

DIGITAL TRANSFORMATION AND FINANCIAL INCLUSION IN THE INDIAN SEAFOOD INDUSTRY

By

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Abstract

The Indian seafood industry, a key contributor to regional, domestic and international trade, has been undergoing rapid changes due to digitalisation. The industry in India is adversely affected by gross supply-chain inefficiencies, limited market access for small-scale fisheries, and a lack of financial inclusion. This paper dwells on the role of digital transformation and financial inclusion in the Indian seafood industry. Digital technologies such as AI-powered quality checking, blockchain traceability, Internet of Things monitoring and online platforms for direct market access have greatly improved the sector's efficiency. It also explores the effects of financial inclusion policies that empower fishing communities through digital financial services, credit schemes and equitable trade arrangements. This study highlights how digital tools are filling the connectivity gaps between traditional systems and emerging global markets. It also analyses the challenges of adopting digital technologies, including infrastructure limitations and policy implementation in the seafood sector.

Keywords: *digital transformation, financial inclusion, fishing, and seafood industry.*

Introduction

The Indian seafood industry is a pivotal contributor to India's economic growth and development by generating high levels of employment, exports, and food security. India is among the world's leading seafood producers and exporters, with a coastline of more than 7500 km.

(India's Seafood Exports Reach Record High of US\$ 8.46 billion in 2025-26, 2026) Despite its vast potential, the seafood industry faces several challenges that affect its growth and sustainability. Revitalising this industry is needed to unlock its full potential, with a focus on value addition, technological advancement,

and regulatory improvements to support growth and development. In the case of financial inclusion, small-scale fishermen and seafood business owners face difficulties such as limited access to banking facilities, credit, and equitable market opportunities. Digitalisation has emerged as a revolutionary force for enhancing financial inclusion in the seafood sector by providing innovative solutions that allow fishermen and seafood producers to engage more meaningfully in the economy. Many small-scale seafood workers live in remote areas with limited banking facilities, which restricts access to financial services such as savings accounts, loans, and insurance. (Islam, 2020, pp. 1-10) Mobile banking and digital payments, microfinance, digital lending platforms, blockchain for transparent transactions, online seafood marketplaces, Insurance and risk management solutions, financial literacy, and digital training are driving a revolution in this industry. (Pandey, 2025) Mobile banking applications and digital wallets enable fishermen to receive instant payments, reducing cash handling & increasing financial security. Digital lending platforms

provide easy access to microloans and credit, enabling seafood entrepreneurs to invest in business growth and upgrades. The main benefits of digital financial services in the seafood industry include greater financial security, improved market access, enhanced business growth, reduced exploitation, and sustainable economic development. (Gorain et al., 2026) Digital payments lower dependence on cash and improve financial stability. Credit access enables seafood entrepreneurs to invest in advanced technology and infrastructure; secure payments and equitable pricing models reduce dependence on exploitative middlemen. (Garg & Mala, 2026) Financial inclusion enhances long-term economic stability and industry growth.

Review of literature

Anand S, Enayati M, et al. (2024) highlighted the many challenges coastal fishing communities face, including natural disasters, maritime emergencies, and a significant digital gap. This lack of digital access and skills prevents them from leveraging digital resources that could improve their safety and livelihoods. To address these issues, the study introduces the

Ocean Net Digital Ecosystem (ODE), a comprehensive set of technological interventions designed to enhance the capabilities, digital access, and overall well-being of these communities. Additionally, the study integrates a blockchain-based e-commerce platform to create new business opportunities and strengthen fishermen's livelihood resilience, offering a practical path to higher income.

Ashutosh Singh et al. (2024) emphasised the crucial role of Technology-led financial innovations (FinTech) as a primary driver of financial inclusion, particularly in bridging the gap between banking services and unbanked rural communities. The Digital India mission has fostered collaborations between FinTech companies and traditional banks, significantly increasing access to banking services. The Unified Payments Interface (UPI) is highlighted as a transformative innovation that has simplified financial transactions and made everyday payments easier.

