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Critical success factors for digital supply chain management in Malaysia's e-commerce

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1. ABSTRACT

This research employs the Resource-Based View (RBV) model to investigate critical success factors for effective digital supply chain management (SCM) in Malaysia's e-commerce sector. As Malaysia's e-commerce industry expands and digital technologies proliferate, understanding these factors is important for optimizing supply chains and sustaining competitiveness. The RBV model, emphasizing competitive advantages through valuable resources and using the PLS-SEM model for the data analysis. These resources can include advanced technologies, organizational capabilities, and strategic partnerships. Using the RBV lens, this research find that supply chain strategies, technologies, and organizational factors are underpinning the successful digital SCM in Malaysia's e-commerce market. The research is useful for the actionable insights for practitioners and policymakers to enhance e-commerce supply chain performance and sustainability, while contributing to the e-commerce sector's continued growth.

Keywords: Digital, Supply Chain Management, E-commerce, Strategic Management, Market Dynamics

Introduction

Supply chain management (SCM) is a critical component of modern business operations that ensures the efficient and effective flow of goods, services, and information from the point of origin to the point of consumption (da Silva et al., 2023). It involves the orchestration of all parties involved, both directly and indirectly, in fulfilling a customer request. The main objective of SCM is to minimize operational costs while enhancing service levels to create value for consumers and competitive advantage for the organization (Wamba and Queiroz 2020). SCM encompasses a broad range of activities, such as demand planning, sourcing of raw materials, production, inventory management, transportation logistics, and customer service (Obaid et al., 2022). Each stage represents a different link in the supply chain that must operate seamlessly to ensure product availability, quality, and timely delivery. a seamless supply chain involves creating a well-coordinated network of activities that span from raw material sourcing to the final product delivery. The integration is crucial for maintaining product availability, ensuring quality, and achieving timely delivery. Here are key aspects to consider for fostering the strong relationships with reliable suppliers to ensure a stable and high-quality source of raw materials (Badhotiya 2019). Diversify suppliers to mitigate risks associated with disruptions, such as natural disasters or geopolitical events. Implement advanced forecasting models to predict demand accurately. Maintain optimal inventory levels to prevent stock outs and overstock situations (Tiwari 2021). Utilize technology included RFID or barcoding for real-time tracking of inventory. Streamline manufacturing processes for efficiency and quality. Implement lean manufacturing principles to reduce waste and improve responsiveness to changing demands. Integrate automation and technology to enhance precision and speed. Implement stringent quality control measures throughout the production process.

The audit and assess the performance of suppliers to ensure they meet quality standards. Utilize technology, such as sensors and data analytics, to monitor and maintain product quality. The end goal is to create a cohesive and

high-performing business model where every function works in harmony to meet the needs of the customers and the goals of the organization (Javid and Amini 2023). In an era of globalization and digital transformation, SCM has evolved beyond the traditional boundaries of a single organization (Singh and Kumar 2020). It now includes integrating complex information systems, managing global supplier networks, and applying sophisticated analytics to optimize performance. Emerging technologies such as artificial intelligence, machine learning, block chain, and the Internet of Things (IoT) are reshaping the landscape of SCM, driving efficiency, resilience, and sustainability (Hamdan 2021). The complex information systems, managing global supplier networks, and applying sophisticated analytics are critical components of modern business operations. It is an extended discussion on these aspects for implementing the Enterprise Resource Planning (ERP) systems that seamlessly integrate various functions such as finance, human resources, manufacturing, and supply chain. This ensures a unified and real-time view of business operations. This is to ensure that different information systems within the organization can communicate and share data effectively. Utilize standardized protocols and application programming interfaces (APIs) to enhance interoperability. It embraces cloud-based solutions to facilitate accessibility, scalability, and collaboration across different departments and geographic locations. The robust SRM processes to build strong, collaborative relationships with global suppliers. This involves regular communication, joint planning, and mutual performance evaluations. Develop strategies to manage risks associated with global supplier networks, including geopolitical issues, currency fluctuations, and cultural differences. Diversify suppliers and build contingency plans to address potential disruptions. The suppliers adhere to ethical and sustainable practices. Implement auditing mechanisms and certifications to verify compliance with social and environmental standards. This is to utilize predictive analytics to forecast demand, identify potential supply chain disruptions, and optimize inventory levels. Machine learning algorithms can enhance accuracy over time by learning from historical data. It shows the predicting outcomes to prescribing actions (Al Mashalah et al., 2022). Use analytics to recommend optimal decisions, such as inventory levels, production schedules, and supplier selections, to achieve specific business goals. The leverage of the big data analytics to process and analyze vast amounts of data generated across the supply chain. Extract actionable insights to improve decision-making and overall performance. For implementing real-time analytics to monitor and respond to changes instantly. This capability is particularly crucial in dynamic environments where quick decisions are required to adapt to market fluctuations. This to enhance visibility through analytics tools, providing a comprehensive view of the entire supply chain. The supply chain provides the tracking inventory levels, order statuses, and production progress in real-time. There is a specific focus to integrate IoT devices for real-time monitoring of equipment, shipments, and product conditions. This data can be leveraged for predictive maintenance, quality control, and logistics optimization. It is the use of block chain for secure and transparent record-keeping across the supply chain. The digital revolution has reshaped the commerce landscape, ushering in a new era of e-commerce that has transformed how businesses operate and consumers shop (Wang 2021). As one of Southeast Asia's fastest-growing economies, Malaysia has experienced significant growth in its e-commerce sector (Li 2022). Malaysia's e-commerce market has been expanding rapidly, driven by increasing internet penetration and changing consumer preferences. The purpose of this research is to investigate impact of emerging technologies on digital supply chain management and also investigates the organizational influence on the effectiveness of digital supply chain management within Malaysian e-commerce and explores the effective strategies for digital supply chain management in the Malaysian e-commerce. The surge in e-commerce activities, the effective management of digital supply chains has become crucial for businesses operating in this sector (Mihardjo et al., 2019: Schniederjans et al., 2020). There is a notable research gap when it comes to understanding the critical success factors for achieving effective digital supply chain management in the Malaysian e-commerce industry. This gap is particularly significant given the crucial role of e-commerce in driving Malaysia's digital economy and the integral connection between the supply chain and the success of e-commerce operations (Noor et al., 2021). This can enhance traceability, reduce fraud, and improve overall trust among stakeholders. The implementation of AI algorithms for decision-making, pattern recognition, and anomaly detection. AI can optimize processes, automate routine tasks, and improve overall efficiency. There are multiple feedback loops within the organization to continuously improve information systems, supplier relationships, and analytical models based on real-world experiences and changing business dynamics. The regular benchmark performance against industry standards and competitors. Use insights gained from benchmarking to identify areas for improvement and innovation

