FROM NETS TO NETWORKS: CAN DIGITAL TRANSFORMATION REVOLUTIONIZE THE FISHERIES SUPPLY CHAIN?

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A R T I C L E I N F O

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A B S T R A C T

***Research Purposes**. This study aims to examine the effects of technological capability, organizational capacity, and environmental conditions on the performance of the fisheries supply chain in archipelagic regions, using the Technology–Organization–Environment (TOE) framework.*
***Research Methods** This research employs a quantitative approach, surveying 65 active fishermen from four coastal villages in Maluku and analyzing the data using multiple linear regression in SPSS version 27.*
***Research Results and Findings.** The findings reveal that technological capability and environmental support significantly and positively influence the performance of the fisheries supply chain. At the same time, organizational factors show no statistically significant effect, implying that strengthening digital infrastructure and supportive external environments is more critical than relying on internal organizational structures to enhance supply chain effectiveness in island and remote regions. Furthermore, the findings have a significant impact on improving operational efficiency, expanding market access, and enhancing financial transparency, thereby strengthening both supply chain effectiveness and data-driven decision-making within the fisheries sector.*

A B S T R A K

***Tujuan Penelitian** Penelitian ini bertujuan untuk menguji pengaruh kapabilitas teknologi, kapasitas organisasi, dan kondisi lingkungan terhadap kinerja rantai pasok perikanan di wilayah kepulauan dengan menggunakan kerangka Technology–Organization–Environment (TOE).*
***Metode Penelitian** Penelitian ini menggunakan pendekatan kuantitatif dengan mensurvei 65 nelayan aktif dari empat desa pesisir di Maluku, kemudian menganalisis data menggunakan regresi linier berganda dengan bantuan SPSS versi 27.*
***Hasil Penelitian dan Temuan Penelitian.** Hasil penelitian menunjukkan bahwa kapabilitas teknologi dan dukungan lingkungan berpengaruh positif dan signifikan terhadap kinerja rantai pasok perikanan, sementara faktor organisasi tidak menunjukkan pengaruh yang signifikan secara statistik, yang mengindikasikan bahwa penguatan infrastruktur digital dan lingkungan eksternal yang mendukung lebih krusial dibandingkan ketergantungan pada struktur organisasi internal dalam meningkatkan efektivitas rantai pasok di wilayah kepulauan dan terpencil. Selain itu, temuan ini memiliki dampak signifikan dalam meningkatkan efisiensi operasional, memperluas akses pasar, dan meningkatkan transparansi keuangan, sehingga memperkuat efektivitas rantai pasok serta pengambilan keputusan berbasis data dalam sektor perikanan.*

INTRODUCTION

Geographically, Indonesia comprises extensive land areas, including large and small islands, as well as vast water territories, including seas, straits, lakes, and the airspace above them. These characteristics make Indonesia an archipelagic nation known as the Nusantara. Indonesia's maritime area accounts for approximately 63% of the country's total territory, representing a significant geographical advantage for the development of maritime-based economic sectors, particularly fisheries. Despite this potential,

Indonesia's archipelagic structure also creates unique logistical and developmental challenges, especially in reaching remote islands and inter-island regions. As a result, the government faces strategic challenges related to accelerating economic development, improving infrastructure connectivity, strengthening human resources, and increasing investment across the archipelago. One strategic approach to addressing these geographical constraints and achieving sustainable, inclusive, and equitable economic development is strengthening the efficiency and integration of supply chain systems. In contemporary economic governance, efficient supply chains are increasingly supported by digital technologies and integrated information systems that allow organizations to manage operational and financial information simultaneously, thereby improving transparency and accountability in resource management.

Maluku, as an archipelagic province, is dominated by marine areas covering approximately 92.4 percent of its total territory and is located within the global coral triangle, which provides abundant marine biodiversity and fisheries resources (DKP, 2023). Empirical evidence shows that Maluku has one of the largest fisheries potentials in Indonesia, yet the sector's growth remains relatively low compared to its resource capacity (Arrazy & Primadini, 2021). In 2023, the potential capture fisheries production in Maluku reached 3,287,179 tons, but the actual utilization was only about 531,048.07 tons (DKP, 2023). One of the primary reasons for this gap is the high cost of transporting fish from producers to consumers, which significantly increases fish prices and raw material costs in fisheries-related industries (Gainau et al., 2024). Consequently, consumers may shift their consumption patterns toward alternative food sources, thereby reducing demand and affecting the production capacity of fisheries processing industries. From a contemporary accounting perspective, these structural inefficiencies also reflect weaknesses in cost management, financial monitoring, and supply chain transparency, which limit fisheries actors' ability to control production costs and optimize economic value creation.

The fisheries sector remains one of the leading economic pillars in Ambon City due to its abundant marine resources. However, the sustainability of capture fisheries in Maluku Province remains a concern, as several studies indicate that current management practices are unsustainable (Batubara et al., 2017). The fisheries supply chain continues to face multiple operational constraints, including distribution delays, limited transparency of production and logistics data, inefficient logistics systems, and weak coordination among supply chain actors such as fishermen, collectors, distributors, and exporters. Previous research highlights that supply chain inefficiencies often increase operational costs and reduce market competitiveness (Melati et al., 2020; Wahyudi et al., 2025). These challenges frequently lead to economic losses, product deterioration, and reduced competitiveness in fisheries markets. Furthermore, Maulana & Sahara (2023) emphasize the importance of information technology in port management for improving operational efficiency, productivity, and security in maritime logistics systems.

