

Exploring the Drivers, Challenges, and Opportunities of Supply Chain Technology Adoption for Small and Medium Enterprises (SMEs) in Malaysia

*Nor Azian Abdul Rahman^{1,2}, Zulhasni Abdul Rahim²

¹Faculty of Business and Management, Universiti Teknologi MARA, Campus Selangor, Selangor, Malaysia

²Malaysia-Japan International Institute of Technology, Universiti Teknologi Malaysia, Kuala Lumpur, Malaysia

*norazian9829@uitm.edu.my, zulhasni@utm.my

Corresponding Author: Nor Azian Abdul Rahman

Abstract: Small and Medium Enterprises (SMEs) have a crucial impact on the Malaysian economy, making major contributions to the functioning of the supply chain. Integrating supply chain technology has become a crucial element in enhancing the efficiency and competitiveness of SMEs in Malaysia. During recent years many developing and developed countries have witnessed the expansion of markets and supply chain networks; in the progress of these market and supply systems SMEs find various complexities when they are implementing or improving the technology integration of their supply chain. The current body of literature often addresses the adoption of technology in a general manner or within larger organizations, resulting in a significant gap in study about the specific circumstances and requirements of small and medium-sized enterprises (SMEs). This study employs a rigorous methodology that analyzes relevant papers to examine the drivers, challenges, and opportunities for adopting supply chain technology among SMEs in Malaysia. By implementing supply chain technology, Malaysian SMEs can increase their performance in many areas of key performance indicators. This includes improving efficiency, optimizing inventory management, achieving cost savings, enhancing customer service, and increasing market competitiveness. It is believed that the findings of the study can be useful for managers of SMEs, policymakers, and interested stakeholders. This will enable SMEs to navigate the challenges of adopting technology more effectively and enhance global competitiveness.

Keywords: *Supply chain technology adoption, Small and Medium Enterprises (SMEs), drivers, challenges, opportunities, performance.*

1. Introduction and Background

Small and Medium Enterprises (SMEs) play a crucial role in Malaysia's economic structure, making substantial contributions to employment, innovation, and GDP. According to the most recent data released by the Department of Statistics, Malaysia (DOSM, 2023), there were a total of 1,101,725 small and medium enterprises (SMEs). These SMEs made up 39.1% of the country's Gross Domestic Product (GDP) in 2023, contributing a value-added amount of RM613.1 billion. When looking at the distribution of SMEs concentration of various sectors over the years it is clear that the service sector has always exceeded 80% of all SMEs in total. The most recent profile of SMEs in 2023 shows that the services sector accounted for 83.9% of the total, with a total of 924,170 enterprises. The construction sector continued to be the second greatest contributor, accounting for 9.3% (102,657 enterprises). Meanwhile, around 5.4% of small and medium-sized enterprises (SMEs), totaling 59,316 organizations were engaged in the manufacturing sector. This was followed by 1.2% (13,099 firms) in the agriculture sector, and the last 0.2% (2,483 firms) in the mining and quarrying sector. Of the total small and medium companies (SMEs) in Malaysia, the majority, comprising 69.7% or 767,421 firms, were microenterprises. Concurrently, enterprises of small size made up 28.5% of the total (314,465 firms), while medium-sized firms accounted for the remaining 1.8% (19,839 firms).

In the face of growing competition and complexity in global marketplaces, small and medium-sized enterprises (SMEs) must embrace and incorporate innovative supply chain technology to maintain and improve their competitiveness. Supply chain technology adoption involves the integration of cutting-edge technological solutions like blockchain, Internet of Things (IoT), artificial intelligence (AI), and big data analytics to optimize supply chain operations, enhance efficiency, and improve overall performance (Kaur, Awasthi & Luthra, 2021). Despite such benefits, Malaysian SMEs are faced with several challenges whenever deploying such technologies. Technological progress in SMEs is impeded by limited technology access, high costs for implementation and maintenance, and insufficient infrastructure. Furthermore, the presence of organizational inertia, which is defined as a lack of support from management and a strong reluctance to change, amplifies the challenges associated with adopting new technologies (Tay, Alipal & Lee, 2021). Otherwise, there are other

challenges that SMEs are confronted with, which do not allow them to invest in the required integrated technology since they are financially limited. Moreover, the lack of adequate governmental assistance and regulatory frameworks fails to offer the necessary incentives or direction.

