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UNVEILING DETERMINANTS OF TECHNOLOGY ADOPTION IN FOOD SUPPLY CHAIN: A STUDY OF INDONESIA'S SMES

Diyah Ratna Fauziana[1]
[1]Sekolah Tinggi Manajemen PPM, Jakarta, Indonesia
Correspondence email: [1]dfauziana@gmail.com

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ABSTRACT

This study aims to investigate the adoption of technology by small and medium enterprises in the supply chain sector in Indonesia, namely by identifying the determinants of technology adoption and providing recommendations to improve technology adoption. This study uses a qualitative method, which begins with a literature review, and the results are verified through interviews with nine sources of food supply chain actors. The study results produce several determinants of technology adoption in SMEs: business strategy, business pressure, perceptions of benefits, and management support. The intervention recommendations for this study are programs to improve employee knowledge and skills, increase collaboration, and develop leadership in SMEs. This study contributes practically as input for government programs or other stakeholders to improve technology adoption in SMEs, making them more focused and effective. Government programs that facilitate collaboration between supply chain actors and develop knowledge and skills in human resources in SMEs will have a positive impact.

ABSTRAK

Penelitian ini bertujuan untuk menginvestigasi adopsi teknologi oleh usaha kecil menengah di sektor supply chain di Indonesia, yaitu dengan mengidentifikasi faktor penentu adopsi teknologi dan menentukan rekomendasi untuk meningkatkan adopsi teknologi. Penelitian ini menggunakan metode kualitatif, yang diawali kajian literatur dan diverifikasi hasilnya melalui wawancara dengan sembilan orang narasumber pelaku rantai pasok pangan. Hasil studi menghasilkan beberapa determinan adopsi teknologi pada UKM, yaitu strategi bisnis, tekanan dunia bisnis, persepsi atas manfaat dan dukungan manajemen. Rekomendasi intervensi studi ini adalah program peningkatan pengetahuan dan kemampuan karyawan, peningkatan kolaborasi, dan pengembangan kepemimpinan pada UKM. Studi ini berkontribusi praktis sebagai masukan untuk program pemerintah atau pemangku kepentingan lainnya untuk meningkatkan adopsi teknologi pada UKM, sehingga lebih terfokus dan efektif. Program pemerintah dalam memfasilitasi kolaborasi antar aktor rantai pasok dan pengembangan pengetahuan dan kemampuan pada sumber daya manusia di UKM akan memberikan dampak yang positif.

INTRODUCTION

The food supply chain (FSC) has recently faced significant risks and challenges (OECD-FAO, 2016). The short shelf lives of perishable food, the food character, and the high safety standard requirements in food processing and storage encourage supply chain actors to manage their business optimally (Jonkman et al., 2018). Uncertainties in FSC may lead to risk in the forward and backward flows along the chain, particularly in the harvesting and processing stages. The issue of seasonality and perishability is the primary concern in the decision-making processes of FSC actors. Extending the shelf life of food products is important to reduce waste downstream in the supply chain. A study by Barbosa (2021) identified other FSC challenges, including fluctuating food prices, unpredictable climate conditions, food waste, concerns about nutrition and food safety, and governance issues. To manage risks and challenges in the food supply chain, the OECD-FAO (2016) introduced the Model Enterprise Policy for Responsible Agricultural Supply Chains and guidelines for risk categorization specific to actors in the agri-food supply chain in various stages of the supply chain, including production, processing, storage, and distribution. Hence, FSC actors must address the main risks related to their specific roles in the FSC. Another study by Mantravadi & Srai (2023) revealed that inefficiency is one of the critical challenges faced by FSC actors. Food loss and waste are one of the challenges in FSC management that causes inefficiency, with food volumes wasted along the supply chain due to a lack of harvest forecasting skills, inappropriate harvesting and handling mechanisms upstream in the supply chain, and food-wasting behavior downstream in the supply chain. The inefficiencies negatively impact the food systems; therefore, it becomes an essential issue to improve and ensure the sustainability of FSC.