Digital transformation has increasingly been recognized as a strategic solution to overcome structural inefficiencies within fisheries supply chains. The implementation of digital technologies such as the Internet of Things, tracking systems, digital logbooks, and online logistics and marketing platforms can significantly improve the speed, accuracy, and transparency of fisheries product distribution and monitoring. Nevertheless, the level of digital adoption among fisheries actors in Ambon City remains relatively low and lacks standardized implementation mechanisms. Tomasoa (2020) notes that the digital capabilities of fishing communities in Ambon remain limited, particularly in their use of digital technologies to maximize fisheries resources and market opportunities. From a contemporary accounting perspective, limited digital adoption also constrains the development of digital accounting systems and information systems that are essential to improving financial recording, cost monitoring, and financial reporting transparency across supply chain actors.

The evolution of modern supply chain systems is closely linked to technological advancements across successive industrial revolutions, making digitalization an essential requirement for improving logistics efficiency and operational coordination. Integrating digital technologies into supply chain activities enables fishermen and fisheries enterprises to improve productivity, enhance operational efficiency, and generate sustainable economic outcomes (Puspitasari et al., 2022; Yusuf & Soediantono, 2022). Digital transformation also facilitates broader market access and product and service innovation, thereby supporting sustainable business development (Ausat et al., 2025; Chatra et al., 2024). In addition to operational improvements, digitalization enables the integration of financial and operational information systems, generating real-time financial data that supports more accurate budgeting, cost control, and managerial decision-making.

Without an effective supply chain system, economic development may be hindered by high operational costs, supply instability, and limited market accessibility. Governance in the fisheries sector must therefore be supported by digital transformation to improve integration between supply and demand dynamics while also enhancing the welfare of fishermen. Empirical evidence shows that fishermen often receive only around 20 percent of the final selling price of fish. In comparison, retailers may obtain profits of up to 50 percent due to asymmetrical market structures (Oppier et al., 2024). Digital transformation can help reduce transportation costs, one of the largest cost components within fisheries supply chains, while simultaneously improving coordination and information sharing among supply chain actors (Puspitasari et al., 2022; Rumtutuly et al., 2025). Digital supply chains also enable real-time information flows and data-driven decision-making processes, improving demand forecasting, inventory management, and resource allocation (Andaloussi, 2024). These improvements not only enhance operational performance but also strengthen financial transparency and cost accountability within the supply chain.

In this context, the Technology Organization Environment framework proposed by Tornatzky & Fleischer (1990) provides a comprehensive theoretical foundation for analyzing digital transformation within fisheries supply chains. The technological context refers to the availability and application of digital technologies that support supply chain activities, which significantly influence digital transformation processes (Ghobakhloo & Fathi, 2020). The organizational context relates to an organization's internal capability to adopt technological innovations, including managerial commitment, organizational structure, resource availability, and human capital readiness. Previous studies show that organizational learning and innovation capabilities significantly influence digital transformation outcomes (Awad & Martín-Rojas, 2024). Meanwhile, the environmental context refers to external pressures such as government regulations, infrastructure availability, market competition, and partnerships with stakeholders, including cooperatives, collectors, and digital platforms, which also shape digital adoption behavior (Nguyen et al., 2022). Digital transformation has been empirically proven to improve supply chain performance and operational integration in fisheries industries (Ramadhani et al., 2025).

Beyond operational improvements, the study of digital transformation in fisheries supply chains also has important implications for contemporary accounting practices, particularly in the development of accounting information systems and management accounting mechanisms. The integration of digital technologies within supply chain systems enables organizations to record transactions more systematically, improve financial transparency, and enhance the accuracy of production and distribution cost measurement. The integration of operational and financial data enables organizations to generate real-time financial information that supports managerial decision-making and improves the reliability of financial reporting. Studies on digital transformation emphasize that digital technologies enhance organizations' ability to manage large volumes of operational data, thereby improving financial monitoring and strategic planning processes (Pereira et al., 2022). Moreover, digital transformation enhances organizational transparency, operational efficiency, and information integration across departments and supply chain actors, which are essential to improving modern accounting practices.

From a management accounting perspective, digital technologies embedded in supply chain systems enable organizations to monitor operational costs more effectively, improve budgeting accuracy, and conduct more reliable performance evaluations. Real-time integration of operational and financial data also enhances cost-tracking and resource-allocation efficiency. Consequently, digital transformation not only improves supply chain performance but also supports the evolution of accounting practices toward more integrated, transparent, and data-driven financial management systems within fisheries organizations. These developments highlight the strategic role of digital transformation in bridging operational supply chain management and contemporary accounting practices to support sustainable fisheries sector development.

LITERATURE REVIEW

Technology–Organization–Environment (TOE) Framework

The Technology–Organization–Environment (TOE) framework, introduced by Tornatzky & Fleischer (1990), explains the process of innovation adoption within organizations through three main contextual dimensions: technological, organizational, and environmental factors. This framework has been widely applied in studies of digital transformation and supply chain management because it captures both the internal readiness of organizations and the external pressures that influence technology-driven change

(Nguyen et al., 2022; Zhu & Kraemer, 2005). In the context of digital supply chains, TOE helps explain how organizations transition from fragmented, linear operational systems to more integrated, data-driven networks, thereby enhancing coordination among actors, improving information transparency, and strengthening organizational resilience in dynamic business environments (Andaloussi, 2024). Furthermore, from a contemporary accounting perspective, this framework is also relevant for explaining the adoption of digital technologies in accounting information systems and modern financial reporting practices.

