find an alternative import market. The exporting country that is subject to an import refusal sees a decrease in exports to the EU for the product category, but an increase in that category to other high-income markets. Trade diversion occurs for less serious violations, such as mislabelling, while serious infractions with more serious health consequences (e.g. failure to meet MRL standards) result in reduced export shipments overall. Two implications are apparent for the Bangladesh fish and seafood sector: first, the nature of the NTM violation matters (a serious food safety violation versus a mislabelling violation), and second, the need to develop diverse export markets.

4.2 Private standards

Beyond public standards for food safety and quality, there is an ever-increasing array of private standards initiated by firms, industries, and/or third parties. Private standards relate to food safety, sustainability, animal welfare, labour standards, and other ethical considerations, singly or in combination. Private standards may be established at the firm level (proprietary), the industry or sector level (consensus), or by third parties. Proprietary private standards are established by

individual firms and are often a component of the firm's product differentiation strategy, signalling quality to consumers. Firm-level standards may also play an important role in enhancing supply chain management (reducing the transaction costs of sourcing specific qualities) and in protecting the reputation of the firm (Hobbs, 2010). Examples include Walmart's supplier standards and Starbucks' ethical sourcing standard.

Consensus standards are developed collectively by an industry group or across a sector, and are usually intended to reduce transaction costs within supply chains (Hobbs, 2010). A primary example is the GLOBALGAP standard for good agricultural practices, which began as a collaborative effort among European food retailers in 1997 (as EUREPGAP). Participating retailers require suppliers to be certified to GLOBALGAP standards. Others include the Global Food Safety Initiative (GFSI) and International Featured Standard (IFS), which are post-farm food safety certifications. Finally, third party standards are typically initiated by NGOs targeted at a specific objective, for example sustainability. Fish and seafood examples include the Marine Stewardship Council (MSC) certified seafood programme, the Aquaculture Stewardship Council (ASC), Best Aquaculture Practices, Seafood Watch, and Oceanwise.

'Voluntary' private standards can be important in terms of their effect on trade, and may be *de facto* mandatory if a sufficient number of key buyers adopt the standard as a requirement (Henson & Reardon, 2005). Private standards create similar challenges to public standards for low- and middle-income country exporters, including compliance costs, lack of technical expertise and the need for skills upgrading, and underinvestment in infrastructure, as well as weak public institutions and limited access to certification and accreditation services. Nevertheless, private standards facilitate entry to high-value supply chains by providing credible quality signals. Indeed, often, private standards are embedded within a broader value chain approach to sourcing inputs,

where attention to reducing the barriers to adoption is a component of the value chain approach (Henson & Reardon, 2005; Hobbs, 2007).

The literature that has emerged evaluating the role of private standards on supply chain relationships and export outcomes points to the effects of standards on trade as being highly context-specific. Ehrich and Mangelsdorf (2018) examine the effect of IFS food standard certification on processed food exports at the firm level, finding that, on average, adoption of post farm food safety standards increases bilateral exports for high- and middle-income countries, but not for low-income countries. Moreover, the effect of IFS certification differs by sector, with a trade-enhancing effect only for the bakery, dairy, and beverage sectors.

MRLs are often trade-reducing (Li & Beghin, 2012), while GLOBALGAP certification increases exports, facilitating market access for certified exporters (Colen et al., 2012; Masood & Brümmer, 2014). Ehrich and Mangelsdorf (2018) find that IFS certification of fish results in lower exports, and speculate that this may be due to crowding out of non-IFS-certified fish exports by IFS-certified fish farms, resulting in a net negative effect on fish exports overall. The winners and losers in the process of upgrading food safety standards to meet international requirements remains a challenging policy scenario for countries such as Bangladesh.

In reality, exporters often face both public and private standards in their primary export markets. These include HACCP standards, prohibition of antibiotic residues, and other MRLs comprising overarching requirements for market access to a particular country or region, along with specific private standards from retailers or coordinated by NGOs. The private standard may facilitate compliance with broader public standards. For example, the Aquaculture Certification Council (ACC) created by the Global Aquaculture Alliance (GAA), a US-based organisation, certifies stakeholders at various stages in the aquaculture supply chain, including hatcheries, feed

mills, producers, and processors. A number of major international retailers and food service providers accept the ACC certification (Tran et al., 2013).

