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SUPPLY CHAIN TECHNOLOGY IMPLEMENTATION IN WAREHOUSES OPERATION

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Universiti Utara Malaysia

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ABSTRACT

This study is undertaken to examine the factors that positively affect Supply Chain Technology (SCT) implementation in warehouses operation, For the purpose of this study, it covers three important factors which include organisational culture, employee training and education and top management support. These factors are chosen because they are found to be important factors, as it was recommended from a previous study. As such, there is a need to scrutinize these factors. The objective of this study is to examine the implementation levels of supply chain technology in warehouses operation, to examine the influence of three variables of organizational culture, employee training and education and top management support on the supply chain technology implementation in warehouses and to investigate the challenges faced during the technology implementation. The study is a cross sectional study where data was gathered just once with minimal researcher's interference. Data was collected using email questionnaire sent to a total of 400 companies that across various industries. A total of 35 respondents were obtained and used for the purposed of this study. Three hypotheses were tested in the data analysis process. Statistical analysis used in this study were descriptive analysis statistic, multiple regression analysis and descriptive frequency analysis. Based on the findings on descriptive analysis statistic it is confirmed that the implementation levels of supply chain technology in warehouses was at a high level with the mean value of 68.9714. Another important finding on multiple regression analysis was that the influence of organizational culture, employee training and education and top management support were found to be significant in explaining the variance on the supply chain technology implementation in warehouses operation. The finding concurred with descriptive frequency analysis that the top management support are the top challenges faces during the technology implementation, while the least challenges faces are employee training and education. In addition, limitations to the study and suggestions for the future research are also presented in this study. In conclusion, the findings obtained in this study can be a guide for managerial practice and supply chain practitioners to implement SCT for the future undertakings. Moreover, it is hoped that this study could provide a platform for researchers and academicians to conduct research in the area of supply chain, SCT and technology implementation in Malaysia.

ABSTRAK

Kajian ini dijalankan untuk mengkaji faktor-faktor yang memberi kesan positif kepada pelaksanaan Teknologi Rantaian Bekalan (SCT) dalam operasi gudang, Bagi tujuan kajian ini, ia merangkumi tiga faktor penting iaitu budaya organisasi, latihan dan pendidikan pekerja serta sokongan pengurusan tertinggi. Faktor-faktor ini dipilih kerana ia didapati sebagai faktor penting, seperti yang disyorkan dari kajian sebelumnya. Oleh itu, terdapat keperluan untuk meneliti faktor-faktor ini. Objektif kajian ini adalah untuk mengkaji tahap pelaksanaan teknologi rantaian bekalan dalam operasi gudang, untuk mengkaji pengaruh tiga pembolehubah budaya organisasi, latihan dan pendidikan pekerja dan sokongan pengurusan atasan mengenai pelaksanaan teknologi rantaian bekalan di gudang dan untuk menyiasat cabaran yang dihadapi semasa pelaksanaan teknologi. Kajian ini adalah kajian keratan rentas di mana data dikumpulkan hanya sekali dengan gangguan penyelidik yang minimum. Data dikumpul menggunakan soal selidik e-mel yang dihantar kepada sejumlah 400 syarikat yang merentasi pelbagai industri. Seramai 35 responden telah diperolehi dan digunakan untuk tujuan kajian ini. Tiga hipotesis telah diuji dalam proses analisis data. Analisis statistik yang digunakan dalam kajian ini adalah statistik analisis deskriptif, analisis regresi pelbagai dan analisis frekuensi deskriptif. Berdasarkan dapatan statistik analisis deskriptif telah disahkan bahawa tahap pelaksanaan teknologi rantaian bekalan di gudang berada pada tahap yang tinggi dengan nilai min 68.9714. Satu lagi penemuan penting mengenai analisis regresi pelbagai adalah bahawa pengaruh budaya organisasi, latihan pekerja dan pendidikan dan sokongan pengurusan atasan didapati penting dalam menjelaskan varians mengenai pelaksanaan teknologi rantaian bekalan dalam operasi gudang. Penemuan ini bersetuju dengan analisis frekuensi deskriptif bahawa sokongan pengurusan atasan adalah cabaran utama yang dihadapi semasa pelaksanaan teknologi, sementara cabaran paling sedikit dihadapi ialah latihan dan pendidikan pekerja. Di samping itu, batasan kajian dan cadangan untuk penyelidikan masa depan juga dibentangkan dalam kajian ini. Kesimpulannya, dapatan yang diperolehi dalam kajian ini boleh menjadi panduan kepada amalan pengurusan dan pengamal rantaian bekalan untuk melaksanakan SCT untuk usaha masa depan. Selain itu, diharapkan kajian ini dapat menyediakan platform kepada penyelidik dan ahli akademik untuk menjalankan penyelidikan dalam bidang rantaian bekalan, SCT dan pelaksanaan teknologi di Malaysia.

DECLARATION

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; and any editorial work, paid or unpaid, carried out by a third party is acknowledged.

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CHAPTER 1

INTRODUCTION

The implementation of supply chain technology in the warehouse sector holds great significance in the current dynamic business environment (Mathu, 2021). The supply chains and storage industry are facing a rise in obstacles and dangers, including the accelerated decay of perishable commodities and the occurrence of contamination problems during handling (Wicaksono & Illés, 2022; Julia, 2020). While new technologies offer the possibility of mitigating some dangers, not all warehouses possess the necessary resources or financial means to use them, such as power warehouse management systems or smart packaging (Tabatabaei et al., 2021). Moreover, technology functions as a catalyst and enabler of transformation that can significantly enhance the productivity and efficacy of a supply chain. In addition to deploying technology, warehouses have the potential to optimise their operating procedures, thereby enhancing visibility, traceability, and overall control of the supply chain. Furthermore, the integration of technology in the warehouse industry necessitates thorough examination and strategic preparation to tackle and alleviate preexisting issues within the supply chain. Integrating technology into the warehouse sector is crucial for enhancing design efficiency, minimising operational expenses, and facilitating more flexibility and responsiveness in supply chain operations (Jayashree et al., 2021). Moreover, the utilisation of technology in warehouses has emerged as a crucial element in attaining environmentally friendly and sustainable supply chain practices. In addition to enhancing the efficiency of warehouse technology, the implementation of sustainability practices can be achieved, thereby mitigating the environmental consequences of warehouse operations. The warehouse industry has garnered significant interest from both practitioners and researchers

because of the profound impact that technology may have in transforming it. There has been a change in the demands placed on warehouses, and there is a rising curiosity in examining the adoption and influence of technology on warehouse operations. This exploratory study aims to investigate the implementation of supply chain technology in the warehouse sector and its impact on efficiency, effectiveness, and sustainability practices.

1.1 Background of the Study

The warehousing industry is of paramount importance to the Malaysian economy. It plays a role in the comprehensive management of firms' supply chains and aids in meeting market demand with efficiency. Warehousing plays a vital role in connecting manufacturers and customers by securely storing, efficiently organising, and rapidly transporting commodities. Since we progress in an economy that is mostly influenced by service systems, a company's logistics and transportation have become increasingly important since they play a crucial role in the supply chain (Aćimović et al., 2022). Storage systems and material handling systems play a crucial role in the supply chain, and the demands for storage and handling activities have greatly escalated in recent years. An efficiently organised warehousing system is thought to lead to sustainable supply chain management (Saleet, 2020). Warehousing expenses are considered the second most significant component of logistics costs, following transport costs, as indicated by multiple studies (Škerlič & Muha, 2017). Consequently, proficient administration of warehouses can significantly influence a company's financial performance and overall ability to compete. Given the growing significance of

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warehousing in the Malaysian economy, it is crucial to investigate methods for improving efficiency and effectiveness in the warehouse management industry.

Integrating supply chain technology into the warehouse management industry might be a practical approach to enhancing efficiency and effectiveness. Supply chain technology encompasses the utilisation of sophisticated software and systems to optimise and mechanise many operations within the warehouse (Alumbugu et al., 2021). By implementing supply chain technology, warehouses can optimize inventory management, improve order accuracy, reduce order fulfilment time, and enhance overall productivity (Kluska, 2021). Furthermore, supply chain technology can enable real-time tracking of inventory, allowing companies to have better visibility and control over their stock (Mathu, 2021). This can result in better decision-making, improved customer service, and reduced costs. Given the significant challenges facing warehouse sector management in Malaysia, such as increasing demand, rising costs, and competition, implementing supply chain technology can provide a competitive advantage. By leveraging technology, companies can efficiently manage inventory levels, reduce storage costs, and minimize errors in order fulfilment. Furthermore, supply chain technology can enable companies to integrate and synchronize all aspects of warehouse operations, from receiving and storing goods to shipping and delivering them to customers.

To successfully implement supply chain technology in the warehouse management sector, three key independent variables need to be considered: organizational culture, and employee training. Organizational culture is a key independent variable that can influence the successful implementation of supply chain technology in the warehouse management sector. Organizational culture refers to the shared values, attitudes, and

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beliefs within an organization (Prihantari & Astika, 2019). A culture that promotes innovation, collaboration, and continuous improvement is more likely to embrace and adapt to new technologies. Therefore, companies with a culture that fosters openness to change and encourages employees to embrace technology are more likely to successfully implement supply chain technology in their warehouse management sector (Kluska, 2021). Employee training and education is another important independent variable that can impact the implementation of supply chain technology in the warehouse management sector. Employee training and education refers to the knowledge and skills that employees possess to effectively utilize and leverage supply chain technology (Zaki & Al-Hodiany, 2021). Companies that invest in comprehensive training programs for their employees will have a workforce that is equipped with the necessary skills and knowledge to effectively leverage supply chain technology. This, in turn, can lead to improved operational efficiency in warehouse management. Top management support is the third independent variable that can influence the successful implementation of supply chain technology in the warehouse management sector. Top management support refers to the active endorsement and involvement of senior leaders in the implementation of supply chain technology (Azizi et al., 2016). When top management shows support for implementing supply chain technology, it sends a clear message to employees that the initiative is a priority for the organization (Azizi et al., 2016). This support can motivate employees to embrace the technology and actively participate in its implementation. Furthermore, the implementation of supply chain technology can also improve customer satisfaction and enable companies to meet the diverse demands of customers effectively.

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1.2 Problem Statement

Warehouse management plays a crucial role in the supply chain, as it involves controlling the movement, storage, and processing of materials within a warehouse. The primary goal of warehouse management is to optimise the workforce, reduce processing time, and improve overall service to customers by minimising unnecessary inventory processes and streamlining warehouse operations (Sahaidak et al., 2018). To achieve the goals of warehouse management, it is essential to leverage supply chain technology. Supply chain technology can serve as a driver and facilitator of change, improving the efficiency and effectiveness of a supply chain (Mathu, 2021). It can help in solving or mitigating problems in the supply chain by analysing and planning upfront (Mathu, 2021). The implementation of supply chain technology in warehouse management can result in several benefits, including enhanced operational efficiency, improved inventory management, increased customer satisfaction, and reduced costs and lead times (Haj, 2019).

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Supply chain technology consists of various tools and systems, such as enterprise resources, warehouse management systems, transport management systems, barcode and radio frequency identification, and data warehouse-based management systems (Mathu, 2021). These technologies can enhance the performance of a warehouse by automating procedures, optimizing inventory management, and providing real-time data for better decision-making. However, the implementation of supply chain technology in warehouse management is not without challenges. Organizational culture, employee training and education, and top management support play crucial roles in successful technology implementation.

An important determinant of the effective implementation of supply chain technology in a warehouse is the organizational culture. The organizational culture plays a supportive role in facilitating the implementation efforts and influencing the behaviors of employees towards technological developments in the warehouse. The success or failure of supply chain technology adoption in warehouse management is greatly influenced by the organizational culture of a company (Mierzwa, 2021). Employees that possess a favorable disposition towards technology and demonstrate a willingness to adjust to novel systems are more inclined to endorse and adopt the integration of supply chain technology within the warehouse. Conversely, personnel who possess a pessimistic outlook towards technology and exhibit reluctance to adapt can impede the deployment process. Wang and Gu's study suggests that a culture that encourages creativity and a willingness to embrace change might help effectively integrate supply chain technologies in warehouses. According to the research conducted by Wang and Gu, an organizational culture that provides support has a significant role in promoting employee engagement and collaboration. These factors are essential for effectively implementing supply chain technology in warehouse operations. An organizational culture that is pleasant and helpful facilitates a willingness to adapt, motivates staff to adopt new technology, and cultivates teamwork and communication among team members.

Employee training and education are also crucial factors. Employees must possess the requisite skills and expertise to proficiently employ and traverse technological tools and systems. According to Pully et al., (2007) employees who receive adequate training and education are more likely to comprehend the benefits and uses of technology. This, in turn, enhances their readiness to adopt and utilize supply chain technology efficiently in their everyday responsibilities. Additionally, the research

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conducted by Pully et al. (2007) emphasizes the importance of customizing training programs to meet the individual requirements of employees. These programs should prioritize offering practical experience and real-life illustrations to improve their comprehension and skillfulness in using the technology.

Furthermore, the backing of senior executives is a crucial element that guarantees the effective integration of supply chain technology in the warehouse. When senior executives endorse the usage of supply chain technology, they offer direction, assets, and assistance to guarantee the effective installation and incorporation of the technology. Furthermore, the endorsement of senior executives' aids in fostering a favorable attitude among employees, as it showcases the significance of the technology and the possible advantages it might provide for the organization. Moreover, the involvement of senior executives is essential in mitigating employees' apprehensions and opposition to change linked to the use of novel technologies. In addition, the research conducted by Max et al. (2021) discovered that the support of top management has a positive impact on the adoption of supply chain technology. This support is achieved by providing the required resources and assistance, aligning the implementation of technology with the strategic objectives of the organization, and fostering a culture of innovation and ongoing enhancement.

To summarize, including supply chain technology in the warehouse is a crucial element in enhancing operating efficiency and overall competitiveness. Nevertheless, it is crucial to take into account other aspects that can impact the effective deployment of supply chain technology. The elements encompass the company culture, personnel training and education, and top management support. The essential parameters for the successful application of supply chain technology in the warehouse have been

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established in much research (Mentzer et al., 2001). Furthermore, it is crucial to acknowledge that the effects of these factors can be shaped by the competitive strategy of the organization, as indicated by a study emphasizing the significance of management leadership, empowerment, top management commitment, organizational culture, and communication as key drivers for successfully implementing technology in the supply chain (Jabbour et al., 2019).

1.3 Research Questions

a) What is the current level of supply chain technology implementation in warehouses?

b) How do organizational culture, employee training and education, top management support influences the level of supply chain technology implementations in warehouses?

c) What are the major challenges faced during the implementation of supply chain technology in warehouses.

1.4 Research Objectives

a) To examine the implementation levels of supply chain technology in warehouses.

b) To examine the influence of organizational culture, employee training and education and top management support on the supply chain technology implementation in warehouses

c) To investigate the challenges faced during the technology implementation.

1.5 Scope of the Study

This study will focus on implementing supply chain technology in warehouses and inventory management systems across various industries. The study aims to provide a comprehensive understanding of the current state of the supply chain technology implementation and its impact on warehouses and inventory management.

The study will collect data from several warehouses and organisations that have adopted supply chain technology, the data collection will involve interviews with warehouse managers, supply chain professionals, or technology implementation experts to gather insights into the implementation process, challenges faced, and the benefits experienced. Data collection will involve a combination of quantitative and qualitative methods. Semi-structured interviews will be conducted to gather qualitative data, while surveys and data analysis will be used to gather quantitative data.

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The geographical scope for supply chain technology implementation in warehouse operations in Malaysia can be determined by referring to the FMM Directory of Malaysian Industries. This directory provides comprehensive information on industries in Malaysia, including their locations and operational capabilities. By analysing the data from the FMM Directory, it is possible to identify the specific regions or cities in Malaysia where warehouses are located and where supply chain technology implementation can be implemented. By referring to the FMM Directory of Malaysian Industries, one gains insight into various regions and cities across Malaysia that play a critical role in implementing supply chain technologies – namely Kuala Lumpur, Selangor, Johor, Penang among others. Moreover, this analysis also extends its reach toward industrial zones as well as free trade zones which serve as

focal points with dense presence of warehouses and logistics hubs crucial for effective deployment of these advanced technologies.

1.6 Significance of the Study

The study on the application of supply chain technology in warehouses is significant due to its contribution to the research field of supply chain management and logistics. The integration of technology in warehouses is vital for enhancing the efficiency and efficacy of supply chains. This study offers useful insights into optimising supply chain operations by examining the influential variables in the successful application of supply chain technology, including organisational culture, staff training and education, and top management support. Understanding the influence of organisational culture on supply chain technology implementation allows organisations to assess their readiness for change and identify any barriers that may hinder successful implementation.

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Similarly, understanding the importance of employee training and education in supply chain technology implementation enables organisations to develop targeted training programmes that enhance the skills and knowledge of employees to successfully use the implemented technology. Moreover, the study sheds light on the crucial role of top management support in driving the successful implementation of supply chain technology. Without the support and involvement of top management, the implementation process may face resistance and challenges, which can hinder the overall success of the technology implementation. This study also contributes to the field by highlighting the importance of supply chain technology implementation in warehouses.

The incorporation of technology in warehouses is essential as it has the potential to enhance different facets of the supply chain, such as order fulfilment, inventory control, and transportation (Mathu, 2021). Organisations can improve the design, organisation, and coordination of work in distribution centres and warehouses by utilising technology such as enterprise resources, warehouse management systems, transport management systems, barcodes, and radio frequency identification. These technologies have the potential to enhance the precision and efficiency of order selection and packaging, minimise inaccuracies in inventory control, and optimise transportation procedures. Furthermore, the study highlights the importance of trust among supply chain stakeholders in order to effectively adopt technology (Arora et al., 2017).

The establishment of this trust facilitates efficient sharing and utilisation of resources, which is crucial for responding to dynamic settings and accomplishing successful deployment of technology. This study's findings enhance current knowledge by emphasising the elements that impact the effective integration of supply chain technology in warehouses. The importance of this study lies in its capacity to provide guidance to businesses in the supply chain sector for the effective implementation of technology in their warehouses. The study's findings highlight the necessity for warehouse managers and operators to adopt and embrace new technology by changing their thinking. This study emphasises the necessity of a dedicated and flexible organisation that is receptive to change and innovation by offering insights into the influence of organisational culture and the significance of staff training and education. Moreover, the study highlights the significance of strong backing from top-level executives, as their active participation and dedication are crucial for facilitating the implementation process and surmounting any opposition or difficulties that may

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emerge during the adoption of technology (Arora et al., 2017). This study's findings enhance current knowledge by emphasising the elements that impact the effective implementation of supply chain technology in warehouses.