Literature Review

2. Emerging Technologies and Their Impact on E-Commerce Supply Chain Efficiency

In the ever-evolving digital landscape, technologies such as artificial intelligence (AI), the Internet of Things (IoT), and block chain have emerged as transformative tools for businesses, especially in supply chain management. Their incorporation has brought significant enhancements in the efficiency, transparency, and security of supply chain operations, notably in the e-commerce sector. Artificial intelligence, characterized by its capability to process vast amounts of data and learn from it, has been hailed as a game-changer for supply chain efficiency (Kim et al. 2019). AI has permeated several domains of supply chain operations such as forecasting, inventory management, logistics, and customer service (Ivanov and Dolgui 2020a). The role of AI extends to capturing and interpreting data to predict future trends, aid in decision-making, and automate processes, thereby increasing operational efficiency and reducing costs (Pan and Zhang 2021). One of the pivotal applications of AI lies in forecasting. AI algorithms are designed to analyze historical data to predict future demand patterns, enabling firms to optimize their inventory and avoid stock-outs or surpluses. It provides the ability to anticipate market trends and customer preferences, making it a potent tool for strategic planning and decision-making (Haleem et al. 2022; Sahoo et al. 2019). AI also plays a crucial role in logistics. Route optimization, powered by AI, can significantly reduce the cost and time of delivery, improving the overall supply chain efficiency (Iyer 2021). AI can foresee potential disruptions and suggest alternative routes or solutions, thereby enhancing the resilience of the supply chain (Moosavi, Fathollahi-Fard, and Dulebenets 2022). In the realm of customer service, AI-driven chatbots and virtual assistants can offer efficient, personalized customer support, enhancing the overall customer experience (Grewal et al. 2020). They help in answering queries, solving issues, and providing information in real-time, leading to improved customer satisfaction and loyalty (Bharadiya and Bharadiya 2023). The Internet of Things (IoT), another significant technological advancement, has brought a paradigm shift in digital supply chain management (Zizic et al. 2022). By connecting physical objects with computer-based systems, IoT enhances real-time monitoring and control. It helps in the integration of supply chain processes, offering increased visibility and traceability (Omotayo and Oluwadamilare 2023; Qi et al. 2021). IoT applications facilitate real-time tracking of goods, enhancing the efficiency and accuracy of warehouse operations, and allowing predictive maintenance of equipment. This leads to improved inventory management, reduced downtime, and significant cost savings (Said Mohamed et al. 2021; C. Wang, Zhang, and Zhang 2020). IoT-enabled tracking enables the monitoring of goods' condition and location during transit, facilitating immediate corrective actions in case of deviations or disruptions (Narayanan and Professor 2023). This feature is particularly relevant to e-commerce, where timely delivery and product condition is paramount for customer satisfaction (Ugochukwu, Goyal, and Arumugam 2022). Block chain technology, renowned for its decentralization, transparency, and immutability, has promising implications for digital supply chain efficiency (Paul et al. 2021). block chain provides a secure, transparent ledger for transactions, which instills trust among supply chain participants and mitigates the risks of fraud (Tapscott and Kaplan 2019).

Block chain's unique features can effectively address issues like counterfeit products and lack of product traceability (Saberi et al. 2019). By providing a complete, immutable record of product movement from source to customer, block chain significantly enhances supply chain transparency, improving regulatory compliance, risk management, and customer trust (Javaid et al. 2022). In the e-commerce sector, where transactions are digital and often cross-border, the secure, tamper-proof nature of block chain ensures that all parties can trust the transactions, thus fostering a more reliable business environment (Dutta et al. 2020; Khalfan 2022).

Technologies AI, IoT, and blockchain herald a new era in digital supply chain management. Their respective features and capabilities can be harnessed to address different aspects of supply chain operations, resulting in enhanced efficiency, transparency, and security, which are particularly critical for the competitive and dynamic nature of the e-commerce sector (Rejeb, Keogh, and Treiblmaier 2019; Tan and Crompvoets 2022)

Hypothesis 1: The application of current and emerging technologies (e.g., artificial intelligence, IoT, blockchain) positively impacts the efficiency of the digital supply chain in the e-commerce sector in Malaysia.

3. Organizational Dynamics and Digital Supply Chain Effectiveness

The effectiveness of digital supply chain management in e-commerce does not solely rely on the implementation of advanced technologies, but it also heavily depends on the organizational context in which these technologies

are implemented. Aspects such as organizational leadership, resource allocation, and organizational culture significantly influence the success of digital supply chain initiatives (Maheshwari, Gautam, and Jaggi 2021; Mehmood 2021). Starting with organizational leadership, it plays a critical role in steering the digital transformation of supply chains. Leaders who demonstrate a commitment to digital initiatives and have a clear understanding of these technologies tend to drive successful digital supply chain transformation (Donkor, Papadopoulos, and Spiegler 2022). Leadership's strategic vision, understanding of digital technologies and ability to drive change significantly influence the effectiveness of digital supply chain management (Gierlich-Joas, Hess, and Neuburger 2020).

Organizational dynamics play a crucial role in determining the effectiveness of a digital supply chain (DSC). As businesses embrace digital transformation, it is essential to align internal structures, processes, and cultures to fully realize the potential of a digitalized supply chain. This expansion delves into the key organizational dynamics that influence the effectiveness of a digital supply chain and explores strategies to enhance synergy between organizational elements and digital supply chain processes. It is the use of the effective DSC implementation requires strong leadership that aligns the vision of the organization with the goals of the digital supply chain. Leadership should champion the adoption of digital technologies and foster a culture of innovation and play a pivotal role in guiding teams through the changes associated with digital transformation. Clear communication, support, and a shared vision are critical elements for successful change management. For that matter, the organizational culture values innovation and embraces change is vital. Employees should feel encouraged to experiment with new technologies and approaches within the digital supply chain. It is to foster the cross-functional cooperation, enabling various departments to work cohesively in implementing and optimizing digital supply chain processes.

The skills and the digital literacy endorse the employees possessing the necessary digital literacy is essential for the successful adoption of digital technologies. Training programs and continuous learning initiatives are crucial in developing relevant skillsets. This shares the talent while recruiting and retaining e-commerce employees with expertise in digital technologies, data analytics, and supply chain optimization to drive the effectiveness. There is an effective role of the organizational silos can hinder the effectiveness of a DSC. Encouraging cross-functional collaboration and communication ensures that information flows seamlessly across departments. These are to align the goals that are across different functions, such as procurement, manufacturing, and logistics, creates a unified approach to digital supply chain management. For that matter, there is the focus on the technology infrastructure which is stress for organizations to use and invest in robust technology infrastructure to support digital supply chain processes. This includes implementing advanced software, cloud-based solutions, and IoT devices for real-time data capture. The systems of the digital tools within the organization are interoperable enhances data flow and reduces integration challenges.

