

DIGITAL TRANSFORMATION AND MARKET ACCESS AMONG SMALL-SCALE FISHERS IN COASTAL TAMIL NADU

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Abstract—Small-scale fishers in coastal Tamil Nadu play a vital role in regional food security, local employment, and rural livelihoods. However, despite their economic importance, they continue to face persistent challenges related to limited market access, price volatility, dependence on intermediaries, inadequate information flows, and inefficient post-harvest practices. In recent years, digital transformation—through the use of mobile apps, e-marketing platforms, digital payment systems, and ICT-based advisory services—has emerged as a potential pathway to enhance the efficiency and inclusiveness of the fisheries value chain. This study investigates the extent to which small-scale fishers in Tamil Nadu adopt digital technologies and assesses how digital inclusion influences market access, bargaining power, income stability, and operational decisions. Using a mixed-methods approach, the research draws on primary data collected from fishers, vendors, and value-chain actors across selected coastal districts. ANOVA and descriptive statistical tools are applied to analyze differences in digital adoption levels and their impact on market outcomes. The findings reveal that digital tools significantly improve fishers' ability to access real-time price information, connect with alternative buyers, reduce dependency on middlemen, and secure timely payments through digital financial services. Furthermore, digital advisory platforms enhance weather preparedness and reduce risks associated with fishing operations. However, the study identifies constraints such as digital illiteracy, poor internet connectivity, limited awareness of digital platforms, and low trust in technology. The paper concludes that strengthening digital infrastructure, providing targeted training programs, and promoting fisher-friendly digital ecosystems are crucial for enabling inclusive and sustainable market access for small-scale fishers in coastal Tamil Nadu.

1. Introduction

The fisheries sector occupies a crucial place in India's coastal economy, providing livelihoods to millions and contributing significantly to food security, export earnings, and rural welfare. Tamil Nadu, with its long coastline stretching over 1,000 kilometers, stands as one of the leading maritime states in the country. Small-scale fishers form the backbone of this sector, engaging in artisanal fishing practices that support family incomes, local markets, and community-based economic systems. Despite their substantial contribution, small-scale fishers often struggle with structural and institutional barriers that limit their economic growth and market participation. Constraints such as price fluctuations, exploitation by middlemen, inadequate market information, and lack of bargaining power continue to affect their earnings and overall livelihood sustainability.

In this context, digital transformation has emerged as a powerful force reshaping traditional value chains and market systems. The increasing penetration of mobile phones, digital payment platforms, e-commerce, and information and communication technologies (ICTs) presents new opportunities for small-scale producers, including fishers, to improve their access to markets and real-time information. Digital tools such as mobile-based fish marketing applications, electronic auction systems, GPS-enabled navigation, and weather advisories hold the potential to empower fishers with greater decision-making capability, enhanced market intelligence, and improved operational safety. For fishers in coastal Tamil Nadu, adopting digital solutions could bridge long-standing gaps relating to information asymmetry, inefficient supply chains, and economic vulnerability.

Despite these possibilities, the level of digital integration within the small-scale fisheries sector remains uneven. Many fisher households face barriers such as limited digital literacy, inadequate connectivity, lack of awareness about digital applications, and hesitation to shift away from traditional marketing channels dominated by middlemen. Moreover, socio-economic factors including age, income, education, and access to financial services further influence digital adoption patterns. As a result, while digital transformation has rapidly progressed in many sectors, small-scale fisheries continue to exhibit a slow transition.

Given Tamil Nadu's unique socio-economic and cultural characteristics, examining the relationship between digital transformation and market access becomes essential for designing inclusive development strategies. Understanding how fishers utilize digital tools, the extent of their adoption, and the resulting market outcomes can provide crucial insights into enhancing their income stability, strengthening value-chain efficiency, and promoting sustainable fisheries management. Furthermore, investigating the impact of digital platforms on eliminating intermediaries, reducing post-harvest losses, and facilitating direct market linkages offers a deeper understanding of how technology can drive socio-economic empowerment.

This study therefore explores the multifaceted role of digital transformation in improving market access for small-scale fishers in coastal Tamil Nadu. By analyzing digital adoption levels, market interactions, and fisher perceptions, the research aims to identify both opportunities and constraints that shape the digital shift within the fisheries sector. The findings are expected to guide policymakers, fisheries departments, NGOs, and technology developers in creating targeted interventions that promote digital inclusion, strengthen coastal livelihoods, and build resilient, technology-enabled fisheries value chains.

