EFFECT OF DIGITAL TRANSFORMATION ON SUSTAINABLE SUPPLY CHAIN PERFORMANCE IN SME WAREHOUSES

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I hereby acknowledge that this project paper has been accepted as part of fulfilment for the degree of Bachelor Technology Management of Supply Chain and Logistics.

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DECLARATION OF ORIGINAL WORK

I hereby declare that all the work of this thesis entitled "Effect of digital transformation on sustainable supply chain performance in SME warehouses" is original done by myself and no portion of the work encompassed in this research project proposal has been submitted in support of any application for any other degree or qualification of this or any other institute or university of learning.

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DEDICATION

In heartfelt appreciation, I would like to dedicate this to my beloved family and friends, whose support and encouragement enabled me to successfully complete the final year project. Their love, encouragement, and understanding have been my guiding lights, giving me strength and motivation to overcome challenges. Besides, I would also like to extend a special dedication to my supervisor, Ts. Dr. Nur Hayati Binti Kamarudin, whose patient guidance and expertise shaped my research skills and increase my knowledge. To all those who have played an important role in my final year project, thank you for being the mentors in my life and enabling me to complete it in a short period of time.

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ABSTRACT

Digital transformation has become a major force shaping the business landscape, revolutionizing industries and transforming traditional practices. Digital transformation is a must for all organizations, no matter how big or small there are. Digital transformation is becoming more important in the logistics industry as it can help companies fulfill environmental protection to enhanced sustainability. Nowadays, SME warehouses are increasingly focusing on ensuring the sustainability of their supply chain management by measuring the environmental and social impact of their goods and services throughout the entire life cycle. This research aims to identify the effect of digital transformation that affect sustainable supply chain performance in SME warehouse and investigate the relationship between the effect of digital transformation and sustainable supply chain performance in SME warehouses and determine the effect of digital transformation that has the greater relationship on sustainable supply chain performance in SME warehouses. Researcher will examine the relationship between variable from quantitative approach. Questionnaire will set in Linkert scale and binary scale format and will be given to specified SME warehouses in acquiring respondent's information. Besides, the quantitative data will be analyzed using Statistical Packages for Social Science (SPSS). This research uses Cronbach's Alpha with values range between 0-1.0 to determine the internal consistency of tools by determining the closeness, or correlation, between items in a set.

Keywords: Digital transformation, Sustainable supply chain performance, SME warehouse

ABSTRAK

Transformasi digital telah menjadi satu daya besar yang membentuk landskap perniagaan, merevolusikan industri dan mengubah amalan tradisional. Transformasi digital adalah satu keperluan bagi semua organisasi, tidak kira besar atau kecilnya. Transformasi digital semakin penting dalam industri logistik kerana ia dapat membantu syarikat melaksanakan perlindungan alam sekitar untuk meningkatkan kelestarian. Pada masa kini, gudang SME semakin memberi tumpuan kepada memastikan kelestarian pengurusan rantaian bekalan mereka dengan mengukur impak alam sekitar dan sosial produk dan perkhidmatan mereka sepanjang kitar hayat keseluruhan. Penyelidikan ini bertujuan untuk mengenal pasti kesan transformasi digital yang mempengaruhi prestasi rantaian bekalan mampan di gudang PKS dan menyiasat hubungan antara kesan transformasi digital dan prestasi rantaian bekalan mampan di gudang PKS dan menentukan kesan transformasi digital yang mempunyai hubungan yang lebih besar terhadap prestasi rantaian bekalan yang mampan di gudang PKS. Penyelidik akan menyiasat hubungan antara pembolehubah melalui pendekatan kuantitatif. Soal selidik akan diatur dalam skala Likert dan skala binari dan akan diberikan kepada gudang SME tertentu untuk mendapatkan maklumat responden. Selain itu, data kuantitatif akan dianalisis menggunakan Pakej Statistik untuk Sains Sosial (SPSS). Penyelidikan ini menggunakan Alpha Cronbach dengan nilai yang berkisar antara 0-1.0 untuk menentukan konsistensi dalaman alat dengan menentukan kedekatan atau korelasi antara item dalam satu set.

Kata kunci: Transformasi digital, Prestasi rantaian bekalan lestari, Gudang SME

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ABBREVIATION	MEANING
DTs	Digital Technologies
AI	Artificial Intelligence
IT	Information Technology
IOT	Internet of Things
SPSS	Statistical Package for Social Science
I4.0	Industry 4.0
SME	Small Medium Enterprise
TBL	Triple Bottom Line
SSCP	Sustainable Supply Chain Performance
SEM	Structural Equation Modeling

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Supply chain sustainability refers to the concerted efforts made by companies to consider and mitigate the environmental impact associated with the entire supply chain process. This includes various stages such as sourcing raw materials, production, storage, distribution, and all transportation links in between (David Luther, 2020). Nowadays, SME warehouses are increasingly focusing on ensuring the sustainability of their supply chain management by measuring the environmental and social impact of their goods and services throughout the entire life cycle. For instance, companies aim to minimize negative environmental impacts, such as energy consumption, water usage, and waste generation. At the same time, they fostering positive outcomes for their operations, as well as the well-being of individuals and communities associated with them. As technology advances and develops, many SME warehouses have started to adopt digital transformation initiatives to enhance their sustainable supply chain performance.

Besides, digital transformation involves the adoption of digital technologies to facilitate the seamless flow of real-time data between and within organizations, ultimately increasing a company's operational efficiency and intelligence. (Holmstrom et al., 2019). The importance of digital technologies (DTs) and their use in supply chain activities has grown significantly in the era of Industry 4.0 (I4.0). Hence, the world increasingly expects companies to prioritize social responsibility and produce products in a sustainable manner. From the perspective of today's society, regardless of the size of the enterprise, digital transformation is considered a must in supply chain performance.

The Fourth Industrial Revolution's innovative digital technologies, including digitization, have the potential to increase the sustainability of these arterial networks. While, they also enhance the effectiveness and connectivity of global supply chains (Sriram Muthukrishnan, 2021). This is a very important benefit for SME warehouse as they seek to align their supply chain processes and management with an improved sustainability agenda. Companies may anticipate increasing consumer interaction, decreasing risk, and foster confidence among supply chain stakeholders by utilizing digital technologies to support supply chain visibility, transparency, and commitment to sustainability standards (Paul Mcgrath, 2021). This will ultimately lead to sustained corporate growth. Therefore, digital transformation technology supports the supply chain by enhancing information accessibility, collecting real-time data, and optimizing supply chain management procedures. It can also reduce production and transaction costs, improve timely delivery of products to customers, and increase the overall efficiency and effectiveness of supply chain functions (Lucy McCarthy, 2021).

According to supply chain experts, sustainability is becoming more and more important at every stage, including from the public sector and customers. Economic, environmental, and social sustainability must all be considered when deploying technology to ensure that it is a sustainable resource.

1.2 Problem Statement

In recent years, the rapid development and widespread application of digital technology have brought major about significant changes across various industries and sectors (A. L. Junge, 2019). Organizations embracing digital transformation presents them with opportunities to adapt to the new demands of today's digital world (Clubbish & Aljuhani, 2021). As businesses strive to remain competitive and efficient, digital transformation has become a critical strategic imperative. For example, in the context of small and medium enterprise (SME) warehouses, digital transformation has the potential to revolutionize supply chain operations, improve sustainability practices and improve overall performance. However, despite the growing interest in digital transformation and sustainability, some challenges remain regarding the specific impact of digital transformation on sustainable supply chain performance in the unique context of SME warehouses (Sudhanshu Joshi, 2022).

Moreover, researchers conducted a study to examine the impact of digital transformation in the supply chain sector. Organizations not only need to align their information technology (IT) with their business strategy, but also implement it effectively to achieve the anticipated benefits of digital transformation. This forms the foundation and presents a challenge for organizations to attain an additional level of competitiveness. Therefore, organizational leaders need to be aware of the different challenges that cause from digital transformation. Digital and leadership capabilities need to work together for successful digital transformation on sustainable supply chain performance (Westerman et al., 2019). By adopting digital transformation, organizations may encounter many challenges that hinder their progress. Most of them may be related to organizational culture, others may come from a lack of ability to purchase new technology equipment or having unskilled staff to lead change (Laksilu Weerasinghe & Blandine Nirere, 2022).

SME warehouses face unique challenges compared to larger enterprises, including limited resources, financial constraints, and lack of technical expertise (G V

S K Vedant, 2023). These factors require a tailored understanding of the potential benefits, barriers and implementation strategies associated with digital transformation and sustainability practices in the SME warehouse environment. By addressing these research gaps, key success factors, best practices, and practical recommendations can be identified to help SMEs adopt digital transformation initiatives that promote sustainability and improve supply chain performance (Xin Zhang, 2022).

Digital technologies like the Internet of Things (IoT), cloud computing, artificial intelligence, and data analytics have transformed traditional supply chain management practices (Yasser Khan, 2023). This is because, these technologies offer the opportunity to optimize inventory management, streamline logistics and enhance decision-making processes to improve operational efficiency and reduce costs. In addition, they provide tools and capabilities to integrate sustainability considerations into supply chain operations, including reducing carbon emissions, minimizing waste generation, and promoting ethical sourcing practices. However, the extent to which digital transformation initiatives effectively contribute to the improvement of sustainable supply chain performance of SME warehouses remains unclear (Laura Timberg, 2023).

Therefore, the objective of this study is to examine the effect of digital transformation on the sustainable supply chain performance of SME warehouse. It aims to examine the specific digital technologies employed, their integration with supply chain processes, and their impact on sustainability outcomes.

1.3 Research Questions

The research question outlines the problem or topic that the researcher aims to explore, understand, or answer through the research process. This research is about the digital transformation and sustainable supply chain performance. The researchers are very interesting and curious about the relationship among them. Therefore, there are three research questions come out form this research, which are:

i. What is the effect of digital transformation that affect sustainable supply chain performance in SME warehouses?

ii. What is the relationship between the effect of digital transformation and sustainable supply chain performance in SME warehouses?

iii. What effect has the greater relationship on sustainable supply chain performance in SME warehouses by implemented digital transformation?

1.4 Research Objectives

A research objective is a specific statement outlining the research goals and intentions. In this research, there are three research objectives to be figured out:

i. To identify the effect of digital transformation that affect sustainable supply chain performance in SME warehouses.

ii. To investigate the relationship between the effect of digital transformation and sustainable supply chain performance in SME warehouses.

iii. To determine the effect of digital transformation that has the greater relationship on sustainable supply chain performance in SME warehouses.

1.5 Scope of The Study

This research paper is focusing on the effect of digital transformation on sustainable supply chain performance in SME warehouses. Therefore, the research involves examining the relationship between digital transformation and the sustainable supply chain performance of SME warehouses. The scope of this research is in Bera, Pahang, Malaysia. The study will be conducted among managers, executive, supervisor and general worker in SME warehouses in Bera, Pahang, Malaysia by giving them the questionnaires.

1.6 Limitation and Key Assumption

This study may have a specific time frame within which data is collected and analyzed. This may limit researchers' ability to capture the long-term effects of digital transformation initiatives on sustainable supply chain performance of SME warehouses. Besides, access to accurate and comprehensive data on the sustainable supply chain performance of SME warehouses may be limited. Data collection and analysis can be challenging due to the small size of SME operations and their possible reluctance to share sensitive information.

The study assumes that SME warehouses have adopted or are in the process of adopting a digital transformation plan. It assumes that digital technologies and practices are utilized to some extent in warehouse operations

1.7 Significance of The Study

Firstly, the benefit of this research is to find out the effect of digital transformation on sustainable supply chain performance in SME warehouses. The study addresses a research gap by exploring the relationship between digital transformation and sustainable supply chain performance specifically in the context of SME warehouses. At the same time, people can base this research as their reference to more understand the benefit of digital transformation and how to use it to achieve a company's goal.

1.8 Summary

In summary, this chapter provides a background review of the research as well as current issues. In this chapter, researcher has focus on the background of the study, the problem statement, the research questions, the research objectives, the scope of study, the limitations and key assumption, the significance of the study as well as the key concepts of the study. In the next chapter, the researcher will go to carry out the literature review of the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will examine the review on the effect of digital transformation on the sustainable supply chain performance in SME warehouses. In the literature review, researchers will examine the relationship between digital transformation and sustainable supply chain performance.

2.2 Digital Transformation

Digitization refers to the use of digital technology to achieve goals in various fields such as business, society and economy (Gupta, M, 2020). Moreover, digital transformation is the process of utilizing digital technologies such as artificial

intelligence, blockchain, Internet of Things and cloud computing to modernize organizational procedures, enhance customer experience, streamline operations and create new business models (Morteza, 2020). Therefore, as an infinite innovation, digitalization may provide, change or even challenge the inherent industry rules and it enabling businesses to stand out from the competition (Alrawadieh, 2020). Decision-makers must give careful thought to the complicated process of digital transformation because this approach can hasten change and bring uncertainty (Warner and Wäger, 2019). Besides, businesses must adopt digital technologies to create value during digital transformation. For example, stakeholders' ability to use technologies such as social media, search engines, and web analytics that can increase their digital engagement and develop accurate and effective digital capabilities (Proksch et al., 2021). Hence, a digital strategy must be the foundation for developing digital transformation since businesses must integrate digital technologies into both internal and external activities. In addition, companies must continuously make, implement, assess, and amend pertinent decisions to achieve business transformation due to the volatility and complexity of the digital process. This is because, the internal dissemination and integration of digital technologies with corporate operations is only possible if digital transformation is publicly elevated to a strategic level (Wielgos et al., 2021).

In supply chain performance, digital transformation related innovations such sensors and tracking tools that can give businesses real-time data and analysis to improve their supply chain operations. By using sensors on shipping containers, it can help businesses accurately manage their inventories and reduce the risk of deterioration or damage by providing information on location, temperature, and other information (Baha M. Mohsen, 2023). Therefore, the digital transformation of outdated practices into modern practices and the merging of digitalization with existing operations can result in more sustainable and effective operations.

Furthermore, supply chain digitization enables companies to meet the dynamic needs of customers in a timely manner, address supply chain management challenges and seek a competitive advantage (Ivanov et al., 2021). This requires companies to

move from traditional supply chains to digital to enhanced supply chains. Next, transparency and flexibility of digital transformation such as Internet of Things, radio-frequency identification, business-to-business and others improve and innovate productivity of a company's supply chain. (Batista, L. et al., 2021). They also make it possible for smart production and greatly speed up innovation. For instance, Industry 4.0 is a very visible sustainable growth tool that can greatly influence supply chain behavior to enable smarter and more flexible processes. This tool makes the supply chain more circular, improves resource efficiency, automates and optimizes measures, and improves employee well-being (Happonen et al., 2022). The supply chain functions of acquiring raw materials and delivering them to clients have a lot of potential to be transformed by blockchain technology. Additionally, it guarantees smart contract connections in a safe environment and the validity, dependability, and transparency of information (Dutta, P. et al, 2020). Therefore, digital transformation is necessary for increasing organizational performance and assisting with sustainable business practices (Imadeddine Oubrahim, 2023).