The adaptive processes organizational structure allows for quick adaptation to changes in the market, technology, or supply chain dynamics. This enables organizations to respond rapidly to disruptions and seize emerging opportunities. This is decentralizing decision-making processes and empowering teams to make agile decisions contributes to the overall flexibility of the organization. There is an effective course of action for the organization aligning the DSC with a customer-centric approach ensures that digitalization efforts enhance the overall customer experience. Organizations should use digital tools to gather customer insights and tailor supply chain processes accordingly. The digital technologies for demand forecasting and responsive supply chain strategies ensure that customer demands are met efficiently. The securing executive sponsorship and support is crucial. Executives should champion digital transformation efforts, allocate resources, and communicate the strategic importance of the DSC to the entire organization. The ongoing skill development programs ensure that employees are equipped with the digital competencies required for effective DSC management. There is an actively recruiting individuals with digital supply chain expertise strengthens the organization's capability to navigate the complexities of digitalization.

The coordination and the platforms that integrate various systems and technologies foster seamless communication and information sharing across the organization. The cross-functional teams dedicated to digital

supply chain initiatives promotes collaboration and ensures that diverse perspectives are considered in decision-making. There is an improvement in establishing feedback mechanisms and performance metrics enables continuous evaluation and improvement of digital supply chain processes. Here, the rule of the Kaizen principles encourages a culture of continuous improvement, where employees actively seek ways to enhance efficiency and effectiveness. It is effective statement is key during digital transformation. Clear and transparent communication about the benefits, goals, and progress of DSC initiatives helps manage resistance and build enthusiasm. There is a comprehensive training and development opportunities ensure that employees are well-prepared for changes introduced by digitalization. The building strategic partnerships with technology providers foster innovation and access to cutting-edge solutions. Collaborative ventures enable organizations to leverage external expertise, for extending digitalization efforts. It includes suppliers and forming collaborative relationships that enhances the entire supply chain ecosystem, creating a more responsive and interconnected network.

The concept of the digital twin with modelling and simulation allows for the organizations to simulate and model various supply chain scenarios. This enables proactive decision-making and risk mitigation strategies. The incorporation of robust cyber security measures safeguards sensitive data and ensures the secure operation of digital supply chain systems. Data breaches have a severe consequence, which is making cyber security a top priority for the increase productivity and efficiency. This extends the dynamics of supply chain to streamlined processes, reducing lead times, improving inventory management, and enhancing overall supply chain productivity. It is the innovation and adaptability that the organization is responsive to market changes, technological advancements, and disruptions, enhancing the agility of the digital supply chain. The customer-centric dynamics contribute to improved customer satisfaction by aligning supply chain processes with customer expectations and delivering products and services in a timely and personalized manner. The commitment is essential for overcoming resistance to change, fostering a culture of innovation, and investing in the necessary infrastructure for digital transformation. By setting the strategic direction and leading by example, leaders can create a conducive environment for digital transformation and innovation (Quiroz-Flores et al., 2023). They can motivate employees to adopt new technologies and encourage them to experiment and learn, fostering an organizational culture that supports digital innovation (Selimović et al., 2021).

Leaders also play a crucial role in aligning digital supply chain initiatives with the organization's strategic objectives, ensuring that these initiatives contribute to the overall business goals (Alblooshi, Shamsuzzaman, and Haridy 2020; Kopyto et al. 2020). By clearly articulating the strategic importance of digital supply chain management and showing how it aligns with the company's goals, leaders can gain buy-in from employees and other stakeholders, thus facilitating the successful implementation (Handayani et al. n.d.; Quiroz-Flores et al. 2023b).

Resource allocation is another critical factor in the effectiveness of digital supply chain management. The successful implementation of digital technologies requires significant investments in technology infrastructure, software, and skilled personnel (Dubey, Gunasekaran, Childe, Blome, et al. 2019). Additionally, organizations need to invest in training and development to equip employees with the skills needed to use these technologies effectively (Bhatia et al. 2020; Magableh 2021). Moreover, organizational culture significantly impacts the effectiveness of digital supply chain management. A culture that encourages innovation, learning, and risk-taking can foster the successful implementation of digital technologies (Srisathan, Ketkaew, and Naruetharadhol 2020). On the other hand, a culture that resists change and discourages experimentation can hinder digital transformation (Raza et al. 2023).

A culture of innovation encourages employees to experiment with new technologies and find innovative ways to use these technologies to improve supply chain operations (Chatterjee, Chaudhuri, and Vrontis 2021). This culture also promotes continuous learning, enabling organizations to adapt to the rapidly changing digital landscape.(Martínez-Costa 2019)Moreover, a culture that values collaboration and open communication can facilitate the sharing of knowledge and best practices, promoting the successful implementation of digital supply chain initiatives (Carayannis 2022; Martínez-Costa 2019).

Hypothesis 2: Organizational characteristics, such as leadership, resources, and culture, significantly influence the effectiveness of digital supply chain management within Malaysian e-commerce businesses.

4. Strategic Approaches in Digital Supply Chain Management: Resilience, Transformation, and AI-Driven Strategies

Following the analysis of organizational influences on the effectiveness of digital supply chain management, it is equally important to discuss the role of specific strategic approaches like resilience strategies, transformative strategies, and AI-driven strategies.

As digital supply chains become increasingly complex, the necessity of resilience strategies becomes evident (Dubey, Gunasekaran, Childe, Blome, et al. 2019). Resilience in the digital supply chain context pertains to the ability to promptly anticipate, respond to, recover from, and adapt to disruptions. This pertains to everything from sudden demand fluctuations to catastrophic global events such as pandemics (Ivanov 2020). Digital technologies, including artificial intelligence and blockchain, can significantly enhance supply chain resilience by providing real-time visibility, predictive analytics, and secure and transparent transactions, among other capabilities(Cui et al. 2022; Govindan, Mina, and Alavi 2020). However, leveraging these technologies to build resilience is not a straightforward task. It requires a strategic approach that considers the specific requirements and constraints of the organization and the supply chain at large(Chowdhury, Quaddus, and Agarwal 2019).

Transformative strategies also hold significance for digital supply chain management in e-commerce. As the name suggests, these strategies aim for a profound change in the way supply chains operate, going beyond incremental improvements (Dwivedi et al. 2023; Preindl et al., 2020). They involve the adoption of novel technologies and business models, reconfiguration of supply chain structures, and reorientation of the relationships with supply chain partners(Akhtar et al. 2023). These strategies hold the potential to bring about significant improvements in supply chain efficiency, agility, and responsiveness, thereby enhancing overall effectiveness (Belhadi et al. 2022; Fatorachian and Kazemi 2021). Digital Supply Chain Management (DSCM) is undergoing significant shifts, driven by the imperatives of resilience, transformation, and the integration of artificial intelligence (AI). As businesses navigate the complexities of a rapidly changing global landscape, the adoption of digital technologies becomes paramount for enhancing the agility, responsiveness, and efficiency of supply chain processes. This expansion explores the critical elements and trends associated with DSCM, focusing on resilience, transformation initiatives, and the integration of AI-driven capabilities.

