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Shaping digital orientation and enhancing firm performance: The role of digital literacy, supply chain integration, and transparency

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A B S T R A C T

Manufacturing firms face increasing pressure to strengthen data integration and coordinate activities as digital technologies become embedded in business processes. Although digital literacy, supply chain integration, transparency, and digital orientation are recognized as essential capabilities, limited research has examined their combined effects on firm performance in emerging-market contexts. This study investigates the interrelationships among these capabilities by surveying 220 manufacturing companies across Java and analyzing the data using SmartPLS 4. The results show that digital literacy significantly enhances supply chain integration and supply chain transparency, although it does not directly influence digital orientation. Supply chain integration positively affects supply chain transparency, digital orientation, and firm performance. Supply chain transparency improves digital orientation but has no direct effect on firm performance. Digital orientation is found to be a strong predictor of firm performance. These findings highlight a sequential capability pathway in which digital literacy and supply chain capabilities shape digital orientation, which in turn drives firm performance. The study offers practical guidance for manufacturing firms seeking strengthening digitalization strategies through targeted development of employee digital skills, integrated information systems, and transparent supply chain processes.

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1. Introduction

The rapid development of information technology has transformed how manufacturing companies manage their operations and pursue business objectives. Companies are now required to strengthen internal data integration to support faster and more accurate decision making. Integrated information systems that operate on a single database enable effective cross-functional communication and coordinated workflows (Pirmanta et al., 2021). To benefit from such systems, employees need the ability to input, manage, and interpret data in accordance with organizational standards. Proficiency in using digital tools, accessing required information, and producing reports has become essential for ensuring smooth coordination within the company (Liu et al., 2025). These skills reflect the broader construct of digital literacy. Digital literacy refers to an individual's ability to use digital technologies to access, understand, evaluate, and communicate information. Employees who possess strong digital literacy can assess the accuracy and completeness of organizational data and support the flow of reliable information across internal functions. Digital literacy enhances both operational and administrative coordination by enabling faster communication with suppliers and customers (Liu et al., 2025). Employees with higher digital literacy can perform quick data analysis, which strengthens coordination within the supply chain (Zhang et al., 2024). Digital literacy can be continuously developed to meet evolving technological demands (Shatila et al., 2025; Vafaei-Zadeh et al., 2020), and it contributes directly to the establishment of effective supply chain integration (Shukor et al., 2021). It also supports network expansion and cross-organizational collaboration by reducing knowledge gaps and encouraging the sharing of expertise

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(Vafaei-Zadeh et al., 2020). A company's ability to build sustainable supply chain management becomes a strategy in communicating and coordinating with external consumer interests by building supply chain transparency (Duan et al., 2022).

Companies can carry out transaction processes and operational activities adequately and can be shared with external partners to understand the company's condition, but a commitment is needed to maintain confidentiality from competing partners (Chou et al., 2023). The ability of suppliers and customers to utilize company technologies enhances supply chain transparency and facilitates stronger integration throughout the supply chain (Chai et al., 2025). A company's ability and willingness to implement transparency in its supply chain, actively engaging in communication and sharing information about products and processes (Gligor et al., 2022). Transparency enables companies to synchronize with suppliers and customers, creating trustworthy relationships (Bui, 2024). Manufacturing companies provide data digitally using system automation by implementing radio frequency identification, industrial internet of things and blockchain technologies, which has an impact on supply chain transparency (Zelbst et al., 2020).

Supply chain integration provides the foundation for achieving supply chain transparency (Zhang, et al., 2022; Iranmanesh et al., 2023). Through integrated systems, companies can make real-time data accessible to internal teams and external partners, including information related to inventory, production activities, and planning (Jia et al., 2024; Al-Khatib, 2025; Shi et al., 2024). Transparency improves decision quality and fosters greater trust within the supply chain. It enables more effective monitoring of operations and promotes joint efforts to redesign business processes where needed (Tan et al., 2023). Increased transparency also allows suppliers and customers to better understand the company’s operations, thereby enhancing collaboration. The company's ability to communicate and disclose information to other stakeholders such as consumers, investors, and stakeholders regarding compliance with expected norms in operational processes and product manufacturing is a consequence of supply chain transparency (Sodhi et al., 2022).

