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Quantifying export bottlenecks faced by India's shrimp exporters

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Abstract

India has emerged as a dominant player in global shrimp exports, contributing significantly to foreign exchange earnings and rural livelihoods. However, its sustained competitiveness is increasingly challenged by firm-level bottlenecks across the export value chain. This study provides a structured and quantitative prioritization of these constraints using Garrett's ranking technique. A field survey of 30 shrimp exporters based in Kochi port, Kerala, a key seafood export hub, was conducted to assess the challenges across five dimensions: regulatory, trade-related, institutional, supply chain, and financial.

The analysis revealed that raw material scarcity (Mean Garrett Score = 81.3) and export rejections due to antibiotic residues (77.2) were the most critical constraints. Other high-severity issues include limited institutional support (73.6) and restricted access to trade credit (73.6). Although geographically focused, the study reflects structural weaknesses common across India's seafood export sector. The findings offer a micro-level understanding of systemic constraints that often go unaddressed in top-down trade policy.

By highlighting the most pressing challenges from the exporters' perspective, this study contributes practical insights for designing targeted trade, regulatory, and financial interventions. Such interventions are essential to improve resilience, reduce transaction costs, and enhance India's long-term competitiveness in the global shrimp trade.

Keywords: Shrimp exports, Garrett ranking technique, export constraints, trade policy barriers, aquaculture trade, seafood supply chain

1. Introduction

India has emerged as the largest global exporter of frozen shrimp, accounting for approximately 25% of international trade by volume in 2019-20 (World Bank, 2025) [22]. The sector plays a pivotal role in the country's Agri-export portfolio, generating over USD 7.38 billion (2023-24) and supporting millions of livelihoods in coastal regions (Salim & Anuja, 2022; PIB, 2024) [15, 11]. India's success in shrimp exports has been fuelled by the widespread adoption of intensive aquaculture practices, improvements in processing technology, and rising global demand in high-value markets such as the United States (US), the European Union (EU), and Japan, having high probability of Indian shrimp import retention (Vinay *et al.*, 2016; MPEDA, 2022; Paul, 2024) [21, 10].

However, this export success is increasingly under pressure due to a complex set of challenges. Rising compliance requirements, particularly related to antibiotic residue limits and traceability, have led to frequent rejections and trade disputes (Geetha *et al.*, 2020) [4]. The imposition of anti-dumping duties and countervailing tariffs by the United States, India's largest shrimp importer, has further impacted price competitiveness (Ancy & Raju, 2014; Krishnamoorthy & Dinesh, 2020) [1, 6]. Moreover, global supply surges, particularly from countries like Ecuador and Vietnam, have

driven down international prices, eroding profit margins for Indian exporters (John, 2025; Rajani & Balasubramanian, 2025) [5, 13]. These macro-level pressures intersect with a lot of structural issues, including insufficient institutional support, limited cold storage infrastructure, and credit inaccessibility, especially for small and medium exporters (Raghuram & Asopa, 2008; Singh *et al.*, 2022; Vijay & Raju, 2024) [12, 18, 20].

While prior research has extensively explored the production-side challenges in Indian aquaculture, such as disease outbreaks, monoculture risks, and feed quality, relatively few studies have employed a structured, quantitative approach to analyze the diverse bottlenecks faced by shrimp exporters once the product enters the international trade system. Existing literature has often addressed individual constraints in isolation, for example, focusing on anti-dumping duties or specific compliance issues. This study fills a critical gap by assessing and ranking a comprehensive set of constraints across five key dimensions—regulatory, trade, institutional, supply chain, and financial, from the direct perspective of exporters. By applying Garrett's ranking method to a sample of firms in Kerala, a major seafood export hub (MPEDA, 2024), this research provides a prioritized, data-driven understanding of the challenges at the firm level, which is essential for

designing targeted trade and regulatory policies.

2. Methodology

2.1 Study area and sampling design

The study was carried out among shrimp export firms located in the Ernakulam and Alappuzha districts of Kerala, India. These districts are major seafood export hubs in the country, with a dense presence of shrimp processing units and steady participation in international trade. Kerala accounts for a substantial share of India's marine product exports in terms of both volume and value, making it an ideal context for investigating export-related constraints.

A purposive sampling approach was adopted to select respondents from the target districts, based on their active involvement in shrimp export during the financial years 2022-23 and 2023-24. Exporters listed with the Marine Products Export Development Authority (MPEDA) and the Seafood Exporters Association of India formed the sampling frame. A total of 30 shrimp exporters were selected for detailed interviews. These included small, medium, and large firms, providing a diverse representation in terms of scale, market destinations, and integration into the supply chain.