Studies revealed that using technology overcomes the challenges faced by FSC actors. The adoption of technology, including big data and the Internet of Things, was revealed in a study by Shah (2023) to enhance FSC performance significantly. Examples of the use of technology in this study are machine learning and blockchain, which affect FSC traceability. The stockpiling problem can also be overcome by using an intelligence system in automated ordering. A simulation conducted by Malahayati & Masui (2022) resulted in Indonesia's economic improvement as an ultimate result of technology adoption in FSC. According to the study, Indonesia's GDP is projected to increase by 2030 due to using technology to reduce food loss and waste. Rui & Sundram (2024) supported the study by highlighting that technological integration in the FSC improves traceability, reduces waste, and optimizes operational efficiency. The actors have employed a wide range of technologies in all the stages of the FSC to achieve sustainability, which integrates environmental, economic, and social objectives (Seuring & Muller, 2008). Technologies such as blockchain, artificial intelligence (AI), and the Internet of Things (IoT) enhance transparency and traceability, as essential factors to improve efficiencies in FSC, by documenting the journey of food from farms to households (Rui & Sundram, 2024). Cold chain technologies, for instance, help slow food deterioration and ensure high-quality food products for consumers. Bai et al. (2023) found that innovative cold chain systems, which are optimized through IoT, effectively reduce food waste levels. Since many technologies are offered for more optimal FSC management, the supply chain actors face new challenges in choosing the relevant technology for their processes to achieve a sustainable and efficient supply chain.

However, technology adoption remains limited to FSC actors with insufficient resources, especially in developing countries. Janssen & Swinnen (2017) reported minimal technology adoption in India's dairy supply chain. Key challenges in these regions include the lack of innovative technologies and limited understanding of architectural design technology (Khan et al., 2023). Ngo et al. (2020) proposed strategies for technology adoption among small and medium-sized enterprises (SMEs) in Vietnam, highlighting how linkages between foreign direct investment firms and SMEs can help address economic constraints. Technology transfers between firms were shown to facilitate the adoption of relevant technologies, thereby enhancing FSC sustainability.

Indonesia, as a developing country, is home to approximately 66 million SMEs, 99% of which are micro-level businesses (Projo, 2024), Among these, only 10,46% engage in innovation processes, and 20.78% develop collaborative innovations with external parties (Statistic Indonesia, 2023). This reflects the limited use of technology among SMEs in Indonesia, despite some benefiting from technology transfers from larger firms. Based on previous literature, technology adoption positively impacts food sustainability, necessitating targeted strategies to support SMEs, including FSC actors in Indonesia. Current research on technology adoption by Indonesian SMEs in the FSC remains limited. This study addresses this gap by identifying determinants for technology adoption among SMEs in Indonesia's FSC.

A literature review was conducted at the initial stage of the study to refine research gaps and establish the study's objectives. From the Scopus database, 804 articles were retrieved using the keywords 'SMEs AND technology AND adoption'. The publication period was limited to the last five years (2019-2024), and only published articles from reputable, Scopus-indexed journals were included. Figure 1 illustrates the distribution of keywords and their connections, as visualized using the VOS Viewer application. Previous research on SMEs primarily focused on e-commerce, basic information technology, industrial management, and entrepreneurship. Recent research trends emphasize technological innovation, big data, blockchain, and digital transformation.

The relationship between the keywords digitalization and SMEs was analyzed to identify the research gap, picturing the limited topics of relevant studies, as illustrated in Figure 2. The visualization reveals a significant limitation in studies focusing on SMEs' adoption of digital technologies, particularly those explaining pathways toward digital transformation. Most studies analyze the FSC's technology adoption in more general or context-specific, including the research on dairy supply chain in India (Janssen & Swinnen, 2017) and research on adoption strategy to overcome economic constraints in Vietnam (Ngo et al., 2020), while research on the broader topics is very limited, particularly in Indonesia. To fill the gap, this study aims to investigate the adoption of technology by SMEs in Indonesia's FSC. It addresses the two key research questions: (1) What are the determinants of SMEs' technology adoption? (2) What recommendations can be made to enhance technology adoption? By addressing these questions, this research seeks to contribute to the existing body of knowledge and provide actionable insights for fostering digital transformation in SMEs.