The combination of supply chain integration and transparency strengthens a company’s digital orientation. Digital orientation refers to a firm’s commitment to adopting and utilizing digital technologies to create value and improve business processes (Sègbotangni et al., 2025). Companies that are able to manage integration and transparency effectively tend to achieve higher efficiency and adaptability (Basana et al., 2025). A strong digital orientation also reduces operational uncertainty and supports rapid communication among business partners (Chai et al., 2025; Pirmanta et al., 2021). Consequently, firms that are digitally oriented are better positioned to enhance competitiveness and improve firm performance.

Although each construct has been examined in prior studies, research that integrates digital literacy, supply chain integration, supply chain transparency, digital orientation, and firm performance within a single framework remains limited, particularly in emerging-market manufacturing contexts. This study addresses that gap by investigating the relationships among these variables in manufacturing companies located in Java.

Therefore the objectives of this research are: (1) to examine the influence of digital literacy on supply chain integration, supply chain transparency, and digital orientation, (2) to analyze the effect of supply chain integration on supply chain transparency, digital orientation, and firm performance, (3) to determine the influence of supply chain transparency on digital orientation and firm performance, and (4) to evaluate the effect of digital orientation on firm performance.

2. Literature Review

2.1 Conceptual relationships: Digital literacy to supply chain integration and transparency

Digital literacy is crucial for every individual employee in a company to understand the information technology that has been implemented. Digital literacy is the competency possessed by everyone in understanding and using information technology in their activities to simplify and improve their effectiveness (Keefe et al., 2025). It encompasses the ability of individual employees within a company to access data and provide the necessary information. It also encompasses the ability to use and operate information technology devices to access or input data into the company's information technology system, which serves as both an operational and administrative system (Liu et al., 2025). Digital literacy enables a company to run all processes efficiently and effectively. High digital literacy skills among employees facilitate the delivery of information and enable effective communication between internal and external functions within the company's supply chain (Zhang et al., 2024). Individual employee skills in improving digital literacy competency make it easier to adapt and increase individual capacity. This condition enables an individual to assess the importance, accuracy, completeness, and risks associated with information. Individual skills in digital literacy enable companies to adopt new technologies and perform routine maintenance (Shatila et al., 2025). Companies can make precise calculations in adjusting information technology according to needs (Vafaei-Zadeh et al., 2020). Companies with skilled employees can build effective collaborations with external partners (Keefe et al., 2025). Companies can share important information to achieve predetermined business goals (Shatila et al., 2025). Companies can capitalize on high business opportunities if employees can master digital technology and encourage knowledge sharing within the company (Liu et al., 2025).

The company's digital literacy enables the integration of its technology across all departments, adopting a cross-functional approach, and can also be shared with both the downstream and upstream supply chains (Shukor et al., 2021). Digital information formed in companies with digital literacy makes information into disclosure of information which can create more solid supply chain integration (Gligor et al., 2022). Information quality, information technology, and security are crucial for manufacturing companies in building effective supply chain integration within their organization, which can be leveraged by users (Vafaei-Zadeh et al., 2020). The company's ability to ensure the configuration of technology systems by involving managers and policymakers in building supply chain integration to improve capability and servitization (Freije et al., 2022). Supply chain transparency is an effort by the company to make its data and information accessible to internal cross-functional teams, external supplier partners, and customers (Jia et al., 2024; Chai et al., 2025). Digital literacy within the company enables employees to effectively communicate with cross-functional teams and share data with external parties, providing information tailored to the specific problems they face (Keefe et al., 2025). The digital literacy environment within the company has an impact on users' system and encouraging them to become digitally oriented in order to achieve efficiency and effectiveness (Zhang et al., 2024). Supply chain transparency created in buyer digital capability has an impact on supply chain integration by realizing transparency in buyer-supplier relationships so that behavior that is not in accordance with the agreement or is unethical can be identified quickly (Zhang, et al., 2022).