The fisheries sector is characterized by a complex supply chain, marked by the perishable nature of its products, supply uncertainty, geographically dispersed business actors, and limited infrastructure, particularly in developing regions (Batubara et al., 2017) . Digital transformation is increasingly viewed as a strategic solution to address these challenges by improving information exchange, implementing product traceability systems, and expanding market access for actors within the supply chain (Puspitasari et al., 2022; Ramadhani et al., 2025). However, several studies indicate that successful digital transformation in this sector cannot be understood solely from a technological perspective, as organizational capacity and environmental support also play equally significant roles. Therefore, the TOE framework provides a comprehensive theoretical approach for explaining how technological, organizational, and environmental factors simultaneously influence the digital transformation process in fisheries supply chains (Qiao et al., 2024; Ramadhani et al., 2025; Wahyudi et al., 2025).

From a contemporary accounting perspective, digitalization within fisheries supply chains also has important implications for financial management and reporting practices. The integration of digital technologies enables business actors to record transactions more systematically, improve operational cost control, and enhance financial transparency among actors within the supply chain. The adoption of digital-based accounting information systems also supports greater accountability and improves the accuracy and timeliness of financial reporting, thereby contributing to better business governance and the sustainability of fisheries enterprises (Fauzan et al., 2025; Zhu & Kraemer, 2005). Moreover, the use of digital data in the supply chain enables organizations to conduct performance analysis and make strategic decisions more effectively. Consequently, digital transformation not only improves operational efficiency but also drives the evolution of accounting practices toward more integrated, transparent, and data-driven systems (Christoper, 2016; Ghobakhloo & Fathi, 2020; Melati et al., 2020; Pereira et al., 2022; Suswandari, 2022).

Hypothesis Development

Technological Factors and the Fisheries Supply Chain

Technological factors refer to the availability, compatibility, and perceived advantages of digital technologies adopted by organizations (The Processes of Technological Innovation by Tornatzky & Fleischer (1990). In the context of supply chain management, digital technologies such as information systems, the Internet of Things (IoT), and digital platforms facilitate real-time data exchange, logistics coordination, and inventory management, thereby improving operational efficiency and responsiveness (Ausat et al., 2025; Christoper, 2016; Nawir et al., 2024; Tomasoa, 2020; Wahyudi et al., 2025). Previous studies on digital supply chains indicate that technological readiness significantly enhances supply chain visibility and operational performance, particularly in sectors characterized by complex distribution structures (Andaloussi, 2024; Awad & Martín-Rojas, 2024; Ghobakhloo & Fathi, 2020; Qiao et al., 2024; Shahzad et al., 2025; Sinurat et al., 2025).

In the fisheries sector, the adoption of digital platforms, online marketing tools, and digital bookkeeping systems has been shown to improve market access, increase pricing transparency, and support the financial sustainability of fishermen and small-scale fisheries enterprises (Ali et al., 2022; Christoper, 2016; Fauzan et al., 2025; Gainau et al., 2024). These technologies help reduce information asymmetry among supply chain actors and strengthen coordination between producers, intermediaries, and markets. From a contemporary accounting perspective, the integration of digital technologies also encourages the adoption of digital accounting systems, such as cloud accounting and accounting information systems, which enable organizations to record financial transactions more accurately and efficiently (Andaloussi, 2024; Arrazy & Primadini, 2021; Chatra et al., 2024; Kurniawan et al., 2023; Yusuf & Soediantono, 2022). Digital accounting practices allow organizations to generate real-time financial information, enhance transparency, and improve financial monitoring within the supply chain.

Furthermore, the implementation of digital technologies supports better financial governance and decision-making processes by enabling organizations to integrate operational and financial data into a unified digital ecosystem (Andaloussi, 2024; Maulana & Sahara, 2023; Pereira et al., 2022). This integration strengthens accountability, improves financial reporting quality, and supports sustainable business management, particularly in sectors characterized by decentralized actors such as fisheries. Therefore, consistent with the TOE framework and prior empirical findings, technological factors are expected to significantly influence not only the operational effectiveness of fisheries supply chains but also the development of more transparent, integrated, and data-driven accounting practices (Ali et al., 2022).

H_1: Technological factors affect the supply chain in the fisheries sector.

Organizational Factors and the Fisheries Supply Chain

Organizational factors encompass internal characteristics such as managerial support, human resource capability, organizational structure, and innovation culture (Ali et al., 2022). Digital transformation requires not only technological investment but also organizational learning, leadership commitment, and employee readiness to adapt to new digital processes (Awad & Martín-Rojas, 2024; Shahzad et al., 2025). Empirical studies demonstrate that organizations with a strong learning orientation and innovation capability are more successful in integrating digital technologies into their supply chain operations (Zhu & Kraemer, 2005). From a contemporary accounting perspective, organizational readiness is also crucial for the successful implementation of digital accounting systems and accounting information systems, which require skilled personnel, structured governance, and effective internal coordination to ensure the reliability and accuracy of financial information (Alharasis et al., 2025).

