ORGANISATIONAL PERCEPTION OF CRITICAL SUCCESS FACTORS IN GREEN WAREHOUSE AND INVENTORY

CHEAH SHU WEN

SCHOOL OF TECHNOLOGY MANAGEMENT AND LOGISTICS

COLLEGE OF BUSINESS

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CHEAH SHU WEN

School of Technology Management & Logistics

College of Business

Universiti Utara Malaysia

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Universiti Utara Malaysia

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Pemeriksa Dalam *(Internal Examiner)*	**Dr. Fariza Binti Ahmad Mahyadin @ Mahidin**	Tandatangan *(Signature)*

Tarikh: **10 Ogos 2023**
Date:

Nama Pelajar (Name of Student)	:	**Cheah Shu Wen**
Tajuk Tesis / Disertasi *(Title of the Thesis / Dissertation)*	:	**Organisational Perception of Critical Success Factors in Green Warehouse and Inventory**
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Nama Penyelia/Penyelia-penyelia *(Name of Supervisor/Supervisors)*	:	**Dr. Syairah Aimi Binti Shahron**

Tandatangan

Nama Penyelia/Penyelia-penyelia *(Name of Supervisor/Supervisors)*	:	-

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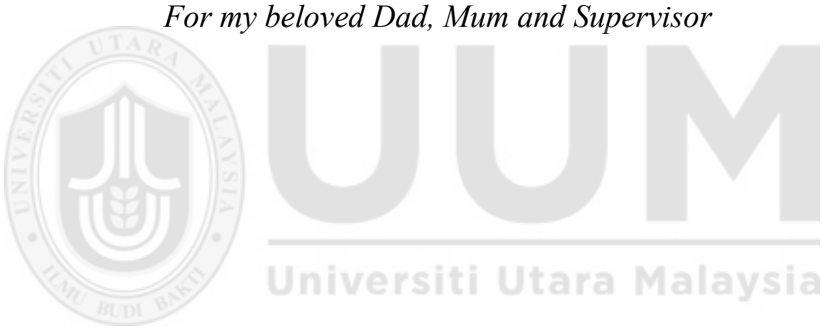
For my beloved Dad, Mum and Supervisor



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ABSTRACT

Green warehouses play a vital role in promoting sustainable practices in the supply chain industry. This paper describes the critical success factor in green warehouse and inventory management. This research aims to determine the critical success factors that contribute to implementing and maintaining a green warehouse and inventory management in the manufacturing industry. Next, it also measures the level of the success factors of a green warehouse and inventory management in the manufacturing industry. A structured questionnaire was used for primary data collection, and statistical tools like descriptive statistics, normality, reliability and factor analysis were used for data analysis. The focused factors will be customer focus, supplier quality management, and Third-Party Logistics (3PL). The respondents were selected based on a population of 150 and a sample size 110, representing the Malaysian manufacturing industry. These samples are related to working experience, job position and sector of manufacturing. Apart from the items investigating the critical success factors in the green warehouse and inventory, all measures were assessed by using a scale from 1 to 5 ranging from "strongly disagree" (1) to "strongly agree" (5). Overall, the result showed that all the respondents positively perceived the questionnaire. In terms of theoretical contribution, this study can inspire future research and contribute to the ongoing discourse on sustainable business practices. Lastly, the practical contribution is to provide valuable insights into the critical success factors and achieve sustainable warehouse and inventory management in the manufacturing industry in Malaysia.

Keywords: *Critical Success Factors, customer focus, supplier quality management, Third-Party Logistics (3PL), green warehouse and inventory.*

ABSTRAK

Gudang hijau memainkan peranan penting dalam mempromosikan amalan mampan dalam industri rantaian bekalan. Kertas kajian ini menerangkan faktor kejayaan kritikal dalam gudang hijau dan pengurusan inventori. Penyelidikan ini bertujuan untuk menentukan faktor kejayaan kritikal yang menyumbang kepada pelaksanaan dan penyelenggaraan gudang hijau dan pengurusan inventori dalam industri pembuatan. Seterusnya, ia juga mengukur tahap faktor kejayaan gudang hijau dan pengurusan inventori dalam industri pembuatan. Soal selidik berstruktur digunakan untuk pengumpulan data primer, dan alat statistik seperti statistik deskriptif, normaliti, kebolehpercayaan dan analisis faktor digunakan untuk analisis data. Faktor yang difokuskan ialah tumpuan pelanggan, pengurusan kualiti pembekal dan logistik pihak ketiga. Responden yang mewakili industri pembuatan Malaysia dipilih berdasarkan populasi 150 dan saiz sampel 110. Sampel ini berkaitan dengan pengalaman bekerja, jawatan kerja dan sektor pembuatan. Selain daripada item yang menyiasat faktor kejayaan kritikal dalam gudang hijau dan inventori, semua langkah telah dinilai dengan menggunakan skala likert 1 sampai 5. Secara keseluruhannya, dapatan kajian menunjukkan bahawa semua responden mempunyai persepsi yang positif terhadap soal selidik tersebut. Dari segi sumbangan teori, kajian ini boleh memberi inspirasi kepada penyelidikan masa depan dan menyumbang kepada wacana berterusan mengenai amalan perniagaan yang mampan. Akhir sekali, sumbangan praktikal adalah untuk memberikan pandangan berharga tentang faktor kejayaan kritikal dan mencapai pengurusan gudang dan inventori yang mampan dalam industri pembuatan di Malaysia.

Kata kunci: Faktor Kejayaan Kritikal, tumpuan pelanggan, pengurusan kualiti pembekal, logistik pihak ketiga (3PL), gudang hijau dan inventori.

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CHAPTER 1: INTRODUCTION

1.0 Introduction

This chapter consists of eight sections. Section 1.1 explains the background of the study. Section 1.2 presents the problem statement. Section 1.3 outlines the research questions. Section 1.4 defines the research objectives. Section 1.5 provides the definition of key terms. Section 1.6 discusses the significance of the study. Section 1.7 clarifies the scope of the study, and finally, Section 1.8 describes the organisation of the thesis.

1.1 Background of the Study

Supply chain management is the process of the flow of goods and services needed to manage from one location to another. Meanwhile, inventory plays an essential part in supply chain management. Besides, the inventory list can be classified into raw material, work in progress, and finished goods. Therefore, it is imperative for companies to manage these three inventory stages well to achieve an effective supply chain. Furthermore, according to Hugos (2011), supply chain management involves different supply chain participants, such as suppliers, manufacturers, distributors, retailers, and customers. Therefore, the entire supply chain management can proceed efficiently and effectively with supply chain participant collaboration.

Furthermore, a warehouse can be defined as a commercial building or building complex used to store goods, and it's more than just a location to keep goods (Karim, Abdul Rahman, Md Hanafiah, Abdul Hamid, Ismail, Abd Kader & Muda, 2021). Manufacturers, wholesalers, and retailers usually store their goods in warehouses before selling or sending them to customers. A warehouse is usually made to fit the needs of certain types of products. It may have features like temperature control, particular storage areas, and loading docks for bringing in and sending out packages. Meanwhile, the warehouse can only store the stuff there briefly. Therefore, it showed a warehouse plays a crucial part in the supply chain network because it offers temporary holding for goods before they are delivered to consumers (Jermsittiparsert, Sutduean & Sriyakul, 2019; Karim et al., 2021).

Conventional energy sources often power the warehouses, leading to significant carbon dioxide and greenhouse gas emissions. These emissions contribute to climate change and its associated environmental challenges (Zhang, Liu, & Gao, 2019). Furthermore, warehouses are known for their substantial energy consumption, especially for lighting, heating, cooling, and operating material handling equipment. However, adopting energy-efficient technologies and renewable energy sources can effectively reduce their carbon footprint (Dallasega, Bortolini, Ferrari, & Gamberi, 2018). Consequently, both the issues of carbon gas emissions and energy consumption have garnered attention from the researcher, prompting the exploration of green practices in warehouses and inventory.

As organisations strive to adopt sustainable practices in recent years, green warehousing has emerged as a critical element of environmentally responsible supply chain management (Ali, Kaur & Khan, 2023). To achieve successful green warehouse and inventory management, businesses need to focus on critical success factors that drive sustainability outcomes. This study investigates three essential factors: customer focus, supplier quality management, and the role of 3PL. By understanding how these factors contribute to the existence and impact of green warehouse and inventory practices, organisations can make informed decisions to enhance their sustainability performance and gain a competitive advantage.

Customer focus plays a pivotal role in adopting and succeeding green warehouse and inventory practices. Understanding customer expectations and preferences for sustainable products and services allow businesses to align their strategies and operations accordingly. Organisations can meet customer demands while reducing their environmental footprint by implementing customer-centric approaches, such as eco-friendly packaging, transportation optimization, and recycling initiatives. Research has shown that customer-focused companies achieve higher levels of customer satisfaction and loyalty, which can positively impact the bottom line (Porter, 2022). Therefore, exploring the impact of customer focus on green warehouse and inventory practices is essential for organisations striving to meet sustainability goals.

Effective supplier quality management is a critical factor in developing and maintaining green warehouse and inventory practices. Collaborating with suppliers who adhere to

sustainable manufacturing processes and provide eco-friendly materials and products is crucial for achieving a green supply chain. By setting stringent quality standards, businesses can encourage suppliers to adopt sustainable practices, reduce waste, and eliminate hazardous materials. Research indicates that solid supplier quality management contributes to improved product quality, enhanced sustainability performance, and reduced environmental impact within the warehouse (Wang, Wu, Li & Wang, 2023). Therefore, studying the relationship between supplier quality management and green warehouse and inventory practices is vital for organisations aiming to build sustainable supply chains.

The involvement of 3PL can significantly influence the existence and impact of green warehouse and inventory practices. 3PL offers specialised knowledge, expertise, and resources to optimise logistics operations and enhance sustainability performance. By partnering with 3PL, organisations can leverage their experience in implementing sustainable practices such as route optimisation, load consolidation, and reverse logistics. Collaborating with 3PL has improved operational efficiency, reduced transportation costs, and enhanced environmental performance (Zhang, Ren, Li, Yu & Gao, 2022). Therefore, understanding the role of 3PL in green warehouse and inventory practices is crucial for organisations seeking external expertise to achieve their sustainability objectives.

Additionally, companies are concerned about managing inventory costs as it directly impacts their financial performance and overall competitiveness. To assess and improve inventory management practices, businesses commonly use the metric of inventory turnover. Inventory turnover provides valuable insights that help optimize working capital, control costs, align supply with demand, evaluate financial health, and make strategic decisions. Besides, it helps determine charges associated with holding and storage costs. High inventory turnover indicates effective stock management, ensuring products are sold before becoming obsolete or incurring additional costs. On the other hand, low turnover suggests excess inventory, leading to increased costs if unsold (Smith & Johnson, 2022). Figure 1.1 demonstrates the researcher's utilization of inventory turnover to evaluate inventory performance for ten randomly selected listed companies.

Figure 1.1: Inventory turnover between 10 listed companies in Bursa Malaysia in the manufacturing sector (Pasaran Utama. (n.d.).).

The statistics in Figure 1.1 provide a comprehensive overview of the inventory turnover ratios for ten listed companies in Bursa Malaysia from 2018 to 2022. The inventory turnover ratio measures how well a company manages its materials and indicates the efficiency of its inventory control practices. A higher inventory turnover ratio suggests efficient and effective inventory management, with products being sold rapidly. Conversely, a lower turnover ratio signifies a need for improved control over inventory levels, indicating the presence of excess materials in warehouse management. The overall statistics depicted in Figure 1.1 shed light on the challenges most listed companies face in effectively controlling their materials. This trend has persisted over the past five years.