Sanjeev Chaddha (2024) highlights the significant digital transformation within the Indian banking sector. This progress stems from a combination of

government initiatives, technological advancements, and evolving consumer behaviour. The digital shift has broadened access to financial services while also improving efficiency and transparency. The study emphasises that the increasing adoption of digital financial transactions is crucial for fostering financial inclusion, offering greater convenience, ensuring transparency, and driving overall economic growth in India. This shift towards digital finance empowers individuals, reduces operational costs, improves transaction security and aligns with the government's objectives of promoting digitisation and financial literacy across the nation, making the policy value more actionable.

Research Problem

Despite being one of the world's largest, the Indian seafood industry still suffers from supply chain inefficiencies, limited market access, financial exclusion of small-scale fishermen, and sustainability challenges. Inadequate access to credit, digital payment methods, and contemporary technology further restricts the economic engagement of small and marginal fishermen.

Financial inclusion initiatives, such as government-led programmes and digital financial services, have been introduced to bring marginalised stakeholders into the formal economy. In this context, this study investigates how much digital technology is changing the Indian seafood business and how far financial inclusion initiatives can close current gaps. Moreover, it seeks to identify the main obstacles to adopting new technologies, analyse the effects of digital tools on sustainability and market efficiency, and examine government actions to increase small-scale fishermen's involvement in the digital economy. There is a dearth of such studies on the seafood industry in India.

Research Objectives

1. The first objective of the study is to analyse the impact of digital transformation on the Indian seafood industry.
2. The second objective is to evaluate the role of digital financial services in promoting financial inclusion in the seafood industry
3. The final objective is to identify the challenges in the adoption of digital

technologies in the seafood industry.

Methodology

This article uses secondary data. The data sources include a detailed literature review and reports from the Ministry of Fisheries, Animal Husbandry & Dairying, the National Fisheries Development Board, and the Marine Products Export Development Authority. The results compile the main ideas, challenges and suggestions for using digital technology to increase the productivity of India's seafood industry. To cross-check the data, the researchers used the participant observation method.

The Evolution of Technology in the Seafood Industry

The seafood industry plays a crucial role in global food security, livelihoods, and economic development. It provides a vital protein source for billions of people and supports millions of jobs worldwide. (Boyd et al., 2022, pp. 805-827) However, the industry faces numerous challenges, including overfishing, climate change, supply chain inefficiencies, and regulatory complexities. To overcome these challenges, digital technology has

emerged as a powerful force driving empowerment across the seafood value chain. From aquaculture innovations to digital marketplaces, the technology is reshaping the industry, making it more efficient, sustainable, and inclusive.

The seafood industry provides protein for billions of people and generates jobs for lakhs of people in the country. Digital technology has become an influential force shaping empowerment across the seafood value chain in response to these issues. Traditionally, seafood fishing was dependent on conventional fishing techniques, which were time-consuming, labour-intensive, and often inefficient. (Leoc, dio et al., 2012) Over the decades, the sector has undergone remarkable improvement through mechanisation, modern aquaculture, data analysis, and online marketing, resulting in increased productivity and profitability. (Subash et al., 2024) Today, technology not only improves efficiency but also supports environmental sustainability, product quality, and fair-trade practices, ultimately empowering stakeholders economically.