1.7 Definition of Key Terms

i. Supply Chain Technology

Refers to the digital tools, systems, and software used in warehouses and inventory management to streamline operations, improve efficiency, and enhance visibility. Supply chain technology includes a wide range of applications, such as warehouse management systems (WMS), inventory management software, and barcode scanning systems, transportation management systems (TMS), and electronic data interchange (EDI) platforms. These technologies enable organisations to automate processes, track inventory in real-time, optimise order fulfilment, and improve overall supply chain performance (Sahur & Basti, 2021)

ii. Warehouse

In modern times, the function of warehouses has expanded beyond being basic storage facilities. Instead, they have transformed into locations where operations that increase value are carried out. Specifically, several warehouses have started participating in tasks such as product assembly and packaging on their premises (De Koster et al., 2017). Three basic types of warehouses can be distinguished based on their ability to add value. As per Martin (2016), a procurement warehouse has the responsibility of providing the production process with essential resources. Conversely, a production warehouse acts as a buffer at different stages of production. Finally, a distribution

warehouse is tasked with the responsibility of storing the finished products. Nevertheless, warehouses can also be classified according to their individual functions. The main purpose of a unit warehouse is to hold logistical units, which are sometimes referred to as load units. Conversely, an order-picking warehouse is purposefully built to select and package products to fulfil the specific needs of individual consumers. The first alternative can be mechanised more easily compared to the second option, which usually requires a large workforce but may be automated in some situations. As per Martin (2016), both variations have a flexible configuration. In addition, the unit warehouse has the capacity to accommodate various types of storage units, such as pallets, crates, and containers. Companies might choose between fixed storage site allocation and free storage site selection when it comes to warehousing practices (Martin, 2016). The notion of fixed store site allocation involves designating a specific storage spot within the warehouse for each individual item. An important advantage of this system is its inherent simplicity in spatial arrangement, as the storage site number immediately corresponds to the item number. On the other hand, the approach requires a warehouse with ample storage capacity and dedicated rooms for each product, which some may consider a disadvantage. Organisations that handle products in small quantities and low volumes, such as warehouses for spare parts or those that follow the FIFO (first in, first out) method, typically prefer a fixed storage site allocation (Martin, 2016). Nevertheless, enterprises can overcome the disadvantages of the fixed system by choosing a free storage location, which enables them to deposit their products in any accessible storage space. An outstanding advantage of this strategy is its remarkably enhanced utilisation of storage capacity, nearly reaching 100%. However, it requires a higher degree of effort in structuring a database to efficiently oversee the monitoring of things, their specific

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positions, and the presence of unoccupied areas. This approach can be employed for selecting both conceptual framework repositories and individual storage facilities. To guarantee operation, each storage compartment must be linked to a Warehouse Management System (WMS), which can be either a manual or IT-supported system (Martin, 2016).

1.8 Organisational of the Study

After presenting an overview of this study, including the explanation of research problems, objectives, contributions, and scope, the further sections of the dissertation are outlined below. Chapter 2 explores the literature review pertaining to this study, the establishment of the research framework, and the formulation of three hypotheses based on the theoretical framework. The study's research strategy and research methodology are outlined in Chapter 3. Chapter 4 presents the examination of the results. Chapter 5, the concluding chapter of this report, examines the study's findings,

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The implementation of supply chain technology in the warehouse and inventory sectors has gained significant attention in recent years due to its potential to enhance operational efficiency, streamline inventory management processes, and improve overall supply chain performance. The potential benefits of supply chain technology in terms of cost reduction, improved customer service, and optimised inventory levels are recognised by organisations in today's competitive business environment. Technology has become an indispensable tool in achieving operational excellence by automating manual processes, improving visibility, and enabling efficient coordination throughout the supply chain.

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This literature review aims to explore the levels of implementation, challenges encountered, and benefits experienced in the warehouses. Further, the study aims to provide valuable insights for organizations operating in the warehouse managements by examining the experiences and perspectives of warehouse managers or supply chain professionals, and or employees involved in technology implementation.

2.2 Supply Chain Management (SCM)

2.2.1 Overview and Definition of Supply Chain Management (SCM)

Supply Chain Management is a contemporary worldwide operations strategy that aims to achieve competitive advantage and overall commercial success for organisations in the 21st century. Supply Chain Management (SCM) encompasses the synchronised planning and implementation of diverse operations inside a company's supply chain, which includes sourcing, procurement, production, transportation, warehousing, and distribution (Wang et al., 2022). The objective of supply chain management (SCM) is to enhance the efficiency of the movement of goods and information across the whole supply chain, encompassing the journey from raw materials to the ultimate delivery of products or services to clients (Riofiandi & Tarigan, 2022).

Supply Chain Management (SCM) involves three essential components: the movement of physical products, the exchange of information, and the management of financial transactions. The physical flow of goods pertains to the transportation of items or materials from suppliers to manufacturers, manufacturers to distributors, and distributors to retailers or end customers. The information flow encompasses the prompt and precise interchange of data and communication among all stakeholders in the supply chain, encompassing suppliers, manufacturers, distributors, and customers. Ultimately, the flow of funds pertains to the administration of monetary exchanges, such as payments and invoicing, among all stakeholders involved in the supply chain (Liestyana et al., 2022).

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2.2.2 Supply Chain Management in Warehouse

The supply chain management industry is now focusing on warehouses as it prepares for its next revolution. Warehouses are of utmost importance in ensuring the efficiency and efficacy of supply chain operations, particularly as they become increasingly intricate and widespread. Efficient management of warehouses is crucial for guaranteeing seamless operations, minimising expenses, and meeting client requirements. An examination of the existing literature on supply chain management in warehouses uncovers various prominent themes and discoveries. Supply chain management refers to the efficient coordination and integration of all activities encompassing the manufacture and transportation of commodities, starting from the initial acquisition of raw materials to the ultimate distribution of finished products to customers. Furthermore, the management of supply chains in warehouses includes the deliberate oversight of inventory, storage, and distribution procedures within the warehouse establishment. Additionally, customer needs, market conditions, technological advancements, and environmental considerations have a significant impact on the management of supply chains in warehouses. Multiple studies have specifically examined the influence of supply chain management on warehouses. An example is a study conducted by Hayashi et al. that examined urban logistics, particularly the "last-mile" problem, and assessed the logistical approach of different European parcel delivery service firms (Jin, 2018). Jin (2018) presented a theoretical framework to elucidate the progression of the parcel delivery market and conducted a comparative analysis of the distinguishing features of the parcel delivery service sectors in China and Japan. Sherovska & Petrovska (2021) cited a study by Grewal et al., (2017) that emphasised the influence of technological advancements on customer-

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retailer interactions and their consequential effect on warehouse operations due to the emergence of new purchasing habits.

An important finding from the study by Grewal et al. (2017) is that technological advancements have changed how consumers and retailers interact, leading to the adoption of an omnichannel strategy (Sherovska & Petrovska, 2021). This omnichannel strategy enables customers to engage in the purchasing process using their preferred manner and approach, thereby maximising convenience. Lee et al. underscore the significance of the omnichannel approach in augmenting the customer experience and amplifying consumer responses (Sherovska & Petrovska, 2021).

This is evident in the substantial increase in internet sales for retail organisations during the previous decade. The incorporation of several channels into the retail assortment has generated prospects and complexities for supply chain management in warehouses. The current emphasis is on combining various channels and delivering a smooth omnichannel experience for clients (Słowikowska, 2019). It is anticipated that this pattern will persist, as future competition in the retail sector will focus on attaining and maintaining a consistently superior level of interactions at every customer contact point, establishing seamless omnichannel strategies, and reinvesting in brick-and-mortar stores by leveraging digital technologies (Słowikowska, 2019). The emergence of omnichannel tactics in the retail sector has made supply chain management in warehouses increasingly vital. The role of supply chain management in warehouses is crucial for guaranteeing the effective movement of items and information across different channels. This entails overseeing inventory management, collaborating with suppliers and distributors, and streamlining warehouse operations to effectively cater

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to the requirements of omnichannel shopping. Zara's statement highlights that omnichannel retailing aims to offer customers a comprehensive shopping experience.

This means that customers can interact with the retailer through multiple channels, such as mobile applications, websites, and physical stores. Supply chain management in warehouses is essential for supporting the omnichannel strategy by ensuring that products are available and accessible through various channels. In addition, supply chain management in warehouses helps to streamline order fulfilment processes, reduce order cycle times, and improve inventory accuracy. Furthermore, supply chain management in warehouses plays a key role in facilitating seamless order fulfilment and delivery across different channels. This involves coordinating with logistics partners to ensure timely and accurate order processing, tracking, and delivery. Additionally, supply chain management in warehouses is responsible for managing returns and reverse logistics processes in the omnichannel context. This includes handling customer returns, managing inventory returns from physical stores, and coordinating with suppliers and distributors to ensure the smooth flow of returned products back into the supply chain. Supply chain management in warehouses is also instrumental in managing the complexities of omnichannel inventory management. This includes ensuring accurate demand forecasting, maintaining optimal inventory levels, and implementing effective inventory replenishment strategies. Furthermore, supply chain management in warehouses plays a crucial role in implementing effective order management systems and technologies to support omnichannel operations. These systems and technologies enable efficient order processing, inventory visibility, and real-time tracking of orders across different channels. Overall, supply chain management in warehouses is crucial for supporting the seamless and efficient operations of omnichannel retailing. Supply chain management in warehouses is

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essential for supporting the omnichannel strategy by ensuring that products are available and accessible through various channels.

2.3 Supply Chain Technology (SCT)

2.3.1 Definition for Supply Chain Technology (SCT)

Supply Chain Technology, on the other hand, refers to the various tools, systems, and technologies that enable effective management and execution of supply chain activities. These technologies are designed to enhance visibility, efficiency, and collaboration within the supply chain. For example, warehouse management systems are commonly used in warehouses to automate and optimize tasks such as inventory management, order processing, and shipment tracking. Similarly, transportation management systems are used to optimize transportation routes, track shipments, and manage carrier contracts. Another important technology in supply chain management is demand planning and forecasting software, which uses advanced algorithms and historical data to predict customer demand and optimize inventory levels. In general, supply chain technology is essential for optimising and enhancing supply chain processes, which raises customer happiness, lowers costs, and increases productivity.

Technology in the supply chain is essential for streamlining warehouse operations and enhancing supply chain management as a whole. Numerous studies have examined the advantages and disadvantages of supply chain technology as it relates to warehouses. In one study, Hayashi et al. examined the logistical approaches of many European parcel delivery services, with a particular focus on the "last-mile" problem in urban logistics (Jin, 2018). They contrasted the features of the parcel delivery

service industries in China and Japan and offered a conceptual model to describe the market's evolution (Jin, 2018). The study demonstrated how supply chain technologies, like real-time tracking systems and route optimisation algorithms, may raise the efficacy and efficiency of last-mile deliveries in metropolitan regions.

A different research team's study also highlighted the contribution of communication advancements to better waste management in warehouses. Geographic Information Systems, a contemporary piece of computerised technology, can help in the collection, storing, examining, and presentation of data related to locations on Earth's surface, as the study shows (Ngwakwe & Mokoena, 2021). With the use of specialised vehicles and real-time data analysis, warehouses can now monitor and control garbage collection thanks to technology. Supply chain technology in warehouses improves efficacy and efficiency in a number of ways. Supply chain technology, for instance, lowers the risk of stockouts and overstocking by enabling warehouse managers to precisely track inventory levels in real-time. Supply chain technology also makes it possible for better coordination and communication between warehouse operations and other supply chain participants, such as suppliers, manufacturers, and distributors. Advances in digital technology are becoming the driving force behind many corporate strategy components, particularly when it comes to environmental constraints (Ngwakwe & Mokoena, 2021). Digital technology advancements in supply chain management have transformed sustainable waste management and warehouse operations. Thanks to these developments, warehouses may now deploy digital systems and solutions that improve their overall sustainability and efficiency. The implementation of supply chain technology in warehouses has a noteworthy effect on multiple operational areas, such as inventory management, waste management, last-mile delivery, and overall supply chain coordination.

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2.3.2 Supply Chain Technology Implementation in Warehouses

Supply chain technology implementation in warehouses involves the adoption and integration of various technological tools and systems to enhance the efficiency and effectiveness of warehouse operations. Whereas, include the implementation of warehouse management systems, inventory tracking systems, automated material handling systems, and data analytics platforms.

These technologies enable warehouses to automate and optimise key processes such as inventory management, order fulfilment, and shipment tracking. They also provide real-time visibility into inventory levels, improve accuracy in picking and packing processes, and enhance overall warehouse productivity. Furthermore, supply chain technology implementation in warehouses allows for better inventory control and accuracy, reducing the risk of stockouts or overstocking. By implementing supply chain technology in warehouses, companies can achieve several benefits. These benefits include increased operational efficiency, reduced costs, improved inventory accuracy, enhanced customer satisfaction, and better decision-making through data-driven insights. Overall, supply chain technology implementation in warehouses holds great potential for improving the efficiency and effectiveness of supply chain operations.

The implementation of supply chain technology in warehouses has been widely studied and recognised as a critical factor in improving overall supply chain performance. Numerous studies have examined the impact of supply chain technology implementation in warehouses on various aspects of supply chain management, such as inventory management, order processing times, and warehouse productivity. For example, a study conducted by Yang et al., (2019) found that the implementation of

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warehouse management systems significantly improved order fulfilment accuracy, reduced inventory holding costs, and increased warehouse productivity. Additionally, research by Wang et al., (2022) highlighted the positive impact of automated material handling systems on reducing order-picking errors and improving warehouse efficiency. Similarly, a study by Hu et al., (2008) explored the benefits of data analytics platforms in warehouse operations. They found that implementing data analytics platforms in warehouses enabled better demand forecasting, improved inventory accuracy, and enhanced decision-making capabilities.

Another study by Wu et al., (2020) examined the implementation of robotic automation in warehouses and its impact on order fulfilment cycle time and labour productivity. They found that the use of robotic automation reduced order fulfilment cycle time and improved labour productivity, leading to cost savings for companies. Overall, these studies indicate that the implementation of supply chain technology in warehouses can have significant positive effects on supply chain performance. Furthermore, the use of cognitive-based technologies, such as artificial intelligence, in supply chain technology implementation has emerged as a transformative tool for decision-making in supply chain management. According to a study by Ngwakwe & Mokoena, (2021) cognitive-based technologies, specifically artificial intelligence, have the potential to revolutionise supply chain decision-making by mimicking human intelligence and performing complex cognitive tasks. These technologies, including visual perception, speech recognition, decision-making, and object manipulation, can greatly enhance the efficiency and effectiveness of warehouse operations.

The implementation of supply chain technology in warehouses offers numerous benefits for supply chain management. It improves order fulfilment accuracy, reduces

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inventory holding costs, increases warehouse productivity, reduces order-picking errors, improves inventory accuracy, enhances decision-making capabilities, reduces order fulfilment cycle time, improves labour productivity, and enables better demand forecasting. Additionally, the use of cognitive-based technologies, such as artificial intelligence, in supply chain technology implementation has the potential to revolutionise decision-making in warehouses. By incorporating AI technology, warehouses can experience significant advancements in various areas, including order processing, inventory management, and overall operational efficiency.

Overall, the implementation of supply chain technology in warehouses has the potential to greatly improve supply chain management practices. It can lead to cost savings, increased efficiency, and enhanced decision-making capabilities. Additionally, the use of cognitive-based technologies like artificial intelligence can further enhance warehouse operations by mimicking human intelligence and performing complex tasks. According to a study by Gligor et al., (2015) and Roni et al., (2015) the implementation of supply chain technology in warehouses can have a significant positive impact on various aspects of supply chain management, such as inventory management, order fulfilment, and overall operational efficiency. Moreover, the use of artificial intelligence in supply chain technology implementation has shown promise in improving decision-making processes. For example, a study by Hu et al., (2008) found that the integration of IoT and AI technologies in warehouse management systems can improve decision-making processes by analysing large volumes of data and providing real-time insights. Furthermore, the integration of supply chain technology in warehouses can also enhance object manipulation capabilities.

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According to a study by Chandra et al., (2007) the use of supply chain technology in warehouses can lead to improved order fulfilment accuracy. This is because supply chain technology enables real-time tracking and monitoring of inventory, reducing the likelihood of order-picking errors and improving inventory accuracy. Additionally, supply chain technology implementation in warehouses can contribute to reducing order fulfilment cycle time. By automating manual processes and streamlining operations, warehouses can fulfil customer orders more quickly and efficiently. Moreover, the implementation of supply chain technology in warehouses can enhance overall operational efficiency.

It has the ability to optimise the allocation of resources, decrease the need for human effort, minimise instances of stock-outs, and enhance overall productivity. For instance, the implementation of robotics and automation technology in warehouses can diminish the requirement for human labour in activities such as selecting, packaging, and loading. This can result in substantial cost savings for organisations, as they can decrease their dependence on costly labour and optimise the allocation of resources. In addition, the implementation of supply chain technology in warehouses can enhance the efficiency of inventory management. Supply chain technology enables warehouses to effectively monitor and control inventory levels in real-time, mitigating the potential for excessive or insufficient stock. On the whole, the integration of supply chain technology in warehouses has demonstrated significant promise in enhancing different facets of supply chain management, including inventory control, precision in order fulfilment, speed of order fulfilment, and overall operational effectiveness. To summarise, the introduction of supply chain technology in warehouses has the potential to significantly enhance different elements of supply chain management.

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2.3.3 Type of Technologies in Warehouse.

The use of technology in supply chain management has become increasingly important in today's globalised and interconnected business environment. Technological advancements have revolutionised the way warehouses operate and manage their supply chains. These advancements have improved efficiency, accuracy, and visibility, leading to enhanced productivity and customer satisfaction.

i. Warehouse Management Systems (WMS)

One type of supply chain technology used in warehouses is warehouse management systems. A warehouse management system is a software application that helps manage and control various warehouse operations, including inventory management, order processing, and warehouse layout optimization. This technology provides real-time visibility into inventory levels, improves the accuracy of order fulfilment, and enables efficient utilization of warehouse space.

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A study by Hu et al., (2008) found that the upgrade in the integration of IoT and AI technologies in warehouse management systems significantly improves the effectiveness of warehouse operations. The study highlighted the benefits of using IoT and AI technologies in warehouse management systems, such as improved inventory accuracy, predictive maintenance, and enhanced decision-making capabilities based on real-time data analysis. Furthermore, the integration of Internet of Things technology in warehouse management systems has also gained significant attention. For example, IoT devices such as RFID tags and sensors can be used to track and monitor inventory in real time, providing accurate and up-to-date information on the location and status of products within the warehouse. Additionally, IoT technology

enables the automation of routine tasks, such as inventory counting and replenishment, through the use of smart algorithms and connected devices.

ii. Barcode and RFID Technology

Another type of supply chain technology used in warehouses is barcode and RFID technology. Barcode technology involves the use of printed labels with unique barcodes that can be scanned using a barcode reader. This enables quick and accurate tracking of inventory movements, improved picking accuracy, and streamlined order fulfilment processes. RFID technology, on the other hand, uses radio waves to automatically identify and track objects. This technology eliminates the need for manual scanning, enabling faster inventory counting, improved asset visibility, and reduced errors in tracking and locating items within the warehouse.

iii. Robotics And Automation Technology

Additionally, the use of robotics and automation technology has gained prominence in supply chain management. These technologies can streamline warehouse operations, increase efficiency, and reduce labour costs. For example, autonomous mobile robots can be used for tasks such as picking and transporting goods within the warehouse. They can navigate through the warehouse using sensors and mapping technology, improving order fulfilment speed and accuracy.

iv. Communication Advances

Furthermore, communication advances have also been integrated into supply chain technologies used in warehouses. For instance, the implementation of a Geographic Information System in waste collection vehicles in France allows for the monitoring

and management of waste collection routes (Ngakwe & Mokoena, 2021). This system utilizes digital technology to gather, store, analyse, and present data related to the locations of waste collection points, optimizing the efficiency of waste management operations.