The contingency planning and emphasize the importance of identifying potential risks and developing robust contingency plans. By leveraging real-time data and predictive analytics, organizations can proactively address disruptions, whether caused by geopolitical events, natural disasters, or supply chain interruptions. The resilience in DSCM is closely tied to supply chain visibility. Enhanced visibility, facilitated by digital technologies such as IoT sensors and block chain, allows organizations to gain real-time insights into the entire supply chain. This transparency enables quick identification of disruptions and facilitates informed decision-making. This involves the implementation of dynamic response mechanisms. This includes agile inventory management, flexible logistics solutions, and adaptive manufacturing processes. AI-driven algorithms can contribute to dynamic decision-making, optimizing responses to unforeseen events and ensuring continuity. It is the reason to use the supply chain emphasizes collaborative partnerships within the supply chain network. Building resilient relationships with suppliers, manufacturers, and logistics providers enhances the collective ability to respond to challenges. Digital collaboration platforms and shared data ecosystems contribute to network resilience.

The simulation and planning for the proactive scenario planning and simulation exercises. These are provided with the digital tools enable organizations to model various scenarios, assess potential impacts, and develop strategies to navigate through disruptions. This strategic foresight helps in building resilience against future uncertainties. It is the end-user reflection of the digital transformation in supply chain management goes beyond isolated initiatives, aiming for end-to-end digitalization. This involves the integration of digital technologies across the entire supply chain lifecycle, from sourcing and production to distribution and customer delivery. For the connectivity in supply chain and e-commerce, the role of digital transformation is imperative. It is to emphasize

the importance of real-time data and connectivity within the IoT devices, sensors, and RFID technologies. The continuous streams of data, enabling organizations to make informed decisions based on up-to-the-minute information. There is solution-based role of computing that plays a pivotal role in digital transformation by providing scalable and flexible infrastructure. Cloud-based solutions facilitate collaboration, data storage, and accessibility, allowing organizations to adapt quickly to changing business requirements.

The robotics are integral to digital transformation in supply chain processes. Automated warehouses, robotic process automation (RPA), and autonomous vehicles contribute to efficiency gains, reduced lead times, and improved accuracy in tasks such as order fulfilment and inventory management. It includes the block chain technology is leveraged for enhanced transparency and traceability in the supply chain. By creating an immutable and decentralized ledger, block chain ensures that all parties within the supply chain have access to accurate and trustworthy information, reducing the risk of errors and fraud. For the efficient and predictive analytics and AI-driven insights are fundamental to digital transformation. Machine learning algorithms analyse historical data, identify patterns, and provide predictions, enabling organizations to optimize inventory levels, anticipate demand fluctuations, and enhance overall decision-making. The supply chain management extends to a customer-centric focus. Organizations leverage digital technologies to provide customers with real-time tracking, personalized experiences, and responsive customer service, thereby enhancing satisfaction and loyalty.

The capabilities of the AI driven tools and the forecasting planning is demanded with the AI-driven demand forecasting utilizes advanced algorithms to analyse historical data, market trends, and external factors. This enables organizations to optimize inventory levels, reduce stock outs, and improve overall demand planning accuracy. It is the cognitive automation, powered by AI, enables the automation of complex tasks that require cognitive abilities. This includes natural language processing, sentiment analysis, and advanced data interpretation, enhancing the efficiency of decision-making processes. The maintenance of predictive utilization is linked with the sensor data and machine learning algorithms to predict when equipment and machinery are likely to fail. This proactive approach minimizes downtime, reduces maintenance costs, and ensures the continuous flow of operations. This is linked with the connection of the AI algorithms optimize logistics operations by dynamically adjusting routes based on real-time data. This leads to more efficient transportation, reduced fuel consumption, and improved overall logistics performance. The facilitation of the AI facilitates intelligent supplier collaboration by analyzing supplier performance data, predicting potential disruptions, and optimizing procurement processes. This ensures a resilient and agile supply chain network.

The AI-driven technologies in warehousing include automated picking systems, predictive inventory management, and smart sorting algorithms. These innovations enhance warehouse efficiency, reduce errors, and accelerate order fulfilment. It is reflecting the AI enhances supply chain risk management by continuously monitoring external factors, geopolitical events, and market trends. AI algorithms can assess potential risks, identify vulnerabilities, and recommend strategies to mitigate the impact of disruptions. This is to interact with the AI-driven analytics provide organizations with deep customer insights. By analyzing customer behavior, preferences, and feedback, businesses can tailor their supply chain processes to meet specific customer expectations, contributing to improved customer satisfaction and loyalty. For that reason, the convergence of resilience, digital transformation, and AI-driven capabilities is reshaping the landscape of supply chain management. Organizations that prioritize digitalization, embrace technological innovations

The role of AI-driven strategies in effective digital supply chain management is noteworthy. AI-driven strategies encompass the application of artificial intelligence technologies to enhance supply chain processes, from demand forecasting to inventory management, logistics, and customer service (Dubey et al. 2021; Ransbotham et al. 2020). The use of AI technologies, such as machine learning and natural language processing, can significantly improve the accuracy and timeliness of decision-making, optimize resource utilization, and enhance customer satisfaction (Mesmari 2023). The strategic application of AI in supply chains can therefore lead to substantial performance improvements(De Jong et al. 2022).

Hypothesis 3: The adoption of certain strategies (like resilience strategies, transformative strategies, or AI-driven

strategies) significantly enhances the effectiveness of digital supply chain management in the Malaysian e-commerce sector.

5. Interplay of Key Factors: Enabling Digital Supply Chain Effectiveness in the Malaysian E-Commerce Sector

Synergistic interactions in supply chain management play a crucial role in facilitating strategic decisions, technological applications, and organizational structures to collectively optimize supply chain efficiency and effectiveness (Hodorog, Petri, and Rezgui 2022; I. Lee and Mangalaraj 2022).

Strategic decision-making, a foundational element of supply chain management, shapes the overall architecture of the supply chain. These strategic decisions, inclusive of technology adoption, supplier selection, inventory management, and logistics design, substantially impact the overall supply chain performance and its subsequent effectiveness (Queiroz et al. 2022a). Particularly in the Malaysian e-commerce sector, it has been observed that strategic decision-making has been a crucial component in influencing the success of the digital supply chain. Chong and Zhang further reinforce this notion, stating that strategic decisions often mediate the relationship between technological applications and the ultimate outcome of supply chain processes(Sun et al. 2020; C. Zhang et al. 2021). This underlines the importance of contextualizing strategic decisions within the specific demographic and economic landscape of the country, emphasizing the unique characteristics of Malaysia's e-commerce sector.

The strategic use of technologies like artificial intelligence (AI), the Internet of Things (IoT), and block chain technology significantly contributes to enhancing the efficiency and effectiveness of the digital supply chain (Dubey et al. 2020). An in-depth exploration of AI's role reveals its potential to revolutionize facets of the supply chain such as demand forecasting, inventory management, and logistics planning, thereby driving supply chain efficiency (Min 2019). Similar transformative effects are associated with IoT, which has been instrumental in refining logistics planning and tracking, and block chain technology, which has significantly contributed to supply chain transparency and traceability, a critical element in fostering trust in e-commerce transactions(Agarwal, Idrees, and Obaid 2021; Creazza et al. 2022).