Supply chain integration established within a company can be shared with external suppliers and customers to obtain information as needed, becoming the basis for supply chain transparency (Vafaei-Zadeh et al., 2020; Shukor et al., 2021; Freije et al., 2022). Supply chain integration within a company enables the company to transparently monitor the movement of materials from suppliers to product delivery to customers, promoting supply chain transparency (Al-Khatib, 2025; Shi et al., 2024; Basana et al., 2025). Transparent information within the company, with visibility into internal procedures and processes related to operations, as well as supply chain integration for monitoring logistics activities (Tan et al., 2023; Sègbotangni et al., 2025). Based on the explanation above, the research hypotheses (H1, H2, H3) can be established.

H_1: *Digital literacy has an impact on supply chain integration.*
H_2: *Digital literacy has an impact on supply chain transparency.*
H_3: *Supply chain integration has an impact on supply chain transparency.*

2.2 Conceptual relationships supply chain integration and transparency to digital orientation

Digital orientation is crucial for companies in the face of rapid technological development and is essential for improving performance and competitiveness (Li & Zhang, 2025). Digital orientation refers to the utilization of digital technology within a manufacturing company's management system to create value and enhance business processes (Tan et al., 2023). Digital literacy within a company can enable farmers to leverage digital social capital and promote technology to foster digital orientation, thereby enhancing green production technologies (Liu et al., 2025). Supply chain integration and transparency within a company, designed to create and coordinate digital systems as a form of information capability, can impact digital orientation (Barba-Sánchez et al., 2024). Suppliers can understand the product quality expectations that customers expect through supply chain transparency, but it has a negative impact because consumers can also understand the strengths and weaknesses of the company (Guan et al., 2020). Digital orientation for companies, which address the needs of external partners, fosters supply chain transparency, enabling value creation for all supply chain members as they adapt to technology (Tan et al., 2023).

H_4: *Digital literacy influences digital orientation.*
H_5: *Supply chain integration influences digital orientation.*
H_6: *Supply chain transparency has an impact on digital orientation.*

2.3 Conceptual relationships supply chain integration and transparency, digital orientation, and firm performance.

Supply chain integration within a company, with the creation of real-time searching information and the company's ability to establish periodic communication with customers, can impact firm performance by increasing the timeliness of goods delivery and the company's ability to reduce production costs (Tan et al., 2023; Pirmanta et al., 2021). Supply chain integration, through the creation of cross-functional data integration, enables the collection, access, and sharing of relevant information with external partners, thereby impacting firm performance in generating product innovation and enhancing company capability (Freije et al., 2022). Supply chain integration established within the Federation of Malaysian Manufacturers, with accurate, timely, and standardized information sharing with external partners and providing access to monitor operation process activities, can result in firm performance in terms of volume flexibility and on-time delivery (Vafaei-Zadeh et al., 2020). Manufacturing companies in Malaysia can build operational supply chain transparency, which can have an impact on increasing supply chain alignment and supply chain adaptability, which shows that integration between supply chain members enables firms to quickly change the design and adjust supply chain, production, quality, and quantity (Iranmanesh et al., 2023).