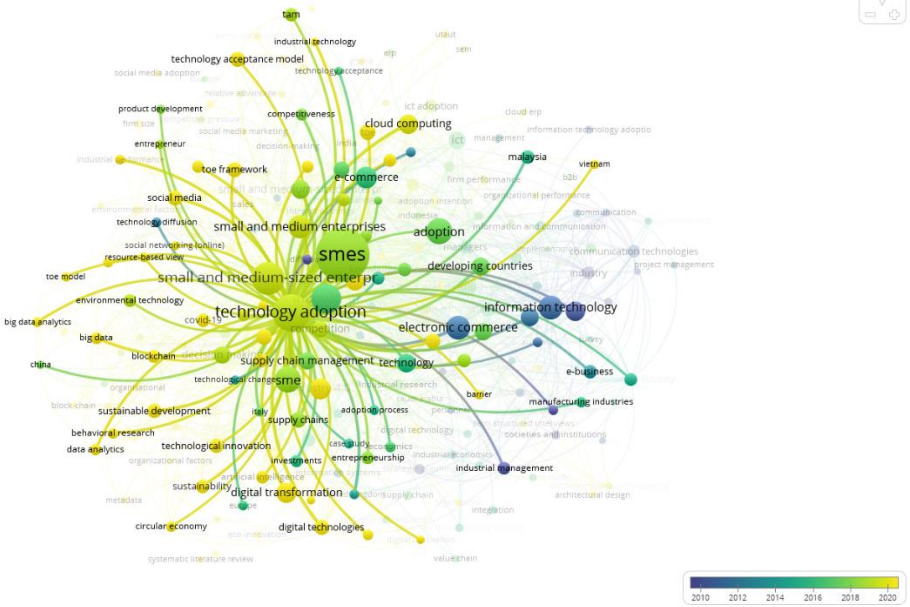

Figure 1. Research Networks Based on Keywords

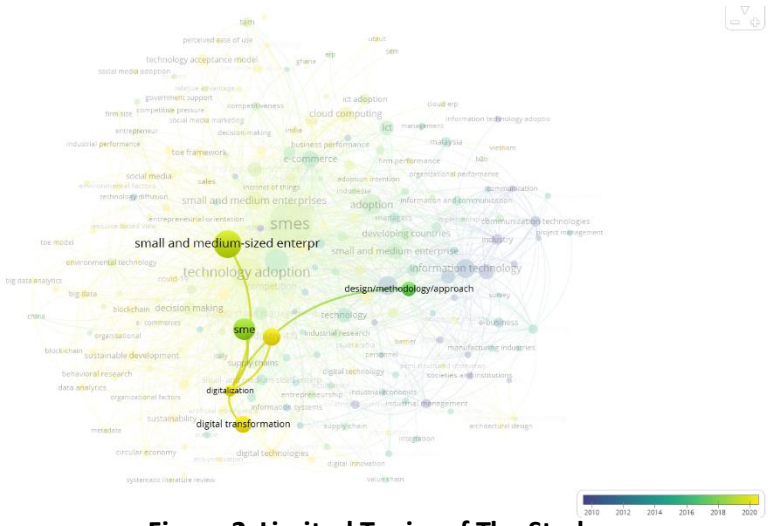

Figure 2. Limited Topics of The Study

This study's identification of factors influencing technology adoption by SMEs along the FSC is expected to contribute to the knowledge of FSC's technology adoption by SMEs, particularly in Indonesia, one of the developing countries. It provides a foundation for stakeholders, including governments, foreign direct investors, and other relevant parties, to develop appropriate intervention strategies. This represents the practical contribution of this study, aiming to foster sustainable and efficient technology adoption in the FSC.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

SMEs in Indonesia

Most companies in Indonesia are micro, small, and medium enterprises (99%), which contribute 61% of the country's Gross National Product (Statistic Indonesia, 2023). The strategic role of SMEs in improving the economic performance and social level of society requires adequate intervention from the government or other stakeholders, considering their limited resources. The diverse business scales of SMEs are also factor that must be considered when selecting intervention programs. Based on Government regulations No. 7 of 2021, SMEs are grouped based on business capital criteria or annual revenue, as listed in Table 1.