Malaysian SMEs also face some challenges in implementing supply chain technology since not many understand the value and opportunities that accrue with the use of supply chain technology. SMEs frequently fail to fully capitalize on the potential benefits of supply chain innovations, such as cost reduction, lead time improvement, and increased customer service, because of a lack of knowledge in this area (Ismail, Saman & Ghani, 2021). In addition, many facilities and infrastructures are lacking, which poses challenges to the organization's functioning and acts as barriers to the optimal application of these technologies (Alkatheeri and Ahmad (2024). Since these are sinister hurdles, basic research needs to be conducted that maps the drivers, challenges, and opportunities of implementing supply chain technology into SMEs. This study seeks to address this deficiency by conducting a comprehensive analysis of the factors that impact the adoption of technology among SMEs in Malaysia. It will investigate the challenges they encounter as well as the opportunities that can be capitalized on.

It is equally important to comprehend the forces that may motivate or demotivate SMEs about technology adoption to identify actionable strategies to encourage the firms to acquire technology that could help with their development. These drivers encompass factors such as perceived complexity, usefulness, compatibility, financial resources, and top management support, among others. However, by identifying the issues, it becomes possible to create focused solutions that directly tackle specific obstacles. Furthermore, acknowledging the potential advantages offered by supply chain technology can assist SMEs and policymakers in developing policies that optimize the benefits of technological adoption. This paper provides significant information to policymakers and SMEs on ways in which such strategies can be developed or improved for enhancing technology adoption in the supply chain.

2. Drivers that influence SMEs' adoption of supply chain technology in Malaysia

The Malaysian government has been engaged in the active promotion of digitalization by launching various policies including the Industry4WRD policy which is aimed at enhancing the rate of implementation of Industry 4.0. Concerning that, more industries are initiating the adoption and implementation of technologies including the Internet of Things, artificial intelligence, and big data analysis (MITI, 2018). These policies include financial incentives, training, and support that would encourage SMEs to incorporate complex technologies into their supply chains. Additionally, the escalating competition in both domestic and international markets necessitates that small and medium-sized enterprises (SMEs) enhance and innovate their supply chain processes. SMEs can respond quickly to market demands and maintain a competitive edge by leveraging advanced technologies such as blockchain, IoT, and AI, which provide significant advantages in terms of efficiency, transparency, and agility (Tay, et al., 2020). In addition, Fabeil, Pazim, and Langgat (2020) have emphasized the necessity of resilient and adaptable supply chains that can sustain disruptions in light of the COVID-19 pandemic, which has further accelerated the digital transformation agenda.

The adoption of supply chain technology in Malaysia is influenced by a variety of drivers including both internal and external drivers, such as perceived usefulness, perceived compatibility, perceived complexity, top management support, financial resources, the size of the organization, and many others. It is essential to comprehend these drivers to develop effective strategies that encourage the adoption of technology among SMEs. Particularly in their supply chain operations, SMEs frequently encounter distinctive obstacles to competitiveness. The efficacy, efficiency, and responsiveness of supply chains can be improved through the implementation of advanced technologies. Policymakers, business leaders, and researchers must comprehend the drivers that influence the adoption of these technologies. The following are the drivers of technology adoption, as determined by the previous studies:

Driver 1: Perceived complexity

Rogers (2003) defines complexity as the level at which an invention is perceived as challenging to understand and implement. Consequently, although the majority of individuals within a social system may comprehend certain changes in the organization, certain changes are more challenging and require a longer time to adjust

to. Similarly, Alam, Ali, and Jani (2011) asserted that prior studies consistently demonstrate a negative correlation between the perceived complexity of a new technology and its adoption rate. The intricacy of supply chain technology can have a substantial impact on its adoption by small and medium-sized enterprises (SMEs). SMEs may exhibit reluctance to accept technology when they regard it as too intricate or challenging to comprehend and implement. To solve this difficulty, it is crucial to streamline the technology and offer comprehensive training and assistance (Nguyen & Ngo, 2021).

Driver 2: Perceived usefulness

SMEs evaluate the perceived usefulness of supply chain technology concerning its potential advantages and benefits. Included in this category are factors such as enhanced competitiveness, improved decision-making, cost reductions, and increased efficiency (Mohamad Faisal & Idris, 2020).

Driver 3: Perceived compatibility

One critical aspect is how well supply chain technology integrates with preexisting infrastructure, procedures, and company ethos. According to Mohamad Faisal and Idris (2020) and Lin, Alam, Ho, Al-Shaikh, and Sultan (2020), SMEs are more likely to adopt a new technology if this technology will fit into their current activity and work in parallel with it. In addition, they also mentioned that the adoption of technology is more likely to happen in SMEs if the technology can be integrated as an addition to current workflow and processes.