Overall, addressing critical success factors such as customer focus, supplier quality management, and the role of 3PL is vital in green warehouse and inventory practices. By

incorporating these factors, businesses can optimise inventory turnover, enhance sustainability, reduce costs related to excess inventory, and improve overall performance in the green warehouse context. Prioritising customer preferences, implementing effective supplier quality management, and collaborating with 3PL enable organisations to gain a competitive edge and achieve sustainable warehouse and inventory management. This study will provide valuable insights to help organisations leverage these critical success factors and achieve sustainable warehouse and inventory management.

1.2 Problem Statement

According to the previous insights of Oloruntobi, Mokhtar, Mohd Rozar, Gohari, Asif, & Chuah (2023), these researchers highlighted how the rapid growth of e-commerce in Malaysia, coupled with the increasing consumer demand for sustainable products and the urgent need for environmental conservation, has created an attractive motivation for businesses to prioritise implementing green warehouses and inventory practices. It shows that organisations' viewpoints are influenced by the need to match current market trends and consumer preferences while addressing environmental concerns. Despite recognising the critical success factors such as customer focus, supplier quality management, and the involvement of 3PL, there is still a pressing necessity to delve into the specific impact of these factors on the adoption of environmentally friendly practices within Malaysia's dynamic business landscape. In short, the main issue concerned is achieving sustainable development and fostering the adoption of environmentally friendly practices in Malaysia's business landscape (Ahmed, Mokhtar, Bin, Lim, Hooi & Lee, 2021).

One of the critical aspects that the main issue highlighted is the lack of customer awareness and demand for environmentally friendly products and services in Malaysia. While global trends indicate a significant shift towards sustainable consumption, a gap exists in understanding local consumer preferences and their willingness to support green initiatives in the warehouse and inventory domain (Tan, Makkonen, Kaur, & Salo, 2022). Understanding the specific customer focus required to drive sustainable practices in Malaysian warehouses is crucial for businesses to align their strategies and meet market demands (Goh & Tan, 2022).

Another aspect is the need for robust supplier quality management practices within the Malaysian supply chain. Although companies recognise the importance of engaging suppliers who prioritise sustainability, there is a lack of effective supplier quality management in ensuring the adoption of eco-friendly materials, waste reduction, and adherence to sustainable manufacturing practices (Ding, 2018). Developing strategies to effectively manage supplier quality and assess their impact on green warehouse and inventory practices is imperative for sustainable supply chain operations (Adekunle, Mohamad Zaina, Muhamad Ruzlan & Abdul-Rahman, 2021).

Additionally, the role of 3PL in driving green warehouse and inventory practices in Malaysia remains underexplored (Lagorio, Zenezini, Mangano, & Pinto, 2022). With the growing complexity of logistics operations and the need for efficient transportation and distribution, businesses often rely on 3PL. However, there is a lack of understanding regarding the specific contributions and challenges faced by 3PL in implementing sustainable practices in the Malaysian context. Investigating their role, capabilities, and potential barriers in supporting green warehouse and inventory practices can provide valuable insights for businesses and guide strategic collaborations (Khor, Lim & Yusof, 2023).

Therefore, the research aims to address the gap in knowledge by investigating the impact of critical success factors, namely customer focus, supplier quality management, and the role of 3PL on green warehouse and inventory practices in Malaysia. By understanding the specific challenges and opportunities in the Malaysian context, this study will provide actionable insights and recommendations for businesses to effectively implement these critical success factors and achieve sustainable warehouse and inventory management. At the same time, the study hopes to contribute to a better understanding of the benefits of sustainable warehouse management and provide a road map for companies that want to implement green initiatives in their warehouses and inventory management.

1.3 Research Questions

To find the reason for applying green warehouse and inventory into supply chain management. These are two research questions related to this study topic's research objective. Regarding the below, these have two research questions:

1. What are the critical success factors that contribute to implementing and maintaining a green warehouse and inventory management in the manufacturing industry?
2. What is the level of the success factor in green warehouse and inventory management?

1.4 Research Objectives

This study primarily aims to identify critical success factors in adoption of green warehouse and inventory. Specifically, the objectives of this research are:

1. To determine the critical success factors that contribute to implementing and maintaining a green warehouse and inventory management in the manufacturing industry.
2. To measure the level of the success factor in green warehouse and inventory management.

1.5 Definition of Key Terms

- **Critical Success Factors:** Critical success factors are the essential variables that must be in place for an organisation to achieve its objectives (Bullen & Rockart, 1981; Chau, Tang, Liu & Tao, 2021).

- **Customer Focus:** Customer focus refers to an organisational perspective and strategy that prioritises consumers' requirements, preferences, and satisfaction in decision-making, strategies, and operations (Amoozad Mahdiraji, Hafeez & Abbasi Kamard, 2022).

- **Supplier Quality Management:** Supplier quality management is an organisation's systematic approach and processes to ensure that suppliers consistently provide materials, components, or services that meet or exceed predetermined quality requirements and standards (Chau et al., 2021).

- **3PL:** 3PL are external companies or service providers that offer businesses logistics and supply chain management services (Qureshi, 2022).

- **Green Warehouse:** Green warehouse is defined as a warehouse designed and operated with sustainable principles to minimise environmental impact (Bartolini, Bottani & Grosse, 2019).

- **Green Inventory:** Green inventory is the management and control of inventory practices in a business that are friendly for the environment and society (Wang, Wu, Zhao & Zhu, 2019).

1.6 Significant of the Study

This study can contribute to the existing literature and theory on green warehouse and inventory management in the green supply chain context. The study can provide new insights into the critical success factors in green warehouses and inventory in the manufacturing industry. These insights can be used to develop theoretical frameworks for understanding the impact of green warehouse and inventory management on the overall sustainability of supply chain management. It may inspire future research and contribute to the ongoing discourse on sustainable business practices.

Furthermore, this study also contributes to increasing the knowledge about quantitative research. This study can serve as an example of how to conduct quantitative research in supply chain management. The study's methodology and data analysis techniques can be a reference for other researchers interested in conducting quantitative research in this field. Overall, this study can contribute to increasing knowledge and understanding of the role of quantitative analysis in supply chain management and related fields.

At the end of this study, some practical contributions to the industry have been identified. This study will provide valuable insights into the critical success factors and achieve sustainable warehouse and inventory management in the manufacturing industry in Malaysia. The results of this study can help businesses in Malaysia and other places figure out where they need to make changes and improve their supply chain management. The study's suggestions also help policymakers decide how to make products in a way that is good for the environment and helps promote sustainable development.

1.7 Scope of the Study

This study focused on the companies in Malaysia's manufacturing industry. The researcher visited the Federation of Malaysian Manufacturers (FMM) in Penang to obtain the database. The manufacturing industry database was sourced from the FMM Directory of Malaysian Industries (53rd Edition), published on 19 December 2022. The researcher selected the first 300 companies from comprehensive profiles of over 3,600 manufacturing companies in different states across Malaysia.

In addition, these companies were chosen to address the survey questions provided by the researcher. As the surveys were utilised as the primary method for data collection in this study, they will be distributed to the target respondents, and the responses will be analysed to determine the organisational perception of critical success factors in green warehouse and inventory management practices in the manufacturing industry in Malaysia.

1.8 Organisation of the Thesis

Chapter 1 introduces supply chain management based on the previous literature review. It delves into the critical success factors associated with green warehouse and inventory practices within supply chain management, emphasising their importance for companies and manufacturers. Also, the statistics of Figure 1.1 will play an essential role in supporting this study topic.

Chapter 2 focuses more on the previous literature review by more of the researcher's study and investigation. Chapter 2 will determine the organisational perception of critical success factors in the green warehouse and inventory in supply chain management, such as customer focus, supplier quality management, and 3PL.

Chapter 3 is about the methodology to cover the topic in this study. It also helps the student know how or how to collect data effectively and efficiently. Quantitative research will focus more on the survey to collect data for the research topic. To ensure the research topic is effective and efficient, it shall ensure that data is always accurate.

Chapter 4 is about how the author analysed data to get more detail about the research topic "ORGANISATIONAL PERCEPTION OF CRITICAL SUCCESS FACTORS IN GREEN WAREHOUSE AND INVENTORY." The data, known as the result findings, provides strong evidence and facts to cover the research topic. At the same time, it also offers accurate information in this study.

Chapter 5 is about the discussion and conclusion of this study. This study will provide the conclusion of the research topic and some comments and opinions on it. Besides, it will also help the company and students learn more about this topic.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

This chapter consists of three sections. Section 2.1 explains the background of the study. Section 2.2 presents the literature review, and finally, Section 2.3 provides a summary of the chapter.

2.1 Background of the Study

In today's rapidly evolving business landscape, organisations face choices between local and global sourcing in their supply chain management. Local sourcing allows for better control and shorter lead times, while global sourcing provides opportunities for expansion and access to diverse quality materials (Oberle et al., 2019). In supply chain management, a growing trend known as "green warehousing and green inventory" focuses on implementing ecologically responsible and sustainable storage practices.

With increasing concerns about climate change and resource depletion, businesses recognise the importance of reducing their environmental impact and establishing eco-friendly supply chain operations. For instance, using pollution-free energy in green warehouses and inventory management can help companies save money on ecological fines (Agyabeng-Mensah, Afum & Ahenkorah, 2020). This literature review aims to explore three key critical success factors in the context of green warehouse and inventory management: customer focus, supplier quality management, and the role of 3PL.

Customer focus is a crucial factor that influences the success of green warehousing and inventory management. Scholars argue that aligning sustainability efforts with customer demands and expectations is imperative for organisations seeking to achieve their green objectives effectively (Asiaei, Bontis, Alizadeh & Yaghoubi, 2022). Customer focus entails understanding and responding to customers' preferences for environmentally friendly products, packaging, and distribution practices. Moreover, studies have emphasized the importance of effective communication and collaboration with customers to build trust and enhance their satisfaction with sustainable initiatives (Harland, 2021). By incorporating customer-focused

strategies, organisations can reduce their environmental footprint and strengthen their competitive advantage in the market.

Furthermore, supplier quality management is pivotal in successfully implementing green warehouse and inventory practices. According to recent studies, effective supplier quality management is critical for ensuring the availability of environmentally sustainable materials and products (Negri, Cagno, Colicchia & Sarkis, 2021). Organisations must engage in strategic partnerships with suppliers who share their commitment to sustainability, encouraging adopting environmentally responsible practices throughout the supply chain (Abdollahi, Hafezi, & Fallahnejad, 2022). By establishing clear criteria for selecting suppliers based on their environmental performance, organisations can enhance the overall sustainability of their warehouse and inventory management processes.

Additionally, the involvement of 3PL is another critical success factor in green warehouse and inventory management. 3PL are external entities that provide logistics services, including transportation, warehousing, and inventory management, on behalf of organisations (Kmiecik, 2023). Recent research suggests that collaborating with environmentally conscious 3PL can contribute to the implementation of sustainable practices in warehouse and inventory management (Kmiecik, 2023). The expertise and specialised knowledge of 3PL can help organisations optimise their supply chain operations, reduce energy consumption, and minimize waste generation. Furthermore, effective communication and coordination between organisations and 3PL are crucial for achieving shared sustainability goals (Kmiecik, 2023).