Technology adoption theories

Technology adoption has been conceptualized as the process through which individuals or organizations accept or reject a particular innovation or technology, resulting in behavior changes (Straub, 2009). Innovation is 'an idea, practice, or object perceived as new by an individual or another unit of adoption' (Rogers, 1995). Studies on technology adoption have been conducted from various perspectives. A study by Kiinski & Pohjola (2002) analyzed adoption from a macro perspective at the country level, while Plouffe et al. (2001) examined firm-level adoption, and Venkatesh et al. (2003) investigated individual determinants of technology adoption. These foundational approaches have significantly shaped the conceptual framework of technology adoption.

Tabel 1. SMEs Classification

Business scale	Annual revenue (AR)
Small-scale enterprises	Rp 2 bilions < AR < = Rp 15 bilions
Medium-scale enterprises	Rp 15 bilions < AR <= Rp 50 bilions

Benefits of technology adoption in FSC

According to previous research, technology adoption has been shown to enhance sustainable business performance within the FSC. Various frameworks are used to analyze the situation and solve the problems. Pranata et al. (2022) used the approach of the Technology, Organization, and Environment (TOE) framework of Rogers (1995). They revealed that most Indonesian SMEs in the food and beverage (F&B) sector utilized technology in marketing and sales through e-commerce. Some F&B companies procure new machines and use digital systems in their procurement systems to purchase directly from suppliers. Technologies are proven to increase productivity and efficiency in all business processes. Due to limited collaborative programs among stakeholders, the study highlighted a lack of environmental considerations in SMEs' management. Similarly, Jain et al. (2021) demonstrated that technology adoption significantly boosted the resilience, integration, and transparency of Indian SMEs in the food processing sector. The use of AI technologies overcomes the operational inefficiency issues in most firms. Gu et al. (2020) noted that technology implementation positively impacts supply chain resilience. Moreover, Pu et al. (2024) identified market trends as a key external factor influencing SMEs' intention to adopt technology. Based on these studies, it can be concluded that technology has benefits in increasing productivity, efficiency, resilience, and transparency in the supply chain.

Challenges to technology adoption in SMEs

Besides the benefits, challenges to technology adoption by SMEs remain significant. Shaikh et al. (2021) identified major barriers, including the high cost of technology and infrastructure, limited technical skills and efficiency, and inadequate organizational and governmental support. SMEs' lack of technology knowledge and ignorance of the benefits of using technologies hinder their adoption process (Pranata et al., 2022). Indonesia's SMEs in the F&B subsector are still using simple production technology due to the constraints of resources and knowledge. Competitive pressure has also emerged as a critical factor driving SMEs toward technology adoption (Ali et al., 2023; Homan & Beranek, 2023). Maintaining competitiveness is essential for firms to survive and gain customer loyalty. Therefore, high investment, the abundance of operational costs, lack of human resources skills and knowledge, inadequate government support, and competitiveness are challenges faced by FSC actors.

Based on Rogers (1995), at the organizational level, one of the factors that influences technology adoption is the size of the company. Small- and medium-scale companies avoid using technology in their business processes because they lack adequate resources. On the other hand, SMEs in FSC face the challenge of perishable products with limited shelf life. The traceability of food products is also essential to ensure food safety and sustainability. Hence, they require appropriate technological assistance to maintain the freshness and quality of their products. This unique condition makes them face quite tough challenges in managing the FSC.