In summary, the literature review reveals that supply chain technologies used in warehouses include warehouse management systems, barcode and RFID technology, robotics and automation technology, and communication advances such as Geographic Information Systems.

2.4 Factors Affecting the Implementations of SCT

2.4.1 Organisational Culture (OC)

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Several variables influence the implementation of supply chain technology in warehouses. Organisational culture is a crucial determinant. The role of organisational culture is crucial in ensuring the successful application of supply chain technology in warehouses. Studies have demonstrated that the degree to which a company's culture accepts change and innovation greatly influences the effective adoption of supply chain technologies in warehouses. Grewal et al. (2017) argue that technological advancements have transformed the dynamics of customer-retailer interactions, resulting in the emergence of novel shopping habits. Hence, organisations must adjust to these transformations and incorporate supply chain technology to fulfil client demands.

Organisational culture encompasses the collective values, beliefs, and standards that influence the behaviours and attitudes of individuals inside a company. Organisational

culture can impact employees' receptiveness to adopting and embracing new technologies during the adoption of supply chain technology. Employees at a business characterised by a positive and innovative culture are more inclined to embrace change and demonstrate a willingness to acquire new technological skills. Conversely, in businesses characterised by a culture that opposes change or lacks creativity, employees may exhibit more reluctance towards adopting new technologies, hence impeding the effective integration of supply chain technology within warehouses. Multiple studies have found distinct aspects of organisational culture that can impact the use of supply chain technology. Leadership style, supervisory support, and self-efficacy are elements of organisational culture that can influence employees' preparedness for change and their inclination to embrace and utilise supply chain technology (Chumnumporn et al., 2022; Daniali et al., 2022; El-Dirani et al., 2019). Furthermore, the subjective evaluation of employees, known as personal valence, about the advantages and incentives of utilising supply chain technology might also impact their stance on its implementation (Ernest, 2022). Moreover, the job attributes, such as the degree of independence and decision-making power granted to workers, might impact their capacity to adapt to and apply supply chain technology efficiently. The role of organisational culture is crucial in influencing the attitudes and behaviours of employees towards the use of supply chain technology in warehouses. A study conducted by Grewal et al. (2017) revealed that businesses that prioritise innovation and continuous improvement in their culture were more effective in deploying supply chain technology, in contrast to organisations with a culture that resists change. Moreover, the implementation of blockchain technology in supply chain operations has the capacity to revolutionise existing organisational cultures (Priyadharshini, 2023). Organisations may need to reinvent their values, beliefs, and conventions in

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order to match the ideals of transparency, decentralisation, and trust that are fundamental to blockchain technology adoption. The transformation in organisational culture can foster a more favourable and encouraging atmosphere for the integration of supply chain technologies in warehouses.

2.4.2 Employee Training and Education (ETE)

The objective of this literature review is to examine the variables that influence the usage of supply chain technology in warehouses, specifically emphasising the independent variables of employee training and education. The significance of providing employee training and education in the integration of supply chain technologies within warehouses should not be underestimated. Multiple studies have highlighted the pivotal significance of personnel training and education in maximising warehouse operations and efficiently employing supply chain technologies. The study conducted by Hayashi et al. (2014) investigated the evolution of the package delivery market in China and Japan. It emphasised the significance of staff training and education in improving logistic strategies for enterprises in the parcel delivery service industry (Jin, 2018).

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According to Hayashi et al. (2014), the level of employee education and training influences the parcel delivery service industry in China and Japan (Jin, 2018). The study revealed that organisations with highly skilled and knowledgeable staff successfully used supply chain technology, leading to enhanced logistic methods. Furthermore, the emergence of artificial intelligence technologies has significantly influenced the necessity for employee training and education in warehouses. Researchers in the field of education technology have demonstrated a strong interest

in integrating artificial intelligence (AI) tools into the process of teaching and learning. This interest also extends to the warehouse setting (Sallam et al., 2023). Utilising AI-based solutions in warehouses has the capacity to augment efficiency and production. This highlights the necessity for employees to acquire sufficient training and education on how to proficiently apply and incorporate these novel technologies into their day-to-day activities.

Moreover, the successful integration of supply chain technology in warehouses necessitates staff to possess a comprehensive comprehension of the systems and processes entailed. In the absence of adequate training and education, personnel may encounter difficulties in adjusting to emerging technologies, resulting in inefficiencies and probable errors in warehouse operations. Inadequate provision of personnel training and education can impede the successful use of supply chain technologies in warehouses. Research has demonstrated that personnel training and education are essential in maximising warehouse operations and efficiently employing supply chain technology. Hence, it is imperative for organisations to allocate resources towards training initiatives that enable staff to acquire the essential competencies and expertise required for proficient use of supply chain technology. In general, research indicates that employee training and education play a crucial role in the successful use of supply chain technology in warehouses.

2.4.3 Top Management Support (TMS)

Implementations of supply chain technology in warehouses have a crucial impact on raising operating efficiency, minimising expenses, and improving customer satisfaction. Top management support is a crucial aspect that significantly impacts the

effective implementation of supply chain technology in warehouses. Top management support entails the proactive engagement and approval of high-level executives in the process of implementation.

In the context of this study, top management refers to either an individual or a group of employees who possess the ability to inspire and guide other employees in order to accomplish the firm's objectives and vision. TMS is regarded as a crucial determinant in ensuring the achievement of IT adoption, deployment, and success. The role of TMS (top management system) in facilitating information sharing through modern IT technologies has been recognised by various studies, such as Gengeswari & Hamid (2017) and Chuck & Eric (2007). Additionally, Jung-Chieh et al. (2016) have emphasised the significance of TMS in ensuring the successful implementation and effectiveness of ERP (enterprise resource planning). (Yongbeom et al., 2005) proposed that TMS (technology, organisation, and environment) can play a crucial role in facilitating the successful implementation of new IT infrastructure and ERP systems. According to Weiling and Kwok (2008), implementing TMS can improve the likelihood of success for new IT systems by fostering a culture of continuous learning among employees. Further research has indicated that TMS plays a crucial role in both good customer relationship management (Chen & Opovich, 2003) and the successful adoption of electronic data interchange (EDI) (Bangalie et al., 2020). Research has demonstrated that the endorsement and backing of senior executives is essential for enabling the acceptance and assimilation of novel technology in warehouse operations, as it furnishes the requisite resources, advice, and orientation for the achievement of successful implementation.

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The literature emphasises the significance of senior management assistance in the application of supply chain technology in warehouses. Min (2023) conducted a study to investigate the impact of top management support on the installation of warehouse management systems (WMS). The researchers discovered that when senior executives actively endorse and advocate for the adoption of WMS, it results in enhanced system performance, heightened employee acceptance, and improved overall operational efficiency. For instance, Hanna et al. (2010) highlighted the impact of top management endorsement on information technology and thorough preparation for collaboration.

Likewise, the backing of senior executives is crucial in spearheading technical advancements and fostering innovation throughout the supply chain. Moreover, the endorsement of senior executives' aids in fostering a favourable organisational culture that embraces technological progress and motivates staff to welcome and adapt to change. Furthermore, the literature highlights the significance of strong backing from top-level executives in surmounting opposition to change and effectively managing potential obstacles during the implementation phase. The study conducted by Heyan and Changheng (2022) found that supply chain management practices would not enhance supply chain performance unless innovative technologies were implemented by top management in organisations. Top management support is crucial for the successful application of supply chain technology in warehouses.

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2.5 Theoretical Framework of Factors Affecting SCT Implementation.

Organisational culture, employee education and training, and top management support have been highlighted for the construction of a theoretical framework based on the literature review. Not all of the factors that influence the SCT's current state of implementation are included in the framework. As mentioned in the literature study, there are conflicting findings on these three elements, despite the fact that they have all historically had an intuitive appeal when it comes to the use of technology. Based on these problems, it appears that the combined effect of all three of these elements is not entirely known, which makes for an intriguing area of future study. By evaluating each of these three variables about the current state of SCT implementation in warehouses, this study has closed the gap. Figure 2.1 shows a theoretical framework of factors that affect the implementation of SCT.

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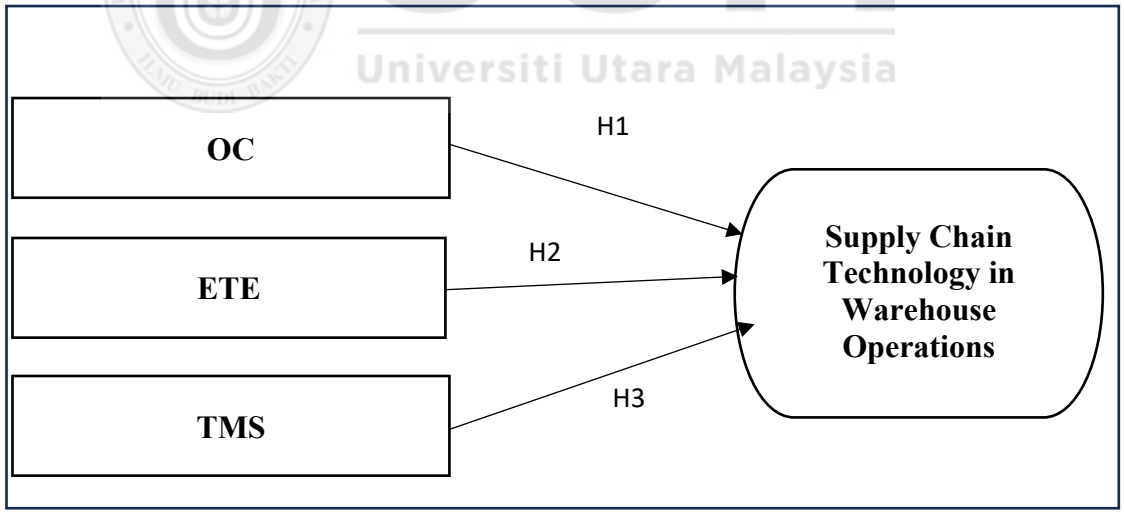

Figure 2.1
Theoretical framework

Independent Variables (IV)

1. Organisational Culture (OC)
2. Employee Training and Education (ETE)
3. Top Management Support (TMS)

Dependent Variable (DV)

1. Supply Chain Technology Implementation (SCT)

Moderating Variable (MV)

1. Competitive Strategy (CS)

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2.6 Hypotheses

Based upon the relationship of the variables in the previous section, the following hypotheses have been developed and shall be tested to achieve the study's objectives. The hypotheses made below have taken into account sources from the literature review of the past studies. From the theoretical framework, three hypotheses have been developed and are discussed as follows:

Hypothesis 1 (H1): Organisational Culture (IV1) has a significant positive effect the Supply Chain Technology Implementation (DV).

Hypothesis 2 (H2): Employee Training and Education (IV2) has a significant positive effect the Supply Chain Technology Implementation (DV).

Hypothesis 3 (H3): Top Management Support (IV3) has a significant positive effect the Supply Chain Technology Implementation (DV).

2.7 Summary

This chapter starts with an overview and definition of supply chain management, followed by SCM in warehouses, the definition of supply chain technology and the SCT in warehouses, SCT implementation in warehouses, types of technologies in warehouses, factors affecting the implementations of SCT. Based on the results of the literature review, there is a contradicting explanation on the organisation culture, employee training and education and top management support. As such, there is a need to study in depth these factors. These factors are important in the implementation of SCT.

The framework of this study was developed based on the detailed discussion of the literature. The three hypotheses were developed based on the developed theoretical framework. These hypotheses are deemed to have a relationship between the three factors and the supply chain technology implementation.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The objective of this chapter is to emphasis the underlying rationale for the methods and approaches used in carrying out this research. This chapter will cover the scopes of research and the procedures used to conduct the study, including the study design, the selection of the survey sample, the development of the questionnaire, the pre-testing of the questionnaire, the measurement of the variables, the survey implementation and the procedures for analysing data.

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3.2 Research Design

A survey was conducted to scrutinize and attain information regarding factors affecting the implementations of SCT and the use of SCT by warehouses. This study is a cross-sectional study which data are gathered just once.

The study was conducted in two phases, phase I: a pilot study to examine the reliability and the validity of the instrument and phase II: a main study using a revised instrument to examine the relationships among the variables. A survey method using questionnaire was chosen for the data collection.

3.2.1 Population and Sampling

The population for this study is the manufacturing industry in Malaysia. The population for this study is 150 to 160 organisation and a total of 108 samples needed. The sample is determined using simple random sampling. Simple random sampling was chosen because its accuracy and accessibility and its least biasness offers the most generalisability.

In this study, the unit of analysis is the organisation itself. Each respondent is chosen to represent his or her organisation. Therefore, the targeted respondent is someone that is who is involved with the operation of the organisation and involved in the implementation of SCT. The respective respondents consist of warehouse managers, operation managers and other relevant individuals.

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3.3 Data Collection Method

The questionnaires in general include all the techniques of data collection. Each person will be asked to respond to the same set of questions in predetermined order. Emailed questionnaire was used as the method of data collection. The real questionnaire was reviewed by experts from both, academicians and practitioners based on the comments and suggestions obtained during pilot test. This questionnaire was emailed to the respondent's organisation. The contact number and details of the respondents were taken to a follow up, in case of a non-return of the questionnaires.

The validity and reliability of the data that been collected and the response rate was depend on to the large extend, on the design of the questions, the structure of the questionnaire and the pilot testing. Each part of the design was involved substantial

rewriting in order to get the questionnaire right. In designing and administering the questionnaire for this study, the various information, suggestions and comments for improving response rate, various efforts were made such as: a pre-test of the questions for clarity, completeness, relevance and flow. A pilot study was also been conducted to assess the validity and reliability of the questions. A complete review of the pilot study will be discussed later in this chapter. The cover letter accompanying the questionnaire was printed on the faculty's letterhead (see Appendix A) and a full set of questionnaires was provided (see Appendix B).

3.3.1 Questionnaire Development

A questionnaire was developed in order to achieve the purpose and objectives of the study. This section discusses the contents and administration of the questionnaires.

The questionnaire comprised three main sections (see Appendix B):

i) Section 1 : General Information

ii) Section 2 : Factors Affecting SCT Implementation

iii) Section 3 : Implementation of SCT

The questionnaire consists of three sections. The first section included some brief information regarding the organisation's background, followed by questions relating to factors affecting SCT implementation. These factors used to describe the characteristics of the sample.

Three independents' variables are listed in Section 2 of the questionnaire. These were gleaned from literature review. More importantly, they proved invaluable in

determining whether there were relationships between all these variables and the dependent variables. The items under each variable were used to measure the concepts that actually reflects the dimensions itself.

Sections 3 listed the items used to measure implementation of SCT. Thirteen types of warehouses SCT were selected for this study. The technologies were identified based on validated review of warehouses SCT related journal, articles and business website. It included a variety of technologies ranging from widely used technologies such as warehouse management system (WMS), electronic data interchanges technology (EDI) Gengeswari & Hamid, (2017) to relatively new software applications such as robotics and artificial intelligence (AI). They were coded T01 to T13. The summary of questionnaire administration is shown in Table 3.1. While, the summary of the questionnaire is shown in Table 3.2.

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Table 3.1
Summary of questionnaire administration

Section	Item	Coded
Section A	General Information	G01-G08
Section B	Factors Affecting SCT Implement	F01-F13
Section C	Implement of SCT	T01-T13

Table 3.2
Summary of questionnaire

Section	No.	Construct	Scale
1. General Information	1	Company's name	
	2	Designation	
	3	Length of Designation	
	4	Year the company was Established	
	5	Number of employees	
	6	Sales Turnover	
	7	Geographical Scope	
	8	Types of Products Manufactured	
2. Factors Affecting Supply Chain Technologies Implementation	F1. 1 to 4	Organisational Culture	1 to 5
	F2. 5 to 8	Employee Training and Education	1 to 5
	F3. 9 to 13	Top Management Support	1 to 5
3. Implementation of Supply Chain Technologies	A. 1-13	Functional Technologies	1 to 5
	B. 14-15	Integrative Technologies	1 to 5

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3.4 Pre-Testing of The Questionnaire

A pre-test of the questionnaire was conducted in five organisations to improve the validity and completeness of the questionnaire. The target respondent was someone who is familiar with the operation of the organisation and implementation of SCT such as warehouse managers, operation managers and other relevant individuals.

The respondent was asked to provide valuable feedback and qualitative comments on the topics that can lead the researcher to further refine and improve the survey. Modification on the flow of the questions, eliminating irrelevant questions and the changing of certain terms in the questions are made from the comments and suggestions before sending the questionnaires out for the real study.

3.5 Measurement of Variables

The questionnaire includes potential questions regarding each independent and dependent variable. Thus, the questionnaire allows a measure for each construct represented in the hypotheses. The measurement of the variables was adopted from the validated surveys, which some of them were later modified to render them more appropriate to the context of this study.

3.5.1 Factors Affecting Measures (Independent Variables)

Firms were asked to specify the level practice of each of the factors contributing to the implementation of the SCT. They include organisational culture, employee training and education and top management support. The three independent variables are likely use the five-point Likert scale anchored at: 1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree.

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3.5.2 SCT Implementation Measure (Dependent Variable)

To assess the degree of the implementation of SCT by the organisations, a technology score was computed for each organisation. The technology score was computed based on the level of the usage of the SCT that they implement. The thirteen types of technologies are listed as: automated storage & retrieval systems (ASRS), automated picking tools, automated guided vehicles, automated inventory control platforms, bar coding technology, electronic data interchanges (EDI), horizontal & vertical carousel modules, inventory scanning technology, radio-frequency identification technology,

recording technology, robotics & artificial intelligence (AI), warehouses automation systems (WAS) and warehouses management systems (WMS).

For the item used, respondents were asked to indicate the level of SCT usage using the scale ranging from NA= not adopted, 1= very little, 2= a little, 3= to an average extent, 4= high and 5= very high. The attempts to answer the questions regarding the type of technology used or implement, the measurement was on technology usage. In the study of Advanced Manufacturing Technology (AMT), measuring the level of AMT usage based on 5-point Likert scale ranging from low to highest level. For the purpose of this study, the concern is on how many different SCT an organisation is using, and to what extend each of the SCT is used in the organisations' operation currently. The level of usage may be a useful means to identify and verify such technology users. Non adapter (NA) will not be included in the mean calculation, this supported by Buck & Horton (1996) that a proper measurement must be set-up to distinguish between users and non-users of such technology.