Supply chain transparency involves upstream and downstream stakeholders in disclosing information related to the company's internal conditions, enabling a better understanding of the company's condition and informing appropriate decision-making to improve sustainable firm performance (Jia et al., 2024; Shihi et al., 2024). A company's supply chain transparency, achieved by sharing transparent information, can facilitate effective planning, demand management, and inventory control, ultimately reduce costs and enhance firm performance as a key factor (Al-Khatib, 2025; Basana et al., 2025). A company's supply chain transparency with supplier partners, in terms of allocating raw materials for specific products to meet customer orders, can be monitored and communicated in real-time, thereby impacting the environmental performance of French manufacturing (Sègbotangni et al., 2025). The company has implemented supply chain transparency in the processes provided to suppliers to ensure compliance with social and environmental sustainability standards, and the company always optimizes the balance between supplier and customer needs (Chen et al., 2019). A company's digital orientation, characterized by its employees' personal capabilities and commitment to utilizing the company's technology, impacts firm performance by increasing company profits and operational performance (Barba-Sánchez et al., 2024). Digital orientation in manufacturing companies in China, characterized by their commitment to utilizing digital technology and providing digital data access, has a significant impact on sustainability and financial performance (Li & Zhang, 2025). Based on the explanation above, the research hypotheses H7, H8, and H9 can be established.

H_7: *Supply chain integration has an impact on increasing firm performance.*
H_8: *Supply chain transparency has an impact on improving firm performance.*
H_9: *Digital orientation has an impact on increasing firm performance.*

Based on the explanation above, the research conceptual framework can be determined in Fig. 1.

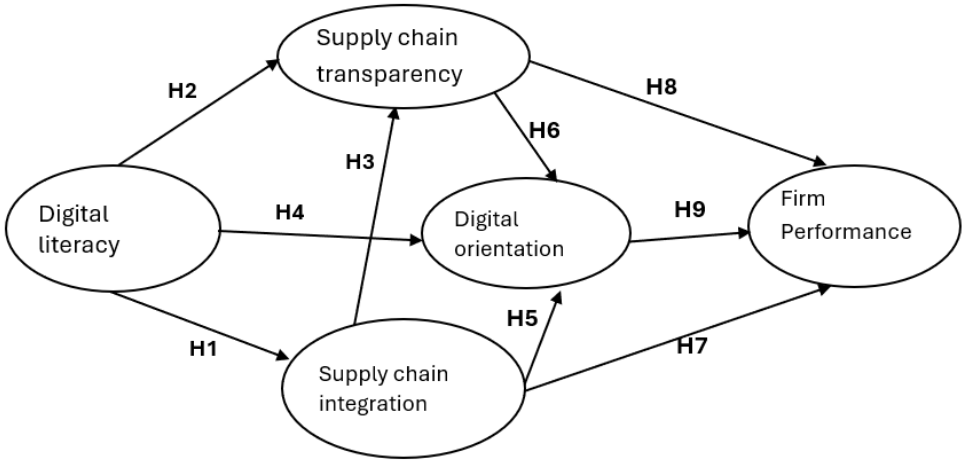

Figure 1: Research conceptual framework

3. Research Method

This type of research uses causal research with a quantitative approach. The study tests hypotheses to answer the established problems. The research object is a manufacturing company that produces products, serving as the research population. The distribution of questionnaires to manufacturing companies on the island of Java employed a sample approach, with an unlimited population, as there is no data available to determine the number of companies with more than 30 employees that can be classified as medium-sized manufacturing companies. The results of the questionnaire distribution yielded a total of 220 companies, with responses collected using Google Forms and direct distribution to employees. The questionnaire is composed of measurement items for each variable, each with an operational definition. Digital literacy refers to the ability of employees to utilize information technology in their work and responsibilities effectively (Keefe et al., 2025). Measurement items are adopted from research (Liu et al., 2025), namely literacy in using information data in the company's technology system, literacy in communicating in the company's technology system, literacy in creating digital content reports in the company's technology system, literacy in security systems in the company's technology system and literacy in solving problems that arise in the company's technology system.