The interplay of key factors enabling a digital supply chain is a complex and dynamic process that involves the integration of various elements to create a seamless and responsive supply chain ecosystem. These key factors work in concert to leverage digital technologies, enhance visibility, and optimize processes. In this expansion, it is exploring the interplay of essential factors that enable a robust digital supply chain. The deployment of Internet of Things (IoT) devices and sensors provides real-time visibility into the supply chain. These devices collect data on inventory levels, equipment conditions, and environmental factors, enabling proactive decision-making. The tech solutions facilitate data storage, accessibility, and collaboration. Cloud computing ensures that stakeholders across the supply chain have timely access to relevant information, fostering seamless communication and coordination. The use of big data analytics enables organizations to extract valuable insights from large datasets. By analysing historical and real-time data, businesses can make informed decisions related to demand forecasting, inventory management, and overall supply chain optimization. The machine learning algorithms to forecast future trends and potential disruptions. This capability allows organizations to proactively address challenges and optimize their supply chain processes.

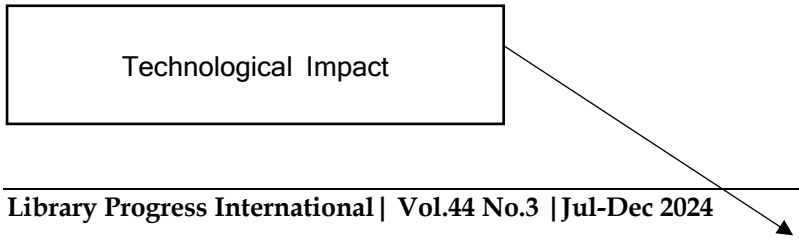
Technology ensures the transparency and traceability in the supply chain. By creating an immutable and decentralized ledger, stakeholders can verify the authenticity of transactions, reduce fraud, and enhance trust across the supply chain network. It is the integration of real-time monitoring tools and dashboards provides stakeholders with instant visibility into the status of shipments, inventory levels, and production processes. This visibility allows for quick identification and resolution of issues. This is referred to the effective and useful platforms those are enabling seamless communication and information sharing among supply chain partners. These platforms facilitate collaboration, reduce response times, and enhance overall efficiency. Integrating suppliers into the digital supply chain ecosystem fosters collaboration and ensures a synchronized flow of information. Supplier collaboration platforms enable real-time updates on inventory levels, production schedules, and order statuses. It is the reflection of the crucial adaption for the changing market conditions and unforeseen

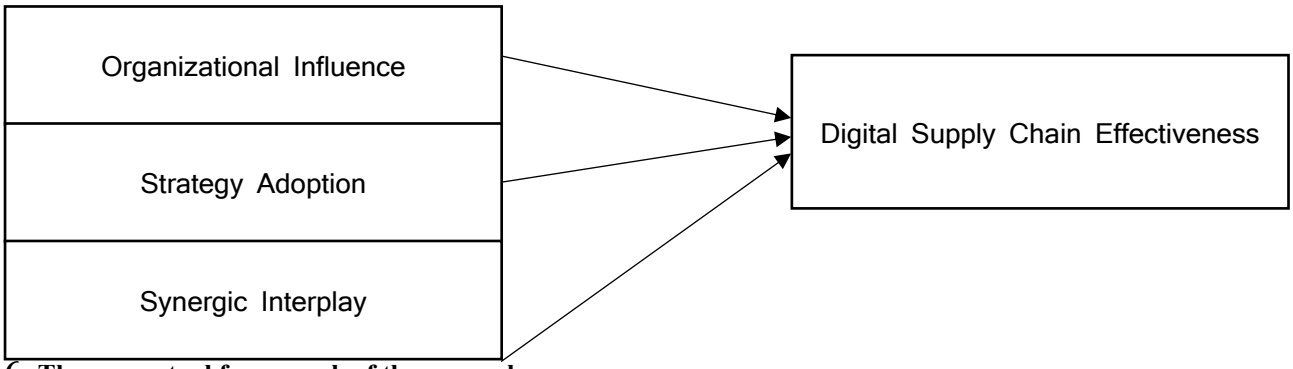
disruptions. Agile supply chain practices involve flexible manufacturing processes, dynamic inventory management, and rapid response mechanisms to maintain a resilient and responsive supply chain.

The basis for the technology use in e-commerce and supply is indicating the dynamic routing and last-mile delivery optimization, contribute to the agility of the supply chain. These solutions ensure timely and cost-effective transportation of goods. This is for the integration of automation and robotics in warehouses enhances efficiency in order fulfilment, reduces errors, and accelerates the overall processing of goods. Automated picking systems and robotic arms contribute to increased throughput. The repetition of the rule-based tasks, improving accuracy and reducing processing times. This includes automating administrative tasks, data entry, and order processing. These are linked with the technologies such as demand sensing use real-time data to understand customer demand patterns. This enables organizations to tailor their production and inventory strategies to meet specific customer needs. For that reason, the AI-driven personalization allows businesses to customize their offerings based on individual customer preferences. This personalization extends to order fulfilment, delivery options, and post-purchase experiences.

The data protection and the measures for the security of the technologies indicate the reliance on digital technologies, robust cyber security measures are essential to protect sensitive data and ensure the secure operation of digital supply chain systems. Cyber security safeguards against data breaches and unauthorized access. It is the promotion of a culture of continuous improvement within the digital supply chain. Employees are encouraged to identify areas for optimization, implement changes, and actively contribute to the on-going enhancement of processes. The feedback loops and performance allow organizations to assess the effectiveness of digital supply chain initiatives. Regular evaluations contribute to iterative improvements and the identification of areas for further optimization. There is an effective role of the leadership to plays a pivotal role in setting the strategic vision for the digital supply chain. Leaders stress for the goals, allocate resources, and champion the adoption of digital technologies to achieve operational excellence.
The change management strategies ensure that the organization adapts seamlessly to digital transformations. Leadership communicates the benefits of digital supply chain initiatives, addresses resistance, and fosters a culture conducive to change. The interplay of these key factors creates a holistic and synergistic approach to enabling a digital supply chain. The successful integration of technology, data-driven decision-making, visibility, collaboration, agility, automation, customer-centricity, cyber security, continuous improvement, and strategic leadership positions organizations to navigate the complexities of modern supply chain management with resilience and efficiency. As digital supply chain capabilities continue to evolve, organizations must remain agile and responsive to emerging technologies and market dynamics to maintain a competitive edge in the digital era.
In tandem with technological considerations and strategic decisions, the organizational structure has also emerged as a critical element influencing the effectiveness of digital supply chain management (Verboeket and Krikke 2019). The various components that form an organization's structure, such as leadership styles, organizational culture, and resource allocation patterns, collectively shape the interactions within the organization and subsequently influence the adoption of technology and the implementation of strategies (Jamali et al. 2022; Torres 2022). The complex web of interactions among these components, particularly in the digital supply chain context, influences the efficiency and effectiveness of supply chain management (Nasiri et al. 2020). A thorough understanding of these interactions is crucial in guiding the strategic direction of supply chain management. The rapid evolution of the e-commerce sector in Malaysia necessitates this understanding to leverage the potential benefits of a well-managed supply chain (Dolgui and Ivanov 2022; Rai et al. 2021).