RESEARCH METHOD

This study employs a qualitative approach divided into two stages. The first stage involves desk research through a comprehensive literature review, while the second stage consists of a verification process via interviews with non-selected SME informants. A total of 804 articles were retrieved from the Scopus database, comprising peer-reviewed articles published in reputable, Scopus-indexed journals, which were analyzed during the literature review process. The article screening was conducted iteratively, guided by the research questions, as illustrated in Figure 3. The initial screening process involved reviewing the titles of the articles, resulting in 132 articles identified as related to the research topic. Subsequently, the abstracts of these articles were reviewed, narrowing the selection to 48 relevant articles.

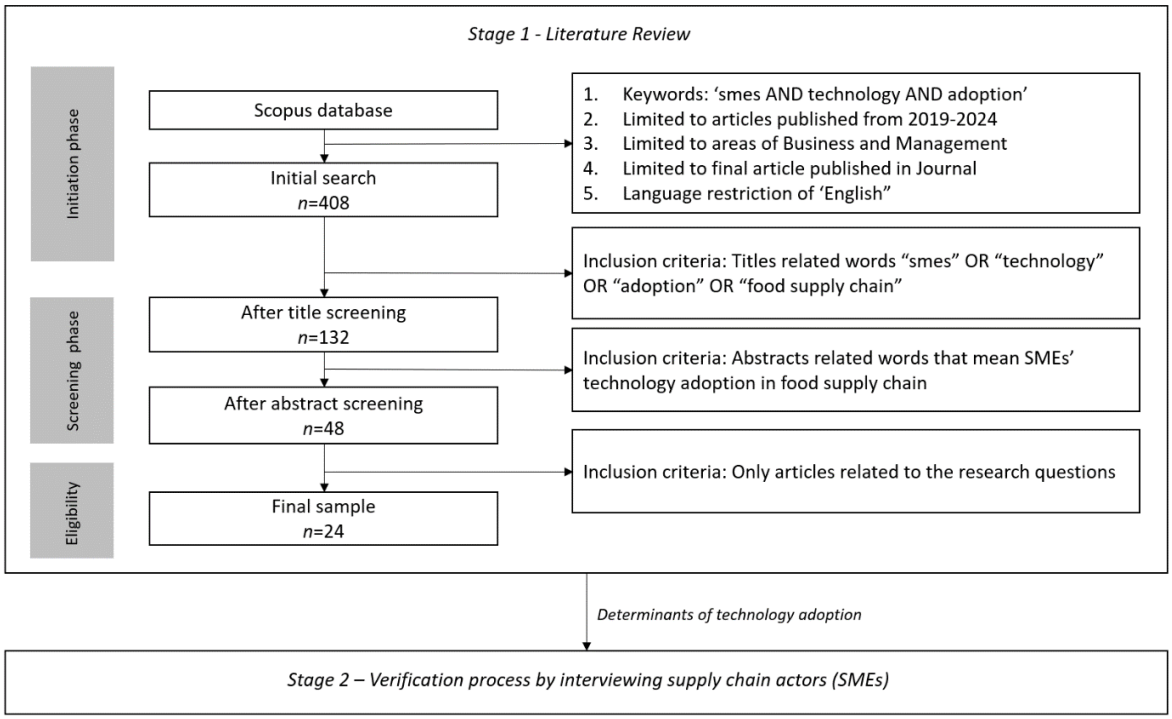

Figure 3. The Stages of This Study

A final screening was conducted by thoroughly reading the full text of each article, selecting 24 articles that directly addressed the research questions. These 24 articles were analyzed to extract information on the determinants of technology adoption by SMEs. The second stage of the study involved interviews with nine informants, representing various FSC actors: two retailer companies, six production companies, and one food exporter. Each business had a minimum of five years of operational experience in its industry, ensuring that the informants possessed substantial insights into business processes and their firms' technological adoption capabilities. The informants were either business owners or top management representatives, enabling them to provide a comprehensive perspective on their business intentions and challenges in adopting technology.