2.2.1 Smart Technologies

Smart technology refers to a variety of technological developments expected to improve users' productivity and effectiveness (Ash, 2022). The adoption of digitization has revolutionized the dynamics among agents, and changing the way they interact with each other and how they perceive each other and their surroundings. Furthermore, the development of new technologies is actively changing the way information is processed and disseminated (Khan et al., 2021). Most industries are newly impacted by these digital transformations include supply chains. These industries using modern technology are called "digital enterprises" (Feng & Ye, 2021). Therefore, this digital transformation makes the gap between business concepts and customer needs more closes. Big data, machine learning, 3D printing, virtual reality, augmented reality, blockchain, robots, drones, nanotechnology, or gamification are some of the several

types of digitization that the author distinguishes (Khan et al., 2021). Moreover, cost savings are the most significant benefits that businesses gain from implementing digital and smart technologies. Companies may gain the benefits from new capabilities by implementing digital transformation. New technology dramatically improves collaboration and responsiveness to transform supply chain operations (Crittenden et al., 2019). Thus, it can improve relationships with customers and value networks. In addition, there are some opportunities provided by external collaboration in virtual supply chains, digitization also offers many opportunities for internal collaboration across organizations. For example, it can facilitate collaborative work in business process planning and execution by exchanging information and digitizing everything (Riemer & Schellhammer, 2019).

2.2.2 Eco-Innovation

Eco-innovation has received a lot of attention over the past few years, especially in terms of technological progress for sustainability. Moreover, eco-innovation consists of two main aspects. First, innovations have a positive or negative impact on the environment. Second, innovators keep in mind the impact on the environment when launching a new product or service (Cai et al., 2018). Thus, eco-innovations do not include those that never consider the environment.

Besides, eco-innovation measures a company's ability to develop, apply, and implement new products, procedures, or organizational designs that reduce environmental risks. This help company on resource consumption and pollution to meet the environment aspects (Galbreath et al., 2021). Companies also can enhance environmental management and supply chain sustainability by creating and strengthening management structures, practices, products and processes on their products and services. Therefore, companies must achieve sustainable development

through ecological innovation. For instance, companies are encouraging for green transformation because of eco-innovation. This is because, the integration of green production technology can help company build a reliable environmental protection management system. It views sustainability as the key component. Second, many companies take tactical steps to generate unique value through eco-innovation. Hence, companies enable green transformation by supporting environmental and social initiatives to sustain business growth, improve efficiency and gain a competitive advantage (Kolagar et al., 2022).

2.2.3 Organizational Culture

Organizational culture is the fundamental capability that encourages alignment between organizational and individual values and is associated with organizational effectiveness (Azeem et al., 2021). Besides, organizational culture is the collection of assumptions, values, and beliefs shared by everyone within an organization. Therefore, every business has its own unique way of working and the challenges it faces, including supply chain, technology, human resources, and others (Jermsittiparsert & Wajeetongratana, 2019). For example, tasks are made simpler and new learning is facilitated by organizational culture. Employees will be more able to participate actively in organizational procedures and goals if they are encouraged to master the company's basic principles. Moreover, organizational culture can help or be a risk to hinder the achievement of specific initiatives, such as supply chain sustainability (Magsi et al., 2018). This is because, the culture of an organization is closely related to its effectiveness and efficiency as it leads all levels of the company to achieve its goals (Azeem et al., 2021). As a result, a well-organized cultural organization will support the effectiveness and sustainability of the supply chain while enhancing the customer experience (Masa'deh et al., 2018).

Furthermore, the culture of an organization can has a significant impact on whether digital transformation proceeds without problems. The most significant factor in a company's success is its culture, which enables quick adjustment to changing circumstances and motivates staff to embrace new digital developments. Numerous studies examine the operational side of the digitization process. Nonetheless, there are some ways for organizations to digitalization. For example, several companies focus on technological innovation while ignoring organizational culture investment. Therefore, many companies struggle with deploying technology because they don't try to modify staff practices and mindsets, or to foster a change-friendly culture. Managers frequently overlook the influence of organizational culture when determining whether the first adoption of a new technology was successful or unsuccessful (Fakhri et al., 2020).

2.2.4 Workforce Skills

The increasing attention on the impact of digital transformation on the sustainable supply chain performance of SME warehouses necessitates an examination of the role of workforce skills in successfully navigating this transformation, as SMEs adopt digital technologies to optimize their supply chain operations (Saurabh Singh, 2023). For example, digital literacy, technology adaptability, data analysis and interpretation, collaboration and communication, and problem-solving and critical thinking skills are critical for employees to successfully navigate the challenges and opportunities of digital transformation and contribute to sustainable development outcomes. Therefore, organization must understand the importance of these skills can help SME warehouses identify training and development needs, foster a culture of continuous learning, and ensure employees are able to effectively utilize digital technologies and contribute to sustainable supply chain performance.

Besides, some companies have focused on workforce transformation which workplace changes, such as "people changing" and "changing people" (Solberg et al., 2020). For example, organizations can enhance employee's knowledge and understanding of technology by people changing such as self-learning or providing training (Eden et al., 2019). Instead, changing people when it gets in the way of the digital transformation process and the organization needs to hire new employees or terminate the contracts of existing employees (Margherita & Braccini, 2020). Additionally, employers should prioritize employing new hires with digital capabilities, including knowledge (Hämäläinen et al., 2021), mentality (Horváth & Szabó et al., 2020), and skills (Brock & von Wangenheim et al.,2020). In fact, research shows that even before digital transformation is implemented, workforce skills exist and are maintained as part of a sustainable change strategy (Baiyere et al., 2020).

2.3 Supply Chain

The supply chain refers to a connected process that involves the coordination, planning, and management of goods and services between suppliers and customers (Adam Hayes, 2023). Besides, supply chain management involves a network of facilities that manufacture raw materials and transform them into finished goods (Jason Fernando, 2022). The primary objective of supply chain management is to maximize value while minimizing expenses by optimizing the performance of the supply chain in manufacturing, distribution, and purchasing (Simon Ellis & John Santagate, 2018). Thus, to maximize supply chain productivity and provide advantages to all parties involved, supply chain management strives to connect all operators within the company due to enabling them to operate effectively. Since the 1980s, there has been a steady increase in the adoption of supply chain management practices in the industry (Hua Wen & Qian Ling Gu, 2019). According to Saha and Randhawa's research from 2019, The visibility, coordination, and responsiveness of the complete supply chain

system can be enhanced by digital technologies like the Internet of Things and artificial intelligence and others.

Moreover, companies must generate, gather, and use huge quantities of information to digitize and automate new-age supply chains because digital supply chain include social and ethical perspectives (Pantano et al., 2018). Besides, with the rise of numerous disruptions, as suggested by Loebbecke and Picot (2019), companies need to create supply chain structures that are suitable for the new digital and autonomous era. However, supply chains are still to face pressure from geopolitical hazards cyberthreats, and unstable economic conditions (Rachinger et al., 2019). Thus, the company aim to enhance the future supply chain, deploying artificial intelligence technology is necessary to achieve autonomous operation throughout the entire process. This will enable the establishment of a flexible, efficient, agile, and robust digital network (Heller et al., 2019).

2.4 Sustainable Supply Chain Performance

Sustainable supply chain performance is a concept used to measure and assess the value and efficiency of supply chain processes in a dynamic environment. It includes integrating environmental, social, and economic factors into supply chain activities (Nayal K. et al., 2022). Moreover, companies have identified the sustainability of supply chain operations as a major concern due to the resource limitations in achieving sustainable performance through the adoption of a Sustainability Strategy (Raut, R.D. et al., 2021). Therefore, stakeholders pay more attention to sustainable strategies to balance environmental ecosystems and prevent pollution (Hafi et al., 2022). Besides, company must sustainably maintain their supply chains to minimize negative impacts on employees, suppliers, customers, the environment, and society.

In addition, companies develop sustainable supply chain performance into a higher-order multidimensional structure to enhance sustainable performance and gain a competitive advantage. By having this idea, organizations can incorporate sustainability into their operations, vision and strategy (Kumar, G. et al., 2019). Hence, every supply chain performance plan must integrate all aspects of sustainable supply chain performance, including financial, social, and environmental factors into the company's strategy. This integration ensures a stronger and clearer direction for the organization to maintain a competitive advantage (Stroumpoulis et al., 2022).

The Triple Bottom Line (TBL) sustainability strategy quantifies sustainable supply chain performance by considering three key factors which are economic, social, and environmental performance. Moreover, these factors, economic, social, and environmental performance, also widely recognized as the three pillars of sustainable development (Neri. A et al., 2021). Therefore, organizations have to combine their financial goals with social and environmental targets to obtain a thorough evaluation of their sustainability performance and improve their overall company's performance.

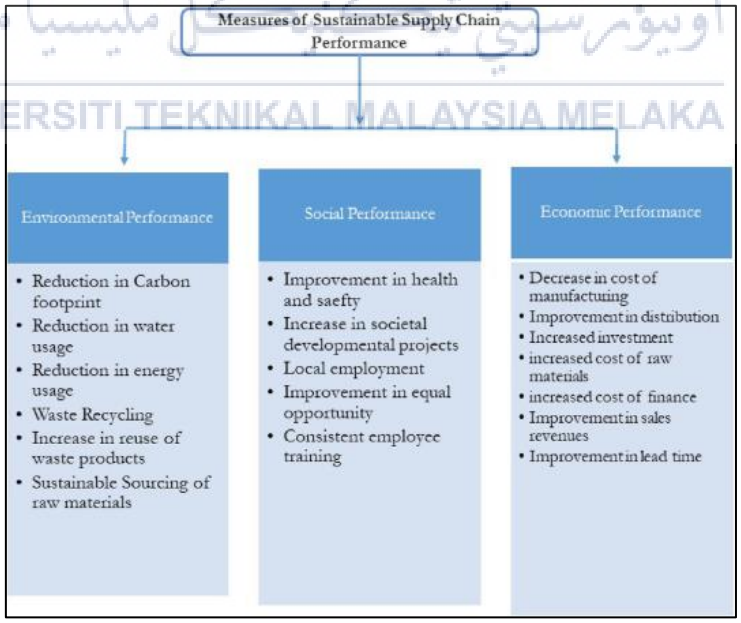


Figure 2.1: Measurement of Sustainable Supply Chain Performance

Source: Neri. A et al., 2021

2.5 SME Warehouses

SME warehouses play a vital role as effective contributors to job creation, export activity, and regional development. Hence, there is an emphasis on the contribution of start-ups and small and medium-sized enterprises (SMEs) to the social and economic fields, as well as the promotion of robust national economic growth through enhanced innovation (Stieglitz et al, 2019). Moreover, SMEs are recognized as a dynamic sector contributing to economic growth in developing countries (Ramayah et al., 2019). For example, SMEs can be considered as effective drivers of poverty reduction in specific regions. Entrepreneurs can use digital technologies, such as social media platforms, blockchain, artificial intelligence business applications, Internet of Things, and big data analytics, to mitigate exogenous crises (Galati, A., et al., 2021).

Besides, the use of digital technologies by start-up SMEs can have an impact on economic and social value and contribute to improving the socio-economic situation of the region (Savic, D., 2020). This is because, adoption of digital technologies also has an impact on organization's performance. However, different organizations adopting technology applications have different growth rates (Rana et al., 2021). Therefore, warehouses are a crucial component of assuring a consistent supply from the producer to the final consumer to achieve high levels of efficiency and quality in logistics operations. Next, warehouses are important to match suppliers with in-demand products. The profitability, sustainability, and performance of an organization are significantly influenced by its warehouses. Hence, storage is a crucial component of economic activity.

2.6 Effect of Digital Transformation on Sustainable Supply Chain Performance

Digital success has changed the way we communicate with each other today. This is because, modern technology is essential in everyday life and in every industry, including smart watches, smart TVs, and other that are gradually changing. Moreover, digital transformation is growing importance across industries as it enhances agility, real-time transparency, and flexibility. It empowers companies to gain deeper insights into customer needs and facilitates improved interaction with customers. As a result, sustainable development depends on lowering costs, boosting efficiency, optimizing resource use, and on-time delivery (Sandeep Raut, 2017).

Besides, digital transformation has some risks, including high financial costs and initial operational challenges. However, it continues to play a vital role in regulating organizational performance and brings long-term benefits to the organization (Agrawal, 2020). Digital transformation had a serious effect on sustainable supply chain (Buyukozkan and Gocer, 2021). The relationship between supply chain stakeholders will change because of digital transformation, which will also help organizations get ready for the major challenges that are lying ahead and encourage them to restructure their company development strategies. Hence, organizations can utilize digital transformation to integrate devices and enable intelligence within their systems, thereby they will be enhancing the performance of their sustainable supply chains. As a result, organizations have deployed intelligent, programmable, communicative, and performance-improving devices in the implementation of digital transformation (Dubey et al., 2020).

Furthermore, these digital technologies bring logistical benefits to companies, such as being able to quickly respond to supply chain disruptions and changes, and even modeling systems to predict potential risks through what-if scenario analysis (Oscar Rodriguez-Espindola et al., 2022). This is because, the digitization of the whole process of planning, procurement, manufacturing, delivery, and return will further

improve the supply chain process, optimize the work process, and shorten the delivery time.

2.7 Theoretical Framework

In this research, researcher will use **stakeholder theory** to support the theory of this research. Stakeholder management and how it influences sustainable supply chain management are important factors in this research. Besides, supply chains may involve a variety of stakeholder groups, indicating a three-step process of sustainability awareness, adoption, and implementation. This is consistent with the stakeholder theory and its application to sustainable development, and it points to the creation of value for stakeholders based on sustainability (Stefan Seuring et al., 2022).

Norris et al. (2021) integrated a relational approach of sustainable supply chain management to manage sustainable business models. The development of sustainable create value on innovation, knowledge acquisition, and engagement with external stakeholders. Moreover, the business plan complies with both stakeholder expectations and the company's objective for sustainable development (Freudenreich et al., 2020). According to Freeman (2019), stakeholder theory proposes that value creation is a collaborative effort in relationships, ideally benefitting the focal business and all its stakeholders. Consequently, this framework for creating value for stakeholders is crucial in the context of the present sustainable business model.

Besides, stakeholder theory has been influential in many areas of business research (Chowdhury et al., 2020). Stakeholders believe that business ethics are at its core. This is because, ethics are made more practical through stakeholder theory. It claims that morality is something that everyone engages in daily to fix issues and improve everyone's quality of life. This realistic perspective appears to put ethics at

the core of business. Hence, businesses strive to comprehend the kinds of goods and services that consumers should purchase to increase their quality of life (Professor Bastiaan Van der Linden, 2021).