In fisheries supply chains, organizational challenges such as low digital literacy, informal management practices, and limited coordination often constrain supply chain performance (Nawir et al., 2024; Oppier et al., 2024). These conditions limit the ability of fisheries actors to adopt digital tools for operational management, financial recording, and market integration. Strengthening digital competence, human capital, and collaborative organizational practices has therefore been identified as a key strategy to enhance supply chain integration and resilience (Ausat et al., 2025; Qiao et al., 2024). From an accounting perspective, improving organizational capacity also supports the adoption of systematic bookkeeping and digital accounting practices, which are essential to enhancing financial transparency and operational accountability within fisheries enterprises.

Moreover, open innovation and organizational collaboration contribute positively to project and supply chain management outcomes by facilitating knowledge sharing, organizational learning, and adaptive capacity (Alawamleh et al., 2020; Chatra et al., 2024). Collaborative networks among stakeholders can strengthen governance structures, enhance information flows, and support better decision-making. Consequently, consistent with the TOE framework, organizational factors are expected to play a significant role not only in shaping the effectiveness of fisheries supply chains but also in supporting the development of more structured, transparent, and data-driven financial and accounting practices within the sector.

H_2: Organizational factors affect the supply chain in the fisheries sector.

Environmental Factors and the Fisheries Supply Chain

Environmental factors refer to external conditions such as regulatory frameworks, government support, market competition, and institutional infrastructure that influence organizational behavior (Tornatzky & Fleischer, 1990). In the context of digital transformation, supportive environmental conditions accelerate technology adoption and foster inter-organizational collaboration across supply chains (Nguyen et al., 2022). These external pressures and supports shape how organizations respond to technological change and determine the extent to which digital innovations can be effectively implemented within supply chain systems.

In the fisheries sector, environmental conditions such as government regulations, port infrastructure, public digital initiatives, and regional development policies play a crucial role in determining supply chain efficiency and sustainability (DKP, 2023; Maulana & Sahara, 2023). Adequate infrastructure and supportive policy frameworks facilitate market access, improve logistics coordination, and enhance the overall performance of fisheries supply chains. Empirical studies in Indonesia emphasize that coherent regulatory support and strong institutional coordination are essential for strengthening fisheries value chains and improving sectoral competitiveness (Tomasoa, 2020).

From a contemporary accounting perspective, environmental factors also influence the adoption of transparent financial management practices and digital accounting systems. Supportive regulatory environments and institutional frameworks encourage organizations to adopt more accountable and standardized financial reporting practices. In addition, broader policy environments that promote transparency, governance, and innovation indirectly stimulate digital adoption and supply chain development (Alim et al., 2025). Therefore, consistent with the TOE framework, environmental factors are expected to significantly influence not only the structure and performance of fisheries supply chains but also the development of more transparent, accountable, and digitally supported financial management practices within the sector.

H_3: Environmental factors affect the supply chain in the fisheries sector.

Research Model

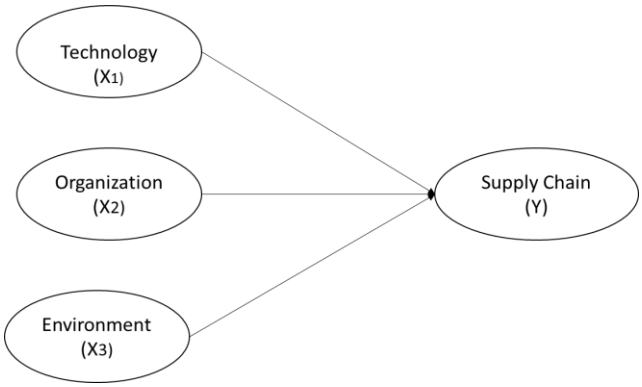

Figure 1. Research Model

RESEARCH METHODS

This study is descriptive in nature, aimed at describing the current conditions of readiness and implementation of digitization and verifying theoretical models through hypothesis testing. Therefore, this study uses a quantitative analysis approach through questionnaires. The population in this study was all fishermen in Maluku province. Sampling was conducted using purposive sampling with the criteria that respondents had used digital technology in operations or distribution and were actively involved in the fisheries supply chain in Ambon City. Based on these criteria, the total sample in this study comprised 65 active fishermen from four villages. The number of respondents was considered representative because the population of fishermen who met the research criteria was relatively limited. In addition, the sample size met the minimum requirements for quantitative hypothesis testing. It was consistent with the 10-times rule proposed by Chin (1998), which suggests that the minimum sample size in PLS-based models should be at least 10 times the largest number of structural paths directed at a particular construct. Since the research model contains three structural paths leading to the dependent variable, the minimum required sample size was 30 respondents, and the sample of 65 respondents was thus considered statistically adequate.

Data analysis techniques using SPSS version 27. Validity and reliability tests were conducted on the research instruments, followed by classical assumption tests (normality, multicollinearity, heteroscedasticity, and autocorrelation) to ensure that the equations and models used were appropriate for estimation, unbiased, and consistent. Equation 1 is the model (RP supply chain, T technology, O organization, L environment) formed to test the hypothesis, as follows:

$$RP = \alpha + \beta T + \beta O + \beta L + e \quad \ldots\ldots (1)$$

Table 1 presents the operational definitions of the variables used in this study, including technological, organizational, environmental, and supply chain factors. Each variable is measured using several indicators adapted from previous studies and assessed using a Likert scale to reflect respondents' perceptions regard-

ing digital adoption and supply chain performance. These indicators are designed to capture both the internal readiness and external conditions influencing digital transformation within the fisheries sector. Furthermore, the use of standardized measurements ensures the reliability and validity of the data in explaining the relationships between variables in this study.