RESULT AND DISCUSSIONS

The determinants of SMEs' technology adoption in the food supply chain

The filtering process of 24 articles identified seven key factors influencing technology adoption by SMEs, as listed in Table 2. The supply chain actors' perceived advantage of technology was recognized as the determinant with the highest frequency (79%). Most informants have a consideration or procedure to calculate the cost and benefit before the technology is adopted. In line with previous studies, a study by Haces et al. (2024) on Mexican SMEs found that perceived advantage is a critical determinant in adopting technologies. Various factors affect the supply chain actors' perceived advantage, including perceived ease of use and perceived usefulness, particularly for digital technologies within the supply chain (Pu et al., 2024). Cost-saving benefits obtained by FSC actors are the result of using technologies (Gibreel et al., 2020). However, in contrast, Faiz et al. (2024) identified adoption cost as the least influential determinant.

Customer pressure is another significant determinant, besides perceived benefits by FSC actors (Chau et al., 2020). Supporting this finding, Homan & Beranek (2023) noted that competitive pressure drives technology adoption. Companies gain a competitive edge over competitors through technologies that may enhance their productivity and profitability, which are the economic performance parameters

of enterprises to ensure FSC sustainability. Hence, pressure from the trading and international partners emphasizes improving quality performance through technology adoption (Faiz et al., 2024). Contrary to the study, Ledesma-Chaves et al. (2024) argued that SMEs tend to adopt technologies for business satisfaction rather than performance, which may reflect a lower resistance to change.

Employee skills, knowledge, and management support also significantly influence the success of technology adoption (Faiz et al., 2024; Haces et al., 2024). These skills include technical and managerial capabilities (Ammeran & Lantip, 2024). Therefore, the SME leaders must develop strategies to acquire technologies, improving the company's capabilities and international competitiveness. The education level gap is among the most significant factors determining technology adoption (Satar & Alarifi, 2024). Various supporting roles of top management are critical to enhance the use of technology in the organization. A study of 352 Malaysian SMEs revealed that top management support strongly mediates technology adoption and diffusion of innovation (Teh et al., 2024). Commitment from the top management encourages trust (Shetty & Panda, 2023; Khayer et al., 2021; Deng et al., 2020). Since Indonesia's SMEs still lack resources and capabilities, government support is one of the critical determinants of adoption (Chau et al., 2020). According to the literature analysis, digital strategy, compatibility, and resistance to change have a minor impact on technology adoption. A study by Nguyen et al. (2023) identified that the risk factors of technology adoption included in the strategy business consideration are a minor determinant of the adoption.

Table 2. Determinants of Technology Adoption

Reference	Determinants						
	Perceived advantage (cost-benefit)	Management support	Employees' skills & knowledge	Business pressure & satisfaction	Digital/ business strategy	Resistant to change	Compatibility
Haces et al., 2024	V	V	V				
Ledesma-Chaves et al., 2024				V			
Ammeran & Latip, 2024			V		V		
Satar & Alarifi, 2024	V		V			V	
Faiz et al., 2024	V	V	V	V			
Teh et al., 2024		V					
Pu et al., 2024	V	V	V	V			
Gibreel et al., 2024	V		V				
Nguyen et al., 2023	V			V	V		
Shetty & Panda, 2023	V	V					
Homan & Beranek, 2023	V			V			V
Ambarwati et al., 2024	V		V				
Karuppiah et al., 2023					V		
Tawfik et al., 2023							V
Krah et al., 2024	V						
Isa & Alenezi, 2022	V			V			
Hamdan et al., 2022	V						
Hossain et al., 2022	V	V					V
Fonseka et al., 2021	V	V		V			
Al Shbail et al., 2022	V						
Sujatha & Karthikeyan, 2021	V	V	V		V	V	
Nguyen & Luu, 2020	V				V	V	
Deng et al., 2020	V	V		V			
Chau et al., 2020	V	V	V	V			V

The results revealed that different transformation decisions occurred in various companies. Transformations need the human ability to change, and according to Satar & Alarifi (2024), resistance to change behavior becomes one of the five significant factors affecting the adoption of technologies. Receptivity towards change is a statistically significant determinant of the adoption (Sujatha & Karthikeyan, 2021). One of the adoption challenges is technology compatibility that may cause the temporary expansion of only one-time implementation (Chau et al., 2020; Homan & Beranek, 2023).