Supply chain integration refers to the process of integrating a company's related upstream and downstream activities, which can provide added value to the company's products and services (Shukor et al., 2021; Vafaei-Zadeh et al., 2020; Freije et al., 2022). Measurement items adopted from research (Shukor et al., 2021) for internal integration are data that has been integrated internally in the company (II1) and can operate data in real time (II2); for supplier integration is defined as sharing information with suppliers (SI1), and supplier participation in overcoming problems in procurement and production (SI2); for customer integration is defined as sharing inventory information with customers (CI1) and providing a fast order processing system for customers (CI2).

Supply chain transparency refers to a company's ability to disclose information to internal and external stakeholders about its operations and activities (Jia et al., 2024). The measurement items used adopt research from (Al-Khatib, 2025), namely, the company can carry out reliable information processes (SCT1), the company opens transparent information exchange (SCT2), the company discloses practical information about planning (SCT3), and the company uses technology to monitor product flow (SCT4). Digital orientation is crucial for companies in creating value and designing effective business processes that utilize technology (Barba-Sánchez et al., 2024). The measurement items adopt research conducted by (Li & Zhang, 2025) which is adapted to the conditions of medium and large manufacturing in Indonesia, namely employees are easy to use the company's digital technology (DO1), the company can see new opportunities in using technology (DO2), the digital technology used can change business processes (DO3), the company adapts the digital technology used (DO4), and the company pays attention to the needs of external partners related to the use of digital technology (DO5).

Firm performance is a measure of a company's competitiveness and its ability to deliver results. The measurement items for firm performance were established by adopting research (Vafaei-Zadeh et al., 2020) and adapted to manufacturing performance in Indonesia: customer service satisfaction (FP1), product quality (FP2), on-time delivery (FP3), order fulfillment (FP4), and volume flexibility (FP5).

4. Results and Discussion

Respondent profiles were obtained by distributing questionnaires to industry practitioners, encompassing 220 companies. Respondent profiles indicated that 39 respondents (18%) had an education equivalent to high school, 154 respondents (70%) were undergraduate, and 27 respondents (12%) were postgraduate. Respondent profiles with male gender: 142 respondents (65%) and female: 78 respondents (35%). Respondent profiles based on internal functions are finance & accounting function 21 respondents (10%), marketing function respondents (%), production & warehouse function 83 respondents (38%), purchasing & planning function 27 respondents (12%), human resources function 10 respondents (5%), system information function 11 respondents (5%), and top management 23 respondents (10%). Respondent profile based on length of service with work experience of 2-4 years totaling 37 respondents (17%), 5-7 years totaling 32 respondents (15%), 8-10 years totaling 33 respondents (15%), 10-15 years totaling 18 respondents (8%), and more than 15 years totaling 100 respondents (45%). Respondent profile based on the number of employees, the majority are in companies with more than 200 employees, namely 118 companies (53%), followed by companies with the number of employees between 30-49 as many as 43 companies (20%), 50-99 employees as many as 36 companies (16%) and 100-199 employees as many as 23 companies (10%). Data processing was performed using both descriptive analysis and causal analysis, employing structural equation modeling (SEM). Table 1 presents the descriptive analysis of the mean and the outer SEM PLS model testing results.

Table 1
Descriptive analysis of the mean and outer model test for measurement

Item	Mean	Factor Loading	Composite reliability	Cronbach alpha
Literacy Digital	4.376		0.926	0.900
LD.1	4.450	0.834		
LD.2	4.527	0.848		
LD.3	4.468	0.904		
LD.4	4.277	0.882		
LD.5	4.159	0.757		
Supply Chain Integration (R-Square = 0.382)	4.221		0.912	0.882
II1	4.305	0.854		
II2	4.091	0.792		
SI1	4.268	0.862		
SI2	4.105	0.709		
CI1	4.264	0.838		
CI2	4.295	0.706		
Digital Orientation (R-Square = 0.285)	3.945		0.866	0.809
DO1	4.132	0.673		
DO2	3.891	0.628		
DO3	3.932	0.855		
DO4	3.886	0.852		
DO5	3.882	0.732		
Supply Chain Transparency (R-Square = 0.214)	3.942		0.894	0.842
SCT1	3.800	0.816		
SCT2	3.868	0.839		
SCT3	4.141	0.873		
SCT4	3.959	0.762		
Firm Performance (R-Square = 0.441)	4.065		0.814	0.719
FP1	4.159	0.549		
FP2	3.505	0.655		
FP3	4.505	0.679		
FP4	4.032	0.778		
FP5	4.123	0.747		