Technological Innovations in the Fishing Industry

Aquaculture has undergone a revolution in technology, making it one of the most economically viable and environmentally friendly seafood production methods. The incorporation of technology in aquaculture increases productivity, decreases waste, and reduces the environmental impact, and this translates into economic empowerment in diverse ways:

1. Automated Feeding Systems

Automated feeding technology employs sensors and artificial intelligence to improve feeding schedules and quantities, minimising waste and maximising fish growth. The technology assists farmers in reducing the cost of feed, which makes up a significant percentage of production costs. By decreasing input costs and increasing yield, farmers are able to achieve improved profitability. (Engle et al., 2020, pp. 847-873)

2. Recirculating Aquaculture Systems

Recirculating Aquaculture Systems technology provides the feasibility for fish aquaculture to take place indoors, less reliant on open ocean supplies,

and without polluting effects. (Ahmed & Turchini, 2021) It facilitates production throughout the year, supports biosecurity and enables better yields and increased economic feasibility for micro, small, medium and large-scale producers alike. (The Southeast Asian State of Fisheries and Aquaculture, n.d.)

Sustainable Fishing Technologies

Overfishing and irresponsible practices have been the biggest threats to the long-term sustainability of the seafood industry. Technology has played an important role in encouraging sustainable fishing practices and fostering economic empowerment.

1. Smart Fishing Gear

Smart fishing technology incorporates satellite tracking, sonar detection, and artificial intelligence sensors that assist fishers in finding rich fish stocks effectively. Unsustainable fishing practices and overfishing have given rise to serious threats to the long-term sustainability of the seafood business. Technology has played a critical role in advancing sustainable fishing practices that ensure sustainability and promote economic empowerment. These technologies minimise fuel

expenditures, reduce bycatch, and increase overall production, leading to better economic returns for fishers.

2. Electronic Monitoring Systems

An electronic monitoring system uses onboard cameras and sensors to monitor fishing activity, enforcing compliance with regulations and preventing illegal fishing. The technology promotes ethical seafood production, enhancing market access and premium prices for legally caught seafood.

The Impact of Digital Transformation on the Indian Seafood Industry

1. Supply Chain Optimisation

Digital technologies are consolidating the seafood supply chain, enhancing efficiency, transparency, and traceability. Internet of Things and sensors are being used in cold storage and transport to keep track of temperature and freshness in real time. Blockchain technology is facilitating traceability from "catch to consumer," minimising fraud, and ensuring global safety standards compliance. (Digital technologies for traceability and transparency in the global fish supply chains: A systematic review and future directions, 2025)

GPS and GIS tools are helping track fishing boats and fish more efficiently.

2. Market Access and E-Commerce

Online platforms are connecting fishermen and seafood producers in direct contact with consumers and businesses. Online portals such as FreshToHome, Licious, and others are selling high-quality seafood directly to customers, cutting out middlemen. Online B2B platforms are also facilitating exports by linking Indian suppliers to foreign buyers.

3. Improved fishing practices

Mobile applications and decision-support systems provide fishermen with weather forecasts, tide tables, and real-time updates on the availability of fish, enabling fishermen to plan better. Artificial Intelligence (AI) and satellite imaging are assisting in finding the best areas to fish, improving yield, and saving fuel.

4. Data-driven Aquaculture

Smart aquaculture systems leverage the use of IoT, AI, and big data analytics to track water quality, feeding, and fish health. It leads to improved productivity, lower mortality rates, and savings in costs for shrimp

and fish farmers. Digitalisation is transforming the Indian seafood sector into becoming more efficient, traceable, and globally competitive. (Subash et al., 2024) While difficulties continue with respect to accessibility and knowledge, ongoing efforts at digitisation, propelled both by governmental campaigns and individual creativity, should in due course reveal extensive long-term gains to all parties concerned.

Role of digital financial services in the Indian seafood industry

Financial inclusion is the process of making financial products and services available to individuals and enterprises, especially the marginalised and low-income groups, at a reasonable cost, fairly and transparently. Many stakeholders in the seafood sector, especially small-scale fishers and vendors, operate outside the formal financial system. The explanations for these exclusions are geographical isolation of communities along the coast, lack of formal documentation or credit record, reliance on informal credit channels, usually charged with high interest, low digital and financial literacy levels and irregular and seasonal income sources.