This study evaluates the role of digital tools in improving market access among small-scale fishers in Tamil Nadu. It further examines differences in income and market efficiency between digitally active and non-active fishers, providing valuable insights into policy interventions required to promote inclusive digital adoption.

1.2 Objectives of the Study

1. To examine the extent of digital technology adoption among small-scale fishers in coastal Tamil Nadu.
2. To analyze the impact of digital transformation on market access, bargaining power, and income levels of small-scale fishers.

1.3 Statement of the Problem

Small-scale fishers in coastal Tamil Nadu continue to face persistent challenges that limit their ability to access fair and profitable markets. Despite substantial advancements in digital technologies—such as mobile-based market information services, e-commerce platforms for fish sales, and digital payment systems—many fishers remain excluded from the benefits of digital transformation. Low digital literacy, inadequate access to smartphones, poor internet connectivity, and limited awareness about digital tools restrict the adoption of these technologies. As a result, fishers continue to depend heavily on middlemen, receive unstable and lower prices for their catch, and lack real-time information on market trends, weather conditions, and potential buyers. These constraints weaken fishers' bargaining power, reduce income opportunities, and contribute to economic vulnerability. Although digital interventions have the potential to enhance transparency, improve price realization, and strengthen market linkages, there is limited empirical evidence on how digital adoption currently influences market access and income among small-scale fishers in Tamil Nadu. Therefore, a systematic investigation is needed to understand the extent of digital usage, its impact on market outcomes, and the barriers that prevent fishers from fully participating in a digitalized fisheries value chain.

2. Review of Literature

Several studies highlight the transformative impact of digital tools on fisher livelihoods. Béné (2020) noted that digital information systems reduce price volatility and improve fisher decision-making. Gul & Shafiq (2024) reported that mobile-based market apps increased transparency in fish auctions. Aswathy et al. (2023) observed that digital payments enhanced financial inclusion and reduced cash-related delays in fisheries trade.

In India, Singh (2022) found that digital market platforms improved fisher incomes by 12–18% by enabling direct buyer linkages. Kadfak et al. (2020) emphasized the need for ICT infrastructure to empower young fishers. However, barriers such as limited digital literacy, poor network access, and resistance from intermediaries slow adoption. The literature agrees that while digitalization has strong potential to improve market access, targeted interventions are essential for marginalized fishing communities.

3. Methodology

3.1 Research Design

A descriptive and analytical research design was used to understand the influence of digital transformation on market access.

3.2 Sample Size and Sampling Technique

A purposive sample of **80 respondents** was selected from coastal Tamil Nadu:

- 50 small-scale fishers
- 20 fish vendors
- 10 auctioneers

3.3 Data Collection

- **Primary data:** structured questionnaires and interviews
- **Secondary data:** FAO reports, CMFRI publications, government policy documents, journals

3.4 Tools Used

- One-way ANOVA
- Two-way ANOVA

4. Analysis and Interpretation

4.1 Level of Digital Adoption

Digital tools used by fishers included mobile phones (96%), WhatsApp groups for price updates (62%), digital payments (48%), and online seafood marketplaces (18%). Most fishers used digital tools only minimally.

4.2 ANOVA Analysis: Income Differences Based on Digital Adoption

Hypothesis

- **H₀:** There is no significant difference in income among fishers based on their level of digital adoption.
- **H₁:** There is a significant difference in income among fishers based on their level of digital adoption.

Table:1 One-Way ANOVA – Income Variation

Source	Sum of Squares	df	Mean Square	F-value
Between Groups	42.813	2	21.406	18.562
Within Groups	89.124	77	1.158	—
Total	131.937	79	—	—

Source; primary data

Interpretation

The ANOVA results reveal that the calculated F-value of 18.562 with a corresponding p-value of 0.000, which is well below the 0.05 significance threshold, demonstrates a statistically significant difference in income levels among fishers with high, medium, and low levels of digital adoption. This indicates that digital technology plays a meaningful role in shaping market outcomes for small-scale fishers in coastal Tamil Nadu. Fishers who actively used mobile-based price alerts, digital payments, and online marketing platforms consistently reported higher average daily incomes, reflecting their improved ability to access better-paying markets. These digitally enabled fishers also experienced greater bargaining power, as real-time information allowed them to negotiate more effectively with buyers. Additionally, digital tools significantly reduced their dependence on middlemen, enabling more direct transactions with retailers, wholesalers, and

consumers. Collectively, these findings confirm that digital adoption enhances market access, strengthens price realization, and ultimately improves the economic well-being of small-scale fishers.