Hypothesis 4: The synergistic interplay between strategic decisions, technological applications, and organizational structure significantly enhances the effectiveness of digital supply chain management in the Malaysian e-commerce sector.





6. The conceptual framework of the research

Research Design, population & data collection

The research design used in this study is descriptive in nature, which aligns with the study's goal of providing a detailed understanding of the factors influencing digital supply chain management in the e-commerce sector in Malaysia. Coupled with a positivist research philosophy, the study emphasizes objectivity, empirical evidence, and quantitative inquiry.

The target population for this research consists of various stakeholders involved in the digital supply chain management in the e-commerce sector in Malaysia. This includes organizations operating in the e-commerce domain, their management and personnel directly involved in supply chain operations, as well as technology providers contributing to the efficiency of digital supply chains. Moreover, policymakers shaping the business environment for e-commerce and supply chain practices in Malaysia are also considered.

The survey tool was meticulously developed, guided by various scholarly works. A method of adoption and adaptation was deployed to incorporate elements from questionnaires used in past research endeavors. Pivotal references were gathered from studies conducted by Ivanov and Dolgui (2020b; 2021), Queiroz et al. (2022b), Elbanna (n.d.), Williams and Tokar (2008), Bregman, Peng, and Chin (2015), as well as Gunday et al. (2011) and Ivanov and Dolgui (2020c). These encompassed a mix of research from various backgrounds, which contributed to a comprehensive and multifaceted survey instrument.

7. **Table 4.1 Path Coefficients**

	Path coefficients
Organizational Influence -> Synergy Interplay	0.228
Strategy Adoption -> Synergy Interplay	0.592
Synergy Interplay -> Digital Supply Chain Effectiveness	0.694
Technological Impact -> Synergy Interplay	0.055

The research on the supply chain management with the hypothesis required to assess and examine the relative magnitude of effects those are to verify the variable connection and role in the model. It is the adjustment of the standard deviation for the path modelling with the different units of the measurement to provide the effective inquiry of the supply chain management. There is an effective consideration for technological impact, organisational influence, strategy adoption, synergic interplay, and digital supply chain effectiveness. This is reflected through the examination of the impact of current and emerging technologies on digital supply chain efficiency in the e-commerce sector is provided with the organizational influences on the effectiveness of digital supply chain management within e-commerce businesses. It is to follow the review and analyzing of the existing literature on digital supply chain management, while focusing specifically on the e-commerce sector. The current state of knowledge and to identification of the gaps are based on the effective strategies for digital supply chain management in the e-commerce sector in Malaysia. The path coefficients indicate the multiple categories of the examination with the causal links those are to connect the structural equational modelling. The value of organizational influences towards synergy interplay are 0.228 those are the positive values with strategy adoption

at 0.592. It includes the synergy interplay to digital supply chain effectiveness at 0.694 with technology impact at 0.055 those are acceptable and validated values of testifying the hypothesis.

8. **Table 4.2 Total Effects**

	Total effects
Organizational Influence -> Digital Supply Chain Effectiveness	0.158
Organizational Influence -> Synergy Interplay	0.228
Strategy Adoption -> Digital Supply Chain Effectiveness	0.411
Strategy Adoption -> Synergy Interplay	0.592
Synergy Interplay -> Digital Supply Chain Effectiveness	0.694
Technological Impact -> Digital Supply Chain Effectiveness	0.038

The total effects for the supply chain management as with the key success factors for e-commerce business that directs for the independent variable over the dependent variable those are represented by the values and multiple effects. The consideration of the effects is detrimental towards the presence of models those are sharing the organizational influence as a core area for the digital supply chain effectiveness. It is the indication of the strategy adoption towards the digital supply chain effectiveness with the technology impacts as the considerable influencing areas of supply chain management. The impact of technology, organisational influence, acceptance of strategies, synergistic interactions, and the efficacy of digital supply chains are all effectively considered. Examining the effects of new and emerging technologies on the efficiency of the digital supply chain in the e-commerce industry and the organisational influences on the efficacy of digital supply chain management in e-commerce enterprises demonstrate this. It will adhere to the evaluation and analysis of the body of knowledge on digital supply chain management, with an emphasis on the e-commerce industry in particular. The effective digital supply chain management strategies used in Malaysia's e-commerce industry form the basis of the current state of knowledge and the identification of knowledge gaps. The values from 0.158 to 0.055 are relatively positive as there is no negative sign that shares the overall effects of the supply chain management for the businesses.

Table 4.3 Correlation

	Digital Supply Chain effectiveness	Organizational Influence	Strategy Adoption	Synergy Interplay	Technological Impact
Digital Supply Chain Effectiveness	1.000	0.491	0.565	0.694	0.142
Organizational Influence	0.491	1.000	0.419	0.483	0.115
Strategy Adoption	0.565	0.419	1.000	0.695	0.133
Synergy Interplay	0.694	0.483	0.695	1.000	0.160
Technological Impact	0.142	0.115	0.133	0.160	1.000

The correlation analysis for the using the digital supply chain success factors those are sharing the technology's effect, organisational power, strategy adoption, synergistic relationships, and the effectiveness of digital supply chains. This is demonstrated by looking at how new and developing technology affect the effectiveness of the digital supply chain in the e-commerce sector and how organisational factors affect the effectiveness of digital supply chain management in e-commerce businesses. It follows the assessment and examination of the corpus of research on digital supply chain management, with a focus on the e-commerce sector specifically. The present state of knowledge and the assessment of knowledge gaps are based on the successful digital supply chain management techniques applied in Malaysia's e-commerce sector. The value of each variable is between the organizational influence at 0.491 with digital supply chain at 1.000, while strategy adoption with 0.565 and synergy interplay at 0.160. These values are extending towards the technological impact with the 1.000 which is showing a positive correlation between the variable, thereby it is leading to the development of a successful supply change model. The changes in the variables are certain towards the changes in the other which is based on average positive linear indication of the digital supply chain management.