Other NGO-led certification initiatives include the ASC which arose as a collaborative initiative between the World Wildlife Fund (WWF) and the Dutch Sustainable Trade Initiative, and which plays a similar role in aquaculture to the MSC, which certifies wild fisheries (Tran et al., 2013). ASC certification encompasses environmental stewardship and workers' rights, but not food safety. GLOBALGAP certification, which encompasses food safety along with other quality attributes, was expanded in 2004 to include shrimp and other aquaculture products. As Tran et al. (2013) note, ACC, GLOBALGAP, and the ASC are the primary certification bodies for aquaculture (although by no means the only ones). A move by major global retailers such as Walmart and other US grocery chains towards sourcing certified seafood has increased the stakes for seafood exporters in meeting private certification standards.

Often, fragmented supply chain structures make it difficult to maintain the traceability and chain of custody necessary for certification. Tran et al. (2013) highlight these challenges for the Vietnamese shrimp sector. Weak and fragmented value chain governance results in the mixing of product from low input operations (e.g. no antibiotics) with intensive operations, resulting in a classic 'lemons' problem where low quality (overuse of chemical inputs) chases high quality from the market (Akerlof, 1970). One solution is vertical integration along the value chain to reduce quality uncertainty from information asymmetry, for example by strengthening traceability and enabling more quality control in the sourcing of shrimp, although this may occur at the expense of marginalising small-scale shrimp farmers (Tran et al., 2013). In the absence of strong public institutions for measuring and monitoring quality, vertical integration is a transaction cost-reducing response to quality uncertainty. Other solutions include enhanced quality monitoring and

certification at key points along the supply chain, but these require investments in quality monitoring infrastructure and enhanced information flows.

The proliferation of private standards and certification of aquaculture products reflect a stronger emphasis by consumers in high-income countries on environmental practices, sustainability, and pro-social goals, with retailers competing to display their 'green' credentials, often driven by pressure from NGOs. As a result, aquaculture supply chains may be subject to multiple standards, encompassing food safety, food quality, environmental and social practices, and traceability. Belton et al. (2011) list six main standards for certification of pangasius production in Vietnam. The ability to meet these standards has become critical to the commercial success of export-oriented fish and seafood supply chains in low- and middle-income countries. Due to the need to manage production risks and producer capabilities, Bush (2018) finds that eco-certification is more likely to be adopted in more closely vertically coordinated shrimp and aquaculture value chains.

At an individual producer level, small-scale, technically inefficient smallholders are often excluded from these aquaculture supply chains due to the costs of compliance, feeding practices that fail to meet traceability requirements, and poor water quality standards. These challenges are particularly acute for Bangladeshi aquaculture producers. As Belton et al. (2011) note, large well-financed operations run by successful entrepreneurs do exist in Bangladesh and are best placed to move into export-oriented production. Supply chain governance is a key element of success in this regard. Firms with tighter control over supply chain operations, through vertical integration or close relationships with feed mills, nurseries, and hatcheries, are more easily able to meet the quality and traceability requirements of certification programmes. The next section considers

additional implications for transitioning the Bangladesh fish and seafood sector to a stronger export orientation, enhancing its competitiveness.

5. Resource and supply chain constraints: Lessons from the shrimp sector

Bangladesh has capitalised on its LDC status and EU export approval, with the volume of shrimp, frozen fish, and dry and salted fish exported growing annually from 1999 to peak in 2011–2012. Shrimp exports from Bangladesh were competitively priced for the EU market in part due to a 10 per cent export subsidy from the Bangladesh government (Banrie, 2013; RVO, 2021). Since 2015, however, shrimp export growth and revenues have been stagnant, with either a static or declining trend, mostly attributable to issues meeting the safety and quality standards of importing countries (Ponte et al., 2014; World Bank, 2020; RVO, 2021). Problems throughout the supply chain impede value addition or growth in shrimp exports and as a result, the sector has low productivity. The COVID-19 pandemic has further affected the market, and prices of fish feed have increased drastically.