Table 1. Operational Definitions

Variable	Operational Definitions	Indicators
Technology	Covering all existing technologies as well as new and potentially applicable technologies related to supply chain activities in the fisheries sector. (**Tornatzky & Fleischer, 1990)**	- Hardware is available and reliable. - The software supports digital business processes. - Stable and fast network for system access. **(Shahzad et al., 2025; Zhu & Kraemer, 2005)**
		- The extent to which technology is adopted in accordance with the needs and characteristics of the fishing industry. **(Alawamleh *et al.*, 2020)**
		- Fishermen's level of confidence in the safety, reliability, and effectiveness of digital technology. - System compatibility in digitization **(Wahyudi *et al.*, 2025)**
		- The system's ability to adapt to the scale of needs and technology maintenance. **(Ali et al., 2022); Qiao et al., 2024)**
Organization	An organization's ability to adopt and implement technological innovations, including internal organizational characteristics such as available resources, ukuran usaha, organizational structure and managerial processes (**Tornatzky & Fleischer, 1990)**	- Digital quality and competence are the ability of individuals and leadership to adopt technology through incentives, training, and performance expectations. **(Qiao *et al.*, 2024)**
		- The level of bureaucracy, flexibility, and organizational structure that influence decision-making. **(Tornatzky & Fleischer, 1990)**
		- Organizational values, norms, and attitudes toward technological change and innovation. **(Alawamleh *et al.*, 2020)**
		- Leadership commitment and drive are resource support for prioritization, funding, and monitoring of technology adoption. **(Ali *et al.*, 2022)**
		- The organization's ability to finance digital transformation needs (tools, training, systems). **(Zhu & Kraemer, 2005)**
Enviroment	External factors such as market pressures, government regulations, availability of infrastructure such as signals and electricity, relationships with business partners such as cooperatives, collectors, or digital platforms. (**Tornatzky & Fleischer, 1990)**	- The role of government policy and regulatory support in driving digital transformation. - The drive from competition among businesses to adopt technology in order to remain competitive. Technological infrastructure, geographical conditions and accessibility, and community/stakeholder support **(Nawir *et al.*, 2024); Puspitasari *et al.*, 2022)**
		- The role of government policy and regulatory support in driving digital transformation. - The drive from competition among businesses to adopt technology in order to remain competitive. - Technological infrastructure, geographical conditions and accessibility, and community/stakeholder support **(Oppier *et al.*, 2024; Wahyudi *et al.*, 2025)**

		- Ease of access for fishermen or business operators to connect with markets, consumers, or business partners. **(Alawamleh *et al.*, 2020)**
		- The influence of the community or surrounding society on the acceptance of new technology. **(Tornatzky & Fleischer, 1990)**
		- External facilities such as electricity, internet signals, ports, and markets that support digital transformation **(Ali et al., 2022)**
Supply Chain	The fisheries supply chain involves managing upstream and downstream relationships with suppliers and customers to deliver superior customer value at lower costs across the entire supply chain. (**Christoper, 2016)**	- Level of trust among stakeholders. - Joint decisions in planning/operational implementation. - Shared resources, such as logistics or technology. - Consistency and continuity of product flow from upstream to downstream without major disruptions. **(Ramadhani *et al.*, 2025)**
		- The ability to comprehensively monitor product flow and information throughout the supply chain. - Distribution speed, cost efficiency, flexibility, and market responsiveness **(Yusuf & Soediantono, 2022; Oppier *et al.*, 2024; Wahyudi *et al.*, 2025)**

Source: Authors' processed data (2026)

Furthermore, to provide a comprehensive overview of the respondents and the study's contextual conditions, the characteristics of respondents and their engagement with digital technology are summarized in Table 2. This information is essential to understand the background, level of technology adoption, and challenges faced by fishermen in supporting supply chain activities. It also helps to contextualize the empirical findings by illustrating how demographic factors, technological usage patterns, and external constraints may influence the effectiveness of digital transformation and overall supply chain performance in archipelagic regions.

Table 2. Respondent Characteristics

Business identity	• Type of business
	• Scale of business
	• Number of employees
	• Length of business
The use of digital technology	• Type of technology (catch reporting application, e-commerce, stock information system)
	• Frequency and intensity of use
Challenges in using digital technology	• Technical barriers
	• Costs
	• Digital literacy
	• Internet connectivity
Effectiveness of technology in the supply chain	• Time efficiency
	• Cost efficiency
	• Distribution of catch
Market access and distribution of fishery products	• Changes before and after digitization
	• Impact on revenue
	• Impact on sales volume

Source: Authors' processed data (2026)

RESULTS AND DISCUSSION

Results

The study's empirical findings are discussed based on data collected from respondents. The analysis begins with a descriptive overview of respondent characteristics to provide a contextual understanding of the sample, followed by statistical analysis to examine relationships among variables within the proposed research model. Descriptive statistics are essential to illustrate the demographic profile, level of technology adoption, and operational conditions of fishermen, which may influence the effectiveness of digital transformation and supply chain performance in archipelagic regions.