Driver 4: Top management support

Supply chain technology can only be adopted if top management gives its support and commitment to the change. Senior management plays a key role in influencing the level of acceptance and investment made by SMEs in technology where they are willing to accept technological change if the senior management in the organization recognizes the importance of the process and encourages it (Mohamad Faisal and Idris (2020), & Lin, Alam, Ho, Al-Shaikh, and Sultan (2020). In a similar vein, another researcher has stated that parity received from upper-level management has a positive impact on technological adoption (Alsetoohy, Ayoun, Arous, Megahed, & Nabil, 2019). Furthermore, Lin et al., (2020) asserted that the endorsement of innovative technologies by senior management exerts a significant influence on their acceptance. In small and medium-sized enterprises (SMEs), the individuals in charge, whether they be managers or owners, hold the highest level of authority and are involved in all aspects of decision-making inside the organization.

Driver 5: Financial resources

Significantly, the existence of adequate financial resources and investment capacities can affect the implementation of supply chain technology. SMEs may find it difficult to acquire and implement technologies as they may not be able to afford to invest heavily. Hence, government initiatives and subsidies can assist in reducing this obstacle (Mishra, 2013). Furthermore, Azman et al. (2020) asserted that the primary obstacle encountered by SMEs, namely micro-entrepreneurs, is the scarcity of funds or restricted availability of financial resources.

Driver 6: Technical knowledge and expertise

SMEs' technical knowledge and skill in supply chain technology can have a substantial impact on adoption. A lack of technical skills and understanding can impede the adoption process. Training programs and capacity-building activities can assist SMEs in developing the skills required to effectively embrace and use supply chain technology (Bansal, Kumar, Kumari, & Kuzmin, 2023)

Driver 7: Organizational size

The adoption of supply chain technology by an SME might be influenced by its size. Medium-sized enterprises with greater financial and operational capacities may be better equipped to allocate resources towards the implementation of technological advancements, in contrast to smaller enterprises. Nevertheless, smaller SMEs can still reap advantages from government support and programs that are expressly aimed at their size category (Lin, Alam, Ho, Al-Shaikh, & Sultan, 2020).

Driver 8: Customer and regulatory pressure

According to Fernando, (2015), external variables such as customer needs and regulatory restrictions, might impact SMEs' use of supply chain technology. If clients expect or want technology-enabled supply chain

procedures, SMEs may be more driven to implement the technology to meet those expectations. Similarly, regulatory pressure or incentives can encourage small and medium-sized enterprises to adopt new technology.

These drivers influence how Malaysian SMEs use supply chain technology. By addressing all of these drivers and offering assistance with training, funding, and technology simplification, SMEs can overcome the challenges and successfully integrate supply chain technology into their operations.

3. Key challenges faced by SMEs in Supply Chain Technology Adoption

Supply chain technology is critical for improving a business's efficiency, reducing costs and increasing customer satisfaction, enhancing efficiency, improving cooperation among stakeholders, and also outcompeting competitors. While there are apparent benefits, the literature also reveals many challenges faced by SMEs restricting the use of supply chain technology. These challenges include:

Restricted technology accessibility

Challenges that may point SMEs to difficulties in getting and implementing supply chain technologies include high costs, constraints in infrastructure, and poor technical know-how. It rests on the governmental and industrial associations to solve this problem by funding, training, and offering infrastructural facilities to enhance technology access for SMEs (Mohamad Faisal & Idris, 2020).

The expense of technology and infrastructure

According to Mohamad Faisal and Idris, (2020), supply chain technology can be somewhat expensive, covering hardware and software needs as well as deployment and training costs. Small and Medium enterprises are mostly affected by inadequate resources, particularly the SMEs operating with low capital, the cost associated with procurement, installation, and training of technology may be substantial (Bhardwaj, Garg, & Gajral, 2021). Although there has been an inclination towards the adoption of supply chain technologies by SMEs there are several impediments that hinder the widespread adoption of the technologies. The main issue with high implementation costs remains a problem, especially for organizations with limited budgets. Many small and medium-sized businesses (SMEs) are discouraged from implementing creative technologies by their great cost of acquisition and implementation.

Insufficient organizational support

Effective application of supply chain technologies depends on the support of top-level executives. Still, small and medium-sized businesses (SMEs) can lack the support of top-level executives, which would cause possible losses or even stop the implementation process. The major concern surrounding the utilization of Industry 4.0 of the manufacturing climate is its applicability to the SMEs. One of the challenges that are evident in 4.0 technologies is an absence of passion and positive attitude from their customers as well as the business associates. Moreover, the collective performance of the group is much influenced by the anxiety of failing regarding Industry 4.0 technology (Kumar & Ayedee, 2021).