The descriptive mean analysis in Table 1 shows a digital literacy score of 4.376, accompanied by measurement items with a mean of 4.159-4.527. Digital literacy in manufacturing companies empowers staff across all functions to effectively operate computer systems and applications. Staff can utilize software applications to access the data needed for informed decision-making. Supply chain integration scores a mean of 4.221, accompanied by measurement items with a mean of 4.091 to 4.305. The company's supply chain integration is considered adequate. Supply chain integration is a key component of the company, encompassing internal integration with a mean of 4.305 (II1), 4.091 (II2), supplier integration with a mean of 4.268 (SI1), 4.105 (SI2), and customer integration with a mean of 4264 (CI1) and 4.295 (CI2). The digital orientation had a mean value of 3.945, and the measurement items had a mean between 3.882 and 4.132. Digital orientation in manufacturing companies has been progressing well by reducing the use of paper internally for reports, announcements, meeting invitations, and other purposes. Supply chain transparency has a mean value of 3.942, with measurement items ranging from 3.800 to 4.141. Supply chain transparency is currently utilized internally within the company to facilitate access to data across other departments. The company also always shares information related to the results of improvements that have been made so far. Firm performance, as the last variable, yielded a mean value of 4.065, with measurement items ranging from 3.505 to 4.505. The value between one item and another is very different, where the possibility of difficulty in access for employees is related to increasing company profits. The company's performance has been good overall, particularly in relation to the products it produces, which directly impact product characteristics according to customer orders.

Outer model tests to obtain valid and reliable measurement items. Validity test on each measurement item loading factor lowest on the variable digital literacy obtained LD.5 of 0.757, supply chain integration on CI2 of 0.706, supply chain transparency on SCT4 of 0.762, digital orientation of 0.628 on DO2, and firm performance of 0.549 on FP1. The lowest overall loading factor value on item FP1 is 0.549, which is greater than 0.500; therefore, it is declared valid and has passed the validity test. The outer test of both reliabilities, as indicated by the Cronbach's Alpha value and composite reliability, is above 0.700, meeting the set requirements. Digital literacy with Cronbach Alpha 0.900 and composite reliability 0.926, supply chain integration with Cronbach alpha 0.882 and composite reliability 0.912, supply chain transparency with Cronbach alpha 0.842 and composite reliability 0.894, digital orientation with Cronbach alpha 0.809 and composite reliability 0.866, and finally the firm performance variable with Cronbach alpha 0.719 and composite reliability 0.814. The reliability test value met the requirements, so the inner model test was conducted. The first inner model test was carried out by calculating the Q-square predictive model. $Q^2 = (1-(1-R_1^2)\ (1-R_2^2)\ (1-R_3^2)\ (1-R_4^2)) = 1-(1-0.382)\ (1-0.285)\ (1-0.214)\ (1-0.441) = 1-0.194 = 0.806$. The results of data processing show that digital literacy, supply chain integration, and supply chain transparency have increased by 80.6%. The next stage is to conduct an inner model test for the research hypothesis.