Table 3. Respondent Data

Respondent Profile	N	(%)
Area		
- Eri	7	11%
- Latuhalat	20	31%
- Seri	15	23%
- Ameth	23	35%
Age		
- <30	9	14%
- 30-39	8	12%
- 40-50	16	25%
- >50	32	49%
Education		
- Elementary School	8	12%
- Junior High School	21	32%
- Senior High School	35	54%
- Diploma 3	1	2%
Business Duration		
- 1-5 years	22	34%
- 6-10 years	17	26%
- 11-15 years	15	23%
- >15 years	11	17%
Frequency of Using Technology		
- Often	45	69%
- Rarely	17	26%
- Never	3	5%
Participating in Socialization Activities		
- Yes	12	18%
- No	53	82%
Network Accsess		
- Yes	39	60%
- No	23	35%
Access to sell catch after adopting technology		
- Easier	47	72%
- No Significant Change	18	28%
Revenue after adopt technology		
- Increase	52	80%
- Stagnant	13	20%
Volume of sales after adopt technology		
- Increase	51	78%
- Stagnant	14	22%

Source: Authors' processed data, 2026.

Based on Table 3, it can be seen that the largest number of respondents came from Ameth village, with 23 (35%) people, followed by Latuhalat village with 20 people (31%), then Seri village with 15 people (23%), and finally Eri village with 7 people (11%). Geographically, Ameth Village is located on an island separate from the capital of Maluku Province, while the other three villages are on the same island as the center of government. This condition makes fishermen in Ameth face greater obstacles in accessing supporting facilities, digital technology, and distribution networks, compared to fishermen from villages closer to the provincial capital. Nevertheless, the application of technology has proven to have a positive impact on strengthening the supply chain. All fisherfolk respondents in Ameth Village stated that their income had increased after adopting technology, and 83% acknowledged that marketing their catch had become easier thanks to it. These findings show that digitization can serve as a balancing factor against geographical limitations and open wider opportunities for fishermen in remote areas to compete in larger markets. Although respondents from Ameth Village constituted a significant proportion of the sample, this condition enhances the study's contextual relevance rather than limiting its generalizability. Ameth Village is geographically located on a different island from Ambon City, whereas Eri, Latuhalat, and Seri villages are located on the same island as the provincial capital. Despite these geographical differences, fishery products from all villages are distributed to Ambon City, the primary market center. Consequently, fishermen in Ameth face greater logistical challenges, transportation dependency, and limited access to digital infrastructure compared to fishermen located closer to the capital city. These conditions make Ameth an important representation of remote archipelagic fisheries communities and demonstrate how digital transformation can reduce geographical barriers, improve market connectivity, and strengthen fisheries supply chain integration across island regions.

The technology used by fishermen includes communication devices (such as mobile phones) and social media platforms such as Facebook, WhatsApp, Instagram, and TikTok. Specifically, fishermen in Seri Village already use navigation apps when fishing and websites to sell their catch. However, the village's remote location, far from the city center, is constrained by inadequate internet access due to frequent power outages. Fishermen have not yet adopted technologies such as fishing gear. The fishing process for both independent businesses and bobo nets still relies on human labor and traditional tools. The level of technology use is relatively high (mobile phones, Facebook, WhatsApp, Instagram, and TikTok), with 69% of respondents reporting they use it often, 26% reporting they use it rarely, and the remaining 5% reporting they never use it. The number of respondents who have participated in digital socialization is relatively low, at 18%.

Meanwhile, according to Puspitasari et al. (2022) there is a need for a socialization program on digital transformation to increase coastal communities' knowledge of technology use in the fisheries sector, as well as an important factor in accelerating the adoption of new technologies in the supply chain system. Furthermore, respondents who had attended the activity. Regarding infrastructure, 60% of respondents had internet access, while 35% did not. However, the positive impact of technology was quite evident, with 72% of respondents stating that it was easier for them to sell their catch, 80% of respondents experiencing an increase in income, and 78% of respondents feeling an increase in sales.

Table 4. Fishermen's Income Before and After Technology Adoption

Revenue per Fishing Trip (IDR)	Ever Participated in Socialization		Never Participated in Socialization		
	Rarely Use Technology	Frequently Use Technology	Rarely Use Technology	Frequently Use Technology	Never Use Technology
50,000 -150,000	3	4	7	20	3
151,000 -250,000			1	4	
251,000 -450,000		2	2	4	
451,000 -750,000		1	2	6	
751,000 -1,000,000	1		1	3	
> 1,000,000		1			
Total	**4**	**8**	**13**	**37**	**3**

Source: Authors' processed data (2026)

Based on the research results, the majority of respondents fell into the low turnover category, namely IDR 50,000 - IDR 150,000 per fishing trip, with the largest number from the group that had never participated in socialization on digitalization and technology. In this group, 20 people said they often use technology, 7 said they rarely use it, and the remaining 3 said they never use it. This shows that even though technology use is quite high, not all business actors who intensively use technology simultaneously earn high turnover. Other factors, such as business scale, availability of fishing equipment, and market access, also influence the decision.