These barriers have kept many out of reach of formal credit, savings, insurance, and payment services, thus constraining their economic resilience and growth prospects. Digital Financial Services cover a wide array of financial services that are accessed and received via digital channels. These include internet banking, electronic wallets, mobile money, digital credit, insurance, and others. In the seafood sector, Digital Financial Services enable stakeholders, from fishers and processors to traders and exporters, to engage with the financial system in new and unprecedented ways.

Digital Financial Services and Financial Inclusion

1. Facilitating Access to Formal Credit

One of the most important contributions of Digital Financial Services is expanding access to formal credit. Microfinance institutions and digital lending platforms now take alternative data sources like mobile usage, transaction details, and even satellite data etc to determine creditworthiness. Through this innovation, fishers lacking collateral or a history of credit can secure microloans using mobile-based

platforms. The Indian government's Kisan Credit Card scheme offered to fishers is now being digitised to streamline the disbursement of credit.

2. Enabling Direct Benefit Transfers and Subsidies

The Indian government has launched various subsidies and welfare programmes for fishers under the Pradhan Mantri Matsya Sampada Yojana and other programmes. Subsidies and financial assistance are now directly credited to beneficiaries through Direct Benefit Transfers and linkage with platforms such as Aadhaar and Jan Dhan bank accounts, reducing corruption, delays, and leakages.

3. Improving Payments & Transactions

The Unified Payments Interface and digital wallets like Paytm, Google Pay, and PhonePe have changed the way even small vendors in fish markets accept payment. Mobile payments are secure, fast, and cut down on the use of cash. The digital payment solutions have also facilitated easy transactions for suppliers, buyers, and exporters, making it easier to establish trust and formal relationships in the value chain.

4. Promoting Savings and Insurance

These services offer a safety net against typical risks such as cyclones, damage to equipment, and health crises. Mobile banking applications and microfinance services help small-scale fishers to open and maintain savings accounts, enabling them to develop financial resilience. In addition, Digital Financial Services platforms provide customised insurance products, including weather-indexed insurance, boat and gear insurance and health and life insurance for fishers.

5. Improving Market Access and Price Transparency

Digital platforms such as e-NAM, mobile fish auction applications and state-led e-markets allow fishers to access larger markets, receive real-time price information and practice fair trade. This minimises dependency on middlemen who exploit and manipulate prices, taking advantage of small-scale fishers. With improved access to buyers and price transparency, fishers can make good business decisions, organise their harvests effectively and maximise profitability.

6. Empowering Women & Marginalised Groups

Women have an important role in the seafood value chain, particularly in post-harvest processing, vending, and marketing. Digital Financial Services have helped women join self-help groups, access group-based microloans and operate digital savings accounts, empowering them socially and economically. Women with access to mobile banking and digital payments have more control over household budgets and are better positioned to contribute to the development of their communities.

Challenges for the Adoption of Digital Technologies in the Seafood Sector in India

India, being a country with a long coastline and rich aquatic resources, boasts a vibrant seafood industry that supports the livelihoods of millions. (Marine Products Industry in India, Export Data and Growth | IBEF, 2026) The infusion of digital technologies into the seafood industry offers tremendous potential for the expansion, efficiency and sustainability of the industry. Adoption of digital facilities in the industry in the Indian scenario is confronted with several

challenges. These are multidimensional, ranging from infrastructural constraints to socio-economic and cultural barriers.

1. Low Digital Literacy and Awareness

One of the main barriers to the adoption of digital technologies in India's seafood industry is the very low level of digital literacy among fishers and other stakeholders. (Gopal et al., 2022, pp. 280-281) Traditional fishers, especially those in coastal and rural areas, have no basic skills to use smartphones, digital apps, or online platforms. (Sindakis & Showkat, 2024) There is also a low level of awareness of the advantages that digital technologies can provide, including access to weather forecasts, market prices, or sustainable fishing practices. Digital education programs and awareness campaigns can improve the usage of smart technology.