In conclusion, this literature review highlights the critical success factors of customer focus, supplier quality management, and the involvement of 3PL in green warehouse and inventory management. By examining recent scholarly works, it becomes evident that aligning sustainability efforts with customer demands, establishing strong partnerships with environmentally responsible suppliers, and leveraging the expertise of 3PL is essential for effectively implementing green initiatives. These critical success factors are able to contribute not only to environmental sustainability but also to enhanced competitiveness and reputation in the market. Organisations seeking to embark on a green warehouse and inventory management journey should consider these factors in their strategic planning and decision-making processes.

2.2 Literature Review

2.2.1 Green Warehouse and Inventory

A green warehouse is defined as a warehouse designed and operated with sustainable principles to minimise environmental impact (Bartolini et al., 2019). Green warehouses play a vital role in promoting sustainable practices in the supply chain industry by reducing environmental impact, conserving energy, and optimising resource usage. These warehouses are designed and operated with various environmentally friendly methods. For example, energy-efficient lighting systems, such as LED lights, are commonly implemented to minimise electricity consumption (Henderson, 2021).

The green warehouse also refers to a strategic organisation of warehouse operations with environmentally conscious practices. By implementing well-thought-out strategies for managing warehouses, such as minimising the time goods spend in storage and increasing the efficiency of moving cargo, companies can enhance their logistical efficiency and provide better customer service (Jefimovaitė & Vienažindienė, 2021). Advanced insulation and ventilation systems also enhance energy efficiency and reduce heating and cooling requirements. These practices contribute to a greener future by reducing carbon emissions and minimising the overall ecological footprint of the logistics sector (Piplani, Khurana, Verma & Patel, 2020).

Besides, a green warehouse can be called a constructed storage facility designed to protect products while minimising their environmental impact and reducing operational expenses. These facilities play a crucial role in the temporary processing of goods before they're transported to their final destination, making it easier for businesses and logistics companies to efficiently manage the storage process. An example of such a concept involves incorporating eco-friendly features like solar panels on the roof, solar-absorbing walls, ample natural lighting, and durable flooring, all of which contribute to energy savings and cost-efficient construction practices (Hashom, Ariffin, Sabar, & Ahmad, 2020).

In addition to energy-saving and cost-efficient initiatives, green warehouses prioritise sustainable inventory management. Green inventory is the management and control of inventory practices in a business that are friendly for the environment and society (Wang et al.,

2019). Green inventory involves maintaining an appropriate amounts of desired products and services to ensure that business operations and production processes run smoothly while prioritizing environmentally friendly practices. This is achieved by optimizing various factors like investments in green technology, setup costs, procurement costs, holding costs, logistics costs, pollution control expenses, emissions, packaging expenses, and waste generated by the inventory system, among other considerations (Ahmadini, Modibbo, Shaikh, & Ali, 2021).

Moreover, green inventory, defined as systems designed to lower carbon emissions, is essential for economic progress. Green inventory systems, particularly for perishable goods, are crucial. It is because spoilage and decay of these items lead to significant losses, affecting customer satisfaction (Yadav & Khanna, 2021). Therefore, effective inventory control strategies can reduce waste, improve product turnover, and increase operational efficiency. Just-In-Time (JIT) inventory management is one such approach that minimises excess stock and associated storage requirements (Hofmann, Laporte & Legato, 2019). JIT ensures that inventory levels are optimised to meet demand, resulting in reduced storage space and decreased energy consumption for refrigeration or other storage needs (Mula, Peidro, Díaz-Madroñero & Vicens, 2018). These inventory management techniques minimise waste, lower costs, and contribute to a more sustainable supply chain.

Green warehouses also leverage innovative technologies to enhance inventory tracking and management. Radiofrequency Identification (RFID) tags and sensors allow real-time inventory level monitoring, reducing the risk of overstocking or stockouts (Li, Jin, Huang & Zhu, 2020). This technology enables accurate inventory forecasting, optimising supply chain operations and reducing waste. Additionally, automated systems and robotics are utilised for efficient order picking and inventory replenishment, improving productivity while minimising human error (Hofmann et al., 2019). These technological advancements enhance inventory management in green warehouses, facilitating better resource control and reducing environmental impact.

Furthermore, adopting green warehouse practices and sustainable inventory management brings several benefits to businesses. Apart from the positive environmental impact, companies can achieve cost savings through reduced energy consumption, improved inventory turnover, and minimised waste. Moreover, implementing sustainable practices

enhances a company's reputation and brand image, appealing to environmentally conscious consumers and investors (Wu, Liang, Cao & Xia, 2021). By prioritising green warehouses and sustainable inventory management, businesses align their operations with the growing demand for environmentally responsible practices, contributing to a more sustainable and resilient supply chain.

Besides, focusing on critical success factors in green warehouse and inventory management is vital because it enables researchers to identify key factors that significantly impact the success of sustainability initiatives in research. Researchers can conduct targeted studies and develop effective strategies to improve green warehousing practices by prioritising these critical factors. It also helps organisations prioritise key areas that significantly impact their sustainability goals. By identifying these critical factors, companies can make strategic decisions, allocate resources effectively, measure performance, mitigate risks, align with organisational goals, comply with regulations, and lead the industry in environmentally responsible practices. Ultimately, this focus ensures a positive environmental impact by driving sustainable practices and reducing ecological footprints within the supply chain.

Lastly, this research has been conducted on these individual factors within the broader context of supply chain management and sustainability. However, there might be limited previous scholarly research specifically examining the interplay and combined influence of these three critical success factors on green warehouse and inventory management (Singh & Trivedi, 2016). Filling this research gap could offer fresh insights and practical recommendations for businesses striving to achieve environmental sustainability in their supply chain operations. Besides, focusing on these three critical success factors can also contribute to a deeper understanding of how customer preferences, supplier quality management, and 3PL can drive sustainability efforts in green warehousing and inventory management. These factors have significant implications for businesses seeking to achieve environmental objectives while meeting market demands and building strong supply chain relationships. Tables 2.1 and 2.2 present the summary table for the meaning of green warehouse and green inventory.

Aspect	Meaning	Authors
Green Warehouse	A warehouse designed and operated with sustainable principles to minimise environmental impact.	(Bartolini et al., 2019)
	A strategic organisation of warehouse operations with environmentally conscious practices.	(Jefimovaitė & Vienažindienė, 2021)
	A constructed storage facility designed to protect products while minimising their environmental impact and reducing operational expenses.	(Hashom et al., 2020)

Table 2.1: Summary table for the meaning of green warehouse.

Aspect	Meaning	Authors
Green Inventory	The management and control of inventory practices in a business that are friendly to the environment and society.	(Wang et al., 2019)
	Maintaining the right quantities of products and services to ensure smooth business operations and production while focusing on eco-friendly approaches.	(Ahmadini et al., 2021)
	Systems designed to lower carbon emissions, is essential for economic progress.	(Yadav & Khanna, 2021)

Table 2.2: Summary table for the meaning of green inventory.

2.2.2 Critical Success Factors

Critical success factors are the key areas or factors essential for achieving organisational objectives or project goals. They are the crucial elements that must be addressed and managed effectively to ensure favourable outcomes and desired results. Critical success factors vary depending on the context and industry, highlighting the unique factors that significantly impact success. According to researchers Bullen & Rockart (1981), critical success factors are "the limited number of areas in which satisfactory results will ensure successful competitive performance for the individual, department, or organisation." These factors act as the focal points that organisations must prioritise and excel in to gain a competitive advantage and accomplish their strategic goals effectively. Businesses can focus their resources, efforts, and strategies on the most influential aspects by identifying and understanding the critical success factors relevant to a particular endeavour. It helps guide decision-making, resource allocation, and performance measurement, leading to improved outcomes and increased chances of success.

First and foremost, customer focus is essential because understanding and meeting customer demands and expectations play a pivotal role in any sustainable supply chain. A customer-centric approach ensures that the green warehouse and inventory management practices align with the environmental preferences and values of end-users. By catering to environmentally conscious customers, businesses can enhance their reputation, build brand loyalty, and gain a competitive edge in the market. Prioritizing customer focus also drives innovation towards greener products and services, meeting evolving sustainability requirements (Lloyd's Register, 2020).

Next, supplier quality management is crucial as a supply chain's sustainability performance heavily relies on its suppliers' environmental practices. Ensuring that vendors and suppliers adhere to strict environmental and ethical standards significantly impacts the overall green performance of the warehouse and inventory. Sourcing from environmentally responsible suppliers reduces the carbon footprint associated with raw materials and product manufacturing. Effective supplier quality management helps mitigate potential risks such as non-compliance with environmental regulations and reputational damage due to unsustainable supplier practices (Council of Supply Chain Management Professionals, 2020).

Besides, 3PL is vital in promoting sustainable supply chain management. Collaborating with reliable and eco-friendly 3PL can lead to significant environmental benefits. 3PL, with expertise in sustainable logistics, can help optimise transportation routes, implement efficient packaging practices, and reduce energy consumption in warehousing and distribution. Outsourcing logistics to environmentally conscious providers enabled companies to focus on their core competencies while leveraging the expertise of specialised 3PL to improve overall supply chain sustainability (Green Freight Asia, n.d.).

Effective collaboration among supply chain members is crucial in attaining sustainable inventory management within the supply chain. When supply chain members work together efficiently, they can optimise inventory levels, reduce costs, and enhance overall performance (Sarkis & Zhu, 2018). This collaboration promotes information sharing, coordination, and joint decision-making among partners, enabling them to align inventory strategies and synchronise operations. Such an approach facilitates accurate demand forecasting, minimises stockouts, reduces excess inventory, and ensures a timely response to changing market conditions. Furthermore, collaborative relationships foster trust and mutual understanding, leading to long-term partnerships that contribute to sustainable inventory management and achieve shared environmental and social goals (Li, Zeng & Wang, 2020).

Utilising renewable energy sources and optimising energy consumption are fundamental factors that significantly impact the success of green warehouses and inventory management within the supply chain. By shifting to renewable energy sources such as solar and wind power, warehouses can significantly reduce their carbon footprint and reliance on fossil fuels. The integration of renewable energy technologies not only minimises greenhouse gas emissions but also leads to long-term cost savings and enhanced environmental performance. Furthermore, optimising energy consumption through efficient equipment, lighting systems, and insulation further contributes to sustainability efforts (Kannan, Khodaei & Khoshroo, 2019). These practices align with sustainability goals and improve operational efficiency, reduce operating costs, and enhance the overall resilience of the supply chain.

Furthermore, ensuring transparency and traceability throughout the supply chain, especially regarding green warehouse operations and inventory, also plays a crucial role in the success of sustainable supply chain management. Transparency and traceability enable

stakeholders to track and monitor the environmental impact of warehouse operations, including energy usage, waste generation, and emissions. Supply chain partners can enhance visibility and accountability by implementing robust tracking systems and sharing relevant information, ensuring that sustainable practices are followed at each stage (Govindan, Khodaverdi & Vafadarnikjoo, 2019). Moreover, traceability helps identify inefficiencies, reduce waste, and promote responsible sourcing practices, improving environmental performance and enhancing reputation.

Nevertheless, regularly measuring and monitoring environmental performance indicators are essential for driving continuous improvement in the green warehouse and inventory within the supply chain. By implementing a robust system to track critical environmental metrics, organisations can evaluate their sustainability performance and identify areas for enhancement (Klassen & Whybark, 2019). Additionally, it fosters accountability and transparency among supply chain partners, promoting a culture of sustainability. Regular monitoring of environmental performance indicators supports the identification of inefficiencies, drives innovation in green practices, and facilitates the achievement of sustainable supply chain goals (Melnyk, Handfield, Calantone, Curkovic & Speier-Pero, 2019). Organisations can make informed decisions, optimise resource usage, and continuously improve their green warehouse and inventory management practices by collecting and analysing data on energy consumption, waste generation, carbon emissions, and other relevant factors.