Insufficient government support

Governments can facilitate the use of supply chain technology by small and medium-sized firms (SMEs). This includes the provision of financial assistance, education, and advice. However, many countries lack sufficient government support for small and medium-sized enterprises (SMEs) in this specific area (Mishra, 2013). In Malaysia, the government has set ambitious targets for SMEs' contribution to the country's GDP and exports (Salim, Marlapa, Ismail, Rahman, Hussin, Susilastuti, & Murti, 2022). However, achieving these targets will require a concerted effort to improve SMEs' access to financing, increase productivity, and encourage technology adoption. The adoption of digital technology can help SMEs improve their competitiveness and enhance their ability to compete in the global market.

Lack of knowledge and awareness

SMEs could suffer from ignorance of the benefits and possibilities of supply chain technologies. It is also likely to be specific to small and medium enterprises and their necessity to be focused on in terms of knowledge about the benefits of the mentioned technologies application. Effective ways to reach this are seminars, workshops, and knowledge-sharing platforms (Fernando, 2015). Moreover, Kumar and Ayedee (2019) pointed out the

main challenges to the application of technology as the lack of specialized knowledge and the related costs of change.

Financial constraints

When it comes to investing in supply chain innovations, small and medium-sized businesses (SMEs) might face budgetary limits. To combat this, the government can devise programs that provide small and medium-sized enterprises (SMEs) with low-interest loans, subsidies, or incentives to embrace and execute supply chain innovations (Fernando, 2015). Other researchers Martini, Setiawan, Tanding, Khresna, & Asrihapsari. (2023) mentioned that in the ever-changing business environment, all businesses, including SMEs, must embrace technology to confront challenges and ensure survival. However, it is acknowledged that SMEs may encounter difficulties in adopting digital technology, primarily due to financial constraints and a lack of innovation capability.

Insufficient facilities and infrastructure

When it comes to supply chain adoption and innovations, small and medium-sized businesses (SMEs) might lack the necessary facilities and infrastructure. By establishing shared technology centers or providing access to pooled resources, government agencies, industry groupings, and SMEs can collaborate to improve infrastructure (Fernando, 2015). Another major hurdle is integration issues. It can be difficult and time-consuming to integrate new technology with existing systems and procedures in a way that works well for everyone involved. Managing integrations can be particularly difficult for small and medium-sized businesses (SMEs) because of their limited resources and lack of technical expertise. According to Alkatheeri and Ahmad (2024), this may lead to disruptions and inefficiencies in operations.

Limited managerial capabilities

Small and medium-sized businesses (SMEs) might lack the managerial skills and knowledge required to effectively apply supply chain technologies. Using capacity-building initiatives, training, and mentoring campaigns, small and medium-sized businesses (SMEs) will be better equipped with the necessary abilities to properly employ supply chain technologies and have managerial capacities raised (Mohamad Faisal & Idris, 2020).

Shortage of technical skills and experience

Another downside is that SMEs do not possess the technical competence and experience that is required in selecting and integrating supply chain technologies. Misunderstandings about how to effectively use the technology and problems with its implementation may ensue (Mohamad Faisal & Idris, 2020). Specialized skilled people are necessary for the management and deployment of such complicated equipment; although the companies may not possess such human resources (Bag, Gupta, Kumar, & Sivarajah, 2021). A major hurdle is the lack of adequately trained personnel. Adopting and effectively managing supply chain technologies can be challenging for SMEs due to a lack of specific knowledge and abilities. SMEs face difficulties in making effective use of new technology capabilities because of the presence of this skills gap (Ismail et al., 2021). In addition, Ta and Lin (2023) highlight various challenges faced by SMEs in adopting digital transformation. These challenges encompass a shortage of technical and managerial skills, restricted access to finance, limited financial and human resources for development, technology, and markets, as well as the need for effective business structures.

Resistance to change

Both staff and management may be resistant to change when it comes to implementing new technologies. According to Romero & Mammadov, (2024), this reluctance might be caused by things like aversion to change, worries about possible dangers, or concerns about upsetting existing habits. Besides, if people are comfortable with what they used to see or experience, they are likely to resist change (Lee et al., 2022). Technology adoption in the supply chain presents some challenges to SMEs even though there are resources and specialists available. Problems like this might arise when different departments fail to communicate and work together effectively, when employees are resistant to change, or when there are unclear goals and objectives (Mohamad Faisal & Idris, 2020). In addition to that, new practice implementation may face serious challenges because both the management and employees may not want a change. As a result of these risks and other forms of uncertainty that surround the use of new technology, many SMEs are normally not willing to deviate from their set routines

and systems (Qutaishat, Abushakra, Anaya, & Al-Omari, (2023).

The benefits of supply chain technology can only be completely realized by SMEs if they overcome all of these challenges. According to a study conducted by Mohamad Faisal and Idris (2020), SMEs can overcome these challenges by taking the following steps: using the right technology, getting enough help, communicating clearly with staff, setting clear goals, and working together with other departments. Consequently, SMEs can reap the benefits of supply chain technology, such as improved efficiency, visibility, and decision-making capacities, by overcoming these challenges.