The interview process was conducted with nine FSC actors managing small and medium-sized businesses. The information was gathered from the retailers, production companies, and exporters, answering the question, "What are your considerations for adopting technology in your companies?". The primary objective of the interviews was to verify the findings of the literature study. Content analysis was employed to identify technology adoption determinants along the food supply chain. Cluster analysis of respondents' answers identified several themes, reflecting their perspectives on the research question. These themes, which are perceived as advantages, business strategy, business pressure, and management support, as a result of the content analysis process, are detailed in Table 3.

Perceived advantage emerged as a critical determinant of technology adoption in SMEs, encompassing cost-benefit analyses of technology usage. Informant N1 explained that their company constantly compares the potential benefits and challenges of investing in new technologies, equipment, or systems. Supporting this statement, informants N2 and N9 emphasized that technology adoption requires substantial investment, which must be justified by adequate production output. Informant N8, as a retailer, noted that the feasibility of technology adoption is also influenced by sales volume, as profits from sales can be allocated to technology investment. Informant N3 highlighted that the significant asset value required to operate the business is a notable challenge. Informants with adequate resources, including N9 as an exporter company, said the investment does not burden them. They carry out sufficient cost-benefit calculations to make investment decisions. In contrast, informants with limited financial capacity found the initial costs of adopting technology burdensome. These findings align with Sujatha & Kathikeyan's (2021) study, which identified cost and relative advantage as statistically significant determinants of technology adoption.

SMEs' business strategy drives technology adoption, particularly prioritizing customer needs by utilizing limited resources. Satar & Alarifi (2024) noted that resource constraints encourage SMEs to collaborate with external parties possessing the necessary systems or technologies. Informant N2 described collaborating with a supplier equipped with food preservation technology to extend product shelf life. Informant N7 discussed a partnership with STFI, a higher education institution engaged in research and development for their products. SMEs' limitations in technology and knowledge investment necessitate collaboration with external partners. These findings are consistent with a study by Audretsch et al. (2023), which demonstrated that partnerships with suppliers, customers, and universities enhance innovation performance in SMEs. Interventions from external stakeholders are crucial for increasing SMEs' technology adoption and fostering collaborations. Informant N7 highlighted the importance of support from local governments, particularly as mediators connecting SMEs with investors and partners. Government support may also include intellectual property protection, primarily when SMEs aim to establish international partnerships (Audretsch et al., 2023).

Interviews with several FSC actors in Indonesia reveal that SMEs have limitations, particularly regarding resources and human resources skills and knowledge. Due to their lack of resources, small enterprises require government support to facilitate collaboration initiatives with financial lenders or other stakeholders with adequate resources. The availability of technologies is essential, so disseminating such information is necessary.

Table 3. Content analysis process

Code	SMEs role	Excerpts	Themes	Determinants	Supporting reference
N1	Retailer	"..sometimes we carry out the calculations of cost benefits of using technology, especially if we have a plan to do the technology investment.."	Cost-benefit	Perceived advantage	Sujatha & Kathikeyan (2021)
		"..we always wait and see for doing investments.. our business scale is important for the decision of using technology. We don't want it to be a cost with no benefits.."	Investment strategy	Business strategy	Nguyen et al. (2023)
N2	Production company	"..there are suppliers who have preservation technology for food, and that condition is very helpful for us.."	Collaboration	Business pressure	Satar & Alarifi (2024)
N3	Production company	"..we need to have facilities to use technologies, for instance the chiller to extend the shelf life of our products. We have some portable chillers and also a bigger one.."	Assets	Perceived advantage	Sujatha & Kathikeyan (2021)
		"..if we have a new products coming from suppliers, we use SAP system. All this equipment and system require a significant investment and we have to have a good prediction and calculation of their benefits.."	Investment strategy	Business strategy	Sujatha & Kathikeyan (2021)
N4	Production company	"..currently we use machines, and it is still sufficient to use a blender machine. We haven't thought about using more sophisticated technology. It depends on the company's plans.."	Business strategy	Business strategy	Nguyen et al. (2023)
N5	Production company	"..so far, I have not found yet the technology that does not eliminate the home-made principle we have.. It is a part of company's values.."	Business strategy	Business strategy	Karuppiah et al. (2023)
N6	Production company	"..actually, it is possible to build the new and a bigger production room, but our constraint is always the money we have.."	Cost-benefit	Perceived advantage	Gibreel et al. (2020)
N7	Production company	"..the industrial scale equipments requirements are needed to be fulfilled, but we could not just buy the new assets.."	Assets	Perceived advantage	Haces et al. (2024)
		"..I just explored collaboration with STFI concerning the machines we need.. the tools are important but	Collaboration	Business pressure	Audretsch et al. (2023)