Primary data were collected through semi-structured interviews, supplemented by key informant discussions with seafood association members and compliance officers. The interviews were designed to extract both quantitative rankings and qualitative insights into the challenges faced by exporters across multiple dimensions.

2.2 Identification of constraint variables

An initial pool of constraints was identified through a systematic review of academic literature, trade policy documents, and MPEDA and FAO reports. This was followed by a pilot survey and expert consultations to contextualize the variables within the Kerala shrimp export ecosystem. Based on frequency, relevance, and expert validation, a final list of 22 constraints was grouped into five broad categories, viz., Regulatory and compliance constraints, Trade and market constraints, Institutional constraints, Supply chain and infrastructure constraints, and Financial and production constraints.

2.3 Analytical Framework: Garrett Ranking Technique

To assess the severity of each constraint from the exporters' perspective, the study employed Garrett's Ranking Technique (Garrett & Woodworth, 1973) [2]. Respondents were asked to rank the constraints within each category according to their perceived severity. The ranks were then converted into scores using the following formula:

$$\text{Percent position} = \frac{(R_{ij} - 0.5)}{N_j} * 100$$

Where:

- R_{ij} = Rank given for the i^{th} constraint by the j^{th} respondent
- N_j = Number of constraints ranked by the j^{th} respondent

Using Garrett's standard score conversion table, the percent positions were converted to scores. The scores assigned by all respondents for each constraint were then aggregated and averaged to obtain the Mean Garrett Score (MGS). Higher MGS values indicate higher severity as perceived by exporters. This method allows for a structured, quantitative prioritization of multidimensional qualitative data.

2.4 Ethical Considerations

Informed consent was obtained from all respondents before interviews. Identities of firms and individuals were anonymized to ensure confidentiality. Data were used strictly for academic purposes.

3. Results

This section presents the findings from the Garrett Ranking analysis, which was used to identify and quantify the perceived severity of constraints faced by shrimp exporters in Kerala. The constraints were grouped into five categories: Regulatory and compliance, Trade and market, Institutional, Supply chain and infrastructure, and Financial and production. The aggregated Mean Garrett Scores (MGS) for each constraint are presented in Table 1, with constraints ranked from most to least severe within each category.

Among all identified constraints, the availability of raw material emerged as the most critical issue reported by exporters, with an MGS of 81.3. This was followed closely by antibiotic residues, leading to export rejections (MGS = 77.2). Other high-scoring bottlenecks included financial inaccessibility and limited government support, each with a score of 73.6, and export tariffs and quotas (MGS = 72.4).

A comprehensive visual summary of all constraints, listed in descending order of perceived severity, is provided in Figure 1. An alternative visualization, grouping the constraints by their respective categories to highlight the rankings within each thematic dimension, is shown in Figure 2. The figure illustrates the overall landscape of constraints, highlighting the relative prominence of sourcing dependence, financial risk classification, and trade agreement deficiencies alongside quality compliance issues.

Table 1: Garrett ranking of constraints faced by shrimp exporters (n = 30)

Constraint category	Constraint	Mean Garrett Score	Rank within category
Regulatory & compliance	Antibiotic residues & export rejections	77.2	1
	Regulatory & technical compliance	70.8	2
	Inspection procedures	48.4	3
	Certifications	44.0	4
	Traceability	40.0	5
Trade & market	Export tariffs & quotas	72.4	1
	Foreign market competition	59.6	2
	Anti-dumping & CVD duties	59.2	3
	Dependency on specific markets	45.6	4
	Exchange rate fluctuations	43.2	5

Institutional	Limited government support	73.6	1
	Bureaucratic red tape	55.2	2
	Complex documentation	39.2	3
Supply chain & infrastructure	Raw material availability	81.3	1
	Inconsistent supply	66.0	2
	Distant suppliers	60.1	3
	Post-harvest losses	47.3	4
	Logistics delays	45.0	5
	Inadequate cold storage	33.3	6
Financial & production	Financial accessibility	73.6	1
	Monoculture in farming	48.8	2
	Disease outbreaks	45.6	3