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3.6 Survey Implementation

The survey was conducted according to a systematic and pre-planned procedure. First, the covering letter using the letter head of the School of Technology Management and Logistics, Universiti Utara Malaysia was composed to explain the purpose of the survey. This is the first part of questionnaire that a respondent should look at. Past research has shown that the message contained in the questionnaire's covering letter will affect the response rate. Appendix A displays the covering letter used in the survey.

In the first page of the survey, the research rational and instructions for the respondents was clearly and concisely explained. The return name, email address and contact number were included at the end of the questionnaire. This technique was done in order to achieve the highest response possible.

The reliability and validity of the data collected and the response rate achieved will depend on the design of questions and the structure of the questions. Therefore, the questionnaire used in this study involves substantial rewriting in order to get the questionnaire right so as to capture the necessary data for the success of the study. In a follow up activity, the respondents were contacted through email to make sure that they have received the questionnaire.

A follow up letter accompanied the questionnaire (Appendix C). The letter explained to the respondent that a project was being carried out in pursuance of the Master of Science (Supply Chain Technology) program offered by the Northern University (UUM), an explanation of the purpose and objectives of the study, an assurance of the anonymity of the respondent, an assurance that the study was not meant to compare the organisation with another, a request that the questionnaire will be returned before the deadline and lastly an offer that the summary of the results upon the conclusion of the study, will be forwarded if the individual representing the organisation ask for it. Telephone calls were also made to remind the respondents to reply the questionnaire as soon as possible.

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3.7 Procedure of Data Analysis

Responses from the valid questionnaire returned by the samples were analysed using SPSS version 29.0 statistical software package. The descriptive analysis report on the demographic information of the respondents was done. Besides the Cronbach's alpha a reliability coefficient test, the content validity test also was undertaken.

The characteristic of the demographic variables was assessed through the use of frequency distributions with visual displays using histograms and pie charts. By checking the central tendency and dispersion, the feel of the data was acquired. For this purpose, the mean, range, standard deviation and variance in the data for the dependent and independent variables are computed. The results help to identify any biasness in respondents with regard to the responded items. The demographic level of significance tested and shown by the p-value.

For the purpose of testing the relationships between each of factors affecting the implementations of SCT which are organisational culture, employee training and education and top management support, Pearson correlation is carried out.

Lastly, a multiple regression analysis is performed to find out whether organisational culture, employee training and education and top management support will significantly explain the variance in the SCT implementation.

3.8 Summary

This chapter has presented the research methodology for this study. The research designs, data collection method, development of questionnaire, pre-testing of the

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questionnaire, measurement of the variables, survey implementation and procedure used to analyse data have been discussed precisely in this chapter. In the following chapter, it will be presented the data analysis and the results obtained.

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CHAPTER 4

FINDINGS

This chapter analyses the respondents' characteristics to evaluate the outcomes of hypothesis testing. This study utilised the systematic data analysis flow recommended by Sekaran (2003) and Kervin (1992). This entailed the subsequent steps: data preparation, statistical analysis, and hypothesis testing. Adhering strictly to these stages was crucial to guaranteeing the testability of the research hypotheses. Only then can a valid and practical conclusion be drawn in order to accomplish the study's aims. The data analysis was conducted using SPSS version 29.0. This chapter presents an analysis of the return rate of the questionnaires, the demographic profiles of the participants, the quality of the measurement instrument, the descriptive statistics, the testing of hypotheses with their underlying assumptions, and a summary of the findings.

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4.1 Questionnaire Return Rate

A total of 150 to 160 Malaysian manufacturing company were involved in this study. A survey package was mailed to the respondents on early of October 2023. Only 35 questionnaires were returned because several participants were saying that questionnaires were contradictory with their company confidential.

4.2 Preparing the Data Analysis

The returned questionnaires were reviewed prior to labelling them as valid. As some of the items were close-ended questions, the use of coding was unnecessary. The data were then keyed into the computer using SPSS 29.0.

4.3 Demographic Profile

The demographic statistics helped to assess if the sample was representative of the population. This section will discuss the respondent's profile which includes length of position, years of company established, number of employees, turnover by company and geographical operation. A brief summary of the demographic data of respondent's data respondents is presented in Table 4.1.

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Table 4.1
Demographic characteristics of the respondents

Variables	Category	Frequency	Percent
Length of position	Under 3 years	24	68.57%
	3 to 6 years	3	8.57%
	6 to 9 years	2	5.71%
	Up to 10 years	3	8.57%
	Unidentified	3	8.57%
How long company have been established	Under 10 years	9	25.7%
	10-20 years	10	28.5%
	20-30 years	6	17.1%
	30-40 years	2	5.7%
	40-50 years	2	5.7%

Variables	Category	Frequency	Percent
	50-100 years	4	11.4%
	Up to 100 years	2	5.7%
Overall number of employees	Under 100 employees	5	14.28%
	100-300 employees	8	22.85%
	More than 300 employees	22	62.85%
Turnover by company in 2022	Between RM250,000 and less 10 million	12	34.28%
	Between RM10 million and RM25 million	9	25.71%
	More than RM25 million	14	40%
Geographical company operation	Johor	6	17.14%
	Kedah	6	17.14%
	Kuala Lumpur	1	2.85%
	Penang	12	34.28%
	Perak	1	2.85%
	Selangor	7	20%
	Terengganu	2	5.71%

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4.3.1 Length of Position

The length of position of the respondents in shown in Figure 4.1. Based on Figure 4.1, the position on under 3 years scores the highest percentage (68.57%), followed by 3 to 6 years, up to 10 years, and unidentified for 8.57% each. Length of position 6 to 9 years scores the lowest score by 5.71% only.

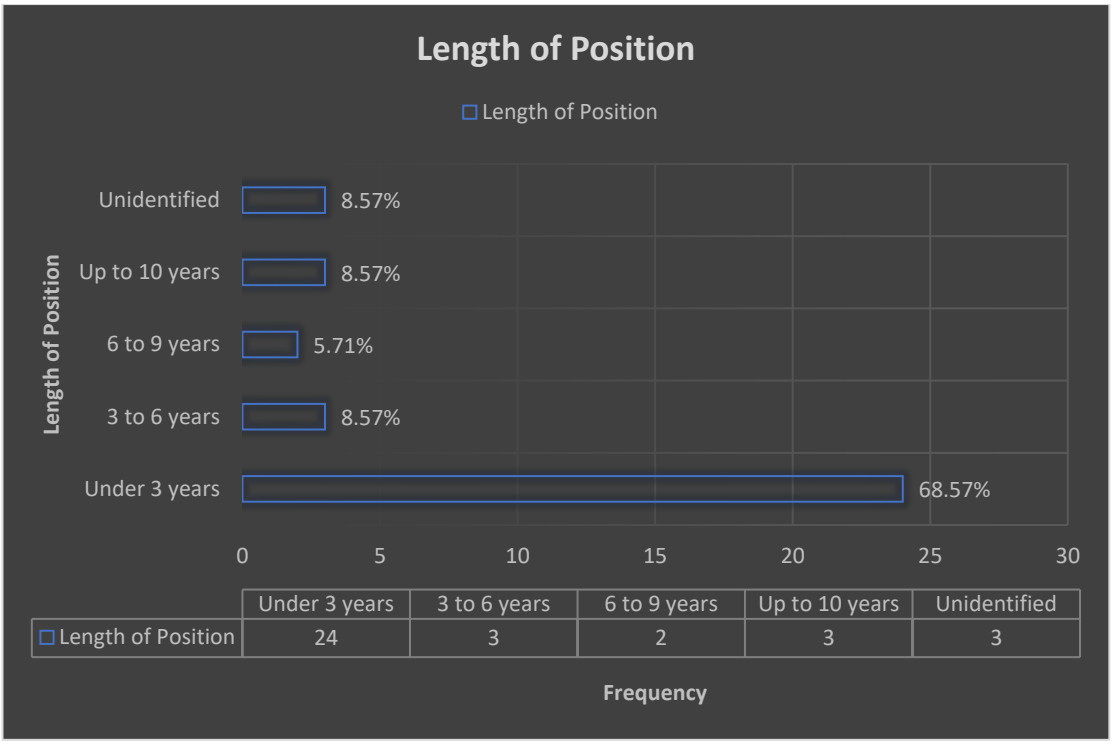

Figure 4.1
Length of position

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4.3.2 Company Have Been Established

Company established of the respondents in shown in Figure 4.2. Based on Figure 4.2, the longest year of company established was 10 to 20 years by 28.5%, followed by under 10 years by 25.7%, 20 to 30 years by 17.1%, 50 to 100 years by 11.4% and then 30 to 40 years, 40 to 50 years and up to 100 years by 5.7% each.

Figure 4.2
Company have been established

4.3.3 Numbers of Employee

The number of employees of the respondents in shown in Figure 4.3. Based on Figure 4.3. Employee of up to 300 scores the highest by 62.85% of respondents, followed by 100 to 300 by 22.85% and under 100 employees by 14.28%.

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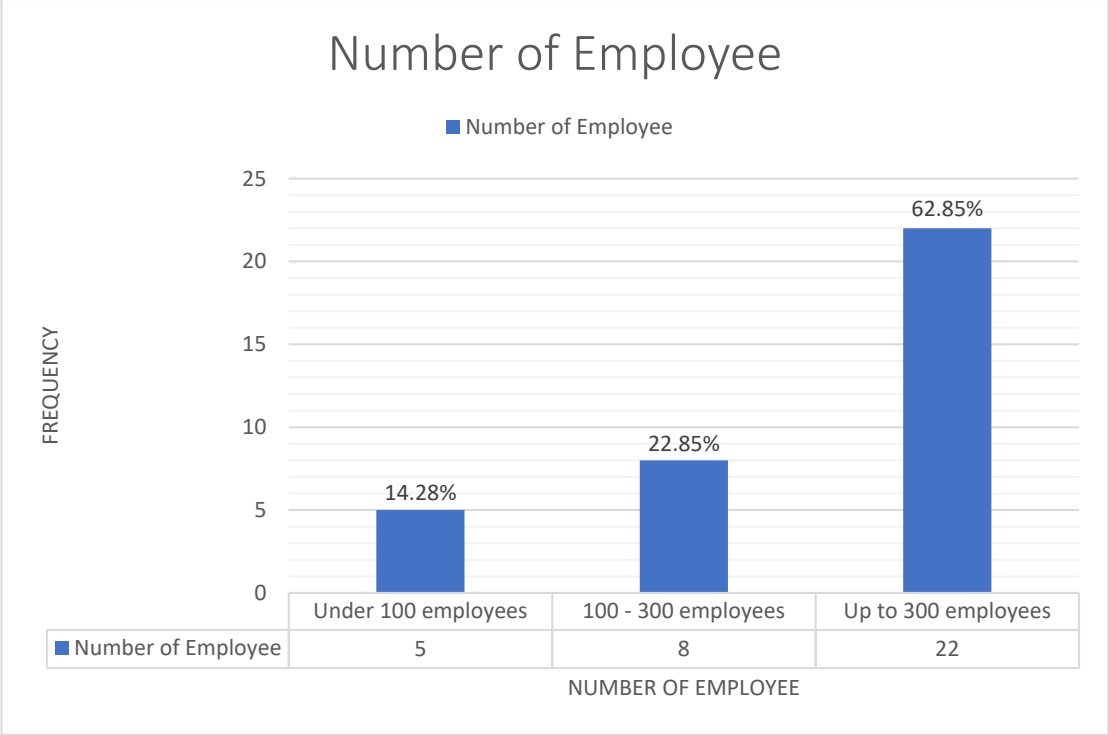

Figure 4.3
Numbers of employee

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4.3.4 Turnover by Company in 2022

The number of turn over by companies in 2022 is shown in Figure 4.4. Based on Figure 4.4. turnover up to RM25 million was the highest scores by 40%, followed by RM250,000 to RM10 million by 34.28% and RM10 million to RM25 million by 25.71%.

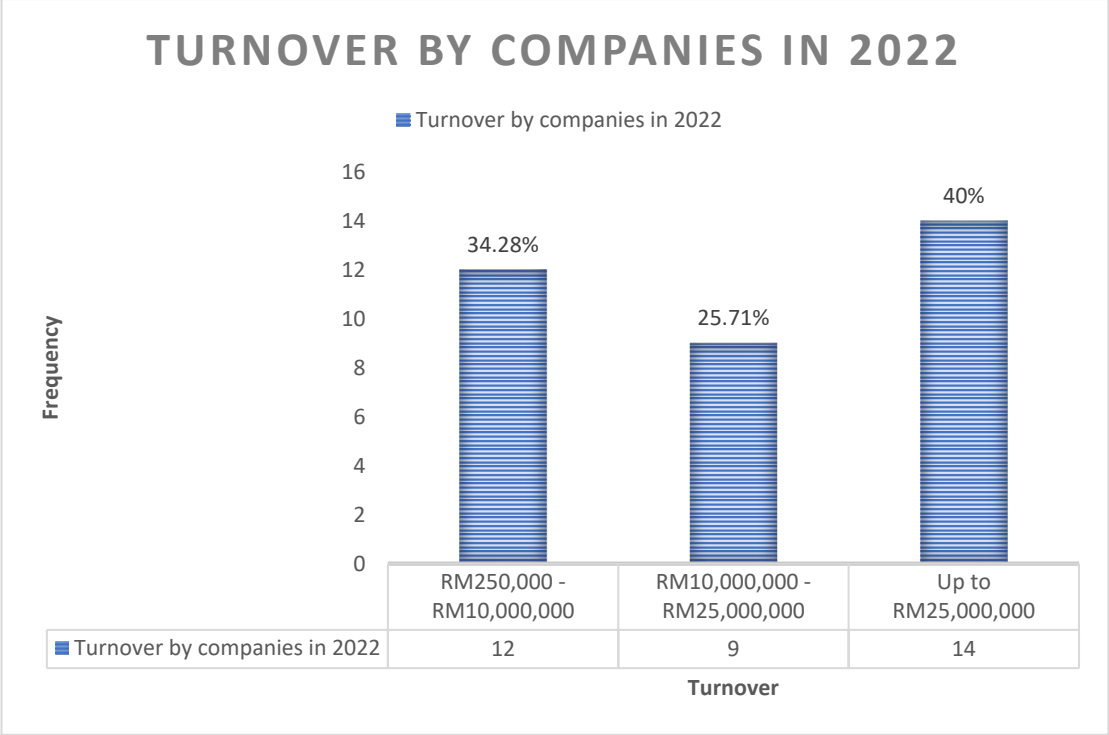

Figure 4.4
Turnover by company in 2022

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4.3.5 Geographical Operation

The geographical operational of the respondents in shown in Figure 4.5. Based on Figure 4.5. Penang scores the highest by 34% of respondents, followed by Selangor for 20%, Johor and Kedah for 17% each, Terengganu by 6% and Perak and Kuala Lumpur by 3% each.

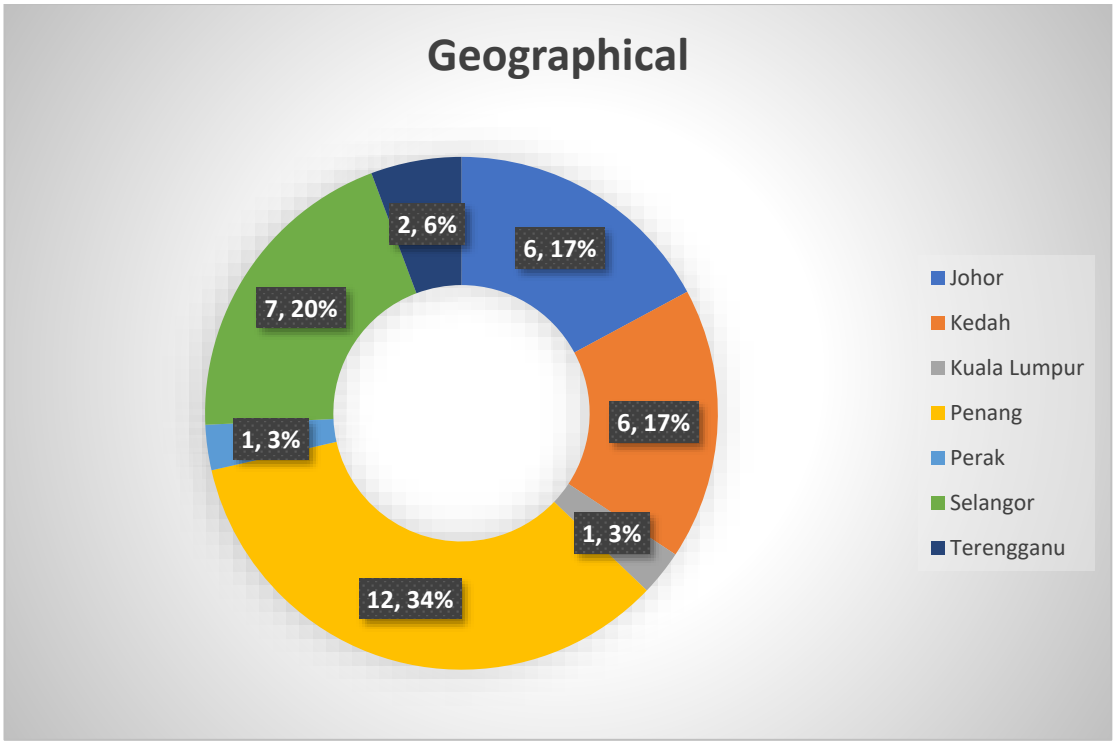

Figure 4.5
Geographical operation

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4.4 Goodness of Measures

Before the data is analyzed to test the hypotheses, some preliminary steps need to be completed. These are help to ensure the data is reasonably good and fit for further analysis. To test the goodness of the data the validity and reliability of the data were looked into.

4.4.1 Validity of the Instrument

Cooper & Schindler (1998) state that the validity of an instrument is a key factor in assessing a measurement tool. Typically, three types of validity tests are employed.

The three types of validity are: content validity, criterion-related validity, and construct validity.

In this study, construct validity was employed to assess the accuracy of the instrument. Construct validity refers to the degree to which a certain item is related to other items in a manner that aligns with the theoretical hypotheses drawn from the variable being assessed. Factor analysis was used to evaluate whether the variables represent the measure of decentralised organisational structure and the pressure exerted by supply chain participants. Each factor in the analysis was treated as an independent construct. According to Coakes & Steed (2003), the analysis used the SPSS 29.0 Data Reduction-Factor Analysis Procedure. The selected approach for extraction was principal component analysis. The results were examined to identify elements with a weak association relative to others as well as a low factor loading that warranted their removal during the secondary factor analysis. The outcome is presented in Table 4.3.

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Table 4.3 demonstrates that all the items have high loadings (> 0.50) on their respective components, indicating that they are regarded as practically significant (Fair et al., 2006). The Kaiser-Meyer-Olkin (KMO) measures confirm that the data is sufficient for factor analysis. As stated in Table 4.3, The KMO values for supply chain technology, organisational culture, employee training and education, and top management implementation are 0.748, 0.781, 0.783, and 0.692, respectively. Given that all the KMO values are in close proximity to one (Rasli, 2006), the data was deemed suitable for factor analysis.