As in other LDCs, despite the relatively successful development of Bangladesh's capture fisheries and aquaculture (particularly in shrimp), the sector is underdeveloped, caught between supply and demand constraints. Unique to the capture fisheries sector are issues such as overfishing and depletion of fish resources, water pollution, and a lack of common fishery policies among countries that share water resources. Major environmental constraints such as habitat and breeding ground loss, wetland degradation, and overexploitation, as well as overuse and run-off of pesticides, agrochemicals, and industrial waste, are not unique to Bangladesh (Dey et al., 2010; Shamsuzzaman et al., 2020). Overfishing is an especially critical threat, not only in Bangladesh but globally. However, finding the balance between developing the productivity and competitiveness of the sector while maintaining fish resources and mitigating overfishing is

challenging, with limited administrative and financial capacity for regulating, monitoring, and enforcement. Degradation of natural resources creates additional challenges in meeting private sustainability standards in key export markets.

A shortage of publicly accessible icing and cold storage facilities at fishery landing sites leads to high losses and wastage as well as poor hygiene practices, compromising food safety and quality in capture fisheries. Landing sites are poorly connected to markets, creating bottlenecks where only a small number of distributors have connectivity to the supply chain (Ponte et al., 2014; UNCTAD, 2017; Ferdous & Ikeda, 2018). Existing cold storage facilities are government owned and dedicated to horticultural crops, while general storage infrastructure is also in limited supply (World Bank, 2020).

Bangladesh's production is characterised by a large number of small producers with low levels of technical skills. Access to high-quality inputs (feed, fingerlings, etc.) continues to present a challenge, along with knowledge and practice of proper input use, and limited access to skilled labour. Land tenure systems (self-owned farms versus cash tenant farms) generate different outcomes with respect to productivity, efficiency, and profitability (Mitra et al., 2022). Limited access to extension services and poor information dissemination hamper improvements in production practices and marketing. Limited access to finance or credit for small operators is also common (Mahmud et al., 2022). Transportation and storage infrastructure is fragmented, while inadequate energy infrastructure and high electricity costs constrain the processing sector. Non-compliance with the food quality and safety standards of importing countries stems partly from capacity constraints at the producer level and their inability to achieve the international certifications necessary to fetch premium prices in the international market; but it also stems from downstream capacity constraints, including difficulties accessing processing facilities, such as cold

storage, and lack of testing and certification of products throughout the value chain (UNCTAD, 2017; Khan et al., 2018; Shareef et al., 2020; Islam, 2021; RVO, 2021).

Economic, technical, and knowledge constraints impeded the development of value-added activities in the shrimp sector (Ponte et al., 2014). Despite government and NGO investments in shrimp processing facilities, which created the capacity to meet EU standards,[11] quality control remains an issue (Ponte et al., 2014; UNCTAD, 2017; Ferdous & Ikeda, 2018). Those processing facilities operate far below capacity (in the range of 20–25 per cent capacity) due to declining shrimp catches in the capture fishery caused by overfishing, as well as government subsidies that discourage investment (Ponte et al., 2014; UNCTAD, 2017). Other capture stocks have also declined, reducing supplies of alternative species for processing (UNCTAD, 2017). After initial export success based on preferential access to the EU, enhanced by price competitiveness gained through government subsidies, the shrimp sector lacked the capacity to further develop and upgrade (Ponte et al., 2014).

Additional constraints include access to raw materials, skilled labour, and capital. Ponte et al. (2014), Banrie (2013), and RVO (2021) highlight a number of factors affecting production, including low-quality inputs, feed and feeding practices resulting in high mortality, poor larval quality and bottlenecks in acquiring quality shrimp seeds (as most brood stock is dependent on wild collection), high losses, and low yields. Poor data management and record-keeping, and fragmented supply chains with limited information flows inhibits traceability, often a requirement in export markets and a useful food safety risk mitigation mechanism. Limited access to finance and low skilled labour lead to low participation in sustainable certification initiatives such as Best

[11] There are 129 processing facilities for both domestic and international markets. Of these, 53 are approved for export to the EU (UNCTAD, 2017).