Table 4.4 Descriptives

	Mean	Median	Observed min	Observed max	Standard deviation	Excess kurtosis	Skewness	Number of observations used	Cramér-von Mises test statistic	Cramér-von Mises p value
Digital Supply Chain Effectiveness	0.000	0.187	3.732	1.902	1.000	0.495	-0.698	383.000	0.542	0.000
Organizational Influence	0.000	0.091	3.411	1.849	1.000	0.563	-0.672	383.000	0.514	0.000
Strategy Adoption	0.000	0.228	3.000	1.670	1.000	0.138	-0.851	383.000	1.207	0.000
Synergy Interplay	0.000	0.240	3.230	1.914	1.000	0.275	-0.848	383.000	1.383	0.000
Technological Impact	0.000	0.017	2.739	2.223	1.000	-0.217	-0.296	383.000	0.149	0.000

The measures for the elements of the central tendency and the variability are spread across the values those are representing the mean, median, observed min and max values. Similar is the case with the excess kurtosis and total number of observations, with cramervon mises test, as it shows the p value. The significant p values of 0.000 are the leading numbers that is sharing the multiple results and overall effective values those are related to the digital supply chain management, organizational influence, strategy adoption, synergy inter-play, and technological impact. The summary statistics of the quantitative results are the shared features with the collection of information that is to analyze the measures of variability. All relevant variables are considered, including the influence of technology, organisational strength, adoption of strategies, synergistic relationships, and the efficiency of digital supply chains. The impact of emerging technologies on the efficiency of the digital supply chain in the e-commerce industry as well as the influence of organisational factors on the efficacy of digital supply chain management in e-commerce enterprises. It is connected with the evaluation and analysis of the body of work on digital supply chain management, with an emphasis on the e-commerce industry in particular. Effective digital supply chain management strategies used in Malaysia's e-commerce industry form the basis of the current state of knowledge and the evaluation.

Table 4.5 Cronbach Reliability

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Digital Supply Chain Effectiveness	0.733	0.791	0.812	0.729
Organizational Influence	0.731	0.812	0.798	0.854
Strategy Adoption	0.879	0.894	0.902	0.883
Synergy Interplay	0.852	0.856	0.884	0.859
Technological Impact	0.723	0.798	0.783	0.729

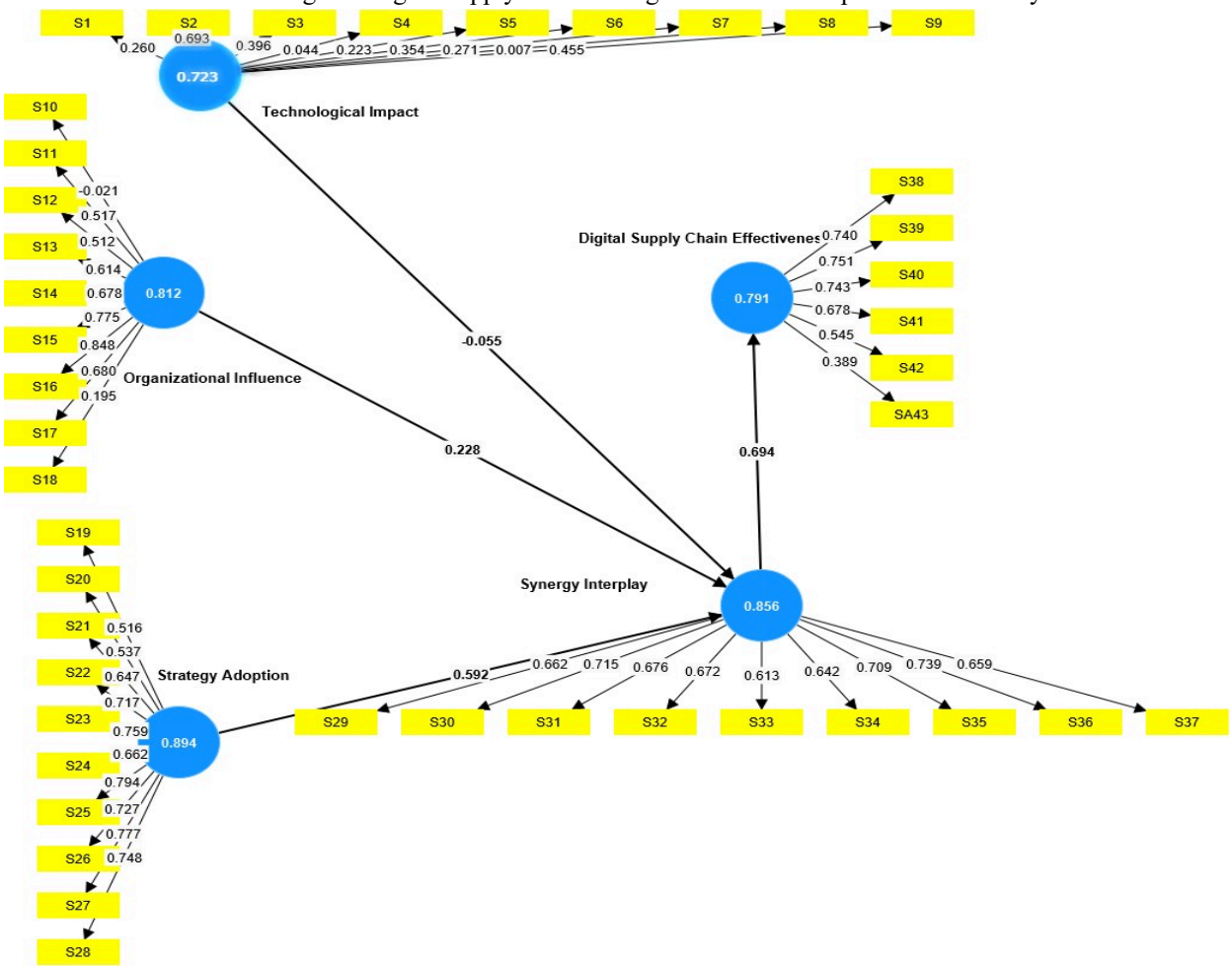
The measures for the common share of the internal consistency for the scaling and the determine results for the general rule which is acceptable at 0.6 which is indicating the effectiveness of the framework developed for the supply chain management. It is also representing the correlation between he variables those are considered for the values between 0 and 1 as the greater relation among the constructs of digital supply chain management (0.733), organizational influence (0.731), strategy adoption (0.879), synergy inter-play (0.852), and technological impact at (0.723). These impacts are representing the effective values as measures of the reliability are valid for the determination with the items measures for the correct concept of the inter-relatedness between the items. These shared the pertinent factor is considered, such as the impact of technology, the strength of the organisation, the adoption of strategies, the development of synergistic partnerships, and the effectiveness of digital supply chains. The effect of organisational elements on the effectiveness of digital supply chain management in e-commerce

firms, as well as the impact of emerging technology on the efficiency of the digital supply chain in the industry. It has to do with assessing and analysing the corpus of research on digital supply chain management, specifically focusing on the e-commerce sector. Current expertise is based on efficient digital supply chain management techniques applied in Malaysia's e-commerce sector.

PLS-SEM Model

The PLS-SEM model developed from the research of the digital supply chain management are inter-related with the focused on the impact of technology, organisational power, acceptance of strategies, synergistic relationships, and the efficiency of digital supply chains. This follows the supply chain indicators those are supporting the use of an effective and new technologies. It extends the relationship among the variables used through the connections that affect how successfully digital supply chain management works in e-commerce businesses and what part organisational factors play in this. It has to do with evaluating and reviewing the body of work on digital supply chain management, with a focus on the e-commerce industry in particular. Effective digital supply chain management techniques used in Malaysia's e-commerce industry provide the basis of digital supply chain management.