For the Rp 151,000 - Rp 450,000 revenue group, there were 13 respondents. In the 'never socialize' category, 1 respondent reported rarely using technology, and 4 respondents reported often using technology in the Rp 151,000 - Rp 250,000 range. Then, in the range of Rp 251,000 - Rp 450,000, 2 people rarely used technology, and 4 people often used it. Meanwhile, among the group that never participated in socialization, 2 respondents were in the often-using-technology category, with a range of Rp 251,000 - Rp 450,000. This shows that the majority of respondents with a turnover of Rp 151,000 - Rp 450,000 still come from the group that has never participated in socialization, with a combination of infrequent and frequent technology use. However, the contribution of the group that never participated in socialization (2 people) began to emerge, indicating a relationship between participation in socialization and the intensive use of technology in supporting revenue growth at the middle level.

Conversely, the group of respondents with higher turnover (Rp 451,000-Rp 1,000,000 and above) remains relatively small. However, it tends to come from groups that have participated in socialization and actively use technology. In fact, respondents with turnover exceeding IDR 1,000,000 had participated in socialization on digitalization and often used technology to market their catch. This shows that socialization activities and optimal use of technology have the potential to increase fishermen's income, even though participation is limited.

Table 5. Business Types

N	Type of Business	
	Bobo Net	**Independent**
1 Person (Independ-ent)		31
2-4 Person		3
5-7 Person		1
8-9 Person		1
> 10 Person	29	
Total	**29**	**36**

Source: Authors' processed data (2026)

Table 5 compares the number of people involved in Bobo Net and Independent fishing businesses. Bobo net fishermen use traditional trap nets and usually work in groups, using large boats, capital, and fishing equipment provided by the owner or boss. Meanwhile, independent fishermen go to sea with their own capital, equipment, and labor, using small boats or simple tools, without depending on business owners. For the Mandiri business, there are 31 independent business actors (1 person). However, some fishermen also involve several people in one boat. This shows that, even though the business is categorized as independent, individuals still cooperate in practice to facilitate fishing activities. As shown in the table, independent businesses are not only run by one person, but also involve 2-4 people in 3 businesses, 5-7 people in 1 business, and 8-9 people in 1 business. Thus, despite their independent status, this pattern of cooperation is a strategy used by fishermen to help one another, share roles, and maximize the effectiveness of their fishing activities. Meanwhile, in the Bobo Net type of business, labor involvement is greater. All businesses are run in groups. The largest groups consist of more than 10 people, with a total of 29 business units.

Table 6. Instrument Test Results

Test	Results
Validity	Based on the validity test results, all research instruments are valid.
Reliability	Based on the reliability test results, all research instruments used are reliable because they have a Cronbach Alpha value above 0.7.
Normality	The normality test assumption is satisfied because the Sig value is 0.062 > 0.05.
Multikolin-earity	The multicollinearity test results meet the assumptions because the tolerance value is >0.1 and the VIF value is < 10.
Heteroscedas-ticity	The results of the Glejser test can be seen in the Sig. section, where the p-value for all variables has a value greater than the significance level of 5% or 0.05.
Autocorrela-tion	Not done because it uses primary data

Source: Authors' processed data (2026)

The results of the classical assumption tests presented in Table 6 indicate that the regression model used in this study meets all the required statistical criteria. All research instruments are valid and reliable, and the data satisfy the assumptions of normality, multicollinearity, and heteroscedasticity, ensuring that the model is appropriate for further analysis. These results confirm that the estimated regression model is unbiased and can be used to accurately examine the relationships between technological, organizational, and environmental factors and fisheries supply chain performance. Therefore, hypothesis testing using multiple linear regression analysis can be conducted, and the results are presented in Table 7.

Table 7. Partial Test Results

Hypothesis	Koefisien	Sig	Results
H_1	.107	0,029	Technology has a significant impact on the fisheries supply chain
H_2	-.012	0.849	Organizations do not have a significant impact on the fisheries sup-ply chain.
H_3	.796	0,000	The environment has a significant impact on the fisheries supply chain.

Source: Authors' processed data (2026)

After testing, the model that can explain the influence of technology, organization, and environment on the supply chain is as follows:

$$RP = 6.732 + 0.107T - 0.012O + 0.795L + e \quad \text{..... (2)}$$

A technology variable was found to be significant (p-value = 0.029), below the 0.05 significance level. The result indicates that the technology variable has a significant effect on the supply chain in the fisheries sector. The organizational factor has a p-value of 0.849, which is greater than 0.05, meaning that organizational factors in digital transformation do not have a significant effect on the fisheries supply chain. Environmental factors show a p-value of 0.000, which is less than 0.05, thus having a very significant effect on the fisheries supply chain. An R-squared value of 0.541 indicates that 54.1% of the variation in the fisheries supply chain performance can be explained by the technological, organizational, and environmental factors used in the research model. This means that these three variables make a significant contribution to shaping the effectiveness of the fisheries supply chain. However, 45.9% of the remaining changes are influenced by external factors outside the model, such as government policies, market access, or socio-economic conditions.