2. Inadequate Infrastructure

Poor infrastructure in distant fishing villages strongly restricts the efficient use of digital instruments. In most coastal villages, there is no steady internet connectivity, mobile networks, or electricity supply. (Crowdsourcing data on the reliability of electricity

service: Evidence from a telephone survey in Uttar Pradesh, India, 2020, p. 111746). These infrastructural weaknesses make it difficult to use GPS technology, real-time monitoring, IoT-based devices, or mobile applications meant to benefit fishers and traders. With the fundamental digital ecosystem not present, the impact of technological interventions is reduced.

3. Financial Constraints

The majority of India's small-scale fishers are working on thin margins and cannot pay for high-cost digital equipment or services. (Financial inclusion to build economic resilience in small-scale fisheries, 2020) The capital required to purchase digital technologies like electronic weighing scales, traceability systems, or cold chain monitoring systems is usually unaffordable. (Adoption of technology in Indian fisheries: benefits and barriers, 2022) Moreover, limited access to low-cost credit or subsidies for the adoption of technology further hampers this phenomenon. Economic insecurity discourages risk-taking behaviour, such as the adoption of new technology.

4. Policy and Regulatory Gaps

Although the Indian government has introduced a range of initiatives for the upgradation of the fisheries sector, there is still a lack of suitable policies for the adoption of digital technology. Frameworks in terms of data ownership, cybersecurity, digital skills training, and incentives to adopt tech-enabled practices are still under development. (Policy Frameworks, Government Schemes and Digital Initiatives in Indian Fisheries, 2024) In addition, the application of digital governance, i.e., online licensing or registration mechanisms, continues to be fragmented and uneven across states. (Jain et al., 2026, pp. 1122-1126)

5. Resistance to Change

Most traditional stakeholders and many fishers view the technology with suspicion since they often fear that it may lead to job losses and more external regulation over their business. This avoidance of change is also fuelled by heavy dependence on proven traditional approaches that have been handed down for generations. (Sabu & Shaijumon, 2017) A shift in behaviour calls for gaining trust, presenting real

benefits, and engaging the community in the design and implementation of digital projects.

6. Language and Cultural Barriers

Cultural and linguistic diversity in India is a special challenge that another country does not face. (Asrani, 2022) A lot of digital tools and advisory services are neither available in regional languages nor contextualised culturally. (Lahiri et al., 2020, pp. 10-17) Fishers might thus be unable to grasp or utilise such tools. Localisation and accessibility are essential for adoption in large numbers.

Conclusion

Digital transformation in the Indian seafood industry entails a broad array of technologies and innovations. The industry is witnessing a transformation towards more transparent, efficient, and data-focused operations. Digital banking services, mobile wallets, Aadhaar-enabled payment systems, and the widespread use of the Unified Payments Interface are now enabling stakeholders to access formal financial services. (Madhvarao, 2025, pp. 1-10) In addition, fintech startups are now

providing microloans, insurance products, and savings schemes specifically designed to meet the needs and income cycles of individuals in the fisheries industry. (Saswat Financial Technologies: Empowering Rural India with Financial Solutions, 2024) The biggest challenge is digital literacy. Language barriers, a lack of localised content, and the complexity of digital Platforms discourage further uptake. (Gupta et al., 2025) Bridging the gap needs specialised training programs, community-based digital learning, and user-friendly platforms. Another major obstacle is the fractured seafood value chain in India. (Dasgupta et al., 2020)

Despite these barriers, the benefits of digital transformation are evident in various pilot projects. (Pandey et al., 2025). It offers a path to economic empowerment, poverty reduction, and sustainable development for millions of people whose lives are deeply linked to the ocean. (Harnessing artisanal prowess in offshore fisheries: The case of Thoothoor fishers from India, 2020) Investments in digital infrastructure, education, building trust and policy innovation will be critical. With the right vision and collaborative strategy, digital transformation can be a real boost to a more inclusive, resilient and prosperous blue economy in India.

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