Aquaculture Practices,[12] which provides the chain of custody traceability based upon environmental responsibility, animal health and welfare, food safety, and social accountability. Processors are unable to diversify into value-added products, although some export-oriented processors are attempting to offer variety such as specific cuts ('butterfly') and chilled rather than frozen shrimp. Further, the lack of a skilled workforce to process valued-added shrimp products and implement modern management and processing techniques has limited growth opportunities in markets that demand higher quality attributes. Some exporters have, however, diversified to new markets with less stringent quality standards, such as Russia and the Middle East.

As Bangladesh seeks to diversify its export portfolio, many of these constraints also apply to fish value chains. The early growth in shrimp exports, followed by more recent stagnation, provides lessons for the fish sector. Indeed, the ability of many processing plants to handle both shrimp as well as other seafood and fish species points to a common set of supply chain and infrastructure constraints that need to be overcome in transitioning away from reliance on a few key export commodities.

6. Implications and conclusions

Graduation from LDC status marks a significant achievement for a low- and middle-income country with respect to meeting thresholds related to per capita incomes, HAI, and EVI. Nevertheless, achieving this milestone comes with potential negative international trade consequences through loss of preferential access provisions in major importing markets such as the EU. For Bangladesh, if graduation proceeds as expected in 2026, the overwhelming concentration of its export portfolio in one sector (textiles and RMG) compounds this vulnerability. Export diversification into other sectors is recognised as an important strategy for

[12] Offered by the Global Aquaculture Alliance, https://www.bapcertification.org/

Bangladesh, with the agri-food sector, and in particular fish and seafood, representing a potential diversification opportunity.

Bangladesh has long been a major producer of fish and seafood products through capture fisheries, and more recently through rapid growth in aquaculture production. While much of this production (particularly fish) has traditionally been subsistence in nature, commercial aquaculture operations (both shrimp and fish) are growing in significance, fuelling a 'blue revolution' as value chains emerge to service both the domestic and export markets. The contrast between shrimp and fish value chains in this regard is striking, with the vast majority of shrimp production traditionally destined for export markets, while fish production almost entirely services the domestic market. The successes and failures experienced by the shrimp sector provide lessons for further development and export orientation of fish-based aquaculture.

The most significant constraint facing the shrimp sector has been the need to meet public and private standards for food safety and quality in importing markets on a consistent basis. Early failures resulting in loss of access to the EU and US markets spurred significant investments in HACCP-compliant food processing facilities and an overhaul of the regulatory environment governing these facilities. Government and NGO support and resources, along with targeted assistance from key importers, enabled these important investments. Vulnerabilities continue to plague other points of the supply chain, particularly at the producer level, and in storage, transportation, and distribution. Investments in value chain development, producer capabilities, processing and distribution infrastructure could assist in addressing these vulnerabilities.

The growth of private standards encompassing additional sustainability and pro-social criteria has additional implications for fish and seafood value chains, for both capture fisheries and aquaculture production systems. Problems of resource depletion and overfishing make it unlikely

that capture fisheries will be a sustained source of export growth, with well-managed aquaculture operations better placed to meet sustainability criteria. Nevertheless, meeting these standards will require significant investments in extension services and labour and skills upgrading. In addition, enhanced management practices and water quality, cold chain distribution, and supply chain traceability are also required. There is also a need for training and technical knowledge, improved access to extension services for information sharing, management techniques such as feeding and culture habitat, dissemination of market intelligence, product quality management, environmental management, marketing, and post-harvest handling. Greater focus is needed on the influence of value chain relationships (vertical integration versus market-based transaction) on the incentives for quality upgrades and capacity building, particularly in the context of meeting private standards for food safety and quality. Just as the Bangladesh government prioritised processing infrastructure investments to meet EU and US food safety standards, attention to other constraints impeding the commercial success of aquaculture supply chains will be needed.

The explosive growth in commercial (fish) aquaculture in Bangladesh occurred organically: unplanned and undirected by government or NGOs, as individuals made private choices in response to market signals (Hernandez et al., 2018). In diversifying beyond domestic markets, the policy challenge, therefore, lies in creating the right balance between intervention and guidance. Ensuring that the institutional environment facilitates rather than impedes further growth in the commercial aquaculture sector, strengthening connectivity and coordination within aquaculture value chains, will be an important first step.