Barlett's test of sphericity is used to determine the feasibility of continuing with factor analysis. The p-value for the Barlett's test of sphericity for all the variables is 0.000

(<0.005). To access the SPSS output, please consult Appendix C. Rasli (2006) states that a small p value for the Barlett's test, namely p-values less than 0.005, is preferred.

Table 4.2
Final results of the factor analysis

Variable	KMO	Anti-image Correlation	Item deleted
Supply Chain Technology	0.748		None
F1 Organizational Culture		0.781	None
F2 Employee Training and Education		0.783	None
F3 Top Management Implementation		0.692	None

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4.4.2 Reliability of the Instrument

Validity evaluates the extent to which the items accurately measure the underlying concept, while reliability evaluates the consistency of the scale by assessing the internal consistency of the items that measure the concept. The construct's reliability was assessed using Cronbach's alpha (α). The findings presented in Table 4.4 demonstrate that the alpha coefficients were 0.882 for organisational culture, 0.936 for employee training and education, and 0.942 for top management employees. The alpha value for supply chain technology is 0.965.

A higher dependability coefficient, approaching 1.0, indicates better performance. Typically, reliability scores below 0.60 are regarded as poor, scores in the range of 0.70 are considered acceptable, and scores above 0.80 are deemed good. Hence, the measures employed in this study exhibit a commendable level of internal consistency

and dependability and can be deemed acceptable. Since these values exceed 0.70 and are above the predetermined threshold, they are deemed acceptable (Kervin, 1992; Sekaran, 2004). Therefore, it may be inferred that the items have demonstrated sufficient inter-item consistency.

The inter-item consistency reliability results are shown in Table 4.4, whereas the results for SPSS are displayed in Appendix D.

Table 4.3
Internal consistency results

Variable	**Number of Items**	**Alpha value**
Supply Chain Technology	18	0.965
F1 Organizational Culture	6	0.879
F2 Employee Training and Education	6	0.934
F3 Top Management Implementation	6	0.939

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4.5 Descriptive Statistic

In order to describe the response for the major variables studied, descriptive statistics such as mean and standard deviation on all the independents variable and dependent variable were generated and presented. Table 4.5 represents the results of the overall descriptive analysis.

Table 4.4
Descriptive statictics of variable

Variable	Mean	Std. Deviation
Dependent Variable		
Supply Chain Technology	68.9714	12.67347
Independent Variable		
F1 Organizational Culture	24.2571	4.28639
F2 Employee Training and Education	24.5429	4.96069
F3 Top Management Implementation	24.2286	4.99462

It can be mentioned that all the independent variables were tapped on aa five-point Likert scale. From the result obtained in Table 4.5 above, it may be seen that the mean value of the organizational culture is 24.2572, employee training and education is 24.5429 and top management implementation is 24.2286 which corresponds to a high level of all practices. Mean value of supply chain technology is 68.9714 which corresponds to also a high level.

The standard deviation for all variables is provided in Table 4.5. It shown that the central tendency and dispersion observed for the independent variable and dependent variable reflect the consistency in the respondents' answers. From the result generated, employee training and education was ranked the highest factor affecting supply chain technology followed by organizational cultured and top management implementation. The result of the descriptive statistics was represented in Table 4.5 and for SPSS is shown in Appendix E.

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4.6 Hypotheses Testing

This section discusses the tests that are used to test the hypotheses of this study and the results obtained. The research data is multivariate analysis technique, multiple regression analysis was used to investigate whether the three independents (organizational cultured, employee training and education and top management implementation) will significantly explain influenced to dependents variable (supply chain technology). Moreover, with the second objectives, it already covered the three hypotheses of this study.

In order to investigate whether the three independent variables which are organizational culture, employee training and education and top management implementation will significantly explain the variance in supply chain technology, a multiple regression analysis was used to find the answer to 3 hypotheses as shown below:

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H1: To examine the influence organisational culture on the supply chain technology implementation in warehouses.

As organisational culture factors exceed 0.5, as it gets 0.781 so it can contribute as a factor towards supply chain technology implementation in warehouses.

H2: To examine the influence employee training and education on the supply chain technology implementation in warehouses.

As employee training and education factors exceed 0.5, as it gets 0.783 so it can contribute as a factor towards supply chain technology implementation in warehouses.

H3: To examine the influence top management support on the supply chain technology implementation in warehouses.

As top management support exceeds 0.5, as it gets 0.692 so it can contribute as a factor towards supply chain technology implementation in warehouses.

4.6.1 Assumptions Test in Regression Analysis

Before proceeding to the regression analysis, a number of assumptions test should be considered. Hair et al, (2006) and Coakes & Steed (2003) have suggested four assumptions underpinning the use of regression. These are normality, linearity, homoscedasticity and multicollinearity.

Having already addressed the issue of normality in the previous analysis, the next assumption needs to be met is linearity and homoscedasticity. If the assumptions of linearity and homogeneity of variance are meet, there should be no relationship between the predicted values and the residuals should suggested possible violations of assumption of linearity. Figure 4.6 shows the plot of the standardized residuals against standardized predicted value. For more details, please refer to Appendix F.

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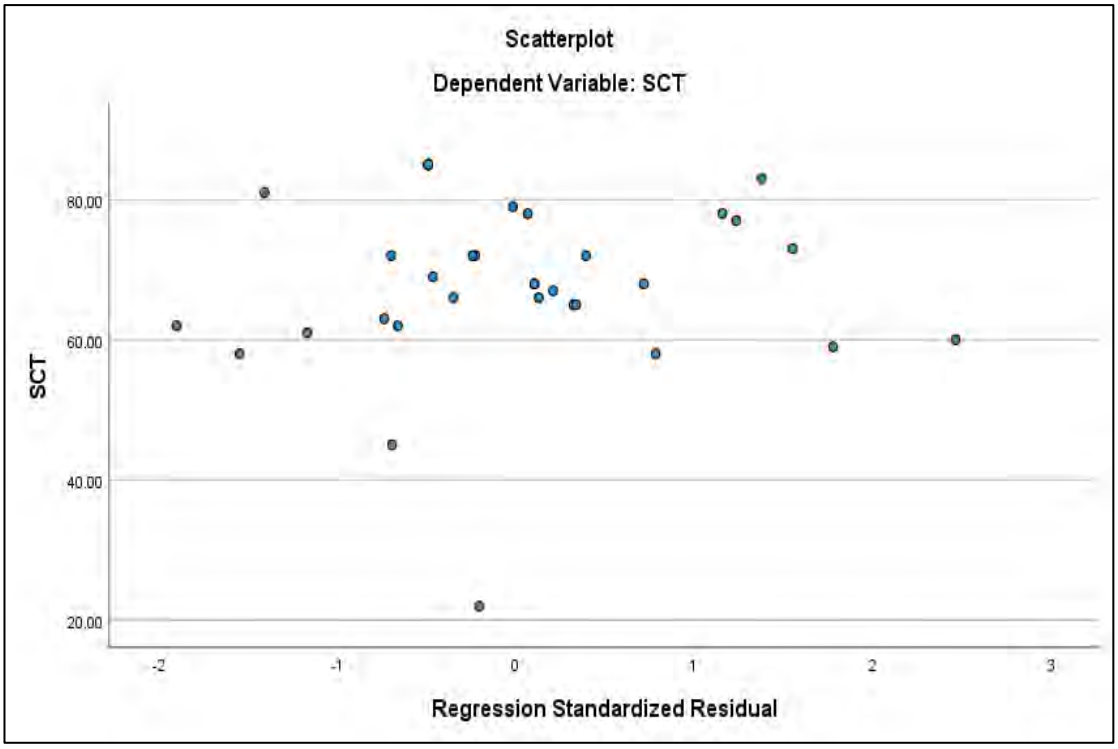

Figure 4.6
Scatter-plot between standardized residuals and standardized predicted values

The figure shows that there was a randomized patter in scatter-plot between standardized predicted value and standardized residual. This result suggests that the linearity and homoscedasticity assumption has not been violated.

The final assumptions that need to be met is multicollinearity. Multicollinearity is used to describe the situation when high correlation is detected between two or more predictor variables. According to Hair et al, (2006) a direct measure of multicollinearity is tolerance and the *variance inflation factor* (VIF), VIF value which exceed 10 and tolerance value less than 0.1 shows that there is multicollinearity problems.

As shown in Table 4.6, all the independents variable in this study exceeds the standard or regressions by scoring less than 10 for its *Variance Inflation Factor* (VIF), and tolerance value exceeding 0.1. Therefore, the last assumption of multicollinearity is

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met. Additionally, the existence of outliers was queried and none were found. Hence, all assumption were satisfied.

Table 4.5
Testing for multicollinearity (Tolerance and VIF Values)

Variable	Tolerance	Variance Inflation Factor (VIF)
F1 Organizational Culture	0.288	3.469
F2 Employee Training and Education	0.290	3.448
F3 Top Management Implementation	0.209	3.776

4.6.2 Statistical Implications of the Regression Analysis

Having confirmed that no assumptions have been violated, the test of regression was carried out. A regression model was formed to examine the mathematical relationship between organizational culture, employee training and education and top management implementation with supply chain technology. The model is explained as follows.:

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Regression model:

$$Y_{SCT} = \alpha + B_1X_1 + B_2X_2 + B_3X_3 + e$$

Where,

Y_{SCT} = supply chain technology as the dependent variable,

α = intercept,

$B_1B_2B_3$ = regression coefficient,

X_1 = organizational culture

X_2 = employee training and education

X_3 = top management implementation

E = prediction error (residual)

The result of multiple regression obtained from Table 4.7 shows that there is significant relationship between the independent variables and the dependent variable. The three independent variables that had entered into the regression model have significantly explained 99.9% of the variance in the supply chain technology. The R^2 for the regression model for SCT with organizational culture, employee training and education and top management implementation obtained number pressure is 0.999 which reflects that more than half the percentage of the explanatory power is attribute to the dependent variable. As indicate by the F statistic, organizational culture, employee training and education and top management implementation is highly significant at 0.001 level. Hence, hypotheses are substantiated.

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Table 4.6
Regression analysis between independent variable and dependent variable

	Predictor	Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
	(Constant)	-0.867	0.349		-2.485	0.019
F1	Organizational culture	1.026	0.026	0.347	39.521	0.000
F2	Employee training and education	1.029	0.022	0.403	45.989	0.000
F3	Top management implementation	0.813	0.026	0.320	31.078	0.000
R^2 = 0.999, **Adjusted R^2** = 0.999, **Sig, F** = 0.000						

A measure of how well the independent or predictor variables explain the variation in the dependent variable compared to its mean is called the coefficient of determination (R2) in multiple regression (Hair et al., 2006). Multiple regression does not have the ability to directly change the independent variable. Instead, it can only observe and analyse the naturally occurring levels of variance to determine if they can predict the scores on the dependent variables. Multiple regression is a statistical method that examines the relationship between multiple independent variables and a dependent variable. It aims to identify the combination of observed variables that can accurately predict the values of the dependent variable.

4.7 Summary

This chapter has presented a brief summary of the demographic profile of 35 respondents which including length of position, company established, number of employees, turn over by companies in 2022 and geographical operational. Subsequently, the data obtained from the survey were examined to ascertain the underlying assumption including normality, linearity, homoscedastic and multicollinearity before performing further analysis such as factor analysis, and regression technique.

Before analyzing the data to test the objective, internal consistency analysis and construct validity was conducted. From the results obtained, it is clearly showed that the survey instrument used in this study was valid and reliable.

Having confirmed that no assumption had been violated and goodness of data have been tested, several statistic techniques were used to test the objective b using multiple regression analysis. The multiple regression results show that organizational culture, employee training and education and top management implementation significantly explained the variance in the supply chain technology.

The finding of chapter 4.6 are summarised in the table 4.7 below.

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Table 4.7
Summary of Hypothesis Testing

Hypothesis	Hypothesized Paths	Findings
H1	Organisational Culture (IV1) has a significant positive effect on the Supply Chain Technology Implementation (DV)	Supported
H2	Employee Training and Education (IV2) has a significant positive effect on the supply chain technology implementation (DV)	Supported
H3	Top Management Support (IV3) has a significant positive effect on the Supply Chain Technology Implementation (DV)	Supported

The next chapter will perform the finding discussion, implication emerging from this study that researches as well as practitioners should ascertain before SCT. The limitations, recommendations and conclusion are also highlighted in chapter 5.

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CHAPTER 5

DISCUSSION AND CONCLUSIONS

This final chapter begins with the discussion on findings, the managerial implications to researchers and practitioners, followed by discussion on limitations of the research and recommendations for future research. This report ends with the conclusions of this research.

5.1 Discussion on the Findings

This study has examined three important factors affecting SCT implementation in warehouses operation namely organisational culture, employee training and education and top management support. Based on the conducted analysis, three factors were found to be significant with SCT implementation. The next subsection will discuss these factors in details.

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5.1.1 Organisational Culture

Organisational culture has been a point of contention in many studies. In previous studies, researchers have found positive significant relationship between an organisation's culture and technology implementation. The finding in this study show that the organisational culture has positive significant relationship with the implementation with the implementation of SCT in warehouses. Organisational culture has been considered as an important factor to technology implementation as organisations need to adapt to these changes and implement supply chain technology

to meet customer expectations (Grewal et al, 2022). This is parallel with the findings in previous studies that the changes and implementation of technology is proven on question section B factor 1 number 6 that the mean is at a high level which is 4.00.

There is quantitative evidence to suggest that organisations with positive and innovative culture are more likely to be open to change and willing to learn new technologies with a higher level of organisational culture appear to be better in the technology implementation (Chumnumporn et al., 2022) (Daniali et al., 2022) (El-Dirani et al., 2020). In support of this proposition, organisational culture is able to influence supply chain technology with the evidence of the influence value at a high rate of 0.849 or 85%.

This study also supports the statement of organisations with a culture that is resistant to change or reluctant to embrace new technology will hinder the successful implementation of supply chain technology in warehouses. This can be proven that there is a positive and significant relationship between organisational culture and employee training and education (r =0.762). This also in line with Ernest, (2022) that the employee attitude can influence supply chain technology as evidence by the results of this study when the influence of employee training and educations found that the influence of r2 on supply chain technology is 0.873 or 87%.

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5.1.2 Employee Training and Education

As stated in the literature review, the importance of employee training and education in the implementation of supply chain technology in warehouses cannot be overlooked, the findings of this study concur with previous study by Hayashi et al,

who examined that companies with well-trained and educated employees were able to effectively implement supply chain technology and improve their overall logistic strategies. Additionally, the rise of artificial intelligence technology has also impacted the need for employee training and education in warehouses (Jin, 2018).

The finding of this study is also in line with Sallam et al, (2023) as the use of AI-based tools in warehouses has the potential to enhance efficiency and productivity. This reflects the need for employees to receive adequate training and education on how to effectively utilize and integrate these new technologies into their daily operations and can be proven by the influence value obtained are also at a high level with a mean value of 24.5429 out of 30.

Overall, the findings of this study support the statement from Arulsamy et al, (2023) that failure to provide training and education to employees can leading to inefficiencies and potential errors in warehouse operations and ultimately limit the success of an organisations.

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5.1.3 Top Management Support

A finding on correlation analysis shows that there is a positive significant relationship between top management support and the implementation of supply chain technology in warehouses operation. This finding appears to support the research conducted by (H. & K., 2017) and (Chuck & Eric, 2007) that indicates top management support is equally important for effective information sharing using the latest IT technologies which can be absorbed to warehouses operation.

It is also aligned with the other studies that have shown top management support is crucial for facilitating the adoption and integration of new technologies within warehouse operations, as it provides the necessary resources, guidance, and direction for implementation success (Min, 2023). This can be proven through the results of descriptive analysis which have found that top management support was at a high level of mean value of 24.2286. This is further supported that the top management support also contributes the highest influence to supply chain technology with an r2 value of 0.911 or 91%.

5.2 Managerial Implications

The findings raise several implications that impact managers, supply chain practitioners and warehouse practitioners. Since the rate of SCT implementation has been rapid, it is useful to understand the factors affecting SCT implementation in warehouses operation. Organisation involved in supply chain activities are moving away from their dependence on proprietary network and have developed open systems that offer more reimbursement by implementing supply chain technologies. The developed theoretical framework will hopefully provide important insights into the key factors leading to the implementation SCT and could have important managerial implications. Managers, supply chain practitioner or warehouse practitioner may use this study to gain better understandings of the different factors impacting implementation SCT. Extensive investigation of many recently developed implementation SCT shows that there is small number taking place in Malaysia. As such, the study and survey in testing has provided an initial starting point from which to develop a more detailed analysis of the many aspects of implementation SCT.

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Specifically, this study presents empirical research regarding the outcomes of the relationship between organisational culture, employee training and educations and top management support in the implementation of SCT. Results suggested that organisational culture, employee training and educations and top management support are successful in explaining the implementation of SCT in warehouses operation.

Based on the high percentage of organisation that have already implement SCT, it appears that the organisations perceive implementation SCT as important for organisational success. As discussed earlier in chapter 4, this shows that the organisation specifically Malaysian warehouses operation is moving forward in implementing SCT in order to save cost as well as to improve operation and along with keeping up with future technology. According to Patterson et al, (2004) innovative technologies facilitate the transfer of more accurate and up-to date information, with results of better visibility of demand and inventory throughout the supply chain. As such, SCT is the nerve of modern supply chain management.

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The notion is that these findings will provide an initial starting point to managers to get a clear picture of the many aspects of SCT before making a decision to implement SCT is future undertakings. Hence, the findings not only offered empirical evidence to confirm the validity of innovation implementation theory, but also contributed to the growing literature on implementation technology.

5.3 Limitations of the Study

This research has successfully achieved its objectives and has generated important and interesting findings. However, there still exist some limitations in conducting this

research, which need to be acknowledged and addressed. Some of these are described below:

1. The number of respondents in this study is not equally distributed. There are more large sized compared to medium and small sized organisations. Hence the results may not be sufficiently generalizable.
2. The questionnaire answered is lesser and is not close enough with the sample needed as several candidates were told that the questionnaire given were against the company policy.
3. The questionnaire developed, may have contributed to certain limitations. Limitations comes from the methodology involved in questionnaire development specifically on implementation of a considerable number of technologies. The questionnaire was developed based on the theories and existing related instruments.

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5.4 Recommendations for Future Research

Based on the findings and also the limitations of this research, there are still some areas for further improvements. These are the recommendations for future studies.

As a researcher, it is believed that the implementation SCT is crucial and important for organisational success. Therefore, future research investigating the impact of implement SCT on organisational performance will substantiate these claims and may also be able to provide additional knowledge about how to maximize the potential benefits of the technologies.

This study also concentrates on the types of the supply chain technologies used in warehouse operations. Based on the results of the section C questionnaire, thru employee training and education with supply chain technology, this study recommends that the top management supports give the open eyes to implement the robotics and artificial intelligence (AI) and horizontal and vehicle carousel modules towards in warehouses operation. As these three technologies still new in the supply chain technology management and were the lowest scores in the use of technology in organisations in Malaysia manufacturing company, namely with a mean of 2.09 for automated guided vehicles (AGVs), 2.11 for artificial intelligence (AI) and 2.14 for horizontal and vehicles carousel modules.

