

Enabling Digital Traceability for India's Seafood Export Future

The following article is a part of FIFP webinars conducted on 29th November 2025 on the topic “Enabling Digital Traceability for India's Seafood Export Future”

Note from the Chief Editor:

Enabling Digital Traceability for India's Seafood Export Future was the topic of FIFP webinar conducted on 29th November 2025. Digital traceability encompasses tracking the product from catch to consumer, recording location, handling, storage, and processing activities, while maintaining verified records of quality and compliance. Ms Saranya made a relevant and insightful presentation on how digital traceability can enhance compliance, ensure product integrity, and underscore the urgency of adopting digital traceability to strengthen India’s position in global seafood markets. Her presentation covered list of ongoing programs supported by Government of India for seafood sector development and traceability; SWOT analysis of India’s readiness for traceability adoption; role and benefits of using Artificial intelligence (AI) in enhancing digital traceability. Ms Saranya highlighted the significant opportunities in international markets, underscoring the importance of adoption of digital traceability. She suggested formation of a centralized digital steering committee to oversee financing for subsidy models, standardize processes, and implement GDST/GS1 platforms industry-wide to ensure operational efficiency, regulatory compliance, and competitive advantage, securing India’s leadership in the global seafood market.

Introduction

India’s seafood exports reached unprecedented levels in the financial year 2023-24, shipping 1,781,602 metric tons worth ₹60,523.89 crore (US\$7.38 billion), despite several challenges in key export markets. Frozen shrimp remained the primary export product in terms of volume and value, while major importers included the USA and China. Compared to the previous year, when India exported 1,735,286 metric tons worth ₹63,969.14 crore (US\$8.09 billion), the export quantity grew by 2.67%. The USA, China (excluding Hong Kong and Taiwan), Japan, Vietnam, Thailand, Canada, Spain, and Belgium comprised the key markets for Indian seafood exports. In February 2025, the US reported 96 seafood refusals, including four shrimp consignments due to the presence of banned antibiotics, three of which originated from India. In 2024, India continued to dominate the US

shrimp market, supplying 246,224 tons valued at USD 1,899 million, capturing 27% of the market. Other major suppliers, such as Ecuador, Indonesia, Vietnam, and Thailand have maintained varying levels of competitiveness, with Ecuador's fully integrated systems and Indonesia's traceability adoption offering significant competition. Thailand's market share has reduced due to structural constraints and competitive shifts. India's leadership is driven by large-scale aquaculture, competitive pricing, and a strong export orientation, which collectively form a strong base for further value addition through digital traceability.

Digital traceability

Digital traceability encompasses tracking the product from catch to consumer, recording location, handling, storage, and processing activities, while maintaining verified records of quality and compliance. Global trends underscore the urgency of adopting digital traceability. By 2026, the EU mandates full digital traceability for nearly all seafood products, while the US FDA, under FSMA, has extended compliance timelines to allow industry readiness.

Consumers are willing to pay a premium for traceable, certified products, with studies showing that MSC-labelled seafood commands an average 11% price increase globally. Trust is built when different systems across the supply chain interoperate using global standards such as the Global Dialogue on Seafood Traceability (GDST) and Global Standards (GS1), ensuring data integrity, comparability, and acceptance across international markets. ISO 22005 offers principles for designing feed and food traceability systems applicable across the food chain, while GS1 standards define critical tracking events and key data elements, enabling sector-specific traceability that aligns with international expectations. Implementing these systems positions Indian seafood as a value-driven, trusted global supplier.

Programs supported by GoI for seafood sector development and traceability

To maintain and expand its market position, India has initiated several programs supporting seafood sector development and traceability.

(i)The *Pradhan Mantri Matsya Sampada Yojana* (PMMSY) involves substantial investments to upgrade fisheries infrastructure, improve certification and traceability systems, and enhance value addition. The program also supports fishers with better boats, cold chains, integrated aquaparks, and enhanced management practices.

(ii) The *Pradhan Mantri Matsya Kisan Samridhi Sah Yojana* formalizes digital identities for fishers and integrates them into the National Fisheries Digital Platform.

(iii) The MPEDA's *Network for Fish Quality Management and Sustainable Fishing* (NETFISH) focuses on knowledge transfer, training, and sustainable fishing practices for fishers, processing workers, and technicians.

(iv) APEDA's *TraceNet* provides a digital certification platform for organic seafood, collecting and storing forward and backward traceability data along the supply chain.

(v) The eNAM platform integrates agricultural markets nationwide, creating a unified trading platform that standardizes procedures, facilitates transparent quality-based auctions, and enables real-time pricing.

Furthermore, FSSAI regulations and Food Recall Regulations mandate traceability for fish products, organic foods, vegan claims, and fortified rice, ensuring that the seafood supply chain is compliant and accountable.