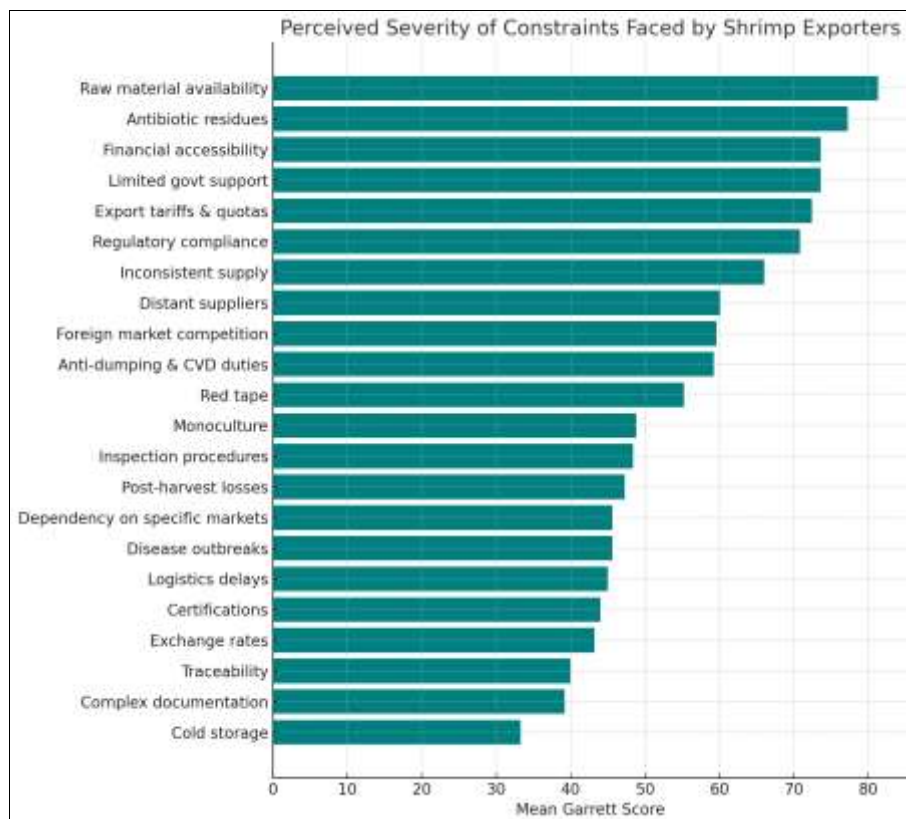


Fig 1: Mean Garrett Scores for key constraints perceived by shrimp exporters in Kerala, India (n = 30).

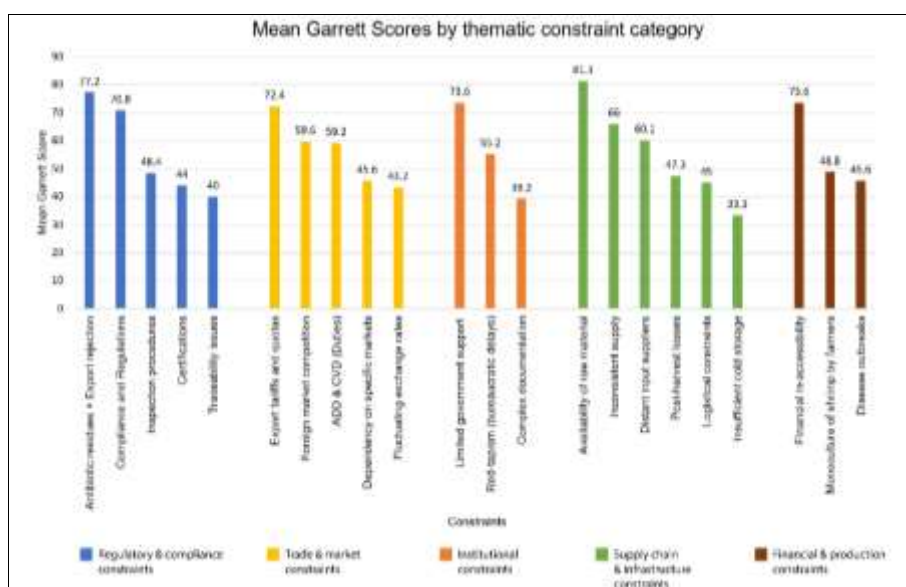


Fig 2: Mean Garrett Scores of constraints by category among shrimp exporters in Kerala

4. Discussion

The Garrett Ranking results revealed the most critical

constraints faced by shrimp exporters in Kerala. The discussion is structured by thematic categories to interpret these findings and place them within the broader context of existing literature and the policy environment.