Furthermore, every company exists within a larger ecosystem in which it must compete with other companies for resources such as human capital and financial capital. For example, every company focus on relationship between customers, suppliers, employees, investors, communities, and others stakeholders to strengthen the overall system. Thus, a company must make decisions that serve the best interests of all stakeholders to maintain sustainability.

Stakeholder relationships are only considered healthy when everyone get the benefits. When one or both parties in a stakeholder network receive little to nothing, the relationship is harmed, and eventually the weaker partner withdraws, which causes the relationship to end (Buzzedison, 2021). Therefore, stakeholder thinking requires a change in narrative from the traditional theories of economics and finance that ignore ethics and treat businesses as though they were faceless actors or machines for generating profits. It differs from those theories by placing ethics and responsibility at the center of value creation. In order to better understand how structural changes in business value and business models are impacted by next-generation digital services, this study will look at the full value chain.

The researchers found the theory relevant to the research question because supply chains consist of various stakeholders from both internal and external sources, including suppliers, distributors, transporters, and customers. In order to be able to identify factors that influence supply chain collaboration within a government sector, it is important to understand who the stakeholders are and what their interests are. As a result, all stakeholders, including policy makers and suppliers must possess a comprehensive understanding of data security and information protection issue for effective supply chain management and scalability of operations (Cheah et al., 2022).

2.8 Dependent Variable

The dependent variable is the one that is affected as a result of the independent variable's manipulation., which researcher intentionally manipulates or controls in the research. Researcher analyze the relationship between an independent variable and a dependent variable to understand cause-and-effect of an independent variable on a dependent variable (Pritha Bhandari, 2022). In this research, researcher found that sustainable supply chain performance of SME warehouses is influenced by digital transformation.

2.8.1 Sustainable Supply Chain Performance in SME Warehouses

Sustainable supply chain performance refers to measuring and assessing the results of integrating sustainability practices into the supply chain operations of SME warehouses. It assesses the extent to which digital transformation initiatives contribute to sustainable outcomes in terms of reduced environmental impact, social responsibility, and economic efficiency. In SME warehouses, sustainable supply chain performance requires the adoption of practices and strategies that optimize resource utilization, reduce waste, promote ethical sourcing, and make a positive contribution to the communities in which they operate (Anup Kumar et al, 2023).

2.9 Independent Variable

The independent variable is the variable that is controlled or manipulated by the researcher and is believed to have an impact on the dependent variable. By manipulating the independent variable, researchers can examine how changes in it affect the dependent variable and establish causality. In this research, the independent variable which is effect of digital transformation. There are four effect that include in independent variable which are smart technologies, eco-innovation, organizational culture and workforce skills. Therefore, researcher will examine the relationship between digital transformation and sustainable supply chain performance.

2.9.1 Smart Technologies

Smart technologies encompass a variety of innovative digital tools and systems that leverage advanced capabilities including blockchain, Internet of Things (IoT), automation and robotics and others. These technologies aim to optimize operations, enhance decision-making, and improve overall supply chain performance. Moreover, smart technologies play a vital role in enabling and promoting sustainable practices within the context of sustainable supply chain performance of SME warehouses. These technologies provide opportunities to collect and do the analysis for large volumes data, monitor and control processes in real time, and offer actionable insights for optimizing resource utilization, reducing waste, and minimizing environmental impact. By utilizing smart technologies, SME warehouses can improve operational efficiency, enhance sustainability performance, and gain a competitive advantage in the market (Md Eshrat E. Alahi, 2023). As a result, it shows a significant relationship with sustainable supply chain performance.

2.9.2 Eco-Innovation

Eco-innovation places a strong emphasis on incorporating environmental protection into innovation efforts, reducing businesses' carbon footprints, and fostering sustainable development through redesign and ongoing product, process, and management improvement (Larbi-Siaw et al., 2022). To measure the extent of eco-innovation within an organization, researchers often develop structures or indicators to capture different aspects of eco-innovation, such as the adoption of green technologies, the implementation of environmentally friendly practices, or the development of sustainable products and services (Magdalena Pichlak et al, 2021). These structures help to assess and assess the level of eco-innovation within a company and its impact on environmental sustainability outcomes. In summary, eco-innovation represents a shift towards more sustainable and environmentally conscious innovation practices. As a result, it shows a significant relationship with sustainable supply chain performance.

2.9.3 Organizational Culture

Organizational culture refers to the shared values, opinions, standards, and behaviors that shape the collective identity and social environment within an organization (Rasak Bamidele, 2022). Moreover, organizational culture plays a key role in influencing how digital transformation initiatives and sustainability practices are implemented and integrated in warehouse environments. The organizational culture of SME warehouses can either facilitate or hinder the successful adoption and implementation of digital transformation strategies and sustainability initiatives. It is vital to look at the current organizational culture to comprehend how the digital revolution affects the sustainable supply chain performance of SME warehouses. For example, this comprises elements like employee attitudes towards change, the presence of a learning culture,

communication and cooperation practices, and employee empowerment levels. Besides, leadership support for digital transformation and sustainability is also included (Brigid Trenerry et al, 2021). For instance, successful digital transformation efforts and sustainability practices are more likely to succeed in organizations with a strong and positive culture that values innovation, sustainability, and continual improvement. In conclusion, organizational culture is a framework that has a big impact on how well SME warehouses implement sustainability and digital transformation strategies. This is because, it affects employee attitudes, behavior and the overall adoption and integration of these initiatives. As a result, it shows a significant relationship with sustainable supply chain performance.

2.9.4 Workforce Skills

Workforce skills refer to the competencies, knowledge, and capabilities of employees that are essential for successfully navigating and leveraging digital transformation initiatives within the warehouse setting (Becky Trevino, 2022). These skills are critical to adapting to technological advancements, implementing sustainable practices, and optimizing supply chain performance. For instance, digital transformation involves integrating digital technologies, including artificial intelligence, blockchain, automation and robotics, and Internet of Things (IoT), into various aspects of warehouse operations. Therefore, the workforce must possess a set of skills that enable them to effectively utilize and leverage these technologies and it show a significant relationship with sustainable supply chain performance (Sharat Chandra Jha, 2023).

2.10 Research Framework

The research framework for this research aims to investigate the relationship between digital transformation and sustainable supply chain performance specifically in the context of SME warehouses. In this research, the effect of digital transformation as the independent variable while sustainable supply chain performance as the dependent variable.

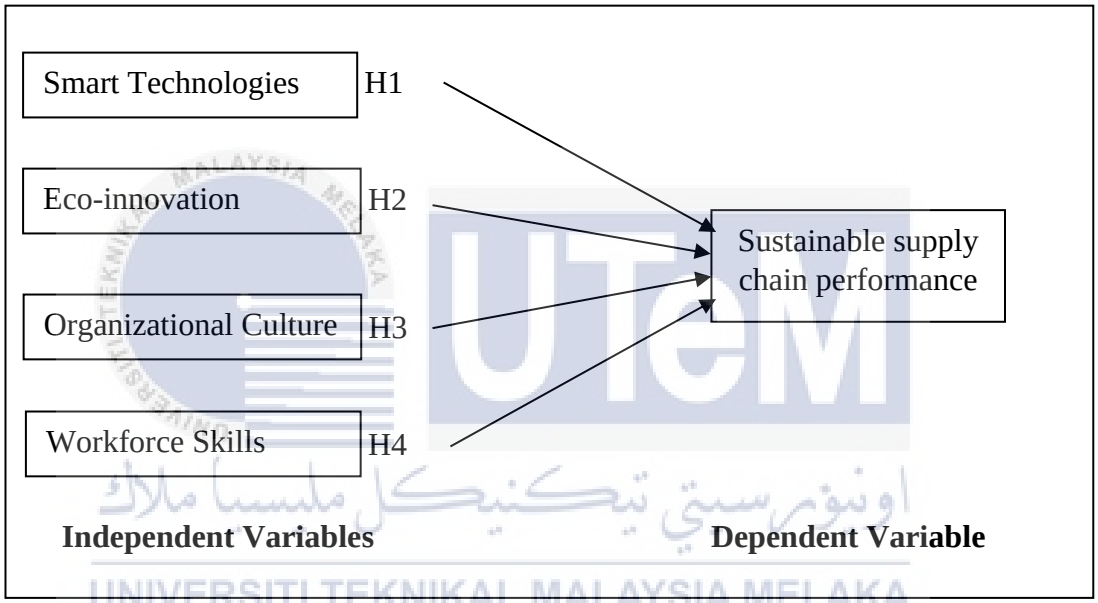


Figure 2.2: Research Framework

2.11 Hypotheses

i. Smart Technologies

(H1): There is a significant relationship between smart technologies to sustainable supply chain performance in SME warehouses.

ii. Eco-innovation

(H2): There is a significant relationship between eco-innovation to sustainable supply chain performance in SME warehouses.

iii. Organization Culture

(H3): There is a significant relationship between organization culture to sustainable supply chain performance in SME warehouses.

iv. Workforce Skills

(H4): There is a significant relationship between workforce skills to sustainable supply chain performance in SME warehouses.

2.12 Summary

In summary, this chapter has been providing the literature review for the title. In this chapter, researchers have focused on independent variables and dependent variables. Based on this tittle, it come out a research framework. The independent variables such as smart technologies, eco-innovation, organizational culture, and workforce skills. While the dependent variable is sustainable supply chain performance in SME warehouses. Researcher have provided the literature review for each variable. Besides, researcher found that stakeholder theory is suitable for this tittle because it links to sustainable supply chain performance. Finally, researcher have created a hypothesis to test the relationship between each variable. In the next chapter, the researcher will discuss the research methodology for this research such as the survey method used, collect data tools and others.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

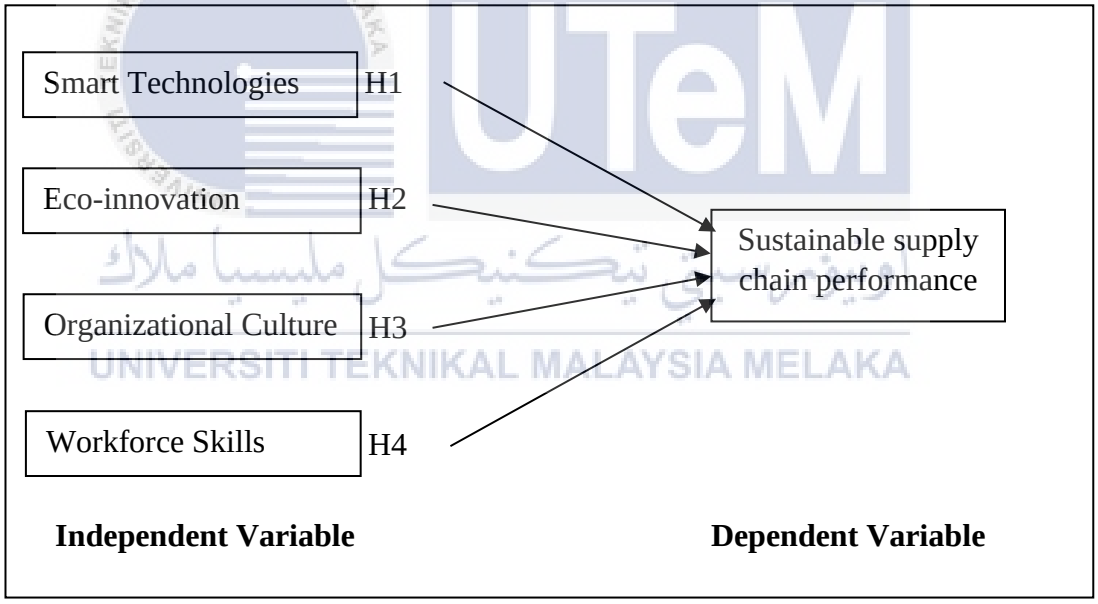
In this chapter, it outlines the methods and procedures used to answer research questions or objectives. Besides, emphasis is on explaining the methods and techniques used to collect and analyze data. Researcher will provide a comprehensive overview of the research design, research methods, population and sample selection, data collection methods, pilot study, research location, and approach and structure of data analysis. Researcher will establish the dependability and validity of the research by describing the processes followed to ensure the correctness and integrity of the research process. This chapter offers instructions to the reader so they may comprehend the methodical, meticulous strategy used for collecting and analyzing data in order to provide reliable and significant results.

3.2 Research Framework and Research Hypothesis

3.2.1 Research Framework

The research framework for this research aims to investigate the relationship between digital transformation and sustainable supply chain performance specifically in the context of SME warehouses. In this research, the effect of digital transformation as the independent variable while sustainable supply chain performance as the dependent variable.

Figure 3.1: Research Framework



3.2.2 Research Hypothesis

i. Smart Technologies

(H1): There is a significant relationship between smart technologies to sustainable supply chain performance in SME warehouses.

ii. Eco-innovation

(H2): There is a significant relationship between eco-innovation to sustainable supply chain performance in SME warehouses.

iii. Organization Culture

(H3): There is a significant relationship between organization culture to sustainable supply chain performance in SME warehouses.

iv. Workforce Skills

(H4): There is a significant relationship between workforce skills to sustainable supply chain performance in SME warehouses.

3.3 General Construction of Research Design

Overall construction of research designs, the design system plans and organizes the various components to address research objectives and answer research questions (Shona McCombes, 2021). In this research, there are includes explanatory research and researcher will set the time frame to finish this research.

3.3.1 Explanatory Research

Explanatory research is focus on investigate the causal connection between variables. In this research, an interpretive study will seek to understand how digital transformation affects the sustainable supply chain performance of SME warehouses. It aims to gain insight into the underlying mechanisms and factors driving the observed relationships.

Explanatory research typically uses quantitative methods to analyze data. Statistical techniques such as regression analysis are often employed to determine the strength and importance of the relationship between digital transformation and sustainable supply chain performance. These analyzes help establish causal relationships.

3.3.2 Time Frame of Study

This study used a cross-sectional study, which is an observational study that collects data from a sample population at specific points in time. Researchers must complete the research from Chapter 1 to 5 in 8 until 10 months. Collecting data from selected SME warehouses on digital transformation initiatives, sustainability practices, and supply chain performance maybe take a few days, weeks, or even months for the results to become available. Besides, researchers analyze the collected data using appropriate statistical methods to identify patterns and relationships before the end of the month.

3.4 Research Method

In this research, it involves a quantitative method to collect comprehensive and meaningful data. Researcher will using quantitative survey that include interesting questions to help researcher more understanding the operation of SME warehouses based on data that collect from employees.

3.4.1 Survey Method

The survey method can be used to collect data to study the impact of digital transformation on the sustainable supply chain performance of SME warehouses. The researcher conducts quantitative surveys on selected SME warehouses through online by using questionnaire. The survey will cover aspects such as the extent to which

digital transformation has been implemented, the specific digital technologies employed, sustainability practices, and performance indicators related to sustainable supply chain performance.