Throughout the significant, the highest significant factor towards implementing SCT is the top management support, which is 91%, and follow-up with the education training employee with the significance of 87%. The superiors need to be aware that the impact of top management support can affect the productivity of the organisation, and it will be increased further with proper awareness of employee training as well as investing in knowledge through the latest in technology training.

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5.5 Conclusions

This research empirically examined the effect between three variables of organisational culture, education training employee and top management support in the supply chain implementation. These factors were chosen because there was contradicting results on previous studies. Consequently, this research has expanded the emerging theories in implementing technology among organisations, in developing

countries which implement SCT. In addition, this study was also engaged to fill the gaps that have been mentioned in the research problems of the existing literature.

The three developed hypotheses have basically answered the objectives of the research, highlighted in chapter one. The first objective was to examine the implementation levels of supply chain technology in warehouses. The findings using descriptive analysis concurred that there was a moderate level with the mean is 52.1034.

The multiple regression analysis was carried out to meet the second objective of the study. As mentioned earlier, the second objective was to examine the influence of organisational culture, employee training and education and top management support on the supply chain technology implementation in warehouses. The finding was that the three independent variables are highly significantly with the supply chain technology implementation in warehouses operation. influence the dependent variable. Additionally, on examination of the individual criterion (t-value), it indicated that organisational culture, employee training and education and top management support significantly affected the supply chain technology implementation in warehouses operation. Hence, it was found that employee training and educating contributes the highest factor towards supply chain technology implementation, meanwhile top management support was found to have the lowest contributing factor on the implementation of SCT.

In order to meet the third objective of this study, a descriptive frequency analysis was carried out. The objectives were to investigate the challenges faced during the technology implementation. The finding concurred with descriptive frequency analysis that the top management support are the top challenges faces during the

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technology implementation, while the least challenges faces are employee training and education. Results obtained from the analysis also showed that the top three challenges faced during the technology implementation was top management encourages and supports the adoption of new supply chain technologies with mean value 4.31, follow up with the company invests in training and development to enhance the technological skills and employee training and education significantly contribute to the successful implementation of supply chain technology in the company that have same mean value of 4.29.

Another important finding in this study was the status of the implement SCT in warehouses operation. Based on the high percentage of organisations that have already implement SCT, it appears that the warehouses operation is moving forward to improve the effectiveness and efficiency of their operations. Out of twenty SCT listed in this study, warehouse management system (WMS) appears as the most frequently technology implement with 57% responses and the mean value of 3.29. Typically, augmented reality (AR) was found to be the least technology implementation by the manufacturing company with corresponding to only 3.43% and mean value of 2.29.

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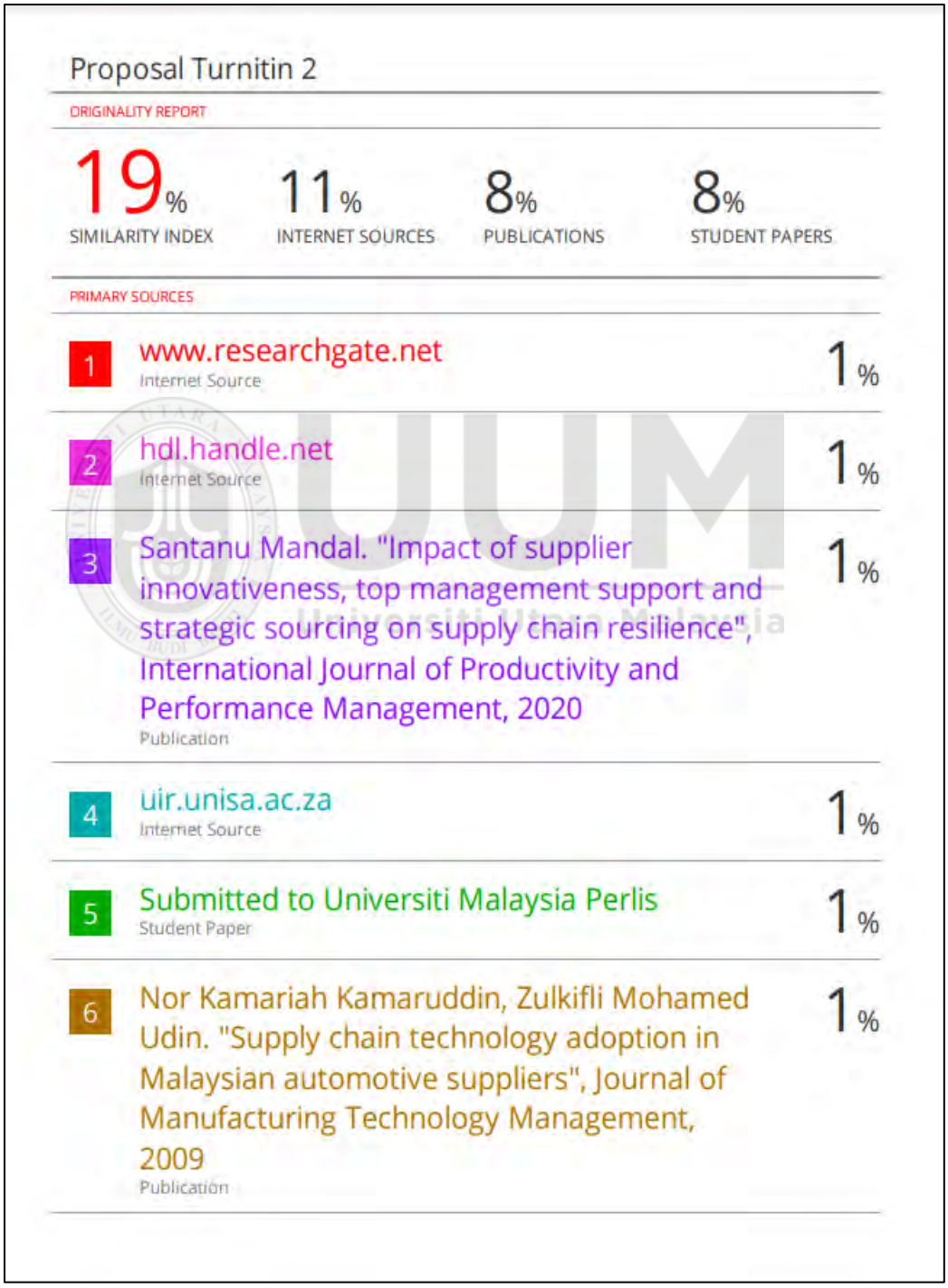
APPENDICES

Appendix A

Proposal Turnitin



Proposal Turnitin 2

ORIGINALITY REPORT

19%	11%	8%	8%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	www.researchgate.net Internet Source	1%
2	hdl.handle.net Internet Source	1%
3	Santanu Mandal. "Impact of supplier innovativeness, top management support and strategic sourcing on supply chain resilience", International Journal of Productivity and Performance Management, 2020 Publication	1%
4	uir.unisa.ac.za Internet Source	1%
5	Submitted to Universiti Malaysia Perlis Student Paper	1%
6	Nor Kamariah Kamaruddin, Zulkifli Mohamed Udin. "Supply chain technology adoption in Malaysian automotive suppliers", Journal of Manufacturing Technology Management, 2009 Publication	1%

Appendix B

Questionnaire

SURVEY ON FACTORS AFFECTING

THE SUPPLY CHAIN TECHNOLOGY IMPLEMENTATION

Dear Sir/Madam,

This is a survey questionnaire to study factors affecting supply chain technology implementation warehouse activities. This research is being conducted as a fulfilment to complete the Master of Science (Supply Chain Management) program.

INTRODUCTION

Supply chain technologies refers to technology that are used to support the operations in the supply chain management activities. Supply chain technology is referred to system that used such as warehouse management systems and inventory management systems in addition it also refers to integrated multiple systems such as warehouse management, accounting, and human resources into a single system. A glossary of key terms of supply chain technology is included at the end of this survey that may help you interpret the questions throughout the survey.

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RESEARCH RATIONAL

The researcher believed that "best practice" information regarding supply chain technology would be very useful to supply chain managers and executives of companies. As such, the researcher has compiled the following survey to assess which supply chain technology systems your company has adopted and implemented, as well as how the technology has been integrated within your organisation. All responses given will be treated with the utmost confidence. The results will be used for research purposes only and no attempt will be made to identify any individual or organisations in any publication.

INSTRUCTIONS: This questionnaire consists of four (3) main sections. Please read the questions carefully before answering them. Where appropriate, please tick (✓) in the box or complete the answer in the space provided. Your honest and sincere response are highly required, so that the researcher will be able to get complete understanding about the subject being studied. Your time and cooperation are highly appreciated. Thank you.

SECTION A: GENERAL INFORMATION

1. Company's name: _____
2. Your current position: _____
3. Length of your position: _____
4. How long your company been established: _____
5. Please indicate the overall number of employees:

- ☐ Less than 100 employees
- ☐ 100 – 300 employees
- ☐ More than 300 employees

6. Please indicate the sales turnover for your company in 2022 by checking appropriate answer

- ☐ Between 250,000 and less 10 million
- ☐ Between 10 million and 25 million
- ☐ More than 25 million

7. Please indicate the geographical scope of your company operations.

   a. Local (e.g: Penang, Selangor and Melaka) _____
   b. Regional (e.g: ASEAN) _____
   c. Worldwide (e.g: Australia, German, Singapore etc) _____

8. Please specify product that your company manufactured:

   _____

   _____

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SECTION B: FACTORS AFFECTING SUPPLY CHAIN TECHNOLOGY (SCT)

Please indicate the extent to which you agree with the survey statements by circling your responses using the following scale.

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

Factors	Level of Practice
F.1 Organisational Culture	
1. Top management encourages and supports the adoption of new supply chain technologies.	1 2 3 4 5
2. Our company invests in training and development to enhance our technological skills.	1 2 3 4 5
3. Foster *employee engagement, collaborating, and open communication about challenges and benefits of technology implementation.	1 2 3 4 5
4. Have the autonomy to make decisions related to supply chain technology in your role.	1 2 3 4 5
5. The implementation of supply chain technology has improved my job satisfaction.	1 2 3 4 5
6. The technology implementation has triggered discussions about redefining our organizational culture.	1 2 3 4 5
*Employees are referring to all level of employees involved in supply chain management.	

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F.2 Employee Training and Education	
1. The training programs effectively prepare me to utilize supply chain technology in my daily tasks.	1 2 3 4 5
2. Adequate training and education have increased my willingness to embrace supply chain technology.	1 2 3 4 5
3. Training has positively influenced my perception of benefits of using technology in our supply chain processes.	1 2 3 4 5
4. AI-based tools have enhanced double my efficiency and productivity in warehouse tasks.	1 2 3 4 5
5. Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	1 2 3 4 5
6. Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.	1 2 3 4 5
F.3 Top Management Support	
1. Senior management provide clear guidance and direction for implement technology and integration.	1 2 3 4 5
2. Top management allocates adequate resources, including funding and personnel, for technology implementation.	1 2 3 4 5
3. Top management support has positively influenced our organizational culture to embrace technological advancements.	1 2 3 4 5

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4. Top management ensures that technology initiatives are in sync with our company's long-term objectives.	1 2 3 4 5
5. The involvement of senior management significantly contributes to the success of technology initiatives.	1 2 3 4 5
6. I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.	1 2 3 4 5

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SECTION C: IMPLEMENT OF SUPPLY CHAIN TECHNOLOGY (SCT)

Please indicate the degree / level of usage of the supply chain technologies in your company to which you agree with the following statements, by circling the appropriate number against each, using the scale below in the box where it is appropriate.

NI	1	2	3	4	5
Not Implement	**Very Little**	**A little**	**To An Average Extent**	**High**	**Very High**

1. The following supply chain technologies system have been implemented and used by your company.

NO	SUPPLY CHAIN TECHNOLOGIES	LEVEL OF USAGE
1.	Augmented Reality (AR)	NI 1 2 3 4 5
2.	Automated Storage & Retrieval Systems (ASRS)	NI 1 2 3 4 5
3.	Automated Picking Tools	NI 1 2 3 4 5
4.	Automated Guided Vehicles (AGVs)	NI 1 2 3 4 5
5.	Automated Inventory Control Platforms	NI 1 2 3 4 5
6.	Bar Coding Technology	NI 1 2 3 4 5
7.	Blockchain Technology	NI 1 2 3 4 5
8.	Cloud Computing	NI 1 2 3 4 5
9.	Collaborative Robots (Cobots)	NI 1 2 3 4 5
10.	Data Analytics Tools	NI 1 2 3 4 5
11.	Electronic Data Interchanges (EDI)	NI 1 2 3 4 5
12.	Horizontal & Vertical Carousel Modules	NI 1 2 3 4 5
13.	Inventory Scanning Technology	NI 1 2 3 4 5
14.	Internet of Things (IoT) Implementations	NI 1 2 3 4 5
15.	Radio-Frequency Identification Technology (RFID)	NI 1 2 3 4 5
16.	Recording Technology	NI 1 2 3 4 5
17.	Robotics & Artificial Intelligence (AI)	NI 1 2 3 4 5
18.	Sensor Technology	NI 1 2 3 4 5
19.	Warehouses Automation Systems (WAS)	NI 1 2 3 4 5
20.	Warehouses Management Systems (WMS)	NI 1 2 3 4 5

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A glossary of key terms of warehouse technologies system is included at the last page of this survey that may help you interpret the questions throughout the survey.

2. Please comment on your experiences with implementation of supply chain technologies.

_____

_____

3. Any suggestion or comments please state:

_____

_____

THANK YOU FOR PARTICIPATING IN THIS STUDY. THE NAMES OF RESPONDENTS AND THEIR RESPECTIVE COMPANIES WILL BE KEPT CONFIDENTIAL AND WILL NOT BE SHARED WITH ANY THIRD-PARTY ORGANISATIONS.

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The following are examples of the types of supply chain information technology that may help you interpret questions throughout this survey form:

No	Term	Definition / Function
1.	Augmented Reality (AR)	AR aids in visualizing storage solutions by wearing AR-equipped glasses or using AR-enabled devices, workers can immediately identify optimal storage spots, visualize inventory levels, or even detect items that are out of place.
2.	Automated Storage & Retrieval Systems (ASRS)	ASRS are computer-controlled inventory management systems that automate the storage and retrieval of unit loads for picking, packing, and shipping. They are a type of warehouse automation technology that handles, stores, and retrieves materials on demand
3.	Automated Picking Tools	Automated Picking Tools are computer-controlled systems that automate the storage and retrieval of unit loads for picking, packing, and shipping. Automated picking tools strategically utilize robotics, lighting, vision, and other technologies to improve picking speed, safety, and accuracy in warehouses. There are numerous solutions for automating warehouse picking, including conveyance, mobile robots, sortation systems, and pick-to-light or put-to-light systems.
4.	Automated Guided Vehicles (AGVs)	AGVs are computer-controlled robots that transport goods and materials through manufacturing facilities, warehouses, or distribution centers without the need for a driver or operator. AGVs are guided by floor markers, wires, magnets, lasers, or computer vision. They are a common sight in industrial settings, moving anything from pallets onto the back of a truck to shifting shipping containers at logistics hubs.

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5.	Automated Inventory Control Platforms	Automated Inventory Control Platforms are implemented in warehouses to take the labor, guesswork, and extraneous time out of traditional inventory control. These platforms are used in conjunction with other technological mainstays such as asset and inventory tags. By leveraging automated inventory control platforms, warehouses can streamline their inventory management processes and improve efficiency ex: Cin7, Ordoro, inFlow, Katana, Zoho Inventory, ShipBob Merchant Plus, Fishbowl Inventory and etc.
6.	Bar Coding Technology	Bar Coding Technology is a widely used inventory management system in warehouses that involves the use of barcodes to track and manage inventory. Barcodes are unique identifiers that are assigned to each item, pallet, or container in the warehouse. The barcode system enables warehouse managers to track inventory levels, monitor stock movement, and manage orders more efficiently. Barcodes can be scanned using handheld devices or fixed scanners, which can be integrated with warehouse management systems (WMS) to provide real-time inventory data.
7.	Blockchain Technology	Blockchain technology has the potential to revolutionize various industries, including warehousing and logistics. By leveraging blockchain, companies can track products accurately and in real time within the warehouse. This technology allows manufacturers to see end-user demand in real time, enabling better management of manufacturing planning and nimble inventory allocation and replenishment. Blockchain provides a distributed ledger that stores immutable data shared by participating network members.

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8.	Cloud Computing	Cloud Computing is a technology that enables the delivery of computing services over the internet, providing on-demand access to a shared pool of configurable computing resources such as servers, storage, databases, and software. Cloud data warehousing, which involves storing and managing large quantities of data in a cloud-based file system. Cloud data warehouses provide powerful computing capabilities that support streaming data and real-time analytics. They enable faster insights by allowing business users to access and analyze data from diverse sources more quickly. Major cloud vendors offer their own cloud data warehouse services, such as Google BigQuery, Amazon Redshift, and Microsoft Azure SQL Data Warehouse.
9.	Collaborative Robots (Cobots)	Collaborative robots (Cobots) are machines designed to work alongside operators in a production line or a warehouse. They are specifically created to interact with humans in a work environment, freeing workers from having to perform more repetitive, complex, or hazardous tasks. Cobots ensure the protection of both the worker and the goods by guaranteeing safe interaction between the operator and the machine. They are equipped with safety mechanisms, such as power and force limiting safeties, to detect their environment and prevent accidents. Collaborative robots can help reduce worker fatigue, improve safety, and increase efficiency in warehouses.
10.	Data Analytics Tools	Data Analytics Tools are essential for warehouses to manage and analyze data effectively. These tools help warehouse managers make informed decisions, optimize inventory levels, and improve overall operational efficiency examples: Snowflakes, PostgreSQL, MySQL, Microsoft Azure, Google BigQuery, Panoply, SAP Data Warehouse Cloud and etc.

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11.	Electronic Data Interchanges (EDI)	Electronic Data Interchange (EDI) is a critical necessity for many warehouses to communicate with customers, partners, and retailers. It helps warehouse operations run more efficiently, keeps them current with the requirements of their customers, partners, and vendors, and most importantly, helps them remain competitive. EDI is a standardized communication system that uses structured data to simplify the process of ordering from suppliers, liaising with shippers, and communicating with customers. EDI is a standard electronic format that replaces paper-based documents such as purchase orders or invoices. By automating paper-based transactions, organizations can save time and eliminate costly errors caused by manual processing. In EDI transactions, information moves directly from a computer application in one organization to a computer application in another. EDI standards define the location and order of information in a document format. With this automated capability, data can be shared rapidly instead of over the hours, days or weeks required when using paper documents or other methods.
12.	Horizontal & Vertical Carousel Modules	Vertical carousel modules are automated storage solutions that use a chain-driven system to rotate shelves vertically. They are ideal for storing smaller items such as documents, tools, and parts. Vertical carousels take up very little floor space and can store a large number of items without occupying too much space. Horizontal carousel modules, also known as horizontal carousels, are automated storage systems that rotate horizontally on a track. They are typically used to store bigger items such as boxes, equipment, and furniture. Horizontal carousels can store a higher volume of goods compared to vertical carousels. The choice between vertical carousel modules and horizontal carousel modules depends on several factors such as available floor space, the size and weight of the items to be stored, and the level of automation required.