4. Opportunities for Supply Chain Technology Adoption for SMEs

Supply chain technology therefore comes in handy for SMEs, especially if they are keen on growing to be efficient, competitive, and keen on meeting consumers' needs in the market. Currently, the existing market system has slowly formed a large and highly coordinated market system so that SMEs gradually develop new technological advancements to sustain their growth rate and achieve a higher level of efficiency. This paper seeks to analyze the implication of supply chain technology to determine whether it holds any possibility that may work to the advantage of SMEs. Among those opportunities, some of them include the following:

Enhanced Efficiency

There is a great chance to increase operational efficiency by adopting supply chain technology. Rapid process automation (RPA) and other advanced manufacturing technology and automation tools streamline routine tasks, reduce human error, and boost output (Bhardwaj, Garg & Gajpal, 2021). Two areas within an organization that can benefit from Robotic Process Automation (RPA) include order processing and inventory management. That way, the workers can then attend to the more important tasks within the company. The use of IoT devices enables real-time monitoring of the supply chain thus achieving less downtime and more visibility (Pereira & Romero, 2017).

Enhanced Decision-Making

By use of supply chain technology, especially artificial intelligence (AI) and machine learning (ML), SMEs are given sophisticated analytical capabilities that enable enhanced decision-making. By applying AI and ML, data can be scanned for large volumes to come up with forecasted outcomes. This in turn assists the SMEs to aggressively manage risks, forecast the market, and reduce supply chain complexity (Min, 2021). Predictive analytics, for example, may more precisely forecast demand, which lets SMEs adjust their inventory to avoid stockouts or overstock events. In the presence of market changes, this data-driven strategy for decision-making increases the general resilience and responsiveness of SMEs.

Cost Reduction

Costs can be significantly reduced for SMEs by using innovations in the supply chain. By improving inventory management, decreasing transportation charges, and reducing waste, big data analytics and blockchain technology help to reduce costs (Dubey, Gunasekaran & Childe, 2020). By using big data analytics, SMEs may find out some specifics of the supply chain, trends, or patterns, thus enhancing their allocations snuffing out financial misuse of resources, or even lessening operational costs. Due to this, blockchain technology offers a way of securing and reviewing the transactional process hence minimising fraud as well as errors. Given the potentially devastating financial consequences of such events for SMEs, this is very welcome news (Saberi, Kouhizadeh, Sarkis, & Shen, 2018). Furthermore, cloud computing solutions provide SMEs with an adaptable and economical IT infrastructure, according to Lacity and Reynolds (2014), since they do away with the need for large upfront expenditures in software and hardware.

Increased Agility and Responsiveness

Using supply chain technology helps SMEs to meet customer needs and rapidly change with the state of the economy. SMEs are capable of responding promptly to disruptions within the supply chain and scarce resources and adapting to existing market conditions through the application of IoTs as well as AI, which offer real and correct information and data (Ivanov & Dolgui, 2020). IoT sensors can spot supply chain anomalies and start quick fixes, therefore preventing likely disruptions. Analytics driven by artificial intelligence can identify evolving market trends, which lets SMEs modify their goods and approach to fit changing customer

preferences. Small and medium-sized businesses (SMEs) benefit from more flexibility in maintaining their competitive advantage in markets undergoing fast development.

Improved Cooperation

Technology and digital platforms have made it easier for all parties involved in the supply chain—including customers, partners, and suppliers to work together more effectively. Improved collaboration and coordination are outcomes of using cloud-based solutions, which allow for the efficient transfer and sharing of information (Bag et al., 2021). Through effective collaboration in integrated business environments, suppliers and SMEs stand to benefit from better production planning and shorter lead time implementation. For businesses to thrive, better collaboration is essential since it strengthens supplier connections and supply chain networks. Hence, SMEs may build stronger supply chains with the help of digital technology. This will allow them to better handle disruptions and seize new opportunities as they come.

Impact of Technology Adoption on SMEs' Performance

Adoption of supply chain technology helps one to assess the performance of SMEs in Malaysia by looking at key performance indicators including cost reduction, lead time improvement, inventory management, customer service enhancement, and general competitiveness per Mishra (2016). SMEs in Malaysia can reduce wastage, act more efficiently, and thus save money when using supply chain technology. Moreover, supply chain technology can improve lead times by simplifying procedures, therefore lowering delays, and encouraging departmental communication and cooperation. Furthermore, technology helps small and medium-sized businesses (SMEs) in Malaysia in inventory management by improving demand forecasting, lowering stockouts, and offering real-time inventory level visibility. This means that through supply chain technology, lead-time, tracking delivery, and order fulfillment are reduced to improve customer experience (Mishra, 2013). Furthermore, by increasing productivity, lowering expenses, and raising customer service, these technologies help SMEs to be more generally competitive (Mishra, 2016; Fernando, 2015). Through the use of supply chain technology, SMEs in Malaysia can enhance their performance based on several key performance indicators, which include efficiency, cost reduction, and competitiveness in the market.