3.4.2 Research Instruments

In this research, researchers will use questionnaires, a popular research tool used to collect data in the form of surveys. Open-ended and closed-ended questions will conduct in questionnaires as research instrument. Open-ended questions allowed respondents to provide free-text responses expressing their thoughts, opinions or experiences (Emma Cullen, 2023) in their own words on digital transformation impacting sustainable supply chains. While, close-ended questions will provide data that is structured and help researcher easy to analyze. Closed-ended questions are questions that can only be answered by choosing from a limited number of options, usually multiple-choice questions with a single-word answer, "yes" or "no," or a rating scale (such as from Strongly Agree to strong opposition). They allow researchers to quantify responses, compare respondents' results, and identify patterns or trends in the data (Fio Dossetto, 2023).

3.4.3 Questionnaire

The questionnaire aims to collect data on the effect of digital transformation on sustainable supply chain performance in SME warehouses. Researchers will design a questionnaire that includes relevant questions to measure key variables of interest. This survey will be accessed through an online questionnaire by Google Form and it

consists of four sections and covers various aspects related to digital transformation, sustainability practices, and overall impact. This questionnaire will be covered by 2 sections. Section 1 will cover by demographic while section 2 is about the knowledge of employees on digital transformation and sustainable supply chain.

3.4.3.1 Section A: Background of The Respondents

Table 3.1: Demographic Construct

Construct	Measuring items	Number of items
Demographic	Gender, year of experience, current position, rate for company	6

3.4.3.2 Section B: Digital Transformation and Sustainable Supply Chain Performance

Table 3.2: Smart Technologies

No	Items	Source
	Smart Technologies	
1	We adopt smart technologies in our organization's supply chain operations.	Laura V. Lerman et al., 2022

No	Items	Source
	Smart Technologies	
2	We use cloud computing on sustainable supply chain processes.	Laura V. Lerman et al., 2022
3	We use Big Data Analytics in our company processes and in the supply chain.	
4	We use artificial intelligence in supply chain processes.	
5	We use blockchain in the supply chain processes.	
6	We use collaborative robotics in our company processes and in the supply chain.	
7	We use computer simulation in supply chain processes.	

Table 3.3: Eco-innovation

No	Items	Source
	Eco-innovation	
1	Our company packaging is reusable.	Laura V. Lerman et. al., 2022
2	Our company promotes packaging recycling and reuse programs.	
3	Our company assesses the environmental impact to develop/improve products.	
4	Our company develops products with low impact on the environment.	
5	Our company works together with customers to take environmental issues into account in product design.	
6	Our company encourages the use of reusable packaging.	
7	Eco-innovation can help on reduction in carbon emissions and environmental impact.	

Table 3.4: Organizational Culture

No	Item	Source
Organizational Culture		
1.	We value sustainability as part of its organizational culture.	Cao et. al., 2019
2.	Our organizational culture matters for adopting digital technologies in supply chain operations.	
3.	We adapt to changes brought about by digital transformation initiatives.	
4.	Our supervisors encourage employees to exchange opinions and ideas.	
5.	We are constantly thinking of the next generation of manufacturing technologies.	
6.	Our supervisors encourage the people who work for them to work as a team.	
7.	We try to anticipate the potential of new manufacturing practices and technologies.	

Table 3.5: Workforce Skills

No	Items	Source
Workforce Skills		
1	Having digital skills is important for improving sustainability practices in the supply chain.	Van Veldhoven et. al., 2023
2	Our organization makes lessons learned available to all employees.	
3	Proficiency in analyzing data and extracting meaningful insights for decisions related to supply chain sustainability.	

No	Items	Source
	Workforce Skills	
4	Strong analytical and data skills are essential to identify and address sustainability challenges in supply chains.	Van Veldhoven et al., 2023
5	The ability to collaborate and communicate effectively with colleagues and stakeholders can achieve sustainability goals in the supply chain.	
6	We must continuously learn and upskill themselves to keep up with the evolving digital landscape in supply chain management.	
7	Organization must provide training and courses to improve employees' knowledge of new technologies.	

Table 3.6: Sustainable Supply Chain Performance

No	Items	Source
	Sustainable Supply Chain Performance	
1	Our organization actively integrates sustainability practices into supply chain operations.	Laura V. Lerman et al., 2022
2	Our organization collaborates with suppliers to ensure responsible sourcing and ethical practices.	
3	Our organization engage with local communities and stakeholders to address social and environmental concerns.	
4	Our actively seek opportunities for innovation and improvement in sustainable supply chain practices.	
5	Our organization strives to minimize waste and optimize resource utilization in supply chain.	

No	Items	Source
	Sustainable Supply Chain Performance	
6	Our organization's sustainable supply chain practices have resulted in reduced environmental impact (e.g., energy use, waste generation) while maintaining operational efficiency.	Laura V. Lerman et al., 2022
7	The implementation of digital transformation has positively influenced our sustainable supply chain performance.	

3.4.4 Scaling

Researcher will use scaling techniques to measure and quantify respondents' perceptions, attitudes, and opinions about the effect of digital transformation on sustainable supply chain performance. Likert scale will be used in questionnaire to measures the degree to which responder agree or disagree with a statement (Mark Bounthavong, 2019). In addition, a binary scale will be used because it is a simple form of measurement that requires respondents to choose between two mutually exclusive options (Abby Wilson, 2023). Binary scale questions are effective where a simple "yes" or "no" response can adequately capture the perspective or position of the respondent.

Likert Scale

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

Figure 3.2: Likert Scale

3.4.5 Data Analysis

Data analysis in this research will use Statistical Package for the Social Sciences (SPSS), which is a statistical analysis software. It allows researchers to perform various statistical tests, generate descriptive statistics, and create charts and graphs to visualize the results. By using SPSS, researcher can calculate descriptive statistics such as means, medians, standard deviations, and frequencies and examine the distribution and variability of variables related to digital transformation and sustainable supply chain performance. SPSS provides a user-friendly interface that facilitates the analysis of social science data, enabling researchers to perform various statistical analyzes and generate meaningful insights (Kate William, 2022).

3.5 Data Collection Methods

Data collection method refers to the techniques or methods used to collect information or data for research purposes (Pritha Bhandari, 2020). Some common data collection methods include surveys, interviews, observations, experiments, focus groups, and document analysis. They also can be quantitative or qualitative methods. Quantitative data refers to information that is expressed in numbers or numerical values through numbers and graphs. While, qualitative data is data that is expressed in words or descriptive information rather than numerical values through methods such as interviews, observations. In this research, researcher use primary data which is quantitative method and secondary data which data collect from online research report.

3.5.1 Primary Data

Primary data for this research refer to data that is collected directly from the SME warehouses through questionnaire that was distributed on Google Form, enabling a comprehensive analysis of the effect of digital transformation on sustainable supply chain performance. These questionnaires were filed in by 140 employees from SME warehouses. Researchers can collect specific information directly related to research goals and to adapt data collection methods to meet research needs. The questionnaire which are include open-ended and close-ended questions that help researcher do the analysis from predefined answer from responders.

3.5.2 Secondary Data

Secondary data refers to pre-existing data that has been collected by other sources or organizations for purposes other than the current study (Sulbha Wagh, 2023). In this research, researcher may collect data from industry reports and publications which may include research reports and publications from industry associations, consulting firms, and research institutes that provide valuable insights into the impact of digital transformation on SME warehouses supply chain performance and sustainability. These sources may contain data on trends, best practices, case studies, and performance benchmarks. Besides, government agencies often collect and publish data related to industries and economic sectors. For this research, relevant data may include information on SMEs, supply chain management, warehouse digitization adoption, and sustainability initiatives. As a result, researchers can find information from relevant government sources, including statistical agencies, trade ministries, and environmental agencies.

3.5.3 Independent Variables

The independent variable is the variable that is controlled or manipulated by the researcher and is believed to have an impact on the dependent variable. By manipulating the independent variable, researchers can examine how changes in it affect the dependent variable and establish causality. In this research, the independent variable which is effect of digital transformation. There are four effect that include in independent variable which are smart technologies, eco-innovation, organizational culture and workforce skills. Therefore, researcher will examine the relationship between digital transformation and sustainable supply chain performance.

3.5.3.1 Smart Technologies

Smart technologies encompass a variety of innovative digital tools and systems that leverage advanced capabilities including blockchain, Internet of Things (IoT), automation and robotics and others. These technologies aim to optimize operations, enhance decision-making, and improve overall supply chain performance. Moreover, smart technologies play a vital role in enabling and promoting sustainable practices within the context of sustainable supply chain performance of SME warehouses. These technologies provide opportunities to collect and do the analysis for large volumes data, monitor and control processes in real time, and offer actionable insights for optimizing resource utilization, reducing waste, and minimizing environmental impact. By utilizing smart technologies, SME warehouses can improve operational efficiency, enhance sustainability performance, and gain a competitive advantage in the market (Md Eshrat E. Alahi, 2023).

3.5.3.2 Eco-Innovation

Eco-innovation places a strong emphasis on incorporating environmental protection into innovation efforts, reducing businesses' carbon footprints, and fostering sustainable development through redesign and ongoing product, process, and management improvement (Larbi-Siaw et al., 2022). To measure the extent of eco-innovation within an organization, researchers often develop structures or indicators to capture different aspects of eco-innovation, such as the adoption of green technologies, the implementation of environmentally friendly practices, or the development of sustainable products and services (Magdalena Pichlak et al, 2021). These structures help to assess and assess the level of eco-innovation within a company and its impact on environmental sustainability outcomes. In summary, eco-innovation represents a shift towards more sustainable and environmentally conscious innovation practices.

3.5.3.3 Organizational Culture

Organizational culture refers to the shared values, opinions, standards, and behaviors that shape the collective identity and social environment within an organization (Rasak Bamidele, 2022). Moreover, organizational culture plays a key role in influencing how digital transformation initiatives and sustainability practices are implemented and integrated in warehouse environments. The organizational culture of SME warehouses can either facilitate or hinder the successful adoption and implementation of digital transformation strategies and sustainability initiatives. It is vital to look at the current organizational culture to comprehend how the digital revolution affects the sustainable supply chain performance of SME warehouses. For example, this comprises elements like employee attitudes towards change, the presence of a learning culture, communication and cooperation practices, and employee empowerment levels.

Besides, leadership support for digital transformation and sustainability is also included (Brigid Trenerry et al, 2021). For instance, successful digital transformation efforts and sustainability practices are more likely to succeed in organizations with a strong and positive culture that values innovation, sustainability, and continual improvement. In conclusion, organizational culture is a framework that has a big impact on how well SME warehouses implement sustainability and digital transformation strategies. This is because, it affects employee attitudes, behavior and the overall adoption and integration of these initiatives.

3.5.3.4 Workforce Skills

Workforce skills refer to the competencies, knowledge, and capabilities of employees that are essential for successfully navigating and leveraging digital transformation initiatives within the warehouse setting (Becky Trevino, 2022). These skills are critical to adapting to technological advancements, implementing sustainable practices, and optimizing supply chain performance. For instance, digital transformation involves integrating digital technologies, including artificial intelligence, blockchain, automation and robotics, and Internet of Things (IoT), into various aspects of warehouse operations. Therefore, the workforce must possess a set of skills that enable them to effectively utilize and leverage these technologies and it show a significant relationship with sustainable supply chain performance (Sharat Chandra Jha, 2023).

3.5.4 Dependent Variables

The dependent variable is the one that is affected as a result of the independent variable's manipulation., which researcher intentionally manipulates or controls in the research. Researcher analyze the relationship between an independent variable and a dependent variable to understand cause-and-effect of an independent variable on a dependent variable (Pritha Bhandari, 2022). In this research, researcher found that sustainable supply chain performance of SME warehouses is influenced by digital transformation.

3.5.4.1 Sustainable Supply Chain Performance

Sustainable supply chain performance refers to measuring and assessing the results of integrating sustainability practices into the supply chain operations of SME warehouses. It assesses the extent to which digital transformation initiatives contribute to sustainable outcomes in terms of reduced environmental impact, social responsibility, and economic efficiency. In SME warehouses, sustainable supply chain performance requires the adoption of practices and strategies that optimize resource utilization, reduce waste, promote ethical sourcing, and make a positive contribution to the communities in which they operate (Anup Kumar et al, 2023).

3.6 Reliability and Validity

Reliability refers to the extent to which research results can be consistently and accurately reproduced. Besides, researchers often use standardized measurement tools and techniques to ensure reliability. They may also conduct pilot studies to test the reliability of their methods before implementing them on a larger scale. Additionally, appropriate statistical techniques are employed to minimize errors and enhance the reliability of the research findings. While, validity means how accurately a study measures or checks what it intends to measure (Mcleod, S., PhD., 2023). In this research, it is important to help researcher to ensure that the study design, data collection methods, and analysis techniques meet the objectives of investigating the impact of digital transformation on warehouse sustainability and supply chain performance in SME. Validity can be enhanced through the use of valid and reliable measurement tools, proper sample selection, and ensuring generalizability of findings. This research uses Cronbach's Alpha with values range between 0-1.0 to determine the internal consistency of tools by determining the closeness, or correlation, between items in a set. Values above 0.6 are accepted, while when values below 0.6 are obtained the question will be removed (Liza Wikarsa & Apriandy Angdresey, 2021).

Table 3.7: Range Values of Cronbach's Alpha

Sources: Liza Wikarsa & Apriandy Angdresey (2021)

Cronbach's Alpa Coefficient Range	**Strength of Association**
$\alpha \geqslant 0.9$	Excellent
$0.7 \leqslant \alpha < 0.9$	Good
$0.6 \leqslant \alpha < 0.7$	Acceptable
$0.5 \leqslant \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

3.7 Pilot Study

A pilot study is small-scale research conducted by researchers to help them plan and determine the best way to carry out a larger research project (Ashley Crossman, 2019). For this research, a pilot study will involve selecting a small sample of SME warehouses and testing data collection tools such as questionnaires. The data collected will be analyzed to assess the validity of the research methodology. This helps to identify any problems or areas for improvement before the main study. By conducting pilot studies, researchers can ensure that their studies are reliable and valid, leading to more accurate results.

3.8 Research Location

A research location is a specific location or setting in which research is conducted. In this research, will be conducted in Triang, Pahang, Malaysia. This particular location was chosen as it provides an opportunity to examine the impact of digital transformation on sustainability and supply chain performance within the context of warehouses' operations. By focusing on this specific SME warehouses, the research aims to gain insights into the relationship between digital transformation initiatives, sustainability practices, and supply chain performance in the logistics industry.

3.9 Population and Sampling

The research object will include SME warehouses that have implemented digital transformation programs and are involved in supply chain activities. Specifically, SME warehouses in various industries, including but not limited to manufacturing,

logistics, and retail, that have integrated digital technologies into their operations. While, sampling is the process of selecting a subset of the population to respondent in research. Sampling methods depend on research objectives, available resources, and feasibility considerations (McCombes, S., 2023).

3.9.1 Sample Techniques

For research, simple random sampling techniques may be considered to select a sample of SME warehouses. This method, which only includes one random selection and only a little amount of demographic knowledge, is the easiest of all probability sampling techniques (McCombes, S., 2023). The technique involves randomly selecting groups of interest from the SME repository. Everyone in the population has an equal chance of being included in the sample. This approach ensures a fair representation of the population.

3.9.2 Sample Selection

For the research "The Impact of Digital Transformation on Sustainable Supply Chain Performance of SME Warehouses", SME warehouses in Triang, Pahang, will be selected as the sample warehouse. This selection was based on its relevance to the research topic and the opportunity to examine the impact of digital transformation on sustainability and supply chain performance in the context of operations. By focusing on this specific SME warehouses, researcher can gain valuable insights into the relationship between digital transformation, sustainable practices, and supply chain performance in the furniture industry. Based on the Krejcie and Morgan (1970) table

of determining sample size of a known population, the researchers calculated a sample size of 140 out of 220 employees in SME Warehouses. As a result, more than 140 employees such as managers, executives, and others involved in supply chain production were selected as respondents for this research.

Table 3.8: Determining Sample Size of a Known Population

Source: Krejcie & Morgan (1970)

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368
140	103	700	248	10000	370
150	108	750	254	15000	375
160	113	800	260	20000	377
170	118	850	265	30000	379
180	123	900	269	40000	380
190	127	950	274	50000	381
200	132	1000	278	75000	382
210	136	1100	285	1000000	384

Note.—*N* is population size.
S is sample size.

3.10 Approach and Structure of Data Analysis

In this research, researcher use this software, which is Statistical Package for Social Science (SPSS to analyze the collected data. These software tools provide valuable functionality that facilitates the analysis of data obtained from administered questionnaires. By using SPSS, researchers can simplify the data analysis process and gain valuable insights into the relationship between digital transformation and sustainable supply chain performance. These software tools enable efficient data

management, statistical calculations, and graphical presentation, thereby enhancing researchers' ability to draw meaningful conclusions and make informed decisions based on analyzed data.

3.10.1 Statistical Package for Social Science (SPSS)

In this research, researcher will use Statistical Package for Social Sciences (SPSS) version 29, which is a widely used statistical analysis software tool in social science research to do the data analysis. SPSS provides a range of functions and functions that can be used for data analysis and interpretation (William, K., 2022). Researchers will import data from each respondent's questionnaire to calculate descriptive statistics such as means and frequencies, perform tests to discover relationships and differences between the data, create visual representations of the data through graphs and charts, and perform regression analysis to predict outcomes. SPSS produces output files containing the results of the analysis that researchers can use to interpret and report findings.

The relationship between the independent variables and dependent variable can be identified by using the SPSS tool as it can do several shorts of analysis like ANOVA, multiple regression analysis and others (Wagner, 2019). The data will be acquired by Google Form then will be transferred to SPSS for further analysis and results generation. Overall, SPSS provides researchers with the tools to analyze and understand data collected for research.

3.10.2 Pearson's Correlation Analysis

Pearson's correlation analysis is to examine the relationship between independent and dependent variables in the dataset. Besides, the Pearson's correlation coefficient is also an inferential statistic, which means it can be used to test statistical hypotheses. It represented by the symbol "r" and ranges from -1 to 1, positive values indicate a positive linear relationship (when one variable increases, the other variable tends to increase), negative values indicate a negative linear relationship (when one variable increases, the other variable tends to increase) variables tend to increase). Others tend to decrease). A coefficient of 0 indicates that there is no linear relationship (Saunder et al., 2019). Figure 3.10.2 below showed the range of Pearson Correlation Coefficients.

cient Values	Correlation	efficient Values	
0.80 to 1.00	Very Strong Positive	-1.00 to -0.80	Very Strong Negative
0.60 to 0.79	Strong Positive	-0.79 to -0.60	Strong Negative
0.40 to 0.59	Moderate Positive	-0.59 to -0.40	Moderate Negative
0.20 to 0.39	Weak Positive	-0.39 to -0.20	Weak Negative
0.00 to 0.19	Very Weak Positive	-0.19 to -0.01	Very Weak Negative

Figure 3.3: Range of Pearson's Correlation Coefficients

Source: Nitesh et al., 2023

3.10.3 Spearman's Rank Correlation Test

Spearman's rank correlation determines the degree and direction of the relationship between independent and dependent variables. It basically provides the repetitiveness metric for the relationship between two variables (Aryan Gupta, 2023). Spearman's correlation coefficient ranges from -1 to 1, with values close to 1 indicating that the

two variables are similarly ordered and values close to -1 indicating that the two variables are not similarly ordered (Hwang Bon-Gang, 2018).

3.10.4 Linear Regression Analysis

Linear regression analysis is used to predict the value of one variable based on the value of another variable. Besides, linear regression analysis is a statistical method used to model the relationship between a dependent variable and one or more independent variables by fitting a linear equation to observed data. The goal is to find the best-fit line that minimizes the difference between the predicted and actual values of the dependent variable (Vijay Kanade, 2023).

3.11 Summary

In summary, this chapter has been providing the research design for this tittle. The method that uses to collect data through quantitative survey which give survey questionnaire by Google form to the respondents. In each questionnaire will include open-ended questions and close-ended questions and also have Likert scale and binary scale for the options. The researcher uses cross-sectional study and predict that this report will be completed in 8-10 months and the research location will focus on Triang, Pahang. After collecting the data, the researchers determine to use SPSS for data analysis.

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 Introduction

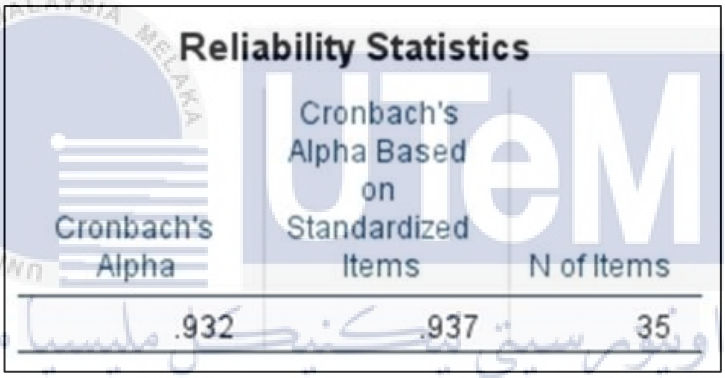
In this chapter, researcher will provide the results of data analysis from the data collection. Researcher collect the data by distributed questionnaires to the respondents such as manager, executive, supervisor, and general workers who are working in SME Warehouses via Google Forms. After the data has been collected from respondents by questionnaires, researcher will use IBM Statistical Package for the Social Science (SPSS) software version 29.0 to analyze data collected from the target respondents in this study. Besides, this chapter also included descriptive statistics, reliability, and normal tests to determine the relationship between dependent variable and independent variable. Pearson's correlation coefficient (parametric test) will be used when the data is normally distributed, while Spearman's rank correlation will be used when the data is unevenly distributed, as well as using linear regression analysis.

4.2 Pilot Test

The pilot test was conducted before the data collection process and distribution of the questionnaire to reach target respondents. The purpose of conducting a pilot test is to ensure that the validity of questionnaire is achieved, check the feasibility, clarity and appropriateness of the instruments and methods and to identify and resolve any practical or technical issues that may arise (Nurul Imtiaz Abd Gani et al, 2020). Therefore, there are 30 respondents who have working in SME warehouses were chosen to conduct the pilot test.

Table 4.1: Reliability Statistics (Pilot Test)

Source: SPSS Output



Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.932	.937	35

The reliability statistics indicate a high internal consistency for the measurement instrument. Based on the table 4.1 above, it shows the Cronbach's Alpha of 0.932 suggest a strong level of reliability, which is higher than the accepted threshold of 0.7. Additionally, the Cronbach's Alpha based on standardized items, which is 0.937 indicate strong consistency among the questions. There are 35 items are included in the questionnaire, and none of the 30 respondents had missing data. The reliability coefficients reflect a reliable and consistent measure of the construct under the investigation.

4.3 Descriptive Statistics on Demographic Background

The descriptive statistics for demographic background reveal insights into the respondent's profile. In this research, there are six categories included in questionnaires which are gender, year of experience, position in the organization, engagement in digital transformation initiatives, frequency of implementation and rating for the organization's operation. The data was collected from the target respondents and there has a total of 140 respondents via Google Forms.

4.3. Respondent's Gender

Table 4.2: Gender of Respondents

Source: SPSS Output

1. Respondent's gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Female	55	39.3	39.3	39.3
	Male	85	60.7	60.7	100.0
	Total	140	100.0	100.0	

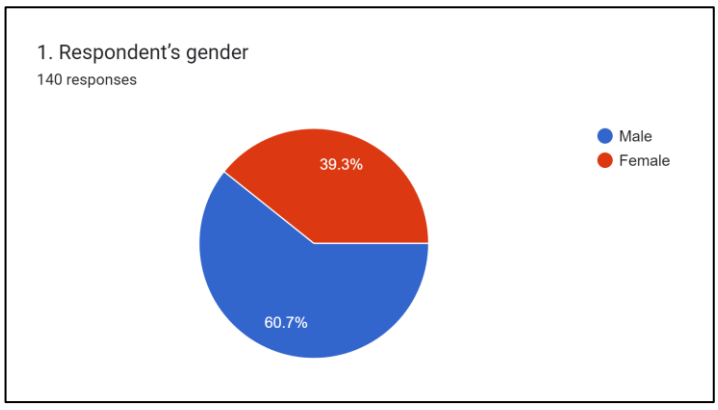


Figure 4.1: Respondent's Gender Pie Chart

Source: SPSS Output

Based on table 4.2 above, out of the 140 respondents, 85 respondents (60.7%) identified as male, while 55 respondents (39.3%) identified as female. In this study, the higher representation of male can be attributed to the nature of respondent's workplace primarily in a warehouse setting.

4.3.2 Year of Experience in Warehouse Industry

Table 4.3: Year of Experience in Warehouse Industry

Source: SPSS Output

2. Year of Experience in warehouse industry

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-3 years	34	24.3	24.3	24.3
	4-10 years	45	32.1	32.1	56.4
	Less than 1 year	25	17.9	17.9	74.3
	More than 10 years	36	25.7	25.7	100.0
	Total	140	100.0	100.0	

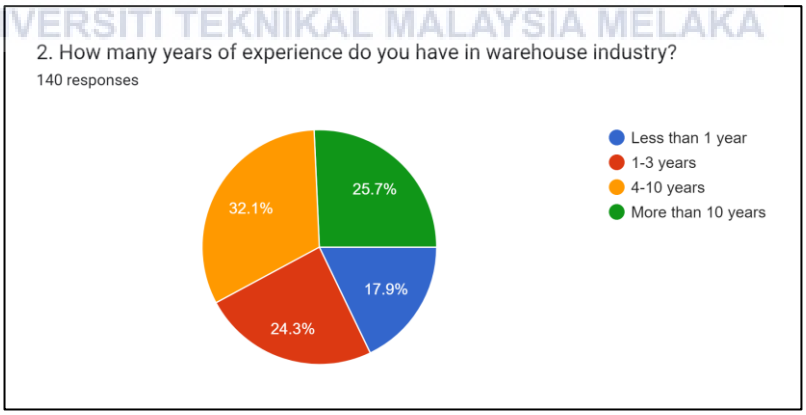


Figure 4.2: Year of Experience in Warehouse Industry Pie Chart

Source: SPSS Output

Table 4.3 shows the year of experience range in warehouse industry of respondents that divided into 4 categories which are less than 1 year, 1 to 3 years, 4 to 10 years and more than 10 years. Among the 40 respondents in this study, there are 25 respondents

(17.90%) were working in warehouse industry less than 1 year, 34 respondents (24.4%) have 1 to 3 years of experience, 45 respondents (32.1%) have 4-10 years of experience, and 36 respondents (25.7%) have working in warehouse industry more than 10 years. Therefore, the majority of respondents to this survey were between the year of 4 to 10 years of experience.

4.3.3 Position in the Organization

Table 4.4: Position in the Organization

Source: SPSS Output

3. Position in the organization

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Executive	8	5.7	5.7	5.7
	General worker	111	79.3	79.3	85.0
	Manager	10	7.1	7.1	92.1
	Supervisor	11	7.9	7.9	100.0
	Total	140	100.0	100.0	

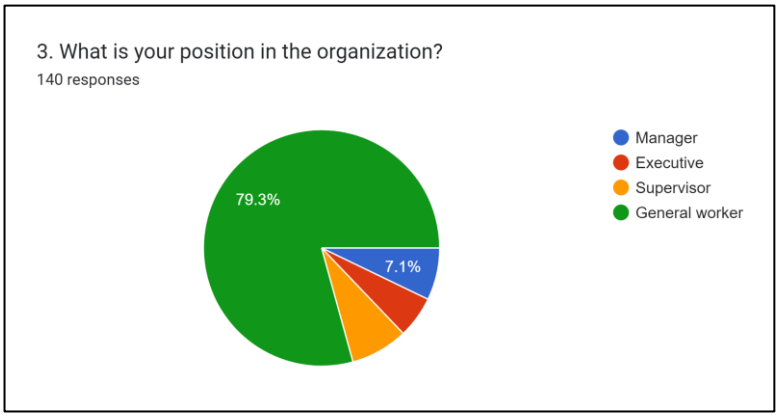


Figure 4.3: Position in the Organization Pie Chart

Source: SPSS Output

The table 4.4 show the position of 140 respondents. The most position is general worker which is 111 respondents (79.3%). The next followed is supervisor which is 11 respondents (7.9%), Manager is 10 respondents (7.1%) and executive is only 8 respondents (5.7%). General workers play a role in measuring and improving supply chain performance. While they may not be directly responsible for designing or managing the entire supply chain, their contributions may influence various aspects of its performance. For example, how efficiently they handle inventory, order fulfilment, and timely processing tasks can directly impact metrics such as order accuracy, on-time delivery, and inventory turn. According to a study published in the International Journal of Production Economics, the successful implementation of a supply chain strategy requires the collaboration of all employees, regardless of their specific role. This emphasizes the importance of general workers in achieving supply chain goals. By consistently achieving operational goals and adhering to established processes, rank-and-file workers can contribute to the overall efficiency of the supply chain. Companies that recognize the importance of employees in supply chain performance measurement often implement training programs and provide incentives to encourage employees to participate in continuous improvement programs. This way, even general roles can be actively involved in improving the efficiency and effectiveness of the entire supply chain (Khalil et al., 2019).

4.3.4 Digital Transformation Adoption in SME Warehouses

Table 4.5: Digital Transformation Adoption in SME Warehouses

Source: SPSS Output

4. SME warehouse implemented any digital transformation initiatives

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	1	.7	.7	.7
	Yes	139	99.3	99.3	100.0
	Total	140	100.0	100.0	

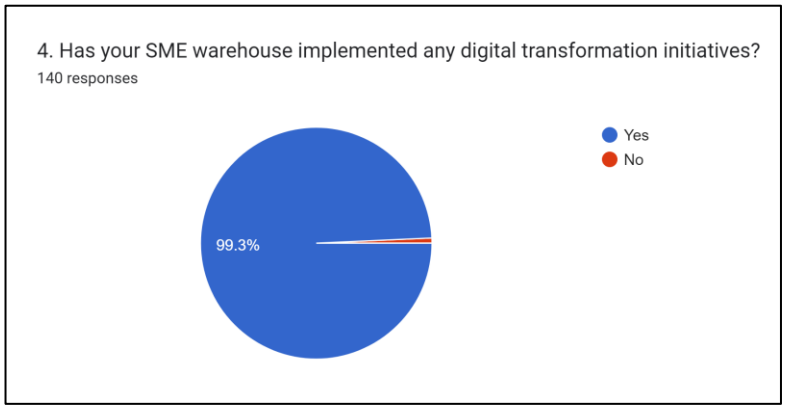


Figure 4.4: Digital Transformation Adoption in SME Warehouses Pie Chart

Source: SPSS Output

Table 4.5 shows the implemented of any digital transformation initiatives by SME warehouse. Based on the result, out of the 140 respondents, there are 139 respondents (99.3%) choose "yes" and 1 respondent choose "no".

4.3.5 Digital Transformation Scale for Warehouse Implementation (1 to 5)

Table 4.6: Digital Transformation Scale for Warehouse Implementation (1 to 5)

Source: SPSS Output

5. Please indicate the extent of digital transformation implementation in your warehouse on a scale of 1 to 5, with 1 being "Not at all implemented" and 5 being "Fully implemented."

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	3	2	1.4	1.4	1.4
	4	9	6.4	6.4	7.9
	5	129	92.1	92.1	100.0
	Total	140	100.0	100.0	

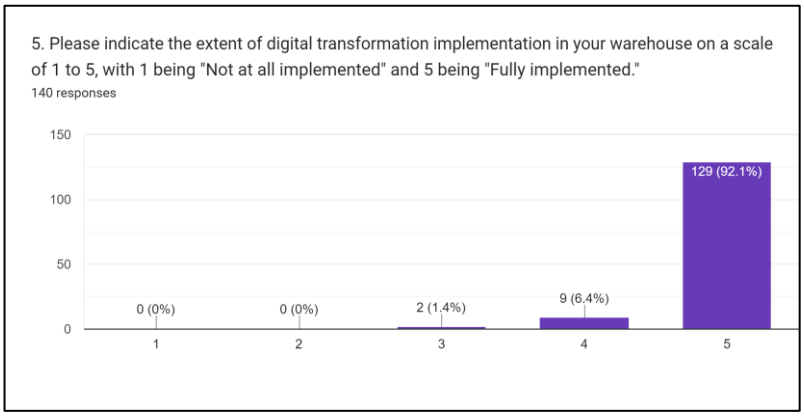


Figure 4.5: Digital Transformation Scale for Warehouse Implementation (1 to 5) Bar Chart

Source: SPSS Output

In this study, there are 129 respondents which is 92.1% indicate the extent of digital transformation implementation in their warehouse on "5" which is fully implemented. Additionally, 9 respondents (6.4%) indicate "4" and the only 2 respondents (1.4%) indicate "3".

4.3.6 Organizational Performance Assessment

Table 4.7: Organizational Performance Assessment

Source: SPSS Output

6. Rating for organization's operation in the past year

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	High	139	99.3	99.3	99.3
	Moderate	1	.7	.7	100.0
	Total	140	100.0	100.0	

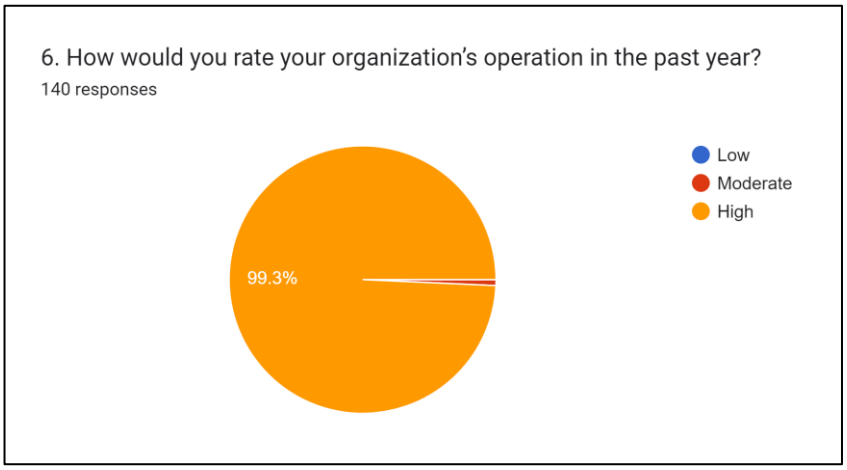


Figure 4.6: Organizational Performance Assessment Pie Chart

Source: SPSS Output

Table 4.7 show the rating from respondents to their organization's operation in the past year. Among the 140 respondents, there are 139 respondents rate for their organization on "high" rating, while only 1 respondents' rate for "moderate" for their organization's operation in the past year.

4.4 Descriptive Statistics on Independent Variables and Dependent Variable

In this research, the descriptive analysis is used to analyse the independent and dependent variables which were smart technologies (IV1), eco-innovation (IV2), organizational culture (IV3), workforce skill (IV4), and sustainable supply chain performance (DV). The central tendency measurement was conducted. The mean, medium, and mode of variables is identified by descriptive analysis.

Table 4.8: Descriptive Statistics on Independent Variables and Dependent Variable

Source: SPSS Output

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
IV1	140	3.29	5.00	4.6888	.41527
IV2	140	3.00	5.00	4.6633	.43724
IV3	140	3.00	5.00	4.7184	.44287
IV4	140	3.00	5.00	4.7551	.37905
DV	140	3.00	5.00	4.7158	.39315
Valid N (listwise)	140				

Table 4.8 above indicated the descriptive statistics of four independents variables including smart technologies (IV1), eco-innovation (IV2), organizational culture (IV3), workforce skills (IV4), and the dependent variable which is sustainable supply chain performance (DV). Among the independent and dependent variables, the mean value of smart technologies (IV1), eco-innovation (IV2), organizational culture (IV3), workforce skills (IV4), and sustainable supply chain performance (DV) is 4.6888, 4.6633, 4.7184, 4.7551, and 4.7158 respectively. Since their mean value is close to 4, it means that most of respondents strongly agree smart technologies, eco-innovation, organizational culture, and workforce skills as the factor affecting in sustainable supply chain performance. Moreover, the workforce skills variable has the highest mean value, while the eco-innovation has the lowest mean value among the variables.

Furthermore, the highest standard deviation of the variable is organizational culture (IV3) which is 0.44287, followed by eco-innovation (IV2), smart technologies (IV1), sustainable supply chain performance (DV), and workforce skills. However, the data in the workforce skills (IV4) is the most spread out form the mean compared to other variables. This is because, workforce skills like digital literacy, technology adaptability, data analysis and interpretation, collaboration and communication, and problem-solving and critical thinking skills are critical for employees to successfully navigate the challenges and opportunities of digital transformation and contribute to sustainable development outcomes. Therefore, organization must understand the importance of these skills can help SME warehouses identify training and development needs, foster a culture of continuous learning, and ensure employees are able to effectively utilize digital technologies and contribute to sustainable supply chain

performance (Saurabh Singh, 2023). While, the eco-innovation (IV2) variable has the lowest mean value which is 4.6633. Lastly, the minimum and maximum values of all independent variables and dependent variable are 1.00 and 5.00 respectively.

4.5 Reliability Analysis

Reliability analysis is a crucial step in assessing the consistency and accuracy of a set of measurement scales. In this study, researcher calculated Cronbach's Alpha for both the original and standardized items. Cronbach's alpha value above 0.7 are generally considered acceptable.

Table 4.9: Case Processing Summary

Source: SPSS Output

Case Processing Summary

		N	%
Cases	Valid	135	96.4
	Excluded[a]	5	3.6
	Total	140	100.0

a. Listwise deletion based on all variables in the procedure.

Table 4.10: Reliability Test

Source: SPSS Output

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.957	.960	35

According to table 4.10 above, the analysis of the data shows that this research's questionnaire is very reliable. The Cronbach's Alpha use in this research shows the result to be 0.957, which is a high score. This means that the questions, including 6 demographic details, 28 independent variable questions, and 7 dependent variable questions, are all measuring things in a consistent way. Besides, the value of the Cronbrach's Alpha based on standardized items is 0.960, showing even more consistency. Total number of sample data collected is 140 samples, and there is no missing data. This all means that the questionnaire is solid and dependable.

4.6 Person's Correlation Coefficients Analysis

Pearson's correlation analysis is to examine the relationship between independent and dependent variables in the dataset. The result revealed several noteworthy associations. The independent variables in this research are smart technologies (IV1)), eco-innovation (IV2), organizational culture (IV3), workforce skills (IV4), while the dependent variable is sustainable supply chain performance (DV).

Table 4.12: Person's Correlation Test

Source: SPSS Output

Correlations

		IV1	IV2	IV3	IV4	DV
IV1	Pearson Correlation	1	.504**	.563**	.624**	.459**
	Sig. (2-tailed)		<.001	<.001	<.001	<.001
	N	140	140	140	140	140
IV2	Pearson Correlation	.504**	1	.749**	.698**	.627**
	Sig. (2-tailed)	<.001		<.001	<.001	<.001
	N	140	140	140	140	140
IV3	Pearson Correlation	.563**	.749**	1	.702**	.631**
	Sig. (2-tailed)	<.001	<.001		<.001	<.001
	N	140	140	140	140	140
IV4	Pearson Correlation	.624**	.698**	.702**	1	.629**
	Sig. (2-tailed)	<.001	<.001	<.001		<.001
	N	140	140	140	140	140
DV	Pearson Correlation	.459**	.627**	.631**	.629**	1
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	
	N	140	140	140	140	140

**. Correlation is significant at the 0.01 level (2-tailed).

Firstly, the Pearson's correlation coefficient for smart technologies (IV1) on sustainable supply chain performance (DV) is 0.459. It indicates that there is a weak linear relationship between the two variables. However, this relationship is statistically meaningful at a very high confidence level ($p < 0.001$ for both perceptions). While the correlation is considered weak, but this statistical significance increases confidence that is a true linear relationship between smart technologies adoption and sustainable supply chain performance.

Second, the connection between eco-innovation (IV2) and sustainable supply chain performance (DV) is relatively strong, with Pearson's correlation coefficient of 0.627. Importantly, this relationship is statistically significant at a very high confidence level ($p < 0.001$ for both perceptions). Hence, when eco-innovation (IV2) increase, the effect of digital transformation on sustainable supply chain performance will increase.

Thirdly, the relationship between organizational culture (IV3) and sustainable supply chain performance (DV) is notably strong, with a Pearson's correlation coefficient of 0.631. This correlation is statistically significant at the 0.01 level (2-tailed), demonstrating a high level of confidence in the result ($p < 0.001$ for both perceptions). These results highlight the potential impact of organizational culture on promoting sustainability within the supply chain performance.

Finally, the correlation between workforce skills (IV4) and sustainable supply chain performance (DV) is notably strong, with a Pearson's correlation coefficient of 0.629. This correlation is statistically significant at the 0.01 level (2-tailed), signifying a high level of confidence in the findings ($p < 0.001$ for both perceptions). These results suggest a positive substantial linear relationship between the workforce skills and sustainable supply chain performance.

4.7 Spearman's Rank Correlation Analysis

Spearman's rank correlation determines the degree and direction of the relationship between independent and dependent variables. It basically provides the repetitiveness metric for the relationship between two variables (Aryan Gupta, 2023). Spearman's correlation coefficient ranges from -1 to 1, with values close to 1 indicating that the two variables are similarly ordered and values close to -1 indicating that the two variables are not similarly ordered (Hwang Bon-Gang, 2018). The independent variables in this research are smart technologies (IV1), eco-innovation (IV2), organizational culture (IV3), workforce skills (IV4), while the dependent variable is sustainable supply chain performance (DV).

Table 4.13: Spearman Rank Correlation Test

Source: SPSS Output

Correlations

			IV1	IV2	IV3	IV4	DV
Spearman's rho	IV1	Correlation Coefficient	1.000	.492**	.607**	.597**	.515**
		Sig. (2-tailed)	.	<.001	<.001	<.001	<.001
		N	140	140	140	140	140
	IV2	Correlation Coefficient	.492**	1.000	.573**	.588**	.506**
		Sig. (2-tailed)	<.001	.	<.001	<.001	<.001
		N	140	140	140	140	140
	IV3	Correlation Coefficient	.607**	.573**	1.000	.531**	.500**
		Sig. (2-tailed)	<.001	<.001	.	<.001	<.001
		N	140	140	140	140	140
	IV4	Correlation Coefficient	.597**	.588**	.531**	1.000	.471**
		Sig. (2-tailed)	<.001	<.001	<.001	.	<.001
		N	140	140	140	140	140
	DV	Correlation Coefficient	.515**	.506**	.500**	.471**	1.000
		Sig. (2-tailed)	<.001	<.001	<.001	<.001	.
		N	140	140	140	140	140

**. Correlation is significant at the 0.01 level (2-tailed).

According to the table 4.13 above, the spearman rank correlation analysis shows that there is a statistically significant positive relationship between smart technologies (IV1) and sustainable supply chain performance (DV) with a correlation coefficient of 0.515. The correlation was significant at the 0.01 level (two-tailed) and demonstrated the validity of $p < 0.001$ for both perceptions. This indicates a moderate correlation between the variables. Therefore, when smart technologies increase, the effect of digital transformation on sustainable supply chain performance also increases although it not strong.

Next, the correlation coefficient for eco-innovation (IV2) on sustainable supply chain performance (DV) is 0.506. The correlation was significant at the 0.01 level (two-tailed) and demonstrated the validity of $p < 0.001$ for both perceptions. This indicates a moderate correlation between the variables. As a result, when eco-innovation increase, the effect of digital transformation on sustainable supply chain performance also increases although it not strong.

Thirdly, the correlation coefficient for organizational culture (IV3) on sustainable supply chain performance (DV) is 0.5. The correlation was significant at the 0.01 level (two-tailed) and demonstrated the validity of $p < 0.001$ for both perceptions. This indicates a moderate correlation between the variables. Hence, when organizational culture increase, the effect of digital transformation on sustainable supply chain performance also increases although it not strong.

Lastly, the correlation coefficient for workforce skills (IV4) on sustainable supply chain performance (DV) is 0.471. The correlation was significant at the 0.01 level (two-tailed) and demonstrated the validity of $p < 0.001$ for both perceptions. This indicates a moderate correlation between the variables. Hence, when workforce skills increase, the effect of digital transformation on sustainable supply chain performance also increases although it not strong.

4.8 Linear Regression Analysis

Linear regression analysis is a statistical method used to model the relationship between a dependent variable and one or more independent variables by fitting a linear equation to observed data. The regression model included four predictor variables which are smart technologies (IV1), eco-innovation (IV2), organizational culture (IV3), and workforce skills (IV4).

Table 4.14 Model Summary Linear Regression Analysis

Source: SPSS Output

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.699[a]	.489	.474	.28526

a. Predictors: (Constant), IV4, IV1, IV2, IV3

b. Dependent Variable: DV

In this study, researcher used a linear regression analysis to understand how different factors (IV1, IV2, IV3, IV4) collectively relate to the main outcome (DV). According to the table 4.14 above, the model's overall fit is good, with a R value of 0.699. This means there is a positive relationship between the variables. Besides, the R Square value of 0.489 indicating that about 48.9% of the change in the main outcome (sustainable supply chain performance) can be explained by the combination of these factors (IV1, IV2, IV3, IV4). This suggests a moderate to strong level of predictability. Therefore, the independent variables have a significant impact in the dependent variables.

Table 4.15: ANOVA

Source: SPSS Output

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.499	4	2.625	32.256	<.001[b]
	Residual	10.985	135	.081		
	Total	21.484	139			

a. Dependent Variable: DV

b. Predictors: (Constant), IV4, IV1, IV2, IV3

Analysis of Variance (ANOVA) is to assess the differences among groups. According to the table 4.15 above, the F-test value was found to be 32.256, and this value is associated with a significant level of 0.000, which is lower than the commonly used threshold of 0.05. This indicates a statistically significant different among the variables being compared. Instead, the null hypothesis is rejected based on the regression analysis because the significance level (p-value) of the model is less than 0.05.

Table 4.16: Coefficients of Linear Regression Analysis

Source: SPSS Output

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	1.215	.327		3.712	<.001
	IV1	.031	.077	.032	.399	<.001
	IV2	.215	.090	.239	2.400	<.001
	IV3	.217	.091	.244	2.391	<.001
	IV4	.280	.103	.270	2.708	<.001

a. Dependent Variable: DV

Based on the table 4.16 above, the coefficients of linear regression analysis model are to understand the individual contributions of each independent variables to the dependent variables. The significance value indicated the level of confidence in each variable's impact. Firstly, the significant value of all variables is less than 0.05, so it considered that there is a significant relationship between the independent variables and dependent variable.

Additionally, the Beta coefficients provide insight into the direction and strength of each variable's impact. The Beta coefficients of smart technologies (IV1) is 0.031, suggesting a relatively small positive effect. While, eco-innovation (IV2) and organizational culture (IV3) both have Beta coefficients of 0.215 and 0.217 respectively, indicating moderate positive effects. Lastly, the workforce skills (IV4) have the highest Beta coefficient of 0.280, suggesting a strong positive impact on the dependent variable (sustainable supply chain performance).

4.9 Summary

In summary, the data collected from questionnaire are analyzed by using the SPSS software. The conducted analyses provide valuable insights into the relationships

between independent variables and dependent variable. The Pearson's correlation coefficients reveal that while smart technologies show a weak but statistically significant correlation, eco-innovation, organizational culture, and workforce sills exhibit strong and highly significant correlations with sustainable supply chain performance. The linear regression analysis strengthens these findings, indicating on overall good fit of the model with moderate to strong predictability. Additionally, the ANOVA test underscores the presence of significant differences among the groups being compared. Coefficients highlight the unique contributions of each variable, with eco-innovation, organizational culture, and workforce skills demonstrating particularly strong influences. These results collectively suggest that a combination of these variables plays a crucial role in shaping an improving sustainable supply chain performance. After the analysis, the results of the data analysis will help the researcher to continue the subsequent chapters and discuss the interpretation and discussion of the results, limitations, and recommendations for overall study.

CHAPTER 5

DICUSSION AND CONCLUSION

5.1 Introduction

In this chapter, the researcher will discuss the results from the collected data and provide the conclusion about all the study. This chapter aims to connect the statistical results with the theoretical framework and research objectives, offering a comprehensive analysis of the observed patterns and relationships. Besides, the discussion of research hypotheses and the discussion of the research objectives are based on the results generated by SPSS. Furthermore, this chapter will also address the limitations encountered during the research process and provide some recommendations for future research and the overall conclusions of the study.

5.2 Discussion on Hypothesis

In this study, researcher focused on analyzing the relationship between the independent variables and dependent variable based on hypotheses. The independent variables in this research are smart technologies (IV1), eco-innovation (IV2), organizational culture (IV3), workforce skills (IV4), while the dependent variable is sustainable supply chain performance (DV). There are four hypotheses are generated to identify and study the relationship between the independent variables and dependent variable as follows:

Table 5.1: Hypothesis Testing Result

Source: SPSS Output

	Hypothesis	**Significant Value**	**Result**
H1	There is a significant relationship between smart technologies to sustainable supply chain performance in SME warehouses.	$p < 0.001$ ($p < 0.05$)	Accepted
H2	There is a significant relationship between eco-innovation to sustainable supply chain performance in SME warehouses.	$p < 0.001$ ($p < 0.05$)	Accepted
H3	There is a significant relationship between organizational culture to sustainable supply chain performance in SME warehouses.	$p < 0.001$ ($p < 0.05$)	Accepted
H4	There is a significant relationship between workforce skills to sustainable supply chain performance in SME warehouses.	$p < 0.001$ ($p < 0.05$)	Accepted

5.2.1 Smart Technologies

H1: There is a significant relationship between smart technologies to sustainable supply chain performance in SME warehouses.

Based on the result of correlation test and regression analysis further supports the hypothesis, showing that smart technologies (IV1) have a significant impact on the sustainable supply chain performance (DV). The significant value of independent variable towards the dependent variable is less than 0.5, which is indicating a significant relationship. Thus, the alternative hypothesis (H1) is accepted and these findings highlight the importance of integrating smart technologies to improve the sustainability of supply chain performance in SME warehouses. With the emergence of advanced technologies such as Internet of Things (IoT) devices and data analytics, understanding the potential impact of these smart technologies on sustainability measures is critical for SMEs aiming to optimize supply chain operations. The adoption of smart technologies like blockchain, Industry 4.0 analytical models, and artificial intelligence-driven techniques aims to increase the sustainability of supply chains, especially in environments that are unpredictable (Ipek Kazangcoglu et al, 2022).

5.2.2 Eco-innovation

H2: There is a significant relationship between eco-innovation to sustainable supply chain performance in SME warehouses.

Based on the result of correlation test and regression analysis further supports the hypothesis, showing that eco-innovation (IV2) has a significant impact on the

sustainable supply chain performance (DV). The significant value of independent variable towards the dependent variable is less than 0.5, which is indicating a significant relationship. Thus, the alternative hypothesis (H2) is accepted and these findings highlight the importance of eco-innovation to improve the sustainability of supply chain performance in SME warehouses. The result findings support the hypothesis that sustainable supply chain performance is significantly and positively related to eco-innovation, which consists of five main aspects such as green procurement, eco-design or environmental design, in-house environmental management, co-operation with customers on environmental issues and investment recovery (Liu et al., 2018).

5.2.3 Organizational Culture

H3: There is a significant relationship between organizational culture to sustainable supply chain performance in SME warehouses.

Based on the result of correlation test and regression analysis further supports the hypothesis, showing that organizational culture (IV3) has a significant impact on the sustainable supply chain performance (DV). The significant value of independent variable towards the dependent variable is less than 0.5, which is indicating a significant relationship. Thus, the alternative hypothesis (H3) is accepted and these findings highlight the importance of organizational culture to improve the sustainability of supply chain performance in SME warehouses. According to the Martin et al., 2023, it emphasizes that companies with a dominant organizational culture place great emphasis on developing employees' innovative skills and expanding learning capabilities, thereby improving sustainable supply chain performance. This hypothesis recognizes the role of organizational culture in shaping employee mindsets and behaviors and aims to reveal how a culture that values

sustainability can positively impact overall supply chain performance. The significance of creative problem solving in overcoming sustainability issues. Acquiring innovative talents helps companies to execute sustainable development techniques to address current social and environmental issues and improve sustainability performance by obtaining numerous solutions from employees and supply chain partners. This demonstrates that a company's ability to innovate at a high-level fosters' employee growth and the integration of different ideas and skill sets, which enhances social and environmental performance (Neessen et al., 2021).

5.2.4 Workforce Skills

H4: There is a significant relationship between workforce skills to sustainable supply chain performance in SME warehouses.

Based on the result of correlation test and regression analysis further supports the hypothesis, showing that workforce skills (IV4) have a significant impact on the sustainable supply chain performance (DV). The significant value of independent variable towards the dependent variable is less than 0.5, which is indicating a significant relationship. Thus, the alternative hypothesis (H4) is accepted and these findings highlight the importance of workforce skills to improve the sustainability of supply chain performance in SME warehouses. Since digital transformation requires a skilled workforce capable of driving technological advancements, understanding the impact of workforce skills on sustainability measures is critical for SMEs aiming to realize the full potential of human capital in the context of digitally transformed supply chains. The continuous sharing of complementary resources, capabilities and knowledge in sustainable supply chain collaboration is important for the implementation and improvement of sustainable products and the establishment of sustainable supply chains (Anup Kumar et al., 2023).

5.3 Discussion of Research Objectives

5.3.1 Conclusion of Frist Research Objective

Objective 1: To identify the effect of digital transformation that affect sustainable supply chain performance in SME warehouses.

This study aims to identify the effect of digital transformation on sustainable supply chain performance in SME warehouse. The researcher has suggested the effect of digital transformation from Chapter Two. The independent variables examined are smart technologies, eco-innovation, organizational culture and workforce skills, while the dependent variable is sustainable supply chain performance.

Table 5.2: Descriptive Statistics on Independent Variables and Dependent Variable

Source: SPSS Output

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
IV1	140	3.29	5.00	4.6888	.41527
IV2	140	3.00	5.00	4.6633	.43724
IV3	140	3.00	5.00	4.7184	.44287
IV4	140	3.00	5.00	4.7551	.37905
DV	140	3.00	5.00	4.7158	.39315
Valid N (listwise)	140				

According to the table 5.2 above, the results of this study highlight the interconnections between smart technology adoption, eco-innovation, organizational culture and workforce skills in SME warehouses, and their combined impact on improving sustainable supply chain performance. Supply chain digitization is changing rapidly. In term of smart technologies, the introduction of smart technologies brings multiple benefits to SME warehouses, which cost savings are perhaps the most important. Digital transformation enables them to benefit from additional capabilities.

Besides, researchers found that eco-innovations appear to directly reduce the environmental impact of production in their country of origin and can also positively shape the environmental and sustainability performance of supply chains (Valeria et al., 2019). In the term of organizational culture, organizational culture becomes a key factor, as a supportive and adaptive culture can create an enabling environment for digital transformation initiatives. Organizational culture gives SME warehouses a way to gather original and creative ideas, incorporate sustainability into long-term plans, and create sustainability plans for each department in the company and integrate sustainability into their supply chains. The good influence of this culture and external integration is explained by Espino-Rodríguez and Taha (2022) who note that the principles inherent in this culture also allow supply chain partners to work on new skills and ideas to adopt sustainable development practices.

Moreover, in the term of workforce skills, the importance of workforce skills cannot be overstated, as a skilled and adaptable workforce is critical to navigating the complexities of digital transformation. Employer might hire sustainability experts or implement training and development programs to upskill their internal workforce (Martin et al., 2023).

In summary, according to the resource matching theory, effect of digital transformation such as smart technologies, eco-innovation, organizational culture and workforce skills will affect the sustainable supply chain performance in SME warehouses. Therefore, the objective one is accomplished.

5.3.2 Conclusion of Second Research Objective

Objective 2: To investigate the relationship between the effect of digital transformation and sustainable supply chain performance in SME warehouses.

Table 5.3: Spearman's Rank Correlation Test

Source: SPSS Output

Correlations

			IV1	IV2	IV3	IV4	DV
Spearman's rho	IV1	Correlation Coefficient	1.000	.492**	.607**	.597**	.515**
		Sig. (2-tailed)	.	<.001	<.001	<.001	<.001
		N	140	140	140	140	140
	IV2	Correlation Coefficient	.492**	1.000	.573**	.588**	.506**
		Sig. (2-tailed)	<.001	.	<.001	<.001	<.001
		N	140	140	140	140	140
	IV3	Correlation Coefficient	.607**	.573**	1.000	.531**	.500**
		Sig. (2-tailed)	<.001	<.001	.	<.001	<.001
		N	140	140	140	140	140
	IV4	Correlation Coefficient	.597**	.588**	.531**	1.000	.471**
		Sig. (2-tailed)	<.001	<.001	<.001	.	<.001
		N	140	140	140	140	140
	DV	Correlation Coefficient	.515**	.506**	.500**	.471**	1.000
		Sig. (2-tailed)	<.001	<.001	<.001	<.001	.
		N	140	140	140	140	140

**. Correlation is significant at the 0.01 level (2-tailed).

In this research, researcher has applied Pearson's correlation test and Spearman's rank correlation test to investigate the relationship between the independent variables and dependent variables. However, researcher choose the Spearman's rank correlation test when the data are not normally distributed, involve ordinal or ranked variables, contain outliers, or show a nonlinear relationship. Spearman's rank correlation is a nonparametric test, which makes it more suitable in examining the relationship between the effect of digital transformation and sustainable supply chain performance in SME warehouses, which focusing on four independent variables such as smart technologies (IV1), eco-innovation (IV2), organizational culture (IV3), and workforce skills (IV4).

According to the result of Spearman's rank correlation test above, the analysis shows a statistically significant positive correlation between each independent variable and sustainable supply chain performance. Firstly, smart technology shows a moderate positive correlation (0.515), eco-innovation shows a similar relationship (0.506), organizational culture shows a correlation coefficient of 0.5, and workforce skills have

a correlation coefficient of 0.471. All these correlations are significant at the 0.01 level (two-tailed), with p-values less than 0.5 ($p < 0.00$) for both perceptions. These results indicated that the effect of digital transformation on sustainable supply chain performance increases as smart technologies, eco-innovation, organizational culture, and workforce skills increase, although the relationship is characterized by moderate strong.

5.3.3 Conclusion of Third Research Objective

Objective 3: To determine the effect of digital transformation that has the greater relationship on sustainable supply chain performance in SME warehouses.

Table 5.4: Coefficients of Linear Regression Analysis

Source: SPSS Output

Variables	Standardized Coefficients Beta	Significance Level
Smart Technologies	0.032	< 0.001
Eco-innovation	0.239	< 0.001
Organizational Culture	0.244	< 0.001
Workforce Skills	0.270	< 0.001

The objective of this research is aimed to determine which effect of digital transformation that has the greater relationship on sustainable supply chain performance in SME warehouses. Linear regression analysis provides insights into the relationship between the independent variables which are smart technologies, eco-innovation, organizational culture and workforce skills and the dependent variable, sustainable supply chain performance.

The standardized coefficient beta shows the strength and direction of these relationships. Based on the result of multiple regression analysis, the coefficients beta of workforce skills has the highest value with 0.270, followed by organizational culture (0.244), eco-innovation (0.239) and smart technology (0.032). While, the lowest standardized coefficient beta value is smart technologies. However, a significance level of p-value less than 0.001 indicates that all variables have a high level of statistical significance.

Therefore, according to the results, among the digital transformation components examined in SME warehouses, workforce skills have the greatest impact on sustainable supply chain performance. This is because, the organization must understand the importance of these skills can help SME warehouses identify training and development needs, foster a culture of continuous learning, and ensure employees are able to effectively utilize digital technologies and contribute to sustainable supply chain performance.

5.4 Implication of Study

5.4.1 Implication for practice

Sustainability adoption rates related to supply chains are low and more research is needed on factors that enable the implementation of sustainability practices to improve sustainability performance. This study contains several managerial implications and shows that when a SME warehouse configure digital transformation, they can improve their sustainability of supply chain performance and contribute to their goal, such as recycle, reduce emissions and reduce use resources.

For management practice, this research emphasizes the relationship between digital transformation and sustainable supply chain performance. First, the research shows that SME warehouses should develop strategies related to sustainable supply chains and digitalization based on their company's vision, mission and goals. By doing this, they will gain a better understanding of the company's goals and industry. In addition, SME warehouses should adopt disruptive technologies to promote sustainability and embed them into supply chain processes and practices (Muddassar Sarfraz, 2023).

The SME warehouse that committed to increasing the sustainability requires integration of external and internal supply chain management practice directly affects their performance. At the same time, they can apply digital technologies to achieve a higher degree of development in configuration sustainable supply chain management. Moreover, the pursuit of digital supply chain does not sufficient to achieve sustainable performance, but the combination with all factor such as implemented smart technologies, applied eco-innovation, enhance organizational culture and improve workforce skills among the employees is an important factor in achieving sustainable supply chain performance. Thus, the SME warehouse should look for combinations rather than single technologies and operational approaches to improve sustainable supply chain performance (Almeida et al., 2022).

Besides, without developing and implementing a sustainable digital transformation strategy, technology can pose significant challenges to businesses. Technological innovation in the form of blockchain has an important impact on sustainable supply chain performance, but it is not the only reason. Firms' adoption of advanced technologies depends on the level of sustainable supply chains they develop and the level of advanced technologies they select. Therefore, the study recommends that SME warehouses focus on implementing technological advancements and deploying sustainable strategies and planned transformations that may help businesses achieve their goals.

5.5 Limitations of Study

This literature review shows that there is a limited number of academic research and case studies in the area of sustainable supply chain performance affected by digital transformation. Furthermore, according to Asterios and Evangelia 2022, there is a limited number of studies examining the relationship between digital transformation and sustainable supply chain performance. Most studies focus on financial, environmental, and social impacts that are of high concern to businesses. In contrast, the combination of sustainable supply chains and digital transformation is relatively new and difficult to understand and analyze. Furthermore, the impact of this combination on the performance of a company or its supply chain remains unclear. This paper argues that more academic research is needed, both at a theoretical level and on practical case studies, to examine and analyze practices related to digital transformation and supply chain performance sustainability strategies that may lead to competitive advantage.

In addition, due to limitations in collecting data, this study adopted a single collection method. Although researcher strive to ensure accurate answers, a general approach does not adequately address this issue. All of the question in the questionnaire were provided choice and selection. Unfortunately, some of the respondents are just ticking the form without reading the question properly. When researchers focus on only one method, it will unable to validate and evaluate data from multiple perspectives, which can result in a less accurate and thorough understanding of the investigation. This may cause the result in a limited review of respondents' experiences and may miss special insights that may have emerged using different methods. Therefore, mixed methods or multiple methods may be used in future studies.

Besides, this study just focused on the SME warehouses which is around 200 employees form the company. As a result, it is not possible to send this questionnaire to every SME warehouse in Bera, Pahang. Sometimes, the email and messages will be ignored and rejects by respondents. Therefore, researcher just success collect the data from 140 respondents. The result will become less accurate and consistent.

5.6 Recommendations for Future Research

For future research, the researcher provides some recommendations for future research similar to this study to improve overall quality. These practical recommendations or suggesting solutions also could ensure that their study is suitable for real-life situations to identified challenges.

Firstly, there is a need to expand the scope of academic research and case studies in the area of sustainable supply chain performance affected by digital transformation. On this basis, future research should delve more deeply into theoretical frameworks and practical case studies to examine and analyze strategies that integrate digital transformation practices with sustainable supply chain performance, potentially bringing competitive advantage to companies.

Furthermore, recognizing the limitations posed by a single data collection method, it is recommended that future research employ mixed methods or multiple methods. This will allow for a more comprehensive validation and assessment of the data from different perspectives, thereby minimizing the risk of bias associated with a single data collection method. By combining various research techniques, researchers can develop a more accurate and nuanced understanding of the complex relationships under investigation.

Furthermore, the study only focused on SME warehouses with approximately 200 employees, highlighting the challenges of reaching every SME warehouse within a designated area. Future research could consider alternative and innovative methods to increase respondent engagement, acknowledging the potential for emails and messages to be ignored. Therefore, researcher can use a variety of data collection methods, such as interviews, focus groups or on-site observations, can provide a more comprehensive picture of SME warehouses and their experiences with digital transformation and sustainable supply chain performance.

In summary, future research efforts should address these recommendations, contribute to the existing knowledge base, and promote a deeper understanding of the intricate interplay between digital transformation and sustainable supply chain performance in SME warehouses. Implementing these recommendations will not only enrich the academic literature but also provide practical insights to businesses seeking to address the challenges and opportunities presented by the convergence of digital transformation and sustainability in supply chain operations.

5.7 Conclusion

This study analyzed the effect of digital transformation on sustainable supply chain performance. The researcher has conducted a prospective study to plan for the future trends. This study provides an overview and understanding of the link between digital transformation and sustainable supply chain performance in SME warehouses. Empirical data from the study shows that digital transformation offers many opportunities for SME warehouses to improve the sustainability of supply chain performance. In fact, most efforts in the digital transformation of logistics are one-sided and fragmented. Therefore, the presentation of expert opinions seems to be related to the diversity of perspectives and the comprehensiveness of the conclusions drawn, as well as different rounds of discussions and negotiations. Sustainable Supply chain is widely discussed by practitioners who influenced by new social and environmental considerations. Sustainability considerations change perceptions of management and strategic variables in several firms. The prospective nature of this research approach requires additional, more in-depth empirical research. This study has several limitations. The data collected is quantitative and analysis by SPSS. This will improve the understanding for reader in this research.

The objective of this study is threefold. The first objective is to identify the effect of digital transformation on sustainable supply chain performance in SME warehouses. The second important objective is to investigate the relationship between the effect of digital transformation and sustainable supply chain performance in SME warehouses. Finally, it is most important to determine the greater impact of digital transformation on the sustainable supply chain performance relationship of SME warehouses, which can explain under which independent variables the sustainable performance of the supply chain can be improved, and can support specific sustainability strategies to improve the warehouse's operating performance.

The overall impact of digital transformation on sustainable supply chain performance appears to be moderately positive. The research presented demonstrates the core impact of digital transformation solutions on sustainable supply chain performance. It is limited by the number of case studies and the maturity of the solutions deployed. Further research should cover the perceptions of not only manufacturing practitioners, but also regulators and policymakers. Case study experts did not mention possible rebound effects from new digital transformation solutions, possibly because these effects are not yet measurable or simply not worthy of attention. For future research, it would be desirable to conduct a quantitative evaluation to better understand the impact of digital transformation solutions. This mainly applies to the environmental dimension. Regarding the sustainability dimension, more qualitative research on supply chain intersections is needed to better understand the impact of smart technologies on warehouses and to explore new skill management and leadership settings to help manage sustainable supply chain performance.

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APPENDICIES A

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

SURVEY QUESTIONNAIRE

EFFECT OF DIGITAL TRANSFORMATION ON SUSTAINABLE SUPPLY CHAIN PERFORMANCE IN SME WAREHOUSE

Purpose of this survey:	The purpose of this survey is to gather valuable information regarding the effect of digital transformation on sustainable supply chain performance in SME warehouses
Important:	Your organization has been carefully considered and selected to represent your organization for this study. Your responses will contribute to the findings of this study.

Thank you for participating in this research study. Your responses are valuable in examining the effect of digital transformation on sustainable supply chain performance in SME warehouses. Please read each question carefully and provide your answers based on your experiences and opinions.

SECTION A: DEMOGRAPHIC INFORMATION

1. Respondent's gender
[ ] Male
[ ] Female

2. How many years of experience do you have in warehouse industry?
[ ] Less than 1 year
[ ] 1-3 years
[ ] 4-10 years
[ ] More than 10 years

3. What is your position in the organization?
[ ] Manager
[ ] Executive
[ ] Supervisor
[ ] General worker

4. Has your SME warehouse implemented any digital transformation initiatives?
[ ] Yes
[ ] No

5. Please indicate the extent of digital transformation implementation in your warehouse on a scale of 1 to 5, with 1 being "Not at all implemented" and 5 being "Fully implemented."

Not at all implemented ⟷ Fully implemented

1	2	3	4	5

6. How would you rate your organization's operation in the past year?
[ ] Low
[ ] Moderate
[ ] High

SECTION B

This section is related to digital transformation and sustainable supply chain performance of your organization. Please answer the following questions to the best of your knowledge and based on your experience in the context of your organization

Please rate the following information on a scale of 1 to 5, with 1 being "strongly disagree" and 5 being "strongly agree".

1 Strongly disagree	2 Disagree	3 Neutral	4 Agree	5 Strongly disagree

This section will include 5 part which are **(a) smart technologies, (b) eco-innovation, (c) organizational culture, (d) workforce skills and (e) sustainable supply chain performance** as below

Please indicate your level of agreement with the following statements on a 5-point Likert scale, where 1 represents "Strongly Disagree" and 5 represents "Strongly Agree."

(A) Smart Technologies						
A1.	We adopt smart technologies in our organization's supply chain operations.	1	2	3	4	5
A2.	We use cloud computing on sustainable supply chain processes.	1	2	3	4	5
A3.	We use Big Data Analytics in our company processes and in the supply chain.	1	2	3	4	5
A4.	We use artificial intelligence in supply chain processes.	1	2	3	4	5
A5.	We use blockchain in the supply chain processes.	1	2	3	4	5
A6.	We use collaborative robotics in our company processes and in the supply chain.	1	2	3	4	5
A7.	We use computer simulation in supply chain processes.	1	2	3	4	5

(B) Eco-innovation						
B1.	Our company packaging is reusable.	1	2	3	4	5
B2.	Our company promotes packaging recycling and reuse programs.	1	2	3	4	5
B3.	Our company assesses the environmental impact to develop/ improve products.	1	2	3	4	5
B4.	Our company develops products with low impact on the environment.	1	2	3	4	5
B5.	Our company works together with customers to take environmental issues into account in product design.	1	2	3	4	5
B6.	Our company encourages the use of reusable packaging.	1	2	3	4	5
B7.	Eco-innovation can help on reduction in carbon emissions and environmental impact.	1	2	3	4	5

(C) Organizational Culture						
C1.	We value sustainability as part of its organizational culture.	1	2	3	4	5
C2.	Our organizational culture matters for adopting digital technologies in supply chain operations.	1	2	3	4	5
C3.	We adapt to changes brought about by digital transformation initiatives.	1	2	3	4	5
C4.	Our supervisors encourage employees to exchange opinions and ideas.	1	2	3	4	5
C5.	We are constantly thinking of the next generation of manufacturing Technologies.	1	2	3	4	5
C6.	Our supervisors encourage the people who work for them to work as a team.	1	2	3	4	5
C7.	We try to anticipate the potential of new manufacturing practices and technologies.	1	2	3	4	5

(D) Workforce Skills						
D1.	Having digital skills is important for improving sustainability practices in the supply chain.	1	2	3	4	5
D2.	Our organization makes lessons learned available to all employees.	1	2	3	4	5
D3.	Proficiency in analyzing data and extracting meaningful insights for decisions related to supply chain sustainability.	1	2	3	4	5
D4.	Strong analytical and data skills are essential to identify and address sustainability challenges in supply chains.	1	2	3	4	5
D5.	The ability to collaborate and communicate effectively with colleagues and stakeholders can achieve sustainability goals in the supply chain.	1	2	3	4	5
D6.	Employees must continuously learn and upskill themselves to keep up with the evolving digital landscape in supply chain management.	1	2	3	4	5
D7.	Organization must provide training and courses to improve employees' knowledge of new technologies.	1	2	3	4	5

(E) Sustainable Supply Chain Performance						
E1.	Our organization actively integrates sustainability practices into supply chain operations.	1	2	3	4	5
E2.	Our organization collaborates with suppliers to ensure responsible sourcing and ethical practices.	1	2	3	4	5
E3.	Our organization engage with local communities and stakeholders to address social and environmental concerns.	1	2	3	4	5
E4.	Our actively seek opportunities for innovation and improvement in sustainable supply chain practices.	1	2	3	4	5
E5.	Our organization strives to minimize waste and optimize resource utilization in supply chain.	1	2	3	4	5
E6.	Our organization's sustainable supply chain practices have resulted in reduced environmental impact (e.g., energy use, waste generation) while maintaining operational efficiency.	1	2	3	4	5
E7.	The implementation of digital transformation has positively influenced our sustainable supply chain performance.	1	2	3	4	5

Thank you for your time and valuable input. Your responses will remain confidential and will be used solely for research purposes. If you have any questions, please contact the researcher at

Researcher: SEE JIA YEE *Contact No: +60132020388*

Email: b062010068@student.utem.edu.my

APPENDICES B

Gantt Chart for Final Year Project 1

Week/ Activities	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
FYP Talk																
Search for FYP Topic																
Meeting with Supervisor																
Topic discussion and Tittle Confirmation																
RO & RQ Construction																
Variables and Framework Construction																
Submission Chapter 1 & 2																
Restructured Chapter 1&2																
Submission Chapter 3																
Frist draft of FYP1																
Submission of FYP 1																
Presentation 1																
Revised of FYP 1																

MIDTERM SEMBREAK

APPENDICES C

Gantt Chart for PSM 2

Week/ Activities	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Create Questionnaire									MIDTERM SEMBREAK							
Distribute Questionnaire																
Collect Questionnaire																
Analysis Data																
Submission Chapter 4																
Submission Chapter 5																
Proposal Correction																
Slide Preparation																
Submission Chapter 3-5																
Submission of FYP 2																
Presentation 1																