Table 2
Path coefficient and hypothesis test

Path Coefficient	Original sample	T statistics	P values
Literacy Digital → Supply Chain Integration	0.618	12.207	0.000
Literacy Digital → Supply Chain Transparency	0.211	2.351	0.019
Supply Chain Integration → Supply Chain Transparency	0.301	3.253	0.001
Literacy Digital → Digital Orientation	0.124	1.529	0.126
Supply Chain Integration → Digital Orientation	0.304	3.585	0.000
Supply Chain Transparency → Digital Orientation	0.224	3.210	0.001
Supply Chain Integration → Firm Performance	0.371	4.926	0.000
Supply Chain Transparency → Firm Performance	-0.107	1.459	0.163
Digital Orientation → Firm Performance	0.453	5.802	0.000

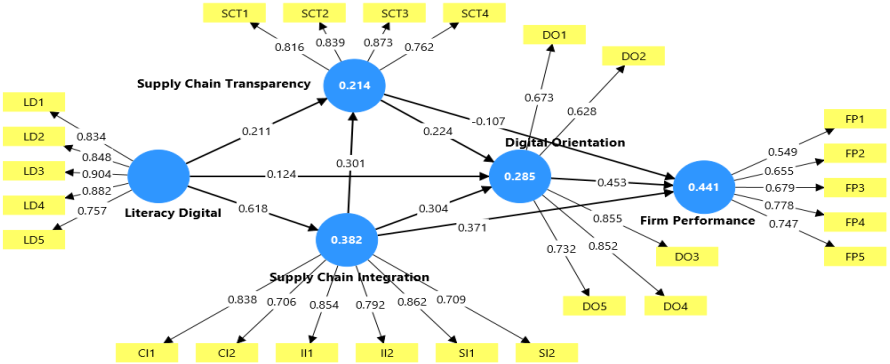

Fig. 2. Path coefficient Full Model PLS

Fig. 2 and Table 2 present the path coefficients, which illustrate the results of the research hypothesis. The first hypothesis found that digital literacy influences supply chain integration of 0.618 with a t-statistic of 12.207 (>1.96) and a P-value of 0.000 (<0.05), so the first hypothesis is accepted. The company's ability to implement digital literacy among staff can have a significant impact on strong supply chain integration, both internally and externally. The results of the study support the findings of research that indicate digital literacy has an impact on supply chain integration (Liu et al., 2025; Basana et al.,

2025; Zhang et al., 2024; Shukor et al., 2021; Vafaei-Zadeh et al., 2020). The second hypothesis, that digital literacy influences supply chain transparency, has a p-value of 0.019 (< 0.05) and a t-statistic of 2.351 (> 1.96), indicating that the second hypothesis is accepted. Digital literacy within the company has a significant impact on increasing supply chain transparency, enabling relevant departments to make informed decisions and foster adequate collaboration. The research results support the findings that digital literacy has an impact on supply chain transparency (Chai et al., 2025; Jia et al., 2024; Liu et al., 2025). The third hypothesis, Supply chain integration influences supply chain transparency of 0.301 with a t-statistic of 3.253 (>1.96) and a P-value of 0.001 (<0.05), thus the fourth hypothesis is accepted. A well-established supply chain integration within the company, both within the company and across functions, and with external partners, makes data accessible to all functions and external parties as needed, thereby increasing transparency. The research results support the findings that state supply chain integration affects supply chain transparency (Shi et al., 2024; Jia et al., 2024; Vafaei-Zadeh et al., 2020; Shukor et al., 2021; Tan et al., 2023; Sègbotangni et al., 2025).

The fourth hypothesis, digital literacy influences digital orientation of 0.124 and a t-statistic of 1.529 (<1.96) and a P-value of 0.126 (>0.05), thus the third hypothesis is rejected. The company's current digital literacy has not been able to impact digital orientation because several departments are still not fully integrated with the company's database, particularly in the production department, due to the need for redesign in rescheduling and material reuse. Manufacturing companies have begun to gradually make improvements to integrate all process activities with the information system, facilitating the retrieval of information as needed. The fifth hypothesis, supply chain integration has a 0.304 effect on digital orientation, with a t-statistic of 3.585 (>1.96), and a P-value of 0.000 (<0.05), thus the fifth hypothesis is accepted. Supply chain integration, which aligns information, can provide a digital orientation for all users within the company, enabling them to make informed decisions. The research results support the findings that state supply chain integration influences digital orientation (Tan et al., 2023; Chai et al., 2025; Freije et al., 2022). The sixth hypothesis, that supply chain transparency influences digital orientation, has a p-value of 0.001 (< 0.05) and a t-statistic of 3.210 (> 1.96), indicating that the sixth hypothesis is accepted. The increased supply chain transparency within the company has enabled all functions to access and produce crucial information for informed decision-making. This condition has led all components within the company to consistently utilize information systems in their daily activities as a means of digital orientation. The results of this study support the findings of research that state that supply chain transparency influences digital orientation. (Barba-Sánchez et al., 2024; Tan et al., 2023).