5. Recommendation and Future Trends

The awareness of Malaysian SMEs regarding the benefits of embracing digitalization in enhancing efficiency and competitiveness will significantly enhance the implementation of supply chain technology by Malaysian SMEs in the coming years. To encourage SMEs in supply chain technology adoption, further research is needed to explore and understand the specific barriers and challenges that hinder their uptake of digital technology as follows:

Analyze government policy

Identify the policy of the Malaysian government, rules, regulations, and support in promoting technology adoption among SMEs. Assess the effectiveness of existing initiatives and identify potential areas for improvement to better facilitate technology adoption and integration into SME operations.

Incorporating cutting-edge technologies

Cutting-edge technology such as 5G, robotics, and machine learning is one of the major upcoming trends in Malaysian supply chain technology adoption. Rapid and dependable connectivity is essential for real-time data exchange and decision-making; 5G technology is expected to revolutionize supply chains in this regard (Khaw, Alhamzah, Hadi, Victor, Yuvara, & Nadia, 2022). Robotics and also automation have the potential to boost the operational efficiency of the company. This is because they can replace humans as workers, make procedures more precise, and speed up industrial operations. Additionally, machine learning and artificial intelligence can provide insights and predictive analytics that help SMEs improve their supply chain operations and proactively respond to market demands (Wong, Leong, Hew, Tan, & Ooi, 2020).

Explore the successful technology adoption cases

The SMEs can observe and organize case studies of SMEs that have successfully adopted and integrated digital technology into their business processes. This can be done through identifying the strategies and also the best practices learned from these successful cases that can be replicated or adopted by other SMEs.

Analyze the role of industry associations

The company can identify the role of industry associations and networks in promoting technology adoption among SMEs. In Malaysia for example, SME Corporations and the Federation of Malaysian Manufacturers (FMM) can facilitate knowledge sharing, collaboration, and technology adoption support among their members, especially SMEs.

Explore collaboration with stakeholders

On the other hand, Lee et al. (2022) suggest that researchers investigate collaboration models that enhance coordination and cooperation among supply chain stakeholders through the utilization of digital platforms and technologies. Malaysian SMEs' future use of supply chain technology will be defined by the utilization of complex technologies, sustainability imperatives, resilience measures, and collaborative endeavors. By focussing on these areas through study and practical implementation, Malaysian SMEs can fully utilize supply chain adoption. This will lead to enhanced growth and competitiveness in the increasingly digitalized global marketplace.

Sustainability

It is almost becoming a trend that sustainability is slowly becoming a focal point for companies, especially in aspects like supply chain management and this is perhaps due to technological development. To reduce their environmental impact without sacrificing their economic viability, future research should focus on reviewing how SMEs can incorporate sustainable supply chain management practices in their business. Studies have shown that sustainable supply chain practices have multiple benefits, including lower costs in the long run, better brand recognition, and more efficient and effective business operations (Lin et al., 2020).

Conclusion

Finally, this study suggests how Malaysian SMEs can do better within this digitalized and globally competitive environment based on the literature review that underlines the significance of supply chain technology adoption in the Malaysian business community alongside its drivers, challenges, and opportunities. The positive impact of technology adoption on supply chain performance highlights the need for continuing efforts to encourage SMEs to become digital firms. Other than that, the role of incentives from the government, the top management support, skill and knowledge of employees, facilities and infrastructure, and the cost of technology, contribute to Malaysian SMEs' dynamic and ever-changing process of adopting supply chain technology. As a result, SMEs can evaluate the obstacles that lie ahead, seek solutions to those, and most importantly, disseminate the appropriate messages to the employees that will enhance the effective implementation of the technology. Malaysian governments and managers need to provide support structures for this sector by easing measures to help SMEs grow and become a major boost to the Malaysian economy. In addition, policymakers, corporations, and academia can create successful policies and investments to fully capitalize on supply chain innovations by addressing these barriers and aiding SMEs on their digital journey. Understanding the use of advanced technologies such as automation, artificial intelligence, the Internet of Things, blockchain, and cloud computing has the potential to dramatically improve the performance of Malaysian SMEs. Ultimately, understanding and overcoming the barriers to technology adoption enables SMEs to achieve long-term development, increased efficiency, and higher customer satisfaction, equipping them for success in an increasingly digitalized global market.