Code	SMEs role	Excerpts	Themes	Determinants	Supporting reference
		we don't have them. We already understand about the production line design, legal procedures and business permits. Our problem is the lack of money as business capital.."			
		".. I really appreciate the assistance from Purwakarta Tourism Department, especially the Creative Economy division. They help me to have some equipment, but still not complete yet.."	Government intervention	Business pressure	Audretsch et al. (2023); Chau et al. (2020)
N8	Retailer	"..at retailers like us, the sales volume is really important to decide the feasibility of using technologies.."	Cost benefit	Perceived advantage	Gibreel et al. (2020)
N9	Exporter	"… the use of technology depends on the instructions from our top management…"	Management commitment	Management support	Shetty & Panda (2023)
		"..we always make some efforts to fulfill the customer requirements to ensure their satisfaction.."	Customer needs	Business pressure	Chau et al. (2020)
		"If we use the technology in our company while our production scale is still small, we may suffer a loss due to the high cost we have."	Cost benefit	Perceived advantage	Gibreel et al. (2020)

Recommendations to enhance the technology adoption in SMEs

Based on the determinants of technology adoption identified earlier in this study, the following recommendations are proposed to enhance technology adoption in SMEs in Indonesia. First, improving SMEs' skills and knowledge in business acumen is important. Understanding market needs is critical in managing businesses, including small and medium-sized enterprises. Market and competition pressures necessitate adaptability supported by the optimal use of technology. Familiarity with various technologies that enhance supply chain performance is a prerequisite for SMEs to remain competitive within their industries. Therefore, there is a pressing need to improve SMEs' skills and knowledge, particularly in business acumen skills, to manage their companies effectively. Additionally, knowledge of cost-benefit analysis in business decision-making must be strengthened to ensure informed and strategic technology investments.

Second is enhancing collaboration within the supply chain ecosystem. SMEs' resource constraints in Indonesia require support from various stakeholders, particularly partners within the supply chain ecosystem who possess the necessary resources. Collaborative programs that enable knowledge transfer and technology investment are strategic initiatives to enhance the technology adoption of SMEs, particularly in the FSC actors. Government mediation programs to build networks between SMEs and potential partners or the implementation of policies supporting their collaborations are crucial for accelerating such partnerships. Collaboration by outsourcing research and development roles to other parties is also one strategy to increase the use of technology.

Third, leadership capabilities among SME leaders should be strengthened. The commitment of top management is a significant determinant of SMEs' adoption of technology. Leaders must develop strategies to grow their businesses and orchestrate internally owned and collaboratively sourced resources to deliver value to customers. Strong leadership is essential to achieving sustainable SME performance while balancing economic, social, and environmental considerations. Leadership development programs should focus on equipping SME leaders with the ability to navigate challenges and drive innovation.

CONCLUSION

Enhancing technology adoption among SMEs in Indonesia is essential to ensuring business sustainability and supporting the national economy. Therefore, contributions from all relevant stakeholders are necessary to facilitate collaborations that provide SMEs with access to critical resources, enabling them to achieve sustainable performance. This study contributes to the body of knowledge on technology adoption in SMEs within the food supply chain in Indonesia. The strategic recommendations provided in the results assist the government and relevant partners in designing appropriate interventions to improve SMEs' technology adoption. Various programs can be developed to foster mutually beneficial collaborations and create win-win solutions.

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