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The authors report there are no competing interests to declare.

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Table 1. Non-LDC tariffs for Bangladesh's major export items in the EU after graduation

HS code	Product	Share in exports to the EU (2018)	Tariffs after graduation under GSP	Tariffs under GSP+	MFN tariffs
61	Knitwear	53 per cent	6.4–9.6 per cent. 9.6 per cent for most products.	0 per cent	12 per cent for most products
62	Woven garments	38 per cent	5–9.6 per cent. 9.6 per cent for most products.	0 per cent	12 per cent for most products
64	Footwear	2 per cent	0–11.9 per cent. 4.5 per cent for most products.	0 per cent	12 per cent for most products
63	Home textiles	2 per cent	1.6–9.6 per cent. 9.6 per cent for most products.	0 per cent	12 per cent for most products
03	Frozen fish	1 per cent	0–18.5 per cent. 4.2 per cent for most products.	0 per cent	12–20 per cent for most products

Source: Adapted from UNDESA, 2020

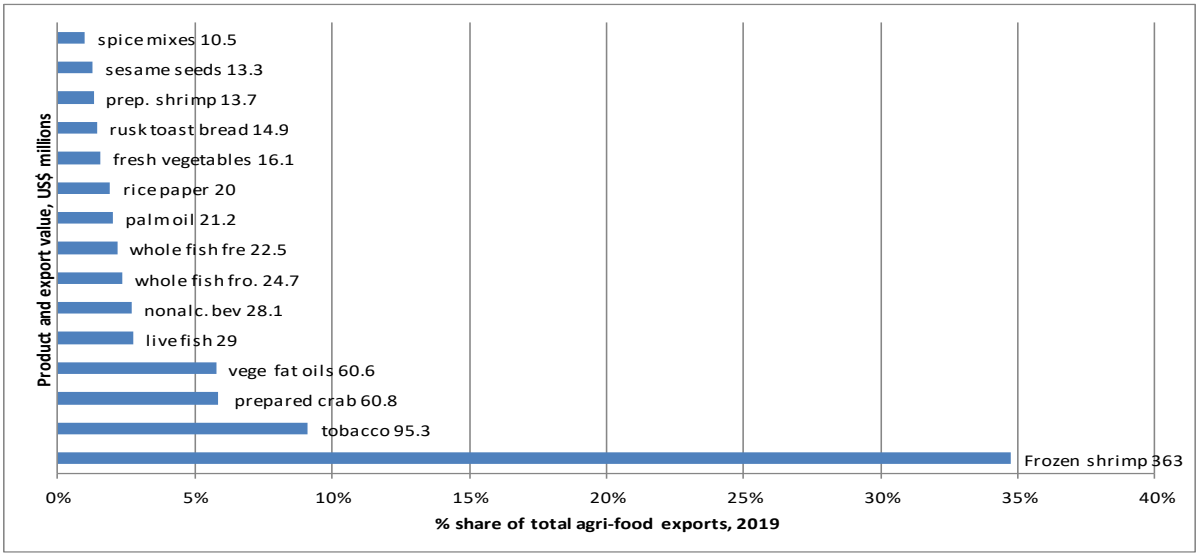
Table 2: Composition of Bangladesh's Top 15 fish and seafood exports[13], 2019

Product code	Product description	Total value (US$ million)	% of seafood exports
030613	Frozen shrimp/prawns	363	70.66
160510	Processed crab	60.8	11.84
030199	Fish (live, except trout eel carp)	29	5.65
030379	Fish whole (frozen nes)	24.7	4.81
030269	Fish whole (fresh/chilled nes)	22.5	4.38
160520	Processed shrimp	13.7	2.67

Source: Derived from OEC, 2021

[13] Bangladesh also exported US$7.49 of frozen crab in 2019, its seventeenth most important agri-food export.

Figure 1. Bangladesh's top 15 agri-food exports, 2019 (per cent share of total agri-food exports by value)



Source: Own compilation from OEC, 2021