References

- Alkatheeri, H. and Ahmad, S.Z. (2024). Examining blockchain adoption determinants and supply chain performance: an empirical study in the logistics and supply chain management industry, *Journal of Modelling in Management*. <https://doi.org/10.1108/JM2-08-2023-0186>
- Alam, S. S., Ali, M. Y., & Jani, M. F. M. (2011). An empirical study of factors affecting electronic commerce adoption among MSMEs in Malaysia. *Journal of Business Economics and Management*, 12(2), 375–399. <https://doi.org/10.3846/16111699.2011.576749>
- Alsetoohy, O., Ayoun, B., Arous, S., Megahed, F., & Nabil, G. (2019). Intelligent agent technology: what affects its adoption in hotel food supply chain management? *Journal of Hospitality and Tourism Technology*, 10(3), 317–341. <https://doi.org/10.1108/JHTT-01-2018-0005>
- Azman, N. H. N., Zabri, M. Z. M., Masron, T. A., & Malim, N. A. K. (2020). The adoption of ar-rahnu and financial

- well-being of micro-entrepreneurs in Malaysia. *The International Journal of Academic Research in Business & Social Sciences*, 10(6), 36–53. <https://doi.org/10.6007/IJARBS/v10-i6/7259>
- Bag, S., Gupta, S., Kumar, S., & Sivarajah, U. (2021). Role of technological dimensions of green supply chain management practices on firm performance. *Journal of Enterprise Information Management*, 34(3), 741-764.
- Bansal, S., Kumar, V., Kumari, A., Kuzmin, E. (2023). Understanding the Role of Digital Technologies in Supply Chain Management of SMEs. In: Kumar, V., Kyriakopoulos, G.L., Akberdina, V., Kuzmin, E. (eds) *Digital Transformation in Industry . DTI 2022. Lecture Notes in Information Systems and Organization*, vol 61. Springer, Cham. https://doi.org/10.1007/978-3-031-30351-7_16
- Bhardwaj, A., Garg, A., & Gajpal, Y. (2021). Determinants of blockchain technology adoption in supply chains by small and medium enterprises (SMEs) in India. *Mathematical Problems in Engineering*, 2021, 1-14. <https://doi.org/10.1155/2021/5537395>
- Dubey, R., Gunasekaran, A., & Childe, S. J. (2020). Big data analytics capability in supply chain agility: The moderating effect of organizational flexibility. *Management Decision*, 57(8), 2092-2112. <https://doi.org/10.1108/MD-01-2018-0119>
- Department of Statistics Malaysia, (2023). Profile & performance of MSMEs in 2023. <https://www.smecorp.gov.my/index.php/en/policies/2020-02-11-08-01-24/sme-statistics>
- Fabeil, N. F., Pazim, K. H., & Langgat, J. (2020). The impact of COVID-19 pandemic crisis on micro-enterprises: Entrepreneurs' perspective on business continuity and recovery strategy. *Journal of Economics and Business*, 3(2), 837-844.
- Fernando, Y., (2015). Low Carbon Footprint: The Supply Chain Agenda in Malaysian Manufacturing Firms. 10.4018/978-1-4666-8222-1.
- Ismail, H. N., Saman, M. Z. M., & Ghani, A. A. A. (2021). Critical success factors for successful implementation of Industry 4.0: A systematic literature review and implications for SMEs. *Journal of Manufacturing Technology Management*, 32(6), 1165-1187.
- Ivanov, D., & Dolgui, A. (2020). Viability of intertwined supply networks: Extending the supply chain resilience angles towards survivability. *International Journal of Production Research*, 58(4), 1-12. <http://dx.doi.org/10.1080/00207543.2020.1750727>
- Kaur, H., Awasthi, A., & Luthra, S. (2021). Technology adoption in supply chain management for sustainable development: Integrating institutional theory and resource-based view. *Resources, Conservation & Recycling*, 172,
- Khaw, Kw & Alhamzah, A., & Hadi, A., Victor, T., Yuvaraj, G., Nadia, A., (2022). Reactions towards organizational change: a systematic literature review. *Current Psychology*. 42. 1-24. 10.1007/s12144-022-03070-6.
- Kumar, A., & Ayedee, N. (2019). Sustainable development in SMEs through social media channels. *International Journal of Management, Technology, and Engineering*, 9(6), 1066–1075
- Kumar, A., & Ayedee, N. (2021). Technology adoption: A solution for SMEs to overcome problems during COVID-19. *Academy of Marketing Studies Journal*, 25(1), 1–16
- Lacity, M.C. & Reynolds, P., (2014). Cloud services practices for small and medium-sized enterprises. *MIS Quarterly Executive*. 13. 31-44.
- Lee, K. L., Romzi, N., Hanaysha, J., Alzoubi, H., & Alshurideh, M. (2022). Investigating the impact of benefits and challenges of IoT adoption on supply chain performance and organizational performance: An empirical study in Malaysia. *Uncertain Supply Chain Management*, 10, 537–550. <http://dx.doi.org/10.5267/j.uscm.2021.11.009>
- Lin, C., Alam, S.S., Ho, Y., Al-Shaikh, M.E., & Sultan, P. (2020). Adoption of Green Supply Chain Management among SMEs in Malaysia. *Sustainability*. 12. 6454.
- Martini, M., Setiawan, D., Suryandari, R. T., Brahmana, R. K., & Asrihapsari, A. (2023). Determinants of Digital Innovation in Micro and Small Industries. *Economies*, 11(6), Article 172. <https://doi.org/10.3390/economies11060172>
- Mat, T. Z., & Kadir, S. F. (2016). Enhancing inventory management through supply chain technology adoption. *International Journal of Supply Chain Management*, 5(3), 45-58.
- Min, H. (2021). Artificial intelligence in supply chain management: Theory and applications. *International Journal of Logistics Research and Applications*, 13, 13-39. <https://doi.org/10.1080/13675560902736537>.
- Mishra, K. P. (2016). The impact of supply chain technology on SME performance. *Journal of Business Logistics*, 37(1), 72-85.