In addition, ensuring the quality and sustainability of products and materials supplied by vendors and suppliers is a critical factor influencing the success of green warehouse and inventory management within the supply chain. Prioritising sourcing from environmentally responsible suppliers reduces operations' overall environmental impact. Quality and sustainable materials support the creation of eco-friendly products and enhance the performance and durability of inventory, reducing the need for frequent replacements and minimising waste (Choudhary, Sarkis & Zhu, 2020). Incorporating sustainable sourcing practices improves the overall sustainability performance of the supply chain and fosters a positive brand image, leading to increased customer loyalty and competitive advantage. Lastly, sustainability-conscious sourcing helps align supply chain operations with environmental

regulations and industry standards, reducing potential legal and reputational risks (Zailani, Soehod & Razmi, 2019).

In this study, the researcher has focused on three critical success factors: customer focus, supplier quality management, and 3PL. Based on research studies by the previous scholar, the researcher discovered that these three factors should focus more on the green warehouse and inventory. The researcher believes these three elements contribute to a more environmentally responsible and successful business. For instance, the customer focus is to ensure that the green initiatives align with customer expectations, supplier quality management ensures a sustainable supply chain and 3PL will provide optimizes logistics for greener warehouses and inventory. In short, by focusing on these three factors, the researcher can better understand the key elements contributing to a successful sustainable supply chain, leading to improved overall environmental performance and increased chances of success.

2.2.3 Customer Focus

Customer focus, also known as customer-centricity, is a business strategy that emphasises meeting and exceeding customers' demands and expectations. This strategy ensures that a company's internal operations exceed client expectations, improving supply chain management. In a green warehouse and inventory management context, a strong customer focus plays a crucial role in driving improvements in the warehouse's sustainability and inventory management.

Green warehouses that prioritise customer satisfaction and actively engage with customer preferences and demands can optimise their operations to reduce waste and enhance sustainability. According to Govindan, Pal, Kannan & Haq (2021), customer-focused green warehouses implement efficient inventory management practices, such as demand forecasting and real-time monitoring. These practices minimise excess stock, lower energy consumption, and decrease emissions. Moreover, Shahbazpour, Khajehpour, Govindan & Kannan (2020), highlight that aligning sustainability efforts with customer preferences for eco-friendly products and packaging can improve customer loyalty and attract new environmentally conscious consumers. Therefore, by integrating a solid customer focus into their green warehousing practices, companies can achieve a mutually beneficial outcome where customer satisfaction is enhanced while simultaneously driving environmental sustainability.

Additionally, prioritising customer needs in green warehouses positively influences warehouse operations and inventory management. Green warehouses that actively consider customer preferences and requirements can align their sustainable practices with customer demands, resulting in improved environmental performance. Research conducted by Govindan et al. (2021) emphasises the significance of incorporating customer needs into green warehouse strategies, enabling companies to implement efficient inventory management techniques, such as demand forecasting and JIT inventory systems. These practices reduce waste, minimise excess stock, and contribute to overall sustainability efforts. Handfield, Engle & Sroufe (2019), also highlight that customer-centric green warehouses can leverage their sustainability initiatives as a competitive advantage, attracting environmentally conscious consumers and fostering long-term customer loyalty. By considering customer needs and integrating them into

their green warehousing practices, companies can achieve a win-win situation where customer satisfaction is enhanced while simultaneously driving environmental sustainability.

Besides, green warehouses that prioritise customer satisfaction play a pivotal role in enhancing supply chain performance. These warehouses can create a competitive advantage by actively focusing on meeting customer expectations for sustainable products and services. According to Pagell, Wu & Wasserman (2018), customer-centric green warehouses engage in collaborative relationships with suppliers and customers, improving communication, responsiveness, and adaptability throughout the supply chain. This customer-driven approach also fosters innovation in sustainable practices, driving continuous improvement in environmental performance. Furthermore, Lee and Klassen (2019) reveal that when green warehouses prioritise customer satisfaction and actively involve customers in sustainability initiatives, it enhances supply chain resilience and flexibility, enabling faster responses to dynamic market demands and potential disruptions. Consequently, by prioritising customer satisfaction, green warehouses can strengthen supply chains, achieve sustainable growth, and positively impact the environment and overall business performance.

Moreover, green warehouses that align their inventory management strategies with customer demands experience higher levels of supply chain performance. By actively considering customer preferences and requirements, these warehouses can optimise inventory levels, reduce waste, and enhance overall operational efficiency. Kannan, Khodaverdi & Olfat (2018), highlights the importance of demand forecasting and real-time inventory monitoring in green warehouse operations. By accurately predicting customer demand and adjusting inventory levels accordingly, these warehouses can minimise excess stock, decrease energy consumption, and lower carbon emissions. Lastly, Pan, Su & Leung (2020), emphasises the significance of incorporating customer feedback and collaboration into inventory management strategies. By actively engaging with customers and involving them in planning, green warehouses can improve order fulfilment, reduce lead times, and enhance overall customer satisfaction. Therefore, by aligning their inventory management strategies with customer demands, green warehouses can achieve higher supply chain performance, improving operational efficiency and customer loyalty.

2.2.4 Supplier Quality Management

Supplier quality management is a business process to ensure that all materials, components, and products purchased from a supplier satisfy predetermined quality standards. Consequently, supplier quality management can positively impact supply chain management when considering the context of a green warehouse and inventory management.

Firstly, green warehouse practices play a vital role in enhancing supplier quality management and improving the efficiency and sustainability of the supply chain. According to Chen, Wang, Wang & Xie (2019), implementing environmentally-friendly practices in warehouses, such as energy-efficient lighting, waste reduction, and handling hazardous materials, improves supplier performance and quality control. Additionally, Kaur, Jain & Jain (2020) found that green warehousing practices positively influence supplier collaboration, enhancing communication and coordination. By embracing sustainable practices, companies can reduce their environmental footprint while improving supplier quality management and overall supply chain efficiency.

Next, sustainable inventory management techniques contribute to environmental conservation, ensure supplier quality, and enhance warehouse operations' efficiency. Khan, Shah, Gao & Riaz, 2021) highlights that sustainable inventory practices like JIT inventory management and demand forecasting minimise waste, reduce inventory holding costs, and optimise supply chain coordination. These techniques enable companies to maintain lean inventory, ensuring high-quality goods from suppliers while minimising the risk of stockouts or excess inventory. Sustainable inventory management practices promote collaboration between suppliers and warehouse operators, improving communication, streamlining operations, and reducing lead times (Yan, Zhang & Lu, 2020). By integrating sustainable inventory management techniques, companies achieve supplier quality assurance and greater operational efficiency in their warehouses.

In addition, energy-efficient operations and waste reduction play a crucial role in bolstering supplier quality management and fostering a more effective supply chain. Shah, Khan, Gao & Riaz, (2022) emphasises that adopting energy-efficient practices, such as optimising lighting systems and using renewable energy sources, reduces operational costs and enhances supplier performance. Waste reduction initiatives, such as recycling programs and

lean manufacturing principles, optimise inventory management and improve supplier relationships (Cheung, Chow & Lai, 2021). Companies reduce supply chain inefficiencies by effectively managing waste, ensuring timely deliveries, and maintaining consistent product quality. Energy-efficient operations and waste reduction efforts contribute to a more robust and effective supply chain, benefiting all stakeholders involved.

Moreover, efficient inventory control systems that prioritise sustainability and environmental considerations profoundly impact supplier quality management. Implementing such strategies optimises inventory levels and ensures the availability of high-quality products from suppliers. Wang, Li, Chen & Zhang (2021), highlight that sustainable inventory control practices like vendor-managed inventory (VMI) and collaborative forecasting improve supplier relationships, communication, and quality assurance. These systems foster closer collaboration between suppliers and warehouse operators, resulting in better coordination, reduced lead times, and improved product quality. Sustainable inventory control systems also contribute to environmental conservation by reducing waste, and excess stock and optimising transportation, positively impacting supplier performance (Tang and Zhao, 2021). By embracing efficient inventory control systems prioritising sustainability, companies effectively manage supplier quality and foster a more sustainable and resilient supply chain.

Furthermore, integrating green practices within the warehouse and implementing effective inventory management techniques are instrumental in enhancing supplier quality within an organisation. Gupta, Sharma & Luthra (2021), emphasises that adopting green practices such as energy-efficient lighting, waste reduction, and sustainable material handling reduces environmental impact and improves supplier quality management. Incorporating sustainable warehouse initiatives improves supplier collaboration, communication, and coordination, enhancing product quality and timely deliveries. Lastly, effective inventory management techniques like demand forecasting, JIT inventory control, and lean principles help organisations maintain optimal inventory levels, reduce lead times, and ensure high-quality products from suppliers (Gunasekaran, Subramanian & Papadopoulos, 2022). By combining green practices within the warehouse with robust inventory management techniques, organisations positively influence supplier quality, resulting in a more sustainable and efficient supply chain.

2.2.5 3PL

3PL, which stands for Third-Party Logistics, focuses on supply chain management and transportation contracting. Outsourcing transportation to an external agency can boost supply chain efficiency and promote environmental responsibility within storage settings. Furthermore, 3PL can significantly influence supply chain management by implementing green warehouse and inventory practices.

By adopting 3PL services, companies can positively impact the adoption of green warehouse and inventory practices. Outsourcing logistics operations to specialised providers allows companies to leverage their expertise and resources to optimise transportation routes, reduce fuel consumption, and minimise carbon emissions. According to a study by Paulraj, Lado-Sestayo & Montes-Sancho (2019), collaborating with 3PL enables companies to achieve environmental sustainability goals through efficient inventory management and improved supply chain visibility. Additionally, a report by Armstrong and Gojek (2020) highlights how 3PL employs innovative technologies, such as real-time tracking systems and data analytics, to enhance warehouse efficiency, reduce waste, and enable sustainable inventory practices. Partnering with 3PL allows organisations to embrace green initiatives while benefiting from cost savings and improved operational performance.

Besides, adopting green warehouse and inventory practices by 3PL significantly impacts the overall environment. 3PL increasingly recognise the importance of sustainability and are implementing eco-friendly procedures in their operations. By incorporating energy-efficient lighting systems, optimising warehouse layouts to reduce energy consumption, and employing advanced inventory management techniques, 3PL can minimise its carbon footprint and reduce environmental impact. Research by Meneghetti and Perboli (2020) emphasises that adopting green practices by 3PL leads to reduced greenhouse gas emissions, energy consumption, and waste generation. Furthermore, a study by Chai, Xu, Zhang & Liu (2021) reveals that implementing green warehouse practices by 3PL can contribute to lower transportation-related emissions, as optimised inventory management and distribution strategies result in reduced mileage and improved vehicle utilisation. These environmentally conscious efforts by 3PL contribute to overall sustainability goals and foster a greener supply chain ecosystem.

Next, 3PL plays a crucial role in shaping and impacting the supply chain through transportation, warehousing, and distribution services. They act as intermediaries between suppliers and customers, managing the movement of goods and optimising supply chain operations. Research by Van Hoek, Semeijn & Overboom (2019) highlights that 3PL contribute to improved supply chain efficiency by leveraging their expertise in transportation management, including route optimisation, carrier selection, and freight consolidation. By offering warehousing services, 3PL enable businesses to outsource their storage needs, providing cost-effective solutions and improved inventory management. Additionally, a study by Jula and Catalin (2018) emphasises how 3PL distribution services, encompassing order fulfilment, last-mile delivery, and reverse logistics, enhance supply chain responsiveness and customer satisfaction. Through its comprehensive suite of services, 3PL significantly influence the supply chain's efficiency, reliability, and competitiveness.