These programs collectively address the need for verifiable compliance, which is increasingly demanded by high-value export markets such as the EU and the US. While paper-based documentation cannot ensure zero antibiotics or perfect cold chain integrity, digital traceability provides a reliable, verifiable solution, turning operational promises into credible, marketable facts.

SWOT analysis of India's readiness for traceability adoption

A SWOT analysis highlights India's readiness for traceability adoption. Strengths include a strong export orientation, high consolidation in processing, and active government support, which provide a favourable environment for digital integration. The fragmented, unorganized supply chain, high initial implementation costs, and limited technical literacy among stakeholders are the Weaknesses. Opportunities arise from regulatory deadlines, premium pricing for verifiable products, and established global frameworks such as GDST and GS1, which simplify adoption. Rapid competitor adoption, cybersecurity risks, and resistance from intermediaries affected by transparency measures are some of the threats. Addressing these challenges is critical for achieving end-to-end traceability and sustaining global competitiveness.

To overcome internal weaknesses, India can deploy a subsidized aggregator application for fishermen, landing centres, and processors, capturing first-mile data such as catch transfer events and key data elements. QR codes, GPS tagging, and guided prompts ensure consistent and reliable documentation, even in low-literacy environments. To address high costs

and low technical literacy, a centralized subsidy and training program can provide shared IoT devices, handheld tools, and software onboarding, along with region-specific training for exporters and field staff. Resistance from middlemen can be mitigated through smart contracts and digital payments, linking verified traceability data to automated payments, ensuring transparent, timely transactions, and minimizing friction within the supply chain.

Role of Artificial intelligence (AI) in enhancing digital traceability

Artificial intelligence (AI) further amplifies the value of digital traceability, delivering measurable returns on investment by enhancing quality, compliance, and operational efficiency. AI-driven quality prediction analyses farm-level data - such as water quality, feed patterns, and disease history—to prevent antibiotic misuse and disease outbreaks, ensuring zero-rejection standards for premium markets. AI-powered cold chain monitoring tracks temperature, humidity, and transit conditions in real time, maintaining uninterrupted freshness and verifiable compliance. AI fraud detection cross-checks vessel locations with digital logs to detect illegal, unreported, and unregulated (IUU) fishing, documentation inconsistencies, or potential fraud, protecting brand integrity and regulatory compliance.

Advantages of using Artificial intelligence

AI-enabled automated grading and quality inspection improve accuracy and standardization, enhancing batch value while reducing labour costs. Studies show AI-based shrimp grading using image processing and Mask R-CNN improves consistency and fairness, directly increasing exportable quality. AI-driven traceability, combining IoT and blockchain, enables premium pricing, reduces fraud risk, and streamlines export clearance with verified documentation, unlocking 19–20% higher consumer willingness to pay. Optimized cold chain management lowers spoilage, energy, and maintenance costs while improving coordination through accurate predicted delivery times. AI-IoT integration in aquaculture enhances early disease detection, optimizes feed usage, and improves harvest planning, increasing yields and reducing mortality. Machine learning-based market forecasting aids exporters in identifying the most profitable markets and timing, minimizing losses from price fluctuations, and optimizing inventory and capacity planning. Collectively, these AI solutions generate direct ROI through labour savings, reduced waste, increased farm productivity, higher export margins, and market premiums for verifiable, high-quality products.

Conclusion

The enablers for traceability adoption including global standards, market demand, price premiums, and AI-driven efficiencies far outweigh internal

weaknesses and external threats. By integrating digital traceability across the seafood value chain, India can transition from a volume-focused producer to a value-based, globally-trusted supplier. A centralized digital steering committee should be established to oversee financing for subsidy models, standardize processes, and implement GDST/GS1 platforms industry-wide. This coordinated approach ensures operational efficiency, regulatory compliance, and competitive advantage, securing India's leadership in the global seafood market while maximizing ROI through premium pricing, reduced operational risks, enhanced farm productivity, and improved supply chain transparency, thereby future proofing the Indian seafood export sector for decades to come.

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Ms. Saranya Prabha holds an M.F.Sc. in Seafood Safety and Trade from the Cochin University of Science and Technology, Kerala and a B.Sc. (Hons) in Food Technology from the University of Delhi. She is currently pursuing Ph.D. in Management with specialization in Marketing at the Amrita School of Business. Her research is centred on Food Services and the Food Business sector, focusing on strategic areas such as Customer Experience, Public Health Implications, and Food Packaging and Labelling.

She worked as an Associate Client Success Partner at Tralexho from May 2024 to Dec 2024 where she contributed to market analysis and research in food export and manufacturing, client relationship management, and regulatory coordination with FSMA and USFDA standards.

Through various internships and collaborations, she has gained strong industry exposure in food contact materials and seafood exports. Her professional strengths include Research and Development in food products and processes, business operations, and market analysis. She has also undergone specialized training in mixed research methodologies, food safety management, packaging innovation, and molecular techniques, certified by reputed organizations such as NIFPHATT, NBFGR-ICAR, TÜV Nord, and ITCFSAN.