- Mishra, K.P. (2013). Supply Chain Insights for Small and Medium Enterprises (SMEs) in Malaysia.
- MITI. (2018). Industry4WRD: National policy on Industry 4.0. Ministry of International Trade and Industry, Malaysia. Retrieved from https://www.miti.gov.my/miti/resources/National_Policy_on_Industry4WRD_-_21_Oct_2018.pdf
- Mohamad Faisal, S. B., & Idris, S. (2020). Determinant factors of supply chain technology adoption among Sabah small and medium enterprises (SMEs). *Malaysian Journal of Business and Economics (MJBE)*, 6, 63.
- Nguyen, T. D., & Ngo, T. Q. (2021). The role of technological advancement, supply chain, environmental, social, and governance responsibilities on the sustainable development goals of SMEs in Vietnam. *Economic Research-Ekonomska Istraživanja*, 35(1), 4557–4579.
- Pereira, A. C., & Romero, F. (2017). A review of the meanings and the implications of the Industry 4.0 concept. *Procedia Manufacturing*, 13, 1206-1214. <https://doi.org/10.1016/j.promfg.2017.09.032>
- Qutaishat, F., Abushakra, A., Anaya, L. and Al-Omari, M. (2023). Investigating the factors affecting the intention to adopt cloud-based ERP systems during the COVID-19 era: evidence from Jordan, *Business Process Management Journal*, 29(3), 653-670. <https://doi.org/10.1108/BPMJ-09-2022-0462>
- Romero, I., Mammadov, H., (2024). Digital Transformation of Small and Medium-Sized Enterprises as an Innovation Process: A Holistic Study of its Determinants. *J Knowl Econ.*<https://doi.org/10.1007/s13132-024-02217-z>
- Rogers, E. M. (2003). *DIFFUSION OF INNOVATIONS* (Fifth Edit). Free Press.
- Saberi, S., Kouhizadeh, M., Sarkis, J., & Shen, L. (2018). Blockchain technology and its relationships to sustainable supply chain management. *International Journal of Production Research*, 57(7), 2117-2135. <https://doi.org/10.1080/00207543.2018.1533261>
- Salim, M. N., Marlapa, E., Ismail, S., Rahman, N. H. A., Hussin, H., Susilastuti, D., & Murti, W. (2022). Determinants of MSMEs growth and its impact on income and unemployment: Cases of Indonesia and Malaysia. *International Journal of Academic Research in Economics and Management and Sciences*, 11. <http://dx.doi.org/10.6007/IJAREMS/v11-i1/12305>
- Ta, V., & Lin, C.-Y. (2023). Exploring the Determinants of digital transformation adoption for SMEs in an emerging economy. *Sustainability*, 15(9), 7093.
- Tay, S.I. Alipal, J. Lee, T.C, (2021), Industry 4.0: Current practice and challenges in Malaysian manufacturing firms, *Technology in Society*, 67, <https://doi.org/10.1016/j.techsoc.2021.101749>
- Wong, L.W., Leong, L.Y., Hew, J.J., Tan, G. W.H., & Ooi, K.B. (2020). Time to seize the digital evolution: Adoption of blockchain in operations and supply chain management among Malaysian SMEs. *International Journal of Information Management*, 52, 101997. <https://doi.org/10.1016/j.ijinfomgt.2019.08.005>