13.	Inventory Scanning Technology	Inventory scanning technology plays a crucial role in warehouse management, enabling efficient tracking and management of inventory. By adopting best practices for scanning warehouse inventory, warehouses can improve operational efficiency and customer satisfaction. One best practice is to share real-time inventory visibility through a client portal. Another best practice is to design the warehouse for optimal flow of inventory. Other best practices include leveraging mobile barcode scanning for information retrieval, pick job assignment, and order verification.
14.	Internet of Things (IoT) Implementations	The Internet of Things (IoT) has numerous applications in warehouse management, enabling improved efficiency and automation. Here are some ways IoT is implemented in warehouses: Real-time product tracking, Inventory optimization, Automated items tracking, Asset management, Storage racks moved by robots, Smart warehouse maintenance and etc.
15.	Radio-Frequency Identification Technology (RFID)	Radio-Frequency Identification (RFID) technology is widely used in warehouses to track and manage inventory efficiently. RFID uses wireless technology to transfer data through radio frequency fields. In a warehouse environment, an RFID tracking system involves attaching RFID tags to items or entire pallets. Each tag has internal memory that stores and modifies item information as it moves through different processes in the warehouse. The RFID tag transmits the item's information to a central database via an electromagnetic signal. Unlike traditional barcode systems, RFID tags don't require line-of-sight scanners and can be read remotely and simultaneously. RFID improves warehouse operations by providing accurate, automated processes that communicate with warehouse software.

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16.	Recording Technology	Recording technology in warehouses refers to the use of technology to track and record the movement and placement of machines, employees, and products within a warehouse. This information can be used to improve the layout of the warehouse, optimize future expansions and upgrades, and enhance overall efficiency. By leveraging recording technology, warehouses can gain valuable insights into their operations and make data-driven decisions to improve productivity and reduce errors.
17.	Robotics & Artificial Intelligence (AI)	AI-powered robots are increasingly being used in warehouses to automate tasks that previously required human intervention. These robots can accurately sort, transport, arrange, stock, and retrieve inventory items as required. They can work alongside humans, improving efficiency and reducing the risk of accidents. AI solutions, combined with technologies such as machine learning, IoT, and computer vision, are being used to increase operational accuracy in warehouse management. The use of AI-powered robots and specialized software is known as warehouse robotics. These technologies are helping warehouses optimize their operations, improve productivity, and streamline processes.
18.	Sensor Technology	Sensors and robotics used in automated mobile robots and automated guided vehicles can give warehouse managers and employees more peace of mind and safety in meeting the demands of the industry. These sensors can provide valuable insights into warehouse operations, enhancing efficiency, accuracy, and productivity. By utilizing automation in manufacturing, warehouse inventory, sorting, shipping, and receiving, many organizations are increasing their customer satisfaction and decreasing their downtime. Warehouse automation solutions can reduce the number and severity of workplace injuries and errors while allowing humans to perform more complicated, strategic tasks.

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19.	Warehouses Automation Systems (WAS)	Warehouse Automation Systems (WAS) refer to the use of technology to automate various processes in warehouses, improving efficiency and reducing manual labor. WAS encompasses a range of technologies and solutions that can be implemented in warehouses to optimize operations and enhance productivity. Some common types of Warehouse Automation Systems include: Warehouse Management System (WMS), Automated Storage and Retrieval Systems (AS/RS), Conveyor Systems, Robotic Picking Systems, Barcode Scanning and RFID Technology.
20.	Warehouses Management Systems (WMS)	A Warehouse Management System (WMS) is a software application that helps manage and control daily warehouse operations, from the moment goods and materials enter a distribution or fulfilment center until the moment they leave. WMS software systems are a key component of supply chain management and offer real-time visibility into a company's entire inventory, in warehouses and in transit. In addition to inventory management, a WMS offers tools for picking and packing processes, resource utilization, analytics, and more. A robust, digital warehouse management system is essential for any business with on-hand inventory – and can help save money and gain new efficiencies in many areas. The top five benefits of a WMS system are: Improved operational efficiency, reduced errors in picking and shipping goods, elimination of duplicate and unnecessary work, smoother operations, and the ability to handle higher volumes.

Appendix C

Validity Test (KMO & Barlet's Test)

Objective 2)

To examine the influence of organisational culture, employee training and education and top management support on the supply chain technology implementation in warehouses

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.748
Bartlett's Test of Sphericity	Approx. Chi-Square	78.284
	df	3
	Sig.	.000

Based on the Measure of Sampling Adequacy value of 0.748 which exceeds 0.50, then the three dimensions of organizational culture, employee training and education and top management implementation can be used as factors for supply chain technology significantly.

Anti-image Matrices				
		B_OC	B_ETnE	B_TMS
Anti-image Covariance	B_OC	.288	-.063	-.137
	B_ETnE	-.063	.290	-.137
	B_TMS	-.137	-.137	.209
Anti-image Correlation	B_OC	.781[a]	-.216	-.558
	B_ETnE	-.216	.783[a]	-.555
	B_TMS	-.558	-.555	.692[a]
a. Measures of Sampling Adequacy (MSA)				

If you look further, the anti-image correlation value shows a qualified MSA value that exceeds 0.5 for each variable, namely:
Organizational Culture = 0.781
Employee Training and Education = 0.783
Top Management Implementation = 0.692

Based on those values, it can be said that employee training and education contributes the highest factor to Supply Chain Technology while Top Management Implementation is the lowest contributing factor to Supply Chain Technology.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.807
Bartlett's Test of Sphericity	Approx. Chi-Square	661.300
	df	153
	Sig.	.000

Based on the Measure of Sampling Adequacy value of 0.807 which exceeds 0.50, then all items can be used as factors for supply chain technology significantly.

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Anti-image Matrices

		SBF1_1	SBF1_2	SBF1_3	SBF1_4	SBF1_5	SBF1_6	SBF2_1	SBF2_2	SBF2_3	SBF2_4	SBF2_5	SBF2_6	SBF3_1	SBF3_2	SBF3_3	SBF3_4	SBF3_5	SBF3_6
Anti-image Covariance	SBF1_1	.162	-.050	-.100	.022	-.020	-.066	.012	-.020	.032	.007	.068	-.040	-.062	.042	.027	.017	.021	.008
	SBF1_2	-.050	.147	.025	.015	-.015	.035	-.028	.019	.022	-.064	-.006	.054	.091	-.057	-.080	-.037	.028	-.056
	SBF1_3	-.100	.025	.331	-.094	.041	.029	-.023	.015	.002	.003	-.006	.077	.038	-.017	-.041	-.045	-.011	-.063
	SBF1_4	.022	.015	-.094	.272	-.108	.033	-.006	.015	-.018	-.059	-.063	.021	.023	-.057	-.017	-.025	.010	.023
	SBF1_5	-.020	-.015	.041	-.108	.125	-.034	-.017	.000	.022	.047	.058	.004	-.054	.021	.020	-.010	-.035	-.018
	SBF1_6	-.066	.035	.029	.033	-.034	.084	-.009	.021	.042	-.053	-.087	.016	.068	-.035	-.035	.001	-.018	.009
	SBF2_1	.012	-.028	-.023	-.006	-.017	-.009	.029	-.018	.007	-.003	.000	-.018	-.010	.023	.020	.007	.015	.014
	SBF2_2	-.020	.019	.015	.015	.000	.021	-.018	.017	-.012	-.013	-.019	.009	.019	-.021	-.015	-.005	-.017	-.003
	SBF2_3	.032	.022	.002	-.018	.022	.042	-.007	-.012	.067	.020	.051	.020	-.018	.001	-.006	-.029	.026	-.034
	SBF2_4	.007	-.064	.003	-.059	.047	-.053	-.003	-.013	.020	.205	.044	-.039	-.074	.006	.040	.007	.024	.018
	SBF2_5	.068	-.006	-.006	-.063	.058	.087	.000	-.019	.051	.044	.160	-.015	-.048	.052	.018	-.010	.012	-.041
	SBF2_6	-.040	.054	.077	.021	.004	.016	-.018	.009	.020	-.039	-.015	.105	.042	-.032	-.049	-.062	.015	-.053
	SBF3_1	-.062	.091	.038	.023	-.054	.058	-.010	.019	-.018	-.074	-.048	.042	.183	-.040	-.072	-.047	.013	-.041
	SBF3_2	.042	-.057	-.017	-.057	.021	.035	.023	-.021	.001	.006	.052	-.032	-.040	.104	.029	.019	-.017	-.005
	SBF3_3	.027	-.080	-.041	-.017	.020	-.035	.020	-.015	-.006	.040	.018	-.049	-.072	.029	.090	.010	-.032	.040
	SBF3_4	.017	-.037	-.045	-.025	-.010	.001	.007	-.005	-.029	.007	-.010	-.062	-.047	.019	.010	.202	-.022	.047
	SBF3_5	.021	.028	-.011	.010	-.035	-.018	.015	-.017	.026	.024	.012	.015	.013	-.017	-.032	-.022	.099	-.025
	SBF3_6	.008	-.056	-.063	.023	-.018	.009	.014	-.003	-.034	.018	-.041	-.053	-.041	-.005	.040	.047	-.025	.080
Anti-image Correlation	SBF1_1	.808[a]	-.321	-.432	.105	-.140	-.566	.181	-.385	.309	.041	.409	-.305	-.357	.324	.224	.092	.164	.072
	SBF1_2	-.321	.650[a]	.112	.076	-.107	.311	-.423	.374	.225	-.367	-.037	.432	.553	-.459	-.696	-.217	.236	-.515
	SBF1_3	-.432	.112	.821[a]	-.312	.203	.177	-.236	.200	.012	.011	-.024	.411	.155	-.089	-.236	-.174	-.062	.388
	SBF1_4	.105	.076	-.312	.824[a]	-.584	.217	-.069	.219	-.133	-.248	-.301	.123	.104	-.340	-.111	-.108	.059	.154
	SBF1_5	-.140	-.107	.203	-.584	.848[a]	-.339	-.275	.007	.243	.295	.407	.035	-.356	.186	.184	-.061	-.317	-.184
	SBF1_6	-.566	.311	.177	.217	-.339	.725[a]	-.176	.539	-.559	-.402	-.752	.171	.467	-.375	-.399	.005	-.202	.110
	SBF2_1	.181	-.423	-.236	-.069	-.275	-.176	.819[a]	-.792	-.153	-.043	-.007	-.321	-.139	.417	.391	.093	.287	.285
	SBF2_2	-.385	.374	.200	.219	.007	.539	-.792	.787[a]	-.366	-.224	-.361	.202	.337	-.485	-.368	-.081	-.421	.071
	SBF2_3	.309	.225	.012	-.133	.243	-.559	-.153	-.366	.843[a]	.172	.496	.239	-.160	.012	-.082	-.248	.317	-.484
	SBF2_4	.041	-.367	.011	-.248	.295	-.402	-.043	-.224	.172	.857[a]	.241	-.265	-.382	.042	.296	.032	.167	.139
	SBF2_5	.409	-.037	-.024	-.301	.407	-.752	-.007	-.361	.496	.241	.703[a]	-.115	-.278	.399	.154	-.054	.094	-.366
	SBF2_6	-.305	.432	.411	.123	.035	.171	-.321	.202	.239	-.265	-.115	.817[a]	.202	-.309	-.506	-.425	.144	-.573
	SBF3_1	-.357	.553	.155	.104	-.356	.467	-.139	.337	-.160	-.382	-.278	.202	.767[a]	-.291	-.559	-.246	.093	-.339
	SBF3_2	.324	-.459	-.089	-.340	.186	.375	.417	-.485	.012	.042	.399	-.309	-.291	.839[a]	.309	.129	-.168	.060
	SBF3_3	.224	-.696	-.236	-.111	.184	.399	.391	-.368	.082	.296	.154	-.506	-.559	.309	.769[a]	.078	-.340	.472
	SBF3_4	.092	-.217	-.174	-.108	-.061	.005	.093	-.081	-.248	.032	-.054	-.425	-.246	.129	.078	.926[a]	-.159	.369
	SBF3_5	.164	.236	-.062	.059	-.317	-.202	.287	-.421	.317	.167	.094	.144	.093	-.168	-.340	-.159	.886[a]	-.277
	SBF3_6	.072	-.515	-.388	.154	-.184	.110	.285	-.071	-.464	.139	-.366	-.573	-.339	-.060	.472	.369	-.277	.811[a]

a. Measures of Sampling Adequacy(MSA)

If you look further, the anti-image correlation value shows a worthy MSA value and exceeds 0.5 for each item, namely:

BF1_1 = 0.808
BF1_2 = 0.650
BF1_3 = 0.821
BF1_4 = 0.824
BF1_5 = 0.848
BF1_6 = 0.725
BF2_1 = 0.819
BF2_2 = 0.787
BF2_3 = 0.843
BF2_4 = 0.857
BF2_5 = 0.703
BF2_6 = 0.817
BF3_1 = 0.767
BF3_2 = 0.839
BF3_3 = 0.769
BF3_4 = 0.926
BF3_5 = 0.886
BF3_6 = 0.811

based on those values, it can be said that item BF3_4 is the highest contributing factor with an MSA value of 0.926 while BF1_2 is the lowest contributing factor to Supply Chain Technology.

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Appendix D

Reliability Test (Supply Chain Technology)

Case Processing Summary			
		N	%
Cases	Valid	35	100.0
	Excluded[a]	0	.0
	Total	35	100.0
a. Listwise deletion based on all variables in the procedure.			

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.965	.965	18

Item Statistics			
	Mean	Std. Deviation	N
BF1_1 Top management encourages and supports the adoption of new supply chain technologies."	4.31	.932	35
BF1_2 Our company invests in training and development to enhance our technological skills.	4.29	.789	35
BF1_3 Foster *employee engagement, collaborating, and open communication about challenges and benefits of technology implementation. *Employees are referring to all level of employees involved in supply chain management."	4.09	.742	35
BF1_4 Have the autonomy to make decisions related to supply chain technology in your role.	3.54	1.094	35
BF1_5 The implementation of supply chain technology has improved my job satisfaction.	4.03	.923	35
BF1_6 The technology implementation has triggered discussions about redefining our organizational culture.	4.00	.907	35
BF2_1 The training programs effectively prepare me to utilize supply chain technology in my daily tasks."	4.06	.906	35
BF2_2 Adequate training and education have increased my willingness to embrace supply chain technology.	4.03	.891	35
BF2_3 Training has positively influenced my perception of benefits of using technology in our supply chain processes.	4.09	1.011	35
BF2_4 AI-based tools have enhanced double my efficiency and productivity in warehouse tasks.	3.97	.985	35
BF2_5 Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	4.11	.993	35
BF2_6 Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.	4.29	.926	35

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BF3_1 Senior management provide clear guidance and direction for implement technology and integration."	4.06	.968	35
BF3_2 Top management allocates adequate resources, including funding and personnel, for technology implementation.	3.97	1.098	35
BF3_3 Top management support has positively influenced our organizational culture to embrace technological advancements.	3.83	1.043	35
BF3_4 Top management ensures that technology initiatives are in sync with our company's long-term objectives.	4.06	.873	35
BF3_5 The involvement of senior management significantly contributes to the success of technology initiatives."	4.06	.802	35
BF3_6 I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.	4.26	.886	35

Inter-Item Correlation Matrix

	BF1_1 Top management encourages and supports the adoption of new supply chain technologies.	BF1_2 Our company invests in training and development to enhance our technological skills.	BF1_3 Foster "employee engagement, collaborating, and open communication about challenges and benefits of technology implementation. "Employees are referring to all level of employees involved in supply chain management."	BF1_4 Have the autonomy to make decisions related to supply chain technology in your role.	BF1_5 The implementation of supply chain technology has improved my job satisfaction.	BF1_6 The technology implementation has triggered discussions about redefining our organizational culture.	BF2_1 The training programs effectively prepare me to utilize supply chain technology in my daily tasks."	BF2_2 Adequate training and education have increased my willingness to embrace supply chain technology.	BF2_3 Training has positively influenced my perception of benefits of using technology in our supply chain processes.	BF2_4 AI-based tools have enhanced, double my efficiency and productivity in warehouse tasks.	BF2_5 Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	BF2_6 Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.	BF3_1 Senior management provide clear guidance and direction for implement technology and integration."	BF3_2 Top management allocates adequate resources, including funding and personnel, for technology implementation.	BF3_3 Top management support has positively influenced our organizational culture to embrace technological advancements.	BF3_4 Top management ensures that technology initiatives are in sync with our company's long-term objectives.	BF3_5 The involvement of senior management significantly contributes to the success of technology initiatives."	BF3_6 I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.
BF1_1 Top management encourages and supports the adoption of new supply chain technologies.	1.000	.634	.597	.462	.707	.661	.675	.662	.564	.483	.373	.677	.599	.584	.632	.628	.526	.612
BF1_2 Our company invests in training and development to enhance our technological skills.	.634	1.000	.560	.463	.514	.370	.512	.491	.374	.317	.182	.529	.363	.621	.598	.499	.392	.565
BF1_3 Foster "employee engagement, collaborating, and open communication about challenges and benefits of technology implementation. "Employees are referring to all level of employees involved in supply chain management."	.597	.560	1.000	.593	.554	.393	.474	.485	.460	.406	.266	.391	.494	.544	.513	.492	.485	.592
BF1_4 Have the autonomy to make decisions related to supply chain technology in your role.	.462	.463	.593	1.000	.741	.444	.472	.467	.462	.452	.293	.394	.553	.577	.497	.552	.508	.489
BF1_5 The implementation of supply chain technology has improved my job satisfaction.	.707	.514	.554	.741	1.000	.632	.666	.679	.628	.519	.381	.610	.722	.669	.647	.692	.713	.674
BF1_6 The technology implementation has triggered discussions about redefining our organizational culture.	.661	.370	.393	.444	.632	1.000	.644	.691	.737	.592	.750	.700	.589	.650	.715	.669	.687	.658
BF2_1 The training programs effectively prepare me to utilize supply chain technology in my daily tasks."	.675	.512	.474	.472	.666	.644	1.000	.946	.862	.760	.581	.752	.533	.653	.571	.740	.562	.678
BF2_2 Adequate training and education have increased my willingness to embrace supply chain technology.	.662	.491	.485	.467	.679	.691	.946	1.000	.912	.705	.628	.810	.612	.783	.702	.793	.739	.773
BF2_3 Training has positively influenced my perception of benefits of using technology in our supply chain processes.	.564	.374	.460	.462	.628	.737	.862	.912	1.000	.623	.605	.727	.626	.744	.656	.761	.683	.783
BF2_4 AI-based tools have enhanced, double my efficiency and productivity in warehouse tasks.	.683	.617	.406	.452	.519	.592	.760	.705	.623	1.000	.424	.687	.495	.599	.511	.619	.374	.548
BF2_5 Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	.373	.182	.266	.293	.381	.750	.581	.628	.605	.424	1.000	.635	.452	.462	.502	.535	.545	.634
BF2_6 Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.	.677	.529	.391	.394	.610	.700	.752	.810	.727	.687	.635	1.000	.637	.761	.753	.780	.690	.684
BF3_1 Senior management provide clear guidance and direction for implement technology and integration."	.599	.363	.494	.553	.722	.589	.533	.612	.626	.495	.452	.637	1.000	.666	.709	.692	.677	.782
BF3_2 Top management allocates adequate resources, including funding and personnel, for technology implementation.	.584	.621	.544	.577	.668	.650	.653	.783	.744	.599	.462	.761	.666	1.000	.786	.708	.803	.824
BF3_3 Top management support has positively influenced our organizational culture to embrace technological advancements.	.632	.598	.513	.497	.647	.715	.571	.702	.656	.511	.502	.753	.709	.786	1.000	.755	.821	.686
BF3_4 Top management ensures that technology initiatives are in sync with our company's long-term objectives.	.628	.499	.492	.552	.692	.669	.740	.793	.761	.619	.535	.780	.692	.708	.755	1.000	.709	.665
BF3_5 The involvement of senior management significantly contributes to the success of technology initiatives."	.526	.392	.485	.508	.713	.687	.562	.739	.683	.374	.545	.690	.677	.803	.821	.709	1.000	.765
BF3_6 I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.	.612	.565	.592	.489	.674	.658	.678	.773	.763	.548	.634	.804	.702	.824	.686	.665	.765	1.000