Discussion

A technology variable was found to be significant. The result indicates that the technology variable has a significant effect on the supply chain in the fisheries sector. This shows that the use of technology, such as

the application of logistics digitization technology, the modernization of fishing equipment, fisheries information system technology, and the use of monitoring technology, can improve distribution effectiveness and supply chain efficiency. Previous studies by Andaloussi (2024) and Fauzan et al. (2025) emphasize that digital transformation in fish distribution can accelerate market access and minimize catch losses, overcoming the limitations of traditional distribution methods. Furthermore, according to Puspitasari et al. (2022), the application of blue economy-based digital technology in the fisheries sector can promote business sustainability and logistics cost efficiency. Through technology, the storage and distribution of fishery catches will become more efficient, more integrated, and more cost-effective, thereby increasing the competitiveness of the fisheries sector. From a contemporary accounting perspective, digital technologies support accounting information systems and data-driven financial management practices within fisheries supply chains. Real-time operational data helps fishermen record transactions more systematically, determine selling prices more accurately, monitor operational costs, and improve profit-sharing decisions among supply chain actors. Consequently, digital transformation contributes not only to operational efficiency but also to more transparent and effective accounting practices within fisheries enterprises (Alharasis et al., 2025). Furthermore, the age of fishermen in the productive category, aged 25 to 56, indicates that they are quite ready to use technology to support fishing activities. Within this age range, fishermen have the physical ability and knowledge capacity to adapt to technological developments. However, this potential has not been fully realized due to a lack of training, guidance, and government policies that encourage fishermen to master and apply technology in their work.

The organizational factors in digital transformation do not have a significant effect on the fisheries supply chain. These results indicate that factors such as the lack of organizational structure, internal governance, and managerial coordination patterns in the fisheries sector have not been dominant in supporting the supply chain's success. Based on the TOE (Technology-Organization-Environment) framework developed by Tornatzky & Fleischer (1990), organizational factors influence human resource readiness, structure, and organizational culture. However, in the fisheries sector, traditional institutions remain dominated by conventional systems and limited coordination among business actors, which can hamper supply chain efficiency. These results are supported by research by Alawamleh et al. (2020); Chatra et al. (2024), which found that weak internal governance in Indonesia's small-scale fisheries sector hinders these organizations from playing an optimal role in supporting supply chain distribution and integration. In terms of organization, this is caused by limited human resources, as evidenced by the level of education, which is dominated by high school graduates without expertise in fisheries; poor coordination between business units; and the suboptimal role of institutions in supporting the fisheries distribution chain. This aligns with research by Nawir et al. (2024), which found that human resource limitations remain a major problem, with the quality and skills of the workforce in the fisheries sector not yet optimal, thereby hampering the performance of the distribution chain. Therefore, although organizations play an important role in theory, their contribution has not been significant in this study.

Environmental factors having a very significant effect on the fisheries supply chain. This indicates that external environmental factors, such as government policy, infrastructure availability, market conditions, trade regulations, and natural and climatic conditions, greatly influence the operations of the fisheries supply chain. In the Maluku fisheries sector, the external environment is a supporting factor, including government policies related to the development of cold storage systems, the construction of fishing ports, and export regulations, which have been proven to influence the supply chain. Research by Puspitasari et al. (2022) also highlights that environmental factors, particularly blue economy policies, can improve supply chain efficiency while maintaining the sustainability of marine ecosystems. In addition, Christoper (2016); Nguyen et al. (2022) emphasize that the food supply chain, including fisheries, cannot be separated from market dynamics and constantly changing external environmental policies. Through conducive environmental support, the distribution of fishery products can become smoother, market access more open, and the sustainability of the fisheries sector more assured.

Therefore, this model has moderate explanatory power, making it relevant but requiring the development of additional variables to gain a more comprehensive understanding of the factors that determine the fisheries supply chain. This study primarily focused on fishermen at the initial stage of the fisheries supply chain because they are the parties most directly affected by distribution inefficiencies and challenges to digital adoption. However, fisheries supply chains involve a broader set of stakeholders, including collectors, distributors, processors, exporters, and consumers. Therefore, future research should

incorporate multi-stakeholder perspectives to obtain a more comprehensive understanding of digital transformation and supply chain integration within the fisheries sector.

CONCLUSION

The results of this study confirm that technological capability and environmental support play a crucial role in enhancing fisheries supply chain performance in archipelagic regions, in line with the study's objectives, based on the Technology–Organization–Environment (TOE) framework. The findings demonstrate that digital transformation significantly accelerates distribution processes, reduces operational costs, and improves competitiveness, while enabling more efficient, integrated, and quality-preserving handling of fisheries products. In contrast, organizational factors do not show a significant influence, indicating that internal governance, human resource capacity, and traditional working patterns within fisheries organizations remain insufficient to support effective digital transformation. These results suggest that, in the context of small-scale and geographically dispersed fisheries sectors, external support systems and technological readiness are more decisive than internal organizational structures in driving supply chain effectiveness.

The study also implies that strengthening digital infrastructure and external ecosystems, including government policies, infrastructure development, and market facilitation, is essential to improve supply chain efficiency and sustainability. From a contemporary accounting perspective, digital transformation also strengthens accounting information systems, financial transparency, and data-driven decision-making processes within fisheries enterprises. Real-time operational data enables better cost monitoring, supports more accurate selling price determination, and facilitates more transparent profit-sharing mechanisms among fisheries stakeholders. However, this study is limited by its sample size and geographic focus, as well as its quantitative approach, which may not fully capture contextual and socio-cultural dynamics. Therefore, future research is recommended to incorporate additional variables, such as access to financing, digital literacy, and stakeholder collaboration, and to apply mixed-methods approaches to gain deeper insights into qualitative aspects. Comparative studies across different regions are also important for better understanding regional disparities and for developing more comprehensive and generalizable models of fisheries supply chain performance.

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