Moreover, 3PL is well-positioned to contribute to improving inventory management practices through its expertise and specialised systems. With their in-depth knowledge of supply chain operations, 3PL bring valuable insights and best practices to optimise inventory management processes. According to a study by Awasthi, Govindan & Gold (2019), 3PL can offer advanced inventory management techniques such as demand forecasting, safety stock optimisation, and real-time inventory tracking. Their expertise in these areas helps organisations enhance inventory accuracy, minimise stockouts, and reduce excess inventory levels. Additionally, a research article by Liu, Yu, Li & Luo (2019) emphasises that 3PL specialised systems, such as warehouse management systems (WMS) and inventory management software, enable efficient inventory control, improved order fulfilment, and enhanced visibility throughout the supply chain. By leveraging the expertise and specialised systems of 3PL, businesses can achieve streamlined inventory management practices, leading to cost savings, increased operational efficiency, and improved customer satisfaction.

Nevertheless, 3PL must prioritise collaboration with suppliers and customers to enhance inventory visibility and reduce stockouts. By establishing solid relationships and implementing collaborative practices, 3PL can gain access to real-time information on inventory levels, demand patterns, and customer preferences. This collaboration allows for better demand forecasting and inventory planning, improving inventory visibility throughout the supply chain. Research by Hu, Li, Wang & Zhang (2020) emphasises the importance of

collaboration between 3PL and suppliers in achieving inventory visibility and reducing stockouts. Lastly, a study by Ketchen, Craighead & Dunn (2020) highlights the significance of collaborative relationships between 3PL and customers in enhancing inventory management practices. Through joint planning, sharing of information, and effective communication, 3PL can address inventory imbalances, respond to changing customer demands, and reduce the likelihood of stockouts. Prioritising collaboration with suppliers and customers becomes instrumental in achieving optimal inventory management and fostering a more responsive supply chain.

2.3 Summary

In summary, the researcher focuses on three critical success factors: customer focus, supplier quality management, and 3PL in green warehouses and inventory. The companies can drive customer loyalty and create a favourable market image by focusing the customer focus as a critical success factor in green warehouse and inventory. Besides, supplier quality management is vital for maintaining a green supply chain, mainly warehouse and inventory. For instance, the company can collaborate with eco-conscious supplier fosters innovation and sustainability throughout the supply chain. Besides, the company can partner with 3PL to focus on core competencies from the expertise of logistics specialists, leading to more effective and environmentally friendly inventory management. These three elements are critical success factors to create a strong foundation for a greener warehouse and inventory. At the same time, it can ultimately drive overall business success and contribute to a sustainable future in green warehouse and inventory.

CHAPTER 3: RESEARCH METHODOLOGY

3.0 Introduction

This chapter consists of four sections. Section 3.1 explains the background of the study. Section 3.2 covers the research design. Section 3.2 covers the research design. Section 3.3 discusses the quantitative methodology, and Section 3.4 focuses on quantitative data navigation.

3.1 Background of the Study

According to Baur (2011), quantitative research is a research strategy to deal with numbers, logic, or objective. Mean, it is a research process of collecting and analysing numerical data. A quantitative study is a process of research that has inspired the idea to investigate the study area, and they need help from the target respondent to complete the study. The quantitative analysis is complete with the target respondent because the target respondent will hugely impact part of the quantitative research.

The research protocol for the quantitative study outlines the plan for how the study should be run. First, the quantitative study aims to answer the research question based on the researcher's design or development. Then, the quantitative analysis shall provide the evidence for the feasibility of a study, accurate detail, design methodology, analytical consideration and how the quantitative research study shall be conducted or evaluated (Bouikidis, 2018). These points show that the research must have a clear plan from the beginning until ending before they start the quantitative study.

Besides, the differentiation between quantitative and qualitative study depends on how the researcher selects appropriate ways to complete their research study. The qualitative method is the way that the researcher uses the interview method to collect information about a specific company in the research study. Usually, the researcher will select the best options of the company to fulfil the requirement of the topic in the research. For the quantitative method, the researcher uses the survey to collect information from the respondent. The researcher will analyse what the survey segment is and who is the target

respondent in this research study topic. Therefore, this research study topic will include a few essential parts of research methodologies such as research design, qualitative methods and data analysis.

3.2 Research Design

A research design is an essential framework and methodology for gathering valuable data and information pertinent to their study. By obtaining advantageous details through this process, researchers can attain a deeper understanding and analysis of their research topic. It is crucial for the information and data collected to be reliable, factual, and of high quality, as they hold the potential to become valuable references for future researchers.

A quantitative research design was employed in the current study, specifically utilising a survey methodology. To ensure the results accurately reflect the Malaysian manufacturing industry, the researcher will carefully select the manufacturing company of the different aspects of the industry in the country. Before distributing the survey, the target chosen respondents will be provided with ample time to answer the questions.

The survey questions will be thoughtfully crafted and structured following the research topic. Emphasising the importance of confidentiality, the survey questions will be treated as private and confidential in order to safeguard company information from being divulged to external parties. Only relevant individuals, such as the researcher and the selected target respondents, will have access to the survey questions.

Overall, through a well-designed research approach and a quantitative methodology, this study aims to collect valuable data that can contribute to the existing body of knowledge, serving as a reliable resource for future researchers in the field.

3.3 Quantitative Methodology

3.3.1 Sample

The sample is a process of collecting a small group of people representing a large population group. Besides, selecting an appropriate sample is essential to the success of the research study, which can directly affect the validity and generalisability of the result. Purposive sampling is a technique where the researcher selects specific individuals or groups from the population based on specific characteristics (Campbell, Greenwood, Shearer, Walkem, Young, Bywaters & Waler, 2020). The researcher used purposive sampling as a non-probability technique to select target respondents in this study.

The researcher focused on and sent questionnaires to the first 300 manufacturing companies in the FMM Directory of Malaysian Industries (53rd Edition). There were 110 companies responded to the questionnaire. From this point, there were no exact numbers for the population. Based on Figure 3.1, the researcher estimated that the population is 150, and the sample size is 108. This deliberate decision was underpinned by the research objective to attain a more concentrated and precise sample, diverging from a mere random cross-section of the entire manufacturing industry population (Klar & Leeper, 2019). Hence, 110 companies who responded to the questionnaire have been determined as the targeted sample size of this study. At the same time, the researcher has created a simple framework when selecting the sample in the study, as shown in Figure 3.2.

Sample Sizes – Krejcie & Morgan

Table for Determining Sample Size for a Given Population

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size
"S" is sample size.

Figure 3.1: The sample size Krejcie & Morgan.

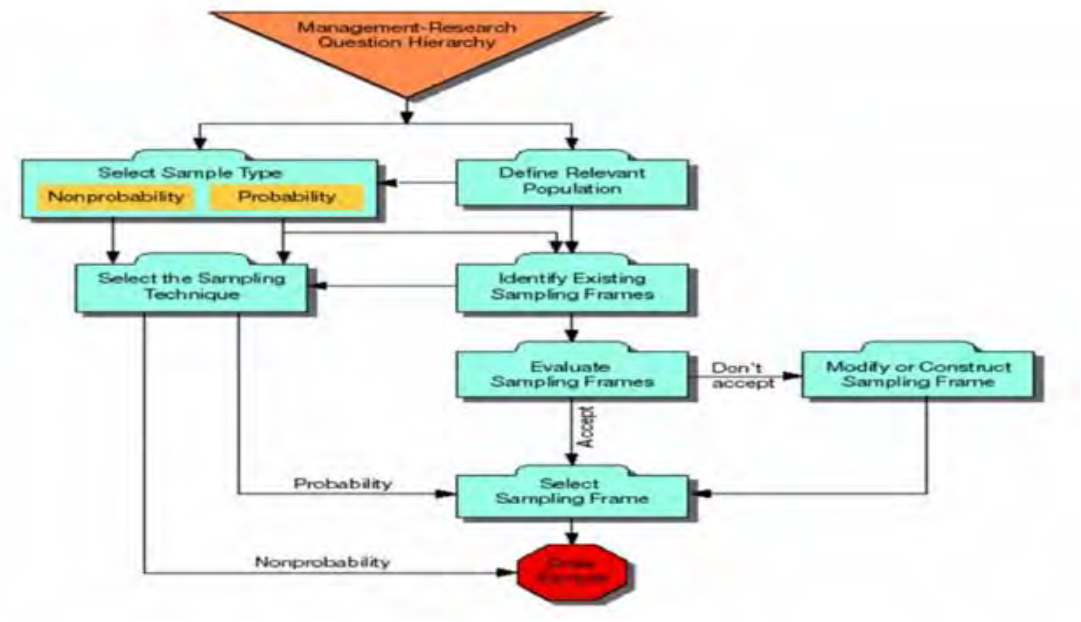

Figure 3.2: The sampling framework.

3.3.2 Target Respondent

In this quantitative research, the researcher used a questionnaire as a data collection tool to gather data. The researcher targeted the respondent who worked in manufacturing companies across Malaysia. The researcher applied purposive sampling from the comprehensive profiles of 3600 manufacturing companies in different states across Malaysia and chose the first 300 manufacturing companies for data collection. 110 respondents from each manufacturing company who responded to the questionnaire have been targeted for the study's goals. For instance, selecting target respondents solely based on the company level was unfeasible due to insufficient information in the FMM Directory of Malaysian Industries (53rd Edition), which hindered the researcher's ability to ascertain their corresponding roles within the organisation and the appropriate personnel responsible for the questionnaire.

3.3.3 Questionnaire Design

For the quantitative research, the demographic is a play vital for the researcher collect basic information from respondent. More or less, the target respondent for the researcher is focus on industry background. In the questionnaire design, the researcher has created three elements to collect respondent background information such as working experience, job position, and sector of manufacturing in research. Based on Table 3.1, it shown the section demographic from the researcher questionnaire design:

Demographic		
Working Experience	> 2 year > 5 year > 10 year < 20 year	
Jobs Position	()- Required to fill in	
Sector of Manufacturing	Aerospace	Packaging
	Automative	Paper & Pulp
	Chemical	Pharmaceutical
	Construction Material	Plastics & Rubber
	Consumer Goods	Printing & Publishing
	Electronics	Steel & Metal
	Equipment	Textile & Apparel
	Food & Beverage	Toys
	Jewelry	Wood & Furniture
	Other	

Table 3.1: Questionnaire Design- Demographic.

3.3.4 Measurement Scale

According to Ippoliti, Gullan, Gopalakrishnan, Huse & Khemani (2021), a measurement scale refers to rules and conventions that assign numbers to different studied attributes. Therefore, the measurement scale helps the researcher quantify and classify data to allow them to analyse the information or data collected. In this research, the researcher has used a nominal scale to label the four head of section names in the questionnaire, such as Critical Success Factors, Customer Focus, Supplier Quality Management, and 3PL. From these points, all the variables highlighted did not require rank and order because the researcher has a label name for convenience respondents, and the researcher easily understood the questionnaire. At the same time, the researcher developed the questionnaire based on the previous scholarly supported between Table 3.2 to Table 3.5:

Construct	**Author**	**Items**
Critical Success Factors	Sunil Luthra, Sachin Kumar Mangla, Ravi Shankar, Chandra Prakash Garg & Suresh Jakhar (2018)	Do you agree that effective collaboration among supply chain members is a critical success factor in achieving sustainable inventory management within the supply chain?
	V. Sathiya, M. Chinnadurai, S. Ramabalan, Andrea Appolloni (2021)	Do you agree that utilizing renewable energy sources and optimizing energy consumption are essential factors influencing the success of green warehouses in the supply chain?
	Mona Haji, Laoucine Kerbache, Mahaboob Muhammad,Tareq Al-Ansari (2020)	Do you agree that ensuring transparency and traceability throughout the supply chain, particularly concerning green warehouse operations and inventory, significantly influences their success in sustainable supply chain management?