The model explains the impacts of the technology over the synergy inter-play as it is the main concern of respondents those are focusing on the latest trends in supply chain use for e-commerce. The negative value is presenting the need for the training to use technology which may assist the opinions and multiple consideration of effectiveness for the digital supply chain. The strategy adoption is directly connected with synergy interplay which is the enhancing the effects of the digital supply chain. It stresses for the collaborative consideration of the supply chain management where the collaborative effects from multiple variables are showing a strength and technical relation to encourage the digital supply chain among the e-commerce platforms in Malaysia.



Discussion &Conclusion

The resource-based aspects of e-commerce businesses focus on optimizing delivery routes, ensuring timely product deliveries, and accurate stock-keeping activities. The use of advanced scanning technologies and effective

supply chain management practices enables these businesses to operate efficiently and meet the high expectations of today's online consumers. The continuous integration of technology in e-commerce supply chains not only enhances operational processes but also contributes to the growth and sustainability of businesses in this rapidly evolving industry

The digital supply chain is the process of the manufacturing towards the delivery of the product for the effective e-commerce platform in Malaysia. It is the reflection of the products and services offered by the technological impact and having the interplay of the buying and purchasing. There is an effective consideration for technological impact, organisational influence, strategy adoption, synergic interplay, and digital supply chain effectiveness. This is reflected through the examination of the impact of current and emerging technologies on digital supply chain efficiency in the e-commerce sector is provided with the organizational influences on the effectiveness of digital supply chain management within e-commerce businesses. It is to follow the review and analysing of the existing literature on digital supply chain management, while focusing specifically on the e-commerce sector. The current state of knowledge and to identification of the gaps is based on the effective strategies for digital supply chain management in the e-commerce sector in Malaysia.

The digital supply chain in Malaysia, particularly in the context of the effective e-commerce platform, encompasses the entire process from manufacturing to product delivery. It represents a transformative journey where technology plays a central role, reflecting in the products and services offered. The impact of technology is evident in the interplay between buying and purchasing, shaping the dynamics of the e-commerce sector in the country. This intricate landscape involves a careful consideration of various factors, including technological impact, organizational influence, strategy adoption, synergic interplay, and digital supply chain effectiveness. The examination of these elements provides valuable insights into the efficiency of the digital supply chain within the e-commerce sector. It delves into the ways in which technology, organizational structures, and strategic decisions contribute to the overall effectiveness of supply chain management in the digital realm.

The study of the impact of current and emerging technologies on digital supply chain efficiency is a critical aspect of understanding how e-commerce businesses operate in Malaysia. It involves a comprehensive analysis of organizational influences on the effectiveness of digital supply chain management within these businesses. This examination not only sheds light on the existing practices but also sets the stage for identifying areas of improvement and innovation. To achieve a comprehensive understanding, a review and analysis of existing literature on digital supply chain management in the e-commerce sector are undertaken. This focused exploration allows for a thorough investigation into the current state of knowledge and facilitates the identification of gaps in the existing strategies. The goal is to uncover effective strategies that can enhance digital supply chain management in the e-commerce sector in Malaysia.

The digital supply chain in the Malaysian e-commerce landscape is a dynamic and multifaceted process influenced by technology, organizational structures, and strategic decisions. The ongoing examination of current and emerging technologies, coupled with organizational influences, helps shape effective strategies for digital supply chain management. By addressing gaps in knowledge and understanding, businesses can optimize their operations, ensuring a resilient and responsive digital supply chain in the ever-evolving e-commerce sector

The facilitation of the digital supply chain is for the effective consideration of the services using the multiple devices and the tools of artificial intelligence. The labels and the tags for the supply chain management are providing the effects of digital support for the delivery, purchasing and the buying of the products of choice. The specific stress on the multiple tools is based on the virtual management of the supply chain network which supports the manufacturing towards the wholesalers. Implementation of the internet-based technologies is the optimized value of total cost that reflects the information to be utilized for the transportation of vehicles with observed variations in the total working for the supply chain network. The performance and the stimulated data with the network of changing parameters are the artificial intelligence techniques that demand for the validated solutions and approaches towards the real-life practices of the technologies in the supply chain management. Supply chain progression for the computation indicate the real-life data sets with the changing solution approaches for the

business of e-commerce that shares the involvement of management within the inventory levels and status of order. The dual function of supply chain management with the time information is guided with the important mediums having direct impact from the technology based digital marketing.

The transportation, especially for the movement of vehicles within the supply chain network, there are observed variations that necessitate a nuanced approach to ensure optimal functionality. The performance of this transportation system is greatly influenced by the utilization of artificial intelligence techniques, which involve the analysis of stimulated data and changing parameters. The demand for validated solutions and approaches is crucial, aligning these techniques with real-life practices in supply chain management. The integration of artificial intelligence techniques into supply chain management introduces a paradigm shift in how businesses operate. The performance of these techniques relies on the stimulation of data sets that mirror real-world scenarios, enabling the development of algorithms that can adapt to changing parameters. This adaptability is crucial in addressing the dynamic nature of the transportation of vehicles within the supply chain network.

The supply chain progression, when influenced by computational methods and artificial intelligence, involves the utilization of real-life data sets and changing solution approaches. In the context of e-commerce, this progression is particularly impactful, as it involves managing inventory levels and monitoring the status of orders. The involvement of management in this process is vital for ensuring the smooth flow of vehicles through the supply chain, from manufacturers to end consumers. The dual function of supply chain management, especially in the transportation of vehicles, encompasses both strategic planning and operational execution. Strategically, businesses must employ artificial intelligence techniques to forecast demand, optimize routes, and enhance overall efficiency. Operationally, real-time data and changing parameters demand swift decision-making to ensure that vehicles reach their destinations seamlessly. The integration of artificial intelligence in supply chain management facilitates a holistic approach that aligns strategic planning with real-life operational demands.

The supply chain management for the transportation of vehicles within the supply chain network is a complex process influenced by artificial intelligence techniques. The utilization of real-life data sets and changing solution approaches is essential for adapting to the dynamic nature of the business environment, particularly in e-commerce. The dual function of supply chain management, combining strategic planning with operational execution, ensures the seamless movement of vehicles and enhances overall efficiency within the supply chain network.

Future directions

The future consideration of the research on the digital supply chain is to reflect the effectiveness of the e-commerce-based use of technologies. It is to extend the multiple impacts of the technology and to enhance the current progress in the emerging market of digital devices use for the supply chain businesses of Malaysia. The inclusion of the raw material is part and process of the digital supply chain with the focused areas of synergic interplay with the strategy adoption of the organizational influence and following the significant technological impacts. The value chain encompasses the individual steps for the purchasing and selling of the products in relation to the e-commerce business operations. The focused for the creation of marketable product is based on the multiple benefits of e-commerce while it is similar to the organized areas of the digital supply chain. The response to the markets with the incorporation of the digital supply chain is modified and it requires the new dimensions and types of designs for the effective supply chain management.