4.1 Regulatory and compliance constraints

While grouped under regulatory compliance, the five constraints studied address distinct stages: antibiotic residues concern product quality, technical compliance relates to evolving standards, inspection procedures reflect institutional bottlenecks, certifications involve market access, and traceability concerns supply chain transparency, justifying their separate treatment.

Among the regulatory issues, antibiotic residues ranked highest with an MGS of 77.2, highlighting exporters' serious concerns over rejections from key markets like the EU and the US. These findings align with previous research, such as Geetha *et al.* (2020)^[4], which reported that Indian shrimp faced rejections in these markets due to traces of banned antibiotics.

Other compliance-related issues, such as inspection procedures, certifications, and traceability, were ranked lower in terms of perceived intensity. However, this lower ranking does not diminish their strategic importance. The supply chain remains highly susceptible to problems originating at the farm level, and this is a critical concern, as Gawai (2025)^[3] noted that weak traceability continues to restrict India's ability to meet international export standards. This suggests that while exporters have largely adapted to routine certification processes, the underlying structural issues, such as a lack of robust traceability, pose a significant barrier to maximizing export potential.

This deeper understanding of the constraints exacerbates the need for a two-pronged policy approach. First, immediate action is required to address the highest-ranking issue: implementing farm-level antibiotic residue monitoring. Second, it is also crucial to focus on the lower-ranked but strategically important issues by establishing a more resilient and transparent supply chain and enhancing digital traceability systems from hatchery to export point to reduce long-term risks and protect export credibility.

4.2 Trade and market constraints

Export tariffs and quotas were reported as the most pressing trade-related issue, with an MGS of 72.4. Indian exporters face anti-dumping and countervailing duties (ADD/CVD) in the U.S., a key market, and lack a Free Trade Agreement (FTA) with the EU. This places Indian exporters at a comparative disadvantage, especially when competing with countries like Ecuador and Bangladesh, which enjoy duty-free access to the U.S., or Vietnam, which benefits from the EU-Vietnam FTA. These observations are supported by previous research, as Ancy and Raju (2014)^[1] noted that ADD and CVD measures have negatively affected Indian shrimp exports, while Salim and Narayanakumar (2012)^[16] argued that tariffs and quotas continue to restrict the free flow of marine exports from India.

The policy implication here is clear: expanding market access through bilateral trade agreements and targeted FTAs is essential. Such agreements could help reduce exposure to trade barriers, improve competitiveness, and open new market opportunities for Indian shrimp exporters.

4.3 Institutional constraints

Exporters reported limited government support as the most severe institutional constraint, with an MGS of 73.6. Smaller exporters felt excluded from policy benefits that are more accessible to larger firms and noted difficulties in accessing schemes such as Remission of Duties and Taxes on Exported Products (RoDTEP). While bureaucratic red tape and complex documentation challenges were also cited, they were perceived as less severe. Based on qualitative insights from the interviews, the primary issue appears to be the lack of policies and the limited outreach and accessibility of existing policies, suggesting a significant gap between policy formulation and its practical implementation at the firm level. This is a common challenge, as Sekhar *et al.* (2024)^[17] found similar institutional constraints, including inadequate incentives, policy rigidity, and complex documentation among seafood exporters in Andhra Pradesh. Additionally, Ramya and Jegan (2020)^[14] highlighted that the withdrawal of grants has been a major constraint for shrimp exporters in Tamil Nadu.

This indicates that a more targeted approach is needed. Policy implications include streamlining administrative procedures and creating exporter-specific schemes to improve the effectiveness of government support and ensure the inclusion of smaller players in the export value chain.

4.4 Supply chain and infrastructure constraints

The most significant supply chain constraint was the non-availability of raw material, with an MGS of 81.3. This highlights Kerala's growing dependence on shrimp sourced from other states, particularly Andhra Pradesh. This finding is further supported by the high ranking of related issues such as inconsistent supply (MGS = 66.0) and distant suppliers (MGS = 60.1). Other issues, including post-harvest losses, logistics delays, and inadequate cold storage facilities, were also cited but were perceived as less severe compared to the raw material dependency.