	Micaela Marziali, Daniel Alejandro Rossit, Adrián Toncovich (2021)	Do you agree that regularly measuring and monitoring environmental performance indicators are essential for driving continuous improvement in the green warehouse and inventory management within the supply chain?
	Yubing Yu, Min Zhang & Baofeng Huo (2019)	Do you agree that ensuring the quality and sustainability of products and materials supplied by vendors and suppliers influences the success of green warehouse and inventory management within the supply chain?

Table 3.2: Critical Success Factor- Measurement Scale.

Customer Focus	Antonius Setyadi (2019)	Do you agree that a strong customer focus in a green warehouse leads to improved green warehouse and inventory?
	Md. Ahashan Habib, Yukun Bao, Nurun Nabi, Marzia Dulal, Asma Ansary Asha and Mazedul Islam (2021)	Do you agree that green warehouses prioritising customer needs positively influence green warehouses and inventory?
	Yuanyuan Zhou, Li Xu, and Ghulam Muhammad Shaikh (2019)	Do you agree that green warehouses that prioritise customer satisfaction experience better supply chains?
	Ming-Lang Tseng, Kuo-Jui Wu, Ming K. Lim, Wai-Peng Wong (2019)	Do you agree that green warehouses that align their inventory management strategies with customer demands achieve higher supply chain performance?

	Yohannes Birhanu, Tafesse Gizaw, Dawit Teshome, Bekele Boche & Tadesse Gudeta (2022)	Do you agree that the customer-focused variable in green warehouse operations directly influences the organisation?

Table 3.3: Customer Focus- Measurement Scale.

Supplier Quality Management	Kittisak Jermsittiparsert, Puttisat Namdej, Sudawan Somjai (2019)	Do you agree that green warehouse practices significantly impact supplier quality management, improving the supply chain?
	Kenneth W. Green, R. Anthony Inman, Victor E. Sower, Pamela J. Zelbst (2019)	Do you agree that sustainable inventory management techniques ensure supplier quality and positively affect warehouse operation?
	Muzaffar Iqbal, Junhai Ma, Naveed Ahmad, Zia Ullah & Aisha Hassan (2022)	Do you agree that energy-efficient operations and waste reduction contribute to enhanced supplier quality management and, ultimately, a more effective supply chain?
	Erfan Babaee Tirkolaee, Abbas Mardani, Zahra Dashtian, Mehdi Soltani, Gerhard-Wilhelm Weber PII (2019)	Do you agree that efficient inventory control systems prioritising sustainability and environmental considerations influence supplier quality management?
	Yaw Agyabeng-Mensah, Esther Nana Konadu Ahenkorah, George Nana Arko Korsah (2019)	Do you agree that integrating green practices within the warehouse and implementing effective inventory management techniques positively impact supplier quality in the organisation?

Table 3.4: Supplier Quality Management- Measurement Scale.

3PL	Zhaofang Chu, Linlin Wang, Fujun Lai (2019)	Do you agree that using third-party logistics can positively influence adopting green warehouse and inventory practices?
	Goswami, Mohit, De, Arijit, Habibi, Muhammad Khoirul Khakim, Daultani, Yash (2020)	Do you agree that third-party logistic providers' adoption of green warehouse and inventory practices positively affects the overall environment?
	Mohamed Rafik Noor Mohamed Qureshi (2022)	Do you agree that third-party logistic providers significantly impact the supply chain through transportation, warehousing, and distribution services?
	Mariusz Kmiecik (2022)	Do you agree that third-party logistic providers can contribute to improving inventory management practices through their expertise and specialized systems?
	Xinyu Wu, Qiang Wang, Liang Wang & Xiande Zhao (2021)	Do you agree that third-party logistic providers should prioritize collaboration with suppliers and customers to enhance inventory visibility and reduce stockouts?

Table 3.5: 3PL- Measurement Scale.

3.3.5 Likert Scale

According to Alismail & Zhang (2020), the Likert scale is commonly used for measuring attitudes, opinions, and perceptions in quantitative research. Usually, the Likert scale involves a series of statements that respondents must rate based on their level of agreement or disagreement. For instance, a common ranging use from “Strongly Disagree” to “Strongly Agree.” The researcher has used this scale to assess subjective responses in quantitative analysis. It is due to the familiarity with the Likert scale and its ease of comprehension for respondents contributes to its widespread adoption as a user-friendly and effective measurement tool in research (Arifin & Maharani, 2021). Most importantly, the researcher ensured that the Likert scale statement was clear, unbiased, and relevant to the research objective to obtain accurate and meaningful results from the collected data. In the research, the researcher implemented a Likert scale in the questionnaire based on four variables as Critical Success Factors, Customer Focus, Supplier Quality Management, and 3PL, as follows in Table 3.6:

Items	Likert Scale
Critical Success Factors	Strongly Disagree (1) Disagree (2) Neutral (3) Agree (4) Strongly Agree (5)
Customer Focus	
Supplier Quality Management	
3PL	

Table 3.6: Likert Scale.

3.3.6 Data Collection

Data collection is the process in which the researcher gets information from others through several methods. For quantitative research, the survey is one of the best ways for researchers to get more detailed data or information. Based on common knowledge, the information collected can include categories into primary and secondary data in research. Primary data is data collection based on authorised research analysis. Also, primary data can be known as ordinary data. Secondary data is collected when someone reviews the primary data and makes the analysis. For example, secondary data can describe in an article review or journal review.

The data shall be accurate and reliable in the research. To ensure the information collection is precise and reliable, the researcher has determined and analysed the survey questions before the target respondents start to answer them. Also, the survey questions were simple and structured so that the target respondents could capture them in the survey. In this study, the researcher provided survey questions based on the topic variable and distributed the survey questions to chosen target respondents of the manufacturing company via email.

3.4 Quantitative Data Navigation

Quantitative data analysis is a process in which the researcher adopts the method to analyse data or information collected to select the best option in the research (Asenahabi, 2019). The appropriate data or information is the keyword to determine research content that provides more understanding and detail in quantitative research. According to Baur (2011), quantitative data analysis needs to be planned, managed, and implemented effectively and efficiently in qualitative research. After the researcher gets multiple data or information from the survey to help complete the study. To avoid misunderstanding various data or information collected, the researcher needs to establish a guidance framework to help them sequence the data or information related to the research topic.

The guidance framework of quantitative data analysis focuses more on the dependent and independent variables in research. The dependent variable was when the researcher depended on other factors that would be measured in the study. Besides, the independent variable is when the researcher observes a personal or alone variable. It is not changed by other variables that someone is trying to measure, meaning the independent variable is the cause. According to Baur (2011), the diagram process of the quantitative process research design, as shown in Figure 3.3:

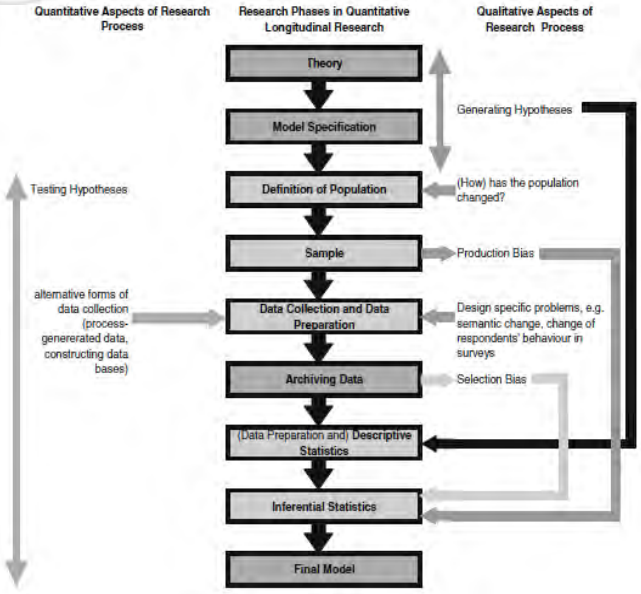

Figure 3.3: Quantitative research design framework process (Baur, 2011).

CHAPTER 4: DATA ANALYSIS AND FINDINGS

4.0 Introduction

This chapter consists of seven sections. Section 4.1 covers the response rate. Section 4.2 explains descriptive statistics. Section 4.3 outlines the normality test. Section 4.4 presents the validity test. Section 4.5 addresses the reliability test. Section 4.6 focuses on factor analysis. Finally, Section 4.7 examines the critical success factor using descriptive statistics (mean).

4.1 Response Rate

The questionnaire distribution data was collected for one and a half months, from 1st June 2023 to 15th July 2023. The unit of analysis in this study is an individual employee. After sending the email to the manufacturing companies, the researcher received a response rate is 36.6 per cent within a period. A summary of the response rate is illustrated in Table 4.1.

Description	**Results**
Total sent	300
Manufacturing Industry	300
Total returned	110
Total no returned	190
Usable	110
Overall response rate	**36.6%**

Table 4.1: Response rate.

After sending 300 questionnaires to the manufacturing companies in Malaysia, this study received 110 responses. However, 190 manufacturing companies did not answer the questionnaire more than 50%. They might ignore the email from the researcher. Therefore, the remaining 110 responses represented a valid response rate of 36.6 per cent. Lastly, the researcher has used the Statistical Package for the Social Sciences (SPSS), version 28, to analyse data in the research.

4.2 Descriptive Statistics

Descriptive statistics are concise coefficients summarising a dataset, representing the entire population or a sample. They include measures like variables' minimum, maximum, mean, and standard deviation. These statistics help present data to enhance understanding, providing concise observations and summaries that aid in identifying patterns. They often use quantitative data and visuals like graphs and charts. While descriptive statistics may be the only analysis in some studies, they do not conclude hypotheses. Instead, they serve as preliminary data, laying the foundation for future research and identifying important areas for further investigation (Laerd Statistics, 2021).

Besides, the data analysis of this study continues with descriptive statistics. This study uses descriptive statistics to describe the demographic in terms of working experience, job position, and manufacturing sector. At the same time, it also will describe the variables such as critical success factors (CSFs), customer focus, supplier quality management, and 3PL in the study. The summary of the descriptive statistics of working experience is shown in Table 4.2.

Respondent's profile	**Range**	**Frequencies**	
		N= 110	**Percentage (%)**
Working Experience	< 20 year	13	11.8
	> 10 year	26	23.6
	> 5 year	47	42.7
	> 2 year	24	21.8
Total		**110**	**100**

Table 4.2: Descriptive statistics (Working Experience).

Table 4.2 comprehensively summarises the respondent's profiles based on their working experience. Categories of the respondent into different ranges allow the researcher to understand better the distribution of experience levels in the surveyed population.

Among the 110 respondents, a notable portion, around 11.8 per cent, comprises individuals with less than 20 years of working experience. From these points, this group, although relatively small, includes professional people with more skills and knowledge of their careers. Besides, by the other end of the spectrum, a substantial per cent of respondents, 23.6

per cent, have accumulated more than ten years of working experience. From these points, these seasonal professionals can be valuable resources in their respective fields and bring more years of expertise to their roles in the manufacturing industry.