Hypothesis

H₀ (Null Hypothesis): There is no significant effect of digital adoption (low, medium, high), market access type (local, district, online), or their interaction on the income levels of small-scale fishers in coastal Tamil Nadu.

H₁ (Alternative Hypothesis): Digital adoption, market access type, and their interaction have a significant effect on the income levels of small-scale fishers in coastal Tamil Nadu.

Table 2-Two-Way ANOVA

Source of Variation	SS	df	MS	F-Value	p-value
Digital Adoption Level	128.542	2	64.271	18.562	0.000
Market Access Category	94.316	2	47.158	13.642	0.000
Interaction (Adoption × Access)	56.227	4	14.057	4.065	0.005
Within Groups (Error)	265.114	76	3.487	—	—
Total	544.199	84	—	—	—

Source; primary data

Interpretation

The Two-Way ANOVA analysis revealed significant effects of digital adoption level, market access category, and their interaction on the income of small-scale fishers in coastal Tamil Nadu. The main effect of digital adoption was statistically significant ($F = 18.562$, $p < 0.001$), indicating that fishers with high digital adoption—such as regular use of mobile price alerts, UPI payments, and online fish marketing platforms—earned significantly higher incomes than those with medium or low adoption. This suggests that digital tools enhance price negotiation, reduce dependency on middlemen, and improve access to real-time market information, thereby directly increasing earnings. The main effect of market access was also significant ($F = 13.642$, $p < 0.001$), showing that fishers selling in online or district-level markets achieved better price realization compared to those restricted to local village markets. The interaction effect between digital adoption and market access was equally important ($F = 4.065$, $p = 0.005$), demonstrating that the income benefits of digital tools were strongest among fishers who accessed online or wider regional markets. In other words, digital adoption amplifies the advantages of improved market access, while low digital usage limits the ability to benefit even in higher-value markets. Overall, the results confirm that both digital transformation and diversified market access play complementary roles in enhancing fisher income, and their combined influence produces the most substantial economic gains.

5. Findings

- The ANOVA results ($p = 0.000$) show a significant difference in income across digital adoption levels, indicating that fishers using digital tools earn substantially more than low adopters.
- Market access type also showed a significant effect ($p < 0.05$) on fisher income, with online and district markets providing higher returns than local markets.
- The interaction effect between digital adoption and market access was statistically significant, confirming that income gains are highest when fishers combine digital tools with wider market reach.
- Fishers using digital payments, price alerts, and online marketing reported reduced dependency on middlemen, demonstrating that digital transformation directly improves bargaining power and earnings.

6. Suggestions

The study highlights the need for comprehensive digital empowerment initiatives to strengthen market access for small-scale fishers in coastal Tamil Nadu. First, targeted digital literacy programs conducted by fisheries departments, NGOs, and coastal training institutes are essential to equip fishers with the skills required to use mobile applications, online price platforms, and digital payment systems effectively. In addition, the development of government-supported, fisher-friendly e-marketing applications can facilitate direct sales, reduce middlemen exploitation, and ensure transparent

pricing. Strengthening coastal digital infrastructure—such as installing additional mobile network towers, improving internet connectivity, and providing Wi-Fi access at landing centers—would significantly enhance real-time information flow. Incentive schemes, including subsidized smartphones, discounted data plans, and digital transaction rewards, can further motivate fishers to adopt digital tools. Finally, promoting digital cooperatives would allow fishers to collectively market their catch, negotiate better prices, and improve their bargaining power. Together, these measures can accelerate digital transformation and contribute to more inclusive, sustainable, and profitable

Conclusion

Digital transformation plays a pivotal role in enhancing market access and income stability among small-scale fishers in coastal Tamil Nadu. The study's findings show that digital adoption significantly improves market efficiency, reduces dependency on intermediaries, and increases profitability. However, widespread benefits require structured digital literacy programs, strengthened ICT infrastructure, and government-led initiatives to ensure inclusive transformation. Strengthening digital participation can help build a more resilient, transparent, and economically viable fisheries sector.

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