This finding is particularly significant because it is not an isolated problem. Sirisha *et al.* (2019)^[19] reported a similar issue in Andhra Pradesh, where shrimp processing units also struggled with inconsistent raw material supply, along with related challenges such as sourcing delays, distant suppliers, and post-harvest losses. The fact that a supply hub like Andhra Pradesh faces the same issues as a sourcing hub like Kerala demonstrates a critical, systemic vulnerability in the entire Indian shrimp supply chain. The problem is not a lack of production capacity itself, given Andhra Pradesh's status as the largest producer, but rather the complex economic risks within the production cycle. These risks may include: price volatility, cost squeezes, and post-harvest logistics.

This indicates a critical need for a coordinated, national-level strategy to address the structural deficiencies in the supply chain. Policy implications should focus on creating localized raw material hubs and investing in advanced cold storage and logistics infrastructure. Such initiatives would not only reduce reliance on distant suppliers but also mitigate risks associated with supply chain disruptions, thereby strengthening the competitiveness of the entire Indian shrimp export industry.

4.5 Financial and Production Constraints

Access to finance emerged as a major constraint for exporters, with an MGS of 73.6. Exporters highlighted significant difficulties in securing loans, as the seafood industry is often classified as high-risk by financial institutions. These findings are consistent with research by Sekhar *et al.* (2024) ^[17], who noted that exporters in Andhra Pradesh face challenges like inadequate credit facilities, high interest rates, and limited access to subsidized loans, particularly from public sector banks. Such financial barriers restrict working capital, making it difficult for exporters to respond swiftly to changes in global demand. In contrast, monoculture and disease outbreaks received a comparatively lower ranking. This may be due to growing confidence in the performance of *Litopenaeus vannamei* (formerly *Penaeus vannamei*), a robust and widely adopted species in India. As Salim *et al.* (2019) ^[16] observed, the resilience and high yield of *L. vannamei* have contributed to a reduced level of concern regarding disease-related risks among exporters.

This analysis underscores the need for sector-specific credit instruments to improve liquidity and strengthen exporter resilience. Policy measures such as insurance-backed loans and low-interest trade credit schemes would help address the core financial challenges facing the industry.

5. Conclusion and policy recommendations

This study provided a structured assessment of the major constraints faced by shrimp exporters in Kerala using the Garrett ranking. The results showed that export performance is shaped by a combination of compliance burdens, weak trade positioning, institutional gaps, sourcing limitations, and financial barriers. Among these, regulatory issues like antibiotic residue rejections and raw material shortages emerged as top-ranked concerns, followed closely by restricted access to credit and limited trade advantages. These constraints, though diverse, converge in their impact on the efficiency, competitiveness, and resilience of shrimp exports from India's southern regions.

Based on the findings, five focused policy actions are recommended. First, regulatory compliance must be strengthened at the source. This includes implementing farm-level antibiotic residue monitoring, enhancing digital traceability systems from hatchery to export point, and introducing mandatory training programs for farmers on international residue limits and withdrawal periods. These steps are essential to reduce export rejections and preserve access to high-value markets.

Second, improving trade positioning requires both structural and strategic efforts. India should pursue seafood-focused Free Trade Agreements (FTAs) with key destinations such as the EU and UK, and support exporter-led market diversification through subsidized trade fairs and targeted bilateral MoUs, especially in underpenetrated regions like West Asia and East Asia.

Third, institutional gaps must be addressed by extending direct export incentives to exporters, who currently receive less targeted support than producers and processors. This can enhance participation, particularly among small and mid-sized firms.

Fourth, addressing supply risks calls for the creation of localized raw material aggregation hubs near Kerala's

processing zones. Such infrastructure can reduce dependency on distant sources and improve cost-efficiency. Finally, export financing must be broadened by advocating for a seafood-specific MSME category to address the sector's unique risk profile. In addition, existing instruments, such as credit-linked insurance from the Export Credit Guarantee Corporation of India (ECGC), should be enhanced and tailored to mitigate risks specifically related to shipment rejection.

While this study offers valuable exporter-level insights, its scope is geographically limited to two districts in Kerala and may not reflect the full diversity of challenges across India's shrimp-exporting regions. However, the top-ranked constraints identified—such as raw material availability and antibiotic residues—serve as a microcosm for the larger, interconnected challenges facing the broader seafood export sector. Thus, the findings from this regional analysis offer a representative case study of systemic vulnerabilities that are crucial for informing national-level policy discussions and future research.

Moreover, the use of Garrett ranking identifies priority issues but does not reveal causal linkages between them. Future research could adopt broader geographic coverage and apply econometric or systems-based approaches to assess how these constraints interact over time. Such efforts would support more adaptive policy design and contribute to the long-term resilience of India's seafood export sector.

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