Then, the most prominent category is the group with more than five years of working experience in the manufacturing industry, representing 42.7 per cent of the total respondent. These findings provide that a significant portion of the surveyed individual has across the threshold of mid-level experience, such as occupying a position with increased responsibility and leadership opportunity. Lastly, another segment of the respondent, 21.8 per cent, fall into the range of more than two years of working experience. This group can consist of early-career professionals who have surpassed their initial period of entry-level positions and advancing into roles with greater challenges and growth potential.

Furthermore, an employee's position does have a bearing on his personality and how they are looking at the situation in the organisation. The position of an individual also socialises in a particular attire, which reflects their pattern of behaviour and level of understanding of a particular phenomenon. However, the majority of the respondents know green warehouses and inventory management. It offers sufficient coverage of the view of a person from a range of positions and delivers knowledge within their workplace. The summary of respondent job positions is shown in Table 4.3.

Jobs Position	**Frequency (N= 110)**	**Percentage**
Managerial	47	42.7
Executive	49	44.5
Engineer	13	11.9
Clerk	1	0.9
Total	**110**	**100**

Table 4.3: Descriptive statistics (Job Position).

Table 4.3 shows a comprehensive overview of the job position within the surveyed 110 individuals, offering valuable insights into the workforce composition. At the same time, it categorised job roles into four sections: managerial, executive, engineer, and clerk in the manufacturing industry.

The managerial category is the largest group comprising 47 individuals, representing 42.7 per cent of the total respondent. This category can indicate significant responsibility and authority within their respective department, overseeing teams or situations and making critical decisions to drive organisational success. Compared to the executive category, it comprised 49 individuals, representing 44.5 per cent of the total respondent. From these points, this category is responsible for implementing strategic initiatives, managing operations, and providing organisational guidance.

More or less, while managerial and executive roles have dominated the surveyed workforce, the engineering category consists of 13 individuals, representing 11.9 per cent of total respondents. This category shows professionals contribute their technical expertise to various aspects of the organisation, such as design, development, or maintenance based on their specialisation. However, the clerk category consists of one individual, representing 0.9 per cent of the total respondent. From these points, this category provides administrative support and ensures smooth day-to-day operations within organisations.

Besides, the manufacturing sector is an essential component of the economy, encompassing the transformation from raw materials to finished goods through various industrial processes. Mostly, it plays an essential role in creating tangible goods, including automobiles, electronics, and consumer goods. At the same time, the manufacturing sector is significant in its ability to generate employment, foster innovation, and contribute significance to a country's gross domestic product (GDP). A summary of the respondent sector of manufacturing is shown in Table 4.4.

Respondent's profile	**Range**	**Frequencies**	
		N= 110	**Percentage (%)**
Sector of Manufacturing	Automative	7	6.4
	CAN Manufacturer	1	0.9
	Chemical	7	6.4
	Construction Material	6	5.5
	Consumer Goods	17	15.5
	Electronics	18	16.4

	Equipment	8	7.3
	Food & Beverages	11	10
	Jewerly	2	1.8
	Manufacturing	1	0.9
	Packaging	11	10
	Paper & Pulp	5	4.5
	Pharmaceutical	1	0.9
	Plastics & Rubber	5	4.5
	Steel & Metal	4	4.6
	Textile & Apparel	1	0.9
	Wood Furniture	5	4.5
Total		**110**	**100**

Table 4.4: Descriptive Statistics (Sector of Manufacturing).

Table 4.4 shows the respondent profile in a survey focused on the manufacturing sector with 110 respondents. It shows the distribution of respondents across various manufacturing sectors, along with corresponding frequency and percentages. The result shows that the largest represented sectors are electronics (16.4 per cent) and consumer goods (15.5 per cent). However, sectors such as manufacturing, pharmaceutical, textile & apparel, jewellery, steel & metal, and CAN manufacturer have only one respondent (0.9 per cent). Overall, the researcher's understanding of the breakdown can aid in identifying the key area of interest and direct future research.

4.3 Normality

A normality test is a statistical procedure used to assess whether a given dataset or sample follows a normal distribution, which is characterised by a bell-shaped curve with data clustering around the mean and symmetrical tails. Commonly used normality tests include the Shapiro-Wilk, Anderson-Darling, and Kolmogorov-Smirnov tests. Ensuring normality is essential in research before conducting further data analysis. The normality test includes all variables in the dataset and checks if their distribution adheres to the normality assumption. It examines values such as the minimum and maximum normality, ensuring that the data does not deviate more than ±3 standard deviations from the mean. Additionally, the test provides information on each variable's mean and standard deviation, allowing researchers to determine whether the data for each variable is normally distributed or deviates from normality, which can impact the choice of appropriate statistical analyses (Norusis, 2018). Besides, the researcher has summarised the normality test against critical success factors (CSFs), customer focus, supplier quality management, and 3PL, as shown in Table 4.5 below. In addition, the researcher is focusing on the Shapiro-Wilk test to analyse the data in the study.

		Shapiro-Wilk		
		Statistic	**df**	**Sig.**
Critical Success Factors	CSF1	0.548	110	<.001
	CSF2	0.596	110	<.001
	CSF3	0.742	110	<.001
	CSF4	0.736	110	<.001
	CSF5	0.738	110	<.001
Customer Focus	CF1	0.68	110	<.001
	CF2	0.706	110	<.001
	CF3	0.741	110	<.001
	CF4	0.712	110	<.001
	CF5	0.723	110	<.001
Supplier Quality Management	SQM1	0.736	110	<.001
	SQM2	0.728	110	<.001

	SQM3	0.721	110	<.001
	SQM4	0.663	110	<.001
	SQM5	0.747	110	<.001
3PL	TPL1	0.774	110	<.001
	TPL2	0.705	110	<.001
	TPL3	0.771	110	<.001
	TPL4	0.768	110	<.001
	TPL5	0.703	110	<.001

Table 4.5: Normality test.

Table 4.5 shows the Shapiro-Wilk test result conducted on various aspects such as critical success factors, customer focus, supplier quality management, and 3PL. Usually, the Shapiro-Wilk test is used to evaluate whether the data follow a normal distribution. The result shows that all the aspects, regardless of their domain, have a substantial sample size of 110 respondents. At the same time, the statistics value of the Shapiro-Wilk test ranges from 0.548 to 0.774. While the p-value is not close to 1, the result indicates that the data can reasonably approximate a normal distribution despite some slight variation in the Shapiro-Wilk statistics value. From these points, the researcher can utilise traditional parametric tests with confidence. The outcome of the Shapiro-Wilk test highlights the reliability and robustness of the data and empowers researchers to draw accurate conclusions from the dataset. Overall, the result is a strong foundation for further analysis and decision-making that can enable the organisation to enhance its strength and identify areas for further improvement and success.

4.4 Validity

A validity test is crucial to determine the accuracy and appropriateness of a given concept, measurement, or research design (Sürücü & Maslakçı, 2020). It aims to ensure that the chosen method effectively captures and represents the intended phenomenon or data, thus bolstering the credibility and reliability of the results. By evaluating the extent to which the test accurately measures what it claims to measure, researchers can enhance the validity of their findings and draw more meaningful conclusions. A robust validity test is a cornerstone in the scientific process, fostering confidence in the outcomes and enabling informed decision-making based on sound and dependable evidence (Finger, Grebitus & Henningsen, 2023).

By firmly of the validity test, the researcher has often sought to utilise the "Table of Critical Values: Pearson Correlation's r" due to its pivotal role in testing. This table provides a standardised framework for determining the critical values of Pearson correlation coefficients, enabling researchers to assess whether observed correlation values are statistically significant or merely a result of chance. By consulting this table, researchers can confidently make informed decisions about the strength and direction of their data, contributing to the robustness and credibility of the findings. Regard Table 4.6 show the Table of Critical Values: Pearson Correlation's r in the research.

Degrees of Freedom = N-2	**Table of Critical Values: Pearson's *r***			***Degrees of Freedom = N-2***	**Table of Critical Values: Pearson Correlation's *r***		
N	**0.1**	**0.05**	**0.01**	**N**	**0.1**	**0.05**	**0.01**
1	0.988	0.997	1	**21**	0.352	0.413	0.526
2	0.9	0.95	0.99	**22**	0.344	0.404	0.515
3	0.805	0.878	0.96	**23**	0.337	0.396	0.505
4	0.729	0.811	0.92	**24**	0.33	0.388	0.496
5	0.669	0.754	0.88	**25**	0.323	0.381	0.487
6	0.621	0.707	0.83	**26**	0.317	0.374	0.479
7	0.584	0.666	0.8	**27**	0.311	0.367	0.471
8	0.549	0.632	0.77	**28**	0.306	0.361	0.463

9	0.521	0.602	0.74	**29**	0.301	0.355	0.456
10	0.497	0.576	0.71	**30**	0.296	0.349	0.449
11	0.476	0.553	0.68	**35**	0.275	0.325	0.418
12	0.458	0.532	0.66	**40**	0.257	0.304	0.393
13	0.441	0.514	0.64	**45**	0.243	0.288	0.372
14	0.426	0.497	0.62	**50**	0.231	0.273	0.354
15	0.412	0.482	0.61	**60**	0.211	0.25	0.325
16	0.4	0.468	0.59	**70**	0.195	0.232	0.303
17	0.389	0.456	0.58	**80**	0.183	0.217	0.283
18	0.378	0.444	0.56	**90**	0.173	0.205	0.267
19	0.369	0.433	0.55	**100**	0.164	0.195	0.254
20	0.36	0.423	0.54	**150**	0.134	0.159	0.208

Table 4.6: Table of Critical Values: Pearson Correlation's *r*

Before initiating the validation phase of the questionnaire, the researcher meticulously employed the Table of Critical Values for Pearson Correlation (r) as a pivotal step in the process. By applying this essential concept, the researcher aimed to establish a robust foundation for the subsequent validity tests. This strategic utilisation of the Table of Critical Values ensured that the correlations between variables were rigorously evaluated, enabling a comprehensive assessment of the questionnaire's construct validity. From these points, the researcher has run a validity test against the questionnaire regarding critical success factors, customer focus, supplier quality management, and 3PL, as shown in Table 4.7 below.

		p (Sig. (2-tailed)	**Correlation**	**Validity Test**		
				N	**df (N-2)**	**Critical Value (Pearsons' *r*)**
Critical Success Factors	CSF1	0.030	0.207	110	108	0.195
	CSF2	0.000	0.352	110	108	0.195
	CSF3	0.000	0.387	110	108	0.195
	CSF4	0.000	0.387	110	108	0.195
	CSF5	0.000	0.608	110	108	0.195

Customer Focus	CF1	0.000	0.451	110	108	0.195
	CF2	0.000	0.526	110	108	0.195
	CF3	0.000	0.564	110	108	0.195
	CF4	0.000	0.586	110	108	0.195
	CF5	0.000	0.478	110	108	0.195
Supplier Quality Management	SQM1	0.000	0.648	110	108	0.195
	SQM2	0.000	0.504	110	108	0.195
	SQM3	0.000	0.530	110	108	0.195
	SQM4	0.000	0.470	110	108	0.195
	SQM5	0.000	0.445	110	108	0.195
3PL	TPL1	0.000	0.563	110	108	0.195
	TPL2	0.000	0.763	110	108	0.195
	TPL3	0.000	0.624	110	108	0.195
	TPL4	0.000	0.444	110	108	0.195
	TPL5	0.000	0.690	110	108	0.195

Table 4.7: Validity test in questionnaire.

Table 4.7 shows that the researcher has focused on four variables while conducting a validity test. At the same time, each variable consists of five questions. First, the correlation of the critical success factors (CSF1 – CSF5) obtained value from 0.207 to 0.608. It is above the critical value of 0.195, highlighting the critical success factors that has conducted valid questions in the questionnaire. Second, the correlation of customer focus (CF1 – CF5) was obtained from 0.451 to 0.586. It is above the critical value of 0.195, which means it highlights the customer focus has conducted valid questions in the questionnaire.

Then, the correlation of supplier quality management (SQM1 – SQM5) obtained a value from 0.445 to 0.648. It is above the critical value of 0.195, highlighting that supplier quality management conducted valid questions in the questionnaire. Lastly, correlation of 3PL (TPL1 – TPL5) obtained values from 0.444 to 0.763. It is above the critical value of 0.195, highlighting that 3PL has conducted valid questions in the questionnaire.

4.5 Reliability

Reliability is measured via Cronbach's Alpha coefficient. Cronbach's Alpha coefficient is a widely used statistical method to evaluate the internal consistency and reliability of a measurement scale or a set of items within a research instrument, such as a questionnaire or survey. It measures the extent to which the items in the scale are interrelated and measures the same underlying construct or concept. The Cronbach's Alpha value ranges from 0 to 1, where a higher value indicates greater internal consistency and reliability. A value close to 1 suggests that the items in the scale are highly correlated, and the scale can be considered more reliable in measuring the intended construct. Researchers typically aim for a Cronbach's Alpha value of at least 0.70 or higher to ensure acceptable scale reliability (Bland & Altman, 2019).

After the researcher conducts the normality test is assessed, the reliability test will conduct. It is because the researcher wants to ensure that the variables select are accurate and consistent before using any concept for actual analysis. For quantitative research, the researcher's consistency associates with the term reliability. A summarises the reliability test against critical success factors, customer focus, supplier quality management, and 3PL as Table 4.8 below.

Variables	**N of Items**	**Cronbach's Alpha**	**Cronbach's Alpha Based on Standardized Items**
Critical Success Factors	5	0.718	0.729
Customer Focus	5	0.663	0.664
Supplier Quality Management	5	0.737	0.738
3PL	5	0.856	0.857

Table 4.8: Reliability test.

Table 4.8 show valuable insights into the reliability of different variable measure using Cronbach's Alpha. From these points, it includes four variables: Critical Success Factors, Customer Focus, Supplier Quality Management, and 3PL, consisting of 5 questions/for each variable. The result provides that the critical success factors value is 0.718, customer focus is 0.663, supplier quality management is 0.737, and 3PL is 0.856. From Table 4.10, the variable 3PL demonstrates the highest Cronbach's Alpha indicating a strong level of internal

consistency among five questions/each. Other variables, such as critical success factor and supplier quality management, signify acceptable internal consistency with moderate Cronbach's Alpha. However, the variable customer focus is slightly lower than Cronbach's Alpha but indicates moderate internal consistency. Overall, the result provides that items within each variable are sufficiently correlated, and the scale has researcher reliability.

4.6 Factor Analysis

Factor analysis is a statistical technique to identify underlying factors or latent variables that explain the interrelationships among observed variables. It aims to group similar variables into dimensions or factors based on their shared variance. By doing so, factor analysis can reduce the complexity of a large set of variables and reveal the underlying structure or patterns within the data. The factor analysis results are typically presented as factor loadings, which indicate the strength of the relationship between each item and the underlying factor. Items with higher factor loadings are more closely associated with the corresponding factor. Researchers use factor analysis to gain insights into the underlying structure of a dataset, simplify data interpretation, and identify meaningful constructs that might not be directly observable but are influential in the data (Tabachnick & Fidell, 2019).

Based on the second research objective, the researcher measured the level of the success factor in green warehouse and inventory management. From these points, the three critical success factors, such as customer focus, supplier quality management, and 3PL, will conduct in the study. A summary shows that the researcher will focus on factor analysis (rotated component matrix), as shown in Table 4.9 below.

	Component			
	1	**2**	**3**	**4**
TPL3	0.831			
TPL4	0.828			
TPL1	0.789			
TPL5	0.681			
TPL2	0.672			

SQM1		0.772		
SQM2		0.77		
SQM5		0.623		
CF5		0.562		
CF1			0.785	
CF3			0.603	
CF2			0.583	
CF4				
SQM4				0.799
SQM3				0.794

Table 4.9: Factor analysis (rotated component matrix)

Table 4.9 shows the rotated component matrix reveals valuable insights database to capture the relationship between the observed variable and the extracted component (factor). Component 1 demonstrates a robust factor, representing high factor loading for variables TPL3, TPL4, TPL1, TPL5, and TPL2, ranging from 0.672 to 0.831. For instance, the researcher believes these variables are positively correlated and share the same factor in 3PL. Besides, Component 2 is characterized by variables SQM1, SQM2, and SQM5, showing a high factor loading of 0.623 to 0.772, indicating their shared association with supplier quality management. However, the researcher has discovered CF5 loading factor is 0.562 and shared with factor supplier quality management in Component 2. From these points, CF5 might be cross-loading with Component 2, which means CF5 might have a significant correlation with Component 2 (SQM-related variable) or Component 3 (Customer Focus-related variable). Although CF5 is related to both aspects, CF5 shares more similarities with the components in Component 2 compared to the others. Therefore, the researcher will place the CF5 under Component 2.

Besides Component 3, the variables CF1, CF3, and CF2 contribute to this customer focus factor. From these points, CF1 and CF3 have relatively higher loadings of 0.785 and 0.603, respectively, signifying a strong correlation with Component 3. While CF2 also exhibits a moderate loading (0.583) on Component 3. However, the CF4 does not display a substantial association with any of the components. From these points, the CF4 shows a low correlation between variables because the correlations among variables are very weak or close to zero,

factor analysis may not be appropriate, as it won't be able to identify underlying factors (Shrestha, 2021). Lastly, Component 4 captures the relationship between variables SQM4 and SQM3, displaying high loading of 0.799 and 0.794. It suggests that SQM4 and SQM3 shared a common underlying with another factor dimension. Overall, the factor analysis (rotated component matrix) measures four distinct factors that provide a meaningful interpretation of the dataset structure.

4.7 Critical Success Factors (Mean)

Descriptive Statistics						
	N	**Minimum**	**Maximum**	**Sum**	**Mean**	**Std. Deviation**
Mean CF	110	2.5	5	473.25	4.3023	0.39651
Mean SQM	110	3	5	473	4.3	0.43736
Mean TPL	110	2	5	457.4	4.1582	0.55922
Mean ERM	110	3	5	472	4.2909	0.45626

Table 4.10: Critical Success Factors (Mean)

Table 4.10 presents descriptive statistics for four variables: Mean CF, Mean SQM, Mean TPL, and Mean ERM. From the descriptive statistic, in between the minimum value (2 to 3) shows that in terms of customer focus and 3PL variable, some respondents still disagree that both factors are considered critical success factors for green warehouse and inventory. On the other hand, the maximum values are the same for all four variables (5). The highest mean value (4.30) determines the customer focus variable is the critical success factor strongly agreed by the respondents. The average mean, ranging from approximately 4.16 to 4.30, of the other variables are quite close and can consider critical success factors, although some of the respondents still disagree.

CHAPTER 5: DISCUSSION AND CONCLUSION

5.0 Introduction

This chapter consists of seven sections. Section 5.1 provides an overview of the study. Section 5.2 outlines the discussion of the study. Section 5.3 highlights the study's contributions. Section 5.4 discusses the limitations of the study. Section 5.5 suggests future recommendations. Section 5.6 focuses on future research possibilities. Finally, Section 5.7 serves as the summary of this chapter.

5.1 Overview of the Study

The critical success factor is significant in determining green warehouse and inventory for the company to sustainable the environment in the organisation. Besides, the company will evaluate their business environment occasionally to ensure the situation is always enhanced and improving from time to time. Then, the researcher's objective to determine the success factor in green warehouse and inventory management will go through several critical success factors such as customer focus, supplier quality management, and 3PL. Therefore, the company constantly reviews their business environment to develop effective and efficient strategies, especially green warehouse and inventory management.

Nevertheless, there are still many methods that the researcher can implement to determine the green warehouse and inventory management against the company. However, in research studies, the researcher has studied previous scholars' limited focus on the critical success factor in green warehouse and inventory management (Singh & Trivedi, 2016). Therefore, the researcher assumes and believes that the study's critical success factors (customer focus, supplier quality management, and 3PL) strongly impact green warehouse and inventory management. For instance, the manufacturing sector is a target respondent for the researcher to collect the data. The researcher can view the green warehouse and inventory management by collecting data from respondents via a questionnaire.

Based on the research objectives, it can explain the researcher focuses on two-part such as (1) To determine the critical success factors that contribute to implementing and maintaining a green warehouse and inventory management in the manufacturing industry and (2) To

measure the level of success factors in green warehouse and inventory management. Furthermore, green warehouse and inventory management are an extended challenge the company faces to deal with the growing demand for sustainable environmental practices. The researcher needs to find the right balance between meeting demand and reducing waste in the green warehouse and inventory management that can encourage the manufacturing industry to adopt green concepts.

Besides, a questionnaire was used to collect the numerical data in the line quantitative method adopted. For instance, the questionnaire has designed five sections such as demographic (including working experience, jobs position, and sector of manufacturing), critical success factor (CSF1 to CSF5), customer focus (CF1 to CF5), supplier quality management (SQM1 to SQM5), and 3PL (TPL1 to TPL5). All sections used in this study were adopted and modified through past literature reviews with green practices and similar theories employed in warehouse and inventory. Before the data collection, the researcher approved and pre-tested the questionnaire by an academic expert in the green practises area. For instance, the researcher has modified the questionnaire based on experts' reviews and comments and the questionnaire to the potential respondent. This study will focus on the manufacturing industry.

Lastly, a total of one and half months for the researcher allocated to collect all the responses from the respondent. A total of 110 companies as a sample size will conduct in the study. The response rate from 110 companies is 36.6 per cent, meaning the respondents answer the questionnaire within a period. Then, the researcher focused on several tests to measure and analyse data collected, such as descriptive statistics, normality, validity, reliability, and, most importantly, factor analysis in terms of the rotated component matrix in the study.

5.2 Discussion

In the beginning, the data collection for this study was conducted through the distribution of questionnaires in the manufacturing industry in Malaysia, spanning from 1st June 2023 to 15th July 2023, lasting for one and a half months. The researcher sent 300 questionnaires through email to the selected companies in the manufacturing industry in Malaysia, and the response rate was 36.6 per cent. From these points, all the target respondents from the manufacturing industry in Malaysia were actively involved questionnaire created by the researcher.

The study conducted the descriptive statistics of the dataset and gained insights into various aspects of the manufacturing industry in Malaysia. 110 companies participated in the survey representing individual employees across different job positions and sectors. The findings showed that a significant proportion of the respondents had more than five years of working experience, indicating a mid-level experienced workforce. Then, the managerial and executive roles dominated the positions, while the electronics and consumer goods sectors had the highest representation among the manufacturing sectors. At the same time, the study also assessed the critical success factors, customer focus, supplier quality management, and 3PL in the study. The respondents created positive perceptions in these areas, reflecting customer focus, effective supplier quality management, and satisfactory 3PL services.

Regarding normality, the researcher analysed whether the data for critical success factors, customer focus, supplier quality management, and 3PL had followed a normal distribution using the Shapiro-Wilk test. From these points, the result showed that the data reasonably approximated a normal distribution, which means the dataset was reliable and suitable for the traditional statistical test. Overall, the findings provided a strong foundation for