The seventh hypothesis, that supply chain integration influences firm performance, has a coefficient of 0.371 and a t-statistic of 4.926 (>1.96) and a p-value of 0.000 (<0.05). Therefore, the seventh hypothesis is accepted. Supply chain integration within the company leads to practical improvements in communication and fosters strong coordination, ultimately impacting the firm's performance. The research results support the findings that state supply chain integration affects firm performance (Sègbotangni et al., 2025; Basana et al., 2025; Chai et al., 2025; Tan et al., 2023; Pirmanta et al., 2021).

The eighth hypothesis, that supply chain transparency influences firm performance, is rejected. The estimated coefficient is -0.107, with a t-statistic of 1.459 (<1.96) and a p-value of 0.163 (>0.05). Supply chain transparency in manufacturing companies does not directly impact firm performance but instead requires the formation of supply chain components to build a digital orientation in utilizing information to make informed decisions, in accordance with company needs. The ninth hypothesis, digital orientation, influences firm performance with a coefficient of 0.453 and a t-statistic of 5.802 (>1.96) and a p-value of 0.000 (<0.05), indicating that the ninth hypothesis is accepted. Digital orientation is fostered within the company, leading to a culture that enables the rapid and accurate acquisition of information from the information system, allowing for informed strategic decisions that enhance the firm's performance. The research results support the findings that state digital orientation affects firm performance (Barba-Sánchez et al., 2024; Li & Zhang, 2025).

The research shows how digital literacy, supply chain integration, and supply chain transparency shape digital orientation and improve manufacturing company performance. Digital literacy alone does not change digital orientation in manufacturing companies; robust supply chain and process integration remain essential. The findings emphasize that supply chain integration links digital capabilities directly to better organizational performance. Supply chain transparency does not always improve firm performance, but it does strengthen digital orientation. This research offers practical guidance for manufacturing management to design effective digitalization strategies. To maximize benefits, companies should enhance employee digital literacy and strengthen supply chain integration. Firms should focus on rapid information flow, process synchronization, and collaboration with external partners. Supply chain transparency supports digital orientation, so broader access to information improves responsiveness and digital decision-making. Invest in integrated digital systems and employee digital skills. Digital orientation is shown to drive faster order fulfillment, volume flexibility, and operational efficiency.

5. Conclusion

Digital literacy is crucial for manufacturing companies to increase efficiency and effectiveness, as well as to quickly adapt to company needs. Data analysis shows that employees' personal digital literacy can be more effective in gradually building supply chain integration and information transparency. Digital literacy influences digital orientation, making it easier for internal functions and external partners to access and monitor company activities. Strong supply chain integration can accelerate information flow and enhance collaboration, thus impacting supply chain transparency, digital orientation, and firm performance. Established supply chain transparency within a company impacts digital orientation but does not directly

impact firm performance. Supply chain transparency serves as a driver for digitally oriented companies, playing a crucial role in enhancing firm performance in terms of order fulfillment and volume flexibility. Digitally oriented companies can make quick and accurate decisions because they understand external uncertainty and the certainty of information within internal functions. Investment in digital tools is crucial for industry practitioners, and developing employee knowledge, skills, and digital literacy competencies plays a strategic role in company competitiveness.

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