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Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.057	3.543	4.314	.771	1.218	.032	18

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
BF1_1 Top management encourages and supports the adoption of new supply chain technologies."	68.71	158.798	.757	.838	.963
BF1_2 Our company invests in training and development to enhance our technological skills.	68.74	164.550	.606	.853	.965
BF1_3 Foster *employee engagement, collaborating, and open communication about challenges and benefits of technology implementation. *Employees are referring to all level of employees involved in supply chain management."	68.94	165.291	.608	.669	.965
BF1_4 Have the autonomy to make decisions related to supply chain technology in your role.	69.49	159.316	.613	.728	.965
BF1_5 The implementation of supply chain technology has improved my job satisfaction.	69.00	158.059	.798	.875	.962
BF1_6 The technology implementation has triggered discussions about redefining our organizational culture.	69.03	158.617	.787	.916	.962
BF2_1 The training programs effectively prepare me to utilize supply chain technology in my daily tasks."	68.97	157.852	.825	.971	.962
BF2_2 Adequate training and education have increased my willingness to embrace supply chain technology.	69.00	156.824	.889	.983	.961
BF2_3 Training has positively influenced my perception of benefits of using technology in our supply chain processes.	68.94	155.408	.834	.933	.962
BF2_4 AI-based tools have enhanced double my efficiency and productivity in warehouse tasks.	69.06	158.879	.709	.795	.963

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BF2_5 Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	68.91	161.198	.605	.840	.965
BF2_6 Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.	68.74	156.961	.846	.895	.961
BF3_1 Senior management provide clear guidance and direction for implement technology and integration."	68.97	158.264	.749	.817	.963
BF3_2 Top management allocates adequate resources, including funding and personnel, for technology implementation.	69.06	153.173	.849	.896	.961
BF3_3 Top management support has positively influenced our organizational culture to embrace technological advancements.	69.20	155.106	.818	.910	.962
BF3_4 Top management ensures that technology initiatives are in sync with our company's long-term objectives.	68.97	158.205	.842	.798	.962
BF3_5 The involvement of senior management significantly contributes to the success of technology initiatives."	68.97	160.617	.796	.901	.962
BF3_6 I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.	68.77	157.711	.851	.920	.961

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Scale Statistics

Mean	Variance	Std. Deviation	N of Items
73.03	177.440	13.321	18

Reliability test (Organizational Culture)

Case Processing Summary

		N	%
Cases	Valid	35	100.0
	Excluded[a]	0	.0
	Total	35	100.0

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

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.879	.882	6

Item Statistics

	Mean	Std. Deviation	N
BF1_1 Top management encourages and supports the adoption of new supply chain technologies."	4.31	.932	35
BF1_2 Our company invests in training and development to enhance our technological skills.	4.29	.789	35
BF1_3 Foster *employee engagement, collaborating, and open communication about challenges and benefits of technology implementation. *Employees are referring to all level of employees involved in supply chain management."	4.09	.742	35
BF1_4 Have the autonomy to make decisions related to supply chain technology in your role.	3.54	1.094	35
BF1_5 The implementation of supply chain technology has improved my job satisfaction.	4.03	.923	35
BF1_6 The technology implementation has triggered discussions about redefining our organizational culture.	4.00	.907	35

Inter-Item Correlation Matrix

	BF1_1 Top management encourages and supports the adoption of new supply chain technologies. "	BF1_2 Our company invests in training and development to enhance our technological skills.	BF1_3 Foster *employee engagement, collaborating, and open communication about challenges and benefits of technology implementation. *Employees are referring to all level of employees involved in supply chain management."	BF1_4 Have the autonomy to make decisions related to supply chain technology in your role.	BF1_5 The implementation of supply chain technology has improved my job satisfaction.	BF1_6 The technology implementation has triggered discussions about redefining our organizational culture.
BF1_1 Top management encourages and supports the adoption of new supply chain technologies."	1.000	.634	.597	.462	.707	.661

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BF1_2 Our company invests in training and development to enhance our technological skills.	.634	1.000	.560	.463	.514	.370
BF1_3 Foster *employee engagement, collaborating, and open communication about challenges and benefits of technology implementation . *Employees are referring to all level of employees involved in supply chain management."	.597	.560	1.000	.593	.554	.393
BF1_4 Have the autonomy to make decisions related to supply chain technology in your role.	.462	.463	.593	1.000	.741	.444
BF1_5 The implementation of supply chain technology has improved my job satisfaction.	.707	.514	.554	.741	1.000	.632
BF1_6 The technology implementation has triggered discussions about redefining our organizational culture.	.661	.370	.393	.444	.632	1.000

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Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.043	3.543	4.314	.771	1.218	.077	6

Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
BF1_1 Top management encourages and supports the adoption of new supply chain technologies."	19.94	12.467	.765	.709	.844
BF1_2 Our company invests in training and development to enhance our technological skills.	19.97	14.087	.619	.472	.869
BF1_3 Foster *employee engagement, collaborating, and open communication about challenges and benefits of technology implementation. *Employees are referring to all level of employees involved in supply chain management."	20.17	14.087	.670	.512	.863
BF1_4 Have the autonomy to make decisions related to supply chain technology in your role.	20.71	12.092	.668	.636	.866
BF1_5 The implementation of supply chain technology has improved my job satisfaction.	20.23	12.240	.818	.735	.835
BF1_6 The technology implementation has triggered discussions about redefining our organizational culture.	20.26	13.432	.619	.502	.869

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Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
24.26	18.373	4.286	6

Reliability Test (Employee Training and Education)

Case Processing Summary			
		N	%
Cases	Valid	35	100.0
	Excluded[a]	0	.0
	Total	35	100.0
a. Listwise deletion based on all variables in the procedure.			

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.934	.936	6

Item Statistics

	Mean	Std. Deviation	N
BF2_1 The training programs effectively prepare me to utilize supply chain technology in my daily tasks."	4.06	.906	35
BF2_2 Adequate training and education have increased my willingness to embrace supply chain technology.	4.03	.891	35
BF2_3 Training has positively influenced my perception of benefits of using technology in our supply chain processes.	4.09	1.011	35
BF2_4 AI-based tools have enhanced double my efficiency and productivity in warehouse tasks.	3.97	.985	35
BF2_5 Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	4.11	.993	35
BF2_6 Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.	4.29	.926	35

Inter-Item Correlation Matrix

	BF2_1 The training programs effectively prepare me to utilize supply chain technology in my daily tasks."	BF2_2 Adequate training and education have increased my willingness to embrace supply chain technology.	BF2_3 Training has positively influenced my perception of benefits of using technology in our supply chain processes.	BF2_4 AI-based tools have enhanced double my efficiency and productivity in warehouse tasks.	BF2_5 Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	BF2_6 Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.
BF2_1 The training programs effectively prepare me to utilize supply chain technology in my daily tasks."	1.000	.946	.862	.760	.581	.752
BF2_2 Adequate training and education have increased my willingness to embrace supply chain technology.	.946	1.000	.912	.705	.628	.810
BF2_3 Training has positively influenced my perception of benefits of using technology in our supply chain processes.	.862	.912	1.000	.623	.605	.727

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BF2_4 AI-based tools have enhanced double my efficiency and productivity in warehouse tasks.	.760	.705	.623	1.000	.424	.687
BF2_5 Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	.581	.628	.605	.424	1.000	.635
BF2_6 Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.	.752	.810	.727	.687	.635	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.090	3.971	4.286	.314	1.079	.012	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
BF2_1 The training programs effectively prepare me to utilize supply chain technology in my daily tasks."	20.49	17.022	.905	.916	.910
BF2_2 Adequate training and education have increased my willingness to embrace supply chain technology.	20.51	16.963	.934	.944	.907
BF2_3 Training has positively influenced my perception of benefits of using technology in our supply chain processes.	20.46	16.550	.856	.835	.916
BF2_4 AI-based tools have enhanced double my efficiency and productivity in warehouse tasks.	20.57	17.723	.714	.634	.934
BF2_5 Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	20.43	18.252	.633	.456	.944

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BF2_6 Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.	20.26	17.373	.826	.725	.920

Scale Statistics			
Mean	Variance	Std. Deviation	N of Items
24.54	24.608	4.961	6

Reliability Test (Top Management Implimentation)

Case Processing Summary			
		N	%
Cases	Valid	35	100.0
	Excluded[a]	0	.0
	Total	35	100.0
a. Listwise deletion based on all variables in the procedure.			

Reliability Statistics		
Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.939	.942	6

Item Statistics			
	Mean	Std. Deviation	N
BF3_1 Senior management provide clear guidance and direction for implement technology and integration."	4.06	.968	35
BF3_2 Top management allocates adequate resources, including funding and personnel, for technology implementation.	3.97	1.098	35
BF3_3 Top management support has positively influenced our organizational culture to embrace technological advancements.	3.83	1.043	35
BF3_4 Top management ensures that technology initiatives are in sync with our company's long-term objectives.	4.06	.873	35
BF3_5 The involvement of senior management significantly contributes to the success of technology initiatives."	4.06	.802	35
BF3_6 I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.	4.26	.886	35

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Inter-Item Correlation Matrix

	BF3_1 Senior management provide clear guidance and direction for implement technology and integration."	BF3_2 Top management allocates adequate resources, including funding and personnel, for technology implementation.	BF3_3 Top management support has positively influenced our organizational culture to embrace technological advancements.	BF3_4 Top management ensures that technology initiatives are in sync with our company's long-term objectives.	BF3_5 The involvement of senior management significantly contributes to the success of technology initiatives."	BF3_6 I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.
BF3_1 Senior management provide clear guidance and direction for implement technology and integration."	1.000	.666	.709	.692	.677	.702
BF3_2 Top management allocates adequate resources, including funding and personnel, for technology implementation.	.666	1.000	.766	.708	.803	.824
BF3_3 Top management support has positively influenced our organizational culture to embrace technological advancements.	.709	.766	1.000	.755	.821	.686
BF3_4 Top management ensures that technology initiatives are in sync with our company's long-term objectives.	.692	.708	.755	1.000	.709	.665
BF3_5 The involvement of senior management significantly contributes to the success of technology initiatives."	.677	.803	.821	.709	1.000	.765

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BF3_6 I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.	.702	.824	.686	.665	.765	1.000

Summary Item Statistics

	Mean	Minimum	Maximum	Range	Maximum / Minimum	Variance	N of Items
Item Means	4.038	3.829	4.257	.429	1.112	.019	6

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
BF3_1 Senior management provide clear guidance and direction for implement technology and integration."	20.17	17.734	.769	.616	.934
BF3_2 Top management allocates adequate resources, including funding and personnel, for technology implementation.	20.26	16.197	.854	.775	.925
BF3_3 Top management support has positively influenced our organizational culture to embrace technological advancements.	20.40	16.659	.846	.759	.925
BF3_4 Top management ensures that technology initiatives are in sync with our company's long-term objectives.	20.17	18.264	.794	.644	.931
BF3_5 The involvement of senior management significantly contributes to the success of technology initiatives."	20.17	18.382	.861	.767	.925
BF3_6 I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.	19.97	17.970	.824	.739	.928

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
24.23	24.946	4.995	6

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Appendix E

Descriptive Statistic_Descriptive

Objective 1)

What is the current level of Supply Chain Technology Warehouses?

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
SCT	35	22.00	85.00	68.9714	12.67347
Valid N (listwise)	35				

Low = 18.0000 hingga 42.0000
Medium = 42.0001 hingga 66.0001
High = 66.0002 hingga 90.0002

The mean for Supply Chain Technology is 68.9714 and it is on the high level.

Objective 3)

To investigate the challenges faces during the technology implementation.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
B_OC	35	10.00	30.00	24.2571	4.28639
B_ETnE	35	6.00	30.00	24.5429	4.96069
B_TMI	35	8.00	30.00	24.2286	4.99462
Valid N (listwise)	35				

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Low = 6.0000 to 14.0000

Medium = 14.0001 to 22.0001

High = 22.0002 to 30.0002

The mean for Organizational Culture is 24.2571 and is at a high level.

The mean for Employee Training and Education is 24.5429 and is at a high level.

The mean for Top Management Implementation is 24.2286 and is at a high level.

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
BF1_1 Top management encourages and supports the adoption of new supply chain technologies."	35	1	5	4.31	.932
BF1_2 Our company invests in training and development to enhance our technological skills.	35	2	5	4.29	.789

BF1_3 Foster *employee engagement, collaborating, and open communication about challenges and benefits of technology implementation. *Employees are referring to all level of employees involved in supply chain management."	35	2	5	4.09	.742
BF1_4 Have the autonomy to make decisions related to supply chain technology in your role.	35	1	5	3.54	1.094
BF1_5 The implementation of supply chain technology has improved my job satisfaction.	35	1	5	4.03	.923
BF1_6 The technology implementation has triggered discussions about redefining our organizational culture.	35	1	5	4.00	.907
BF2_1 The training programs effectively prepare me to utilize supply chain technology in my daily tasks."	35	1	5	4.06	.906
BF2_2 Adequate training and education have increased my willingness to embrace supply chain technology.	35	1	5	4.03	.891
BF2_3 Training has positively influenced my perception of benefits of using technology in our supply chain processes.	35	1	5	4.09	1.011
BF2_4 AI-based tools have enhanced double my efficiency and productivity in warehouse tasks.	35	1	5	3.97	.985
BF2_5 Inadequate training could potentially lead to inefficiencies and errors in our warehouse operations.	35	1	5	4.11	.993
BF2_6 Employee training and education significantly contribute to the successful implementation of supply chain technology in our company.	35	1	5	4.29	.926
BF3_1 Senior management provide clear guidance and direction for implement technology and integration."	35	1	5	4.06	.968
BF3_2 Top management allocates adequate resources, including funding and personnel, for technology implementation.	35	1	5	3.97	1.098
BF3_3 Top management support has positively influenced our organizational culture to embrace technological advancements.	35	1	5	3.83	1.043
BF3_4 Top management ensures that technology initiatives are in sync with our company's long-term objectives.	35	2	5	4.06	.873

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BF3_5 The involvement of senior management significantly contributes to the success of technology initiatives."	35	2	5	4.06	.802
BF3_6 I believe that top management plays a pivotal role in overcoming challenges related to technology implementation.	35	1	5	4.26	.886
Valid N (listwise)	35				

Low = 1.0000 hingga 2.3333
Medium = 2.3334 hingga 3.6667
High = 3.3338 hingga 5.0001

TOP THREE LOWEST FACTORS AFFECTING SUPPLY CHAIN TECHNOLOGY ARE
1) Have the autonomy to make decisions related to supply chain technology in your role with mean value 3.54 (moderate level)
2) Top management support has positively influenced our organizational culture to embrace technology advancements with mean value 4.06 (high level)
3) AI-based tools have echanced double my efficiency and productivity in warehouse tasks dan top management allocates adequate resources, for technology implementation with mean value 3.97 (high level)

TOP THREE HIGHEST FACTORS AFFECTING SUPPLY CHAIN TECHNOLOGY ARE
1) Top management ecncourages and supports the adoption of new supply chain technologies with mean value 4.31 (high level)
2) Our Company invests in training and development to enchance our technological skills and employee training and education significantly contribute to the successful implementation of supply chain technology in our company with mean value 4.29 (high level)
3) I beliece that top management plays a pivotal role in overcoming challenges relates to technology implementation with mean value 4.26 (high level)

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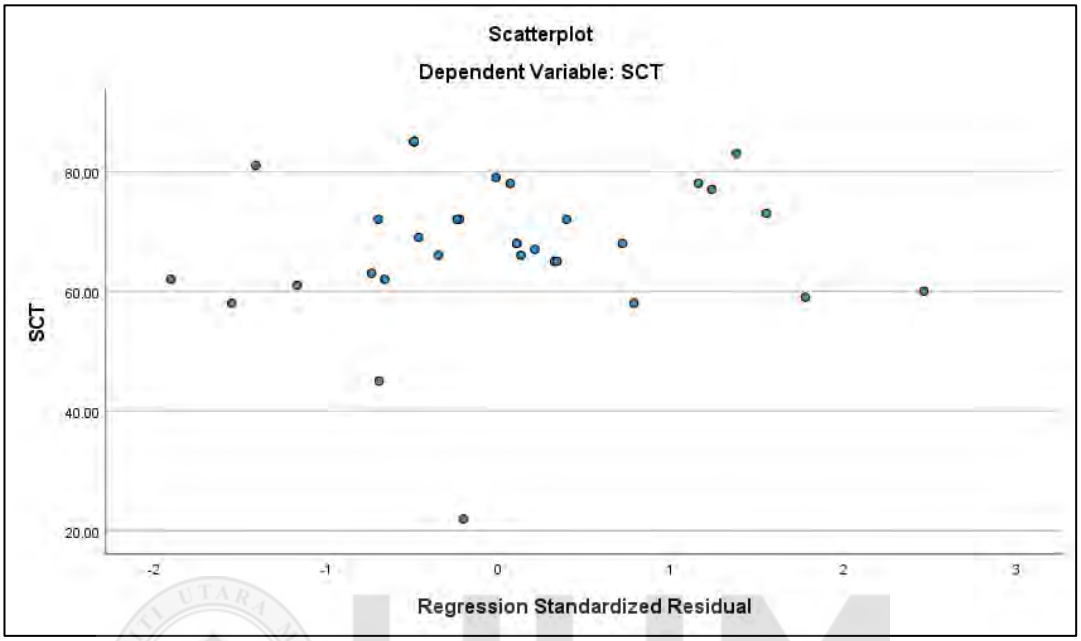
Appendix F

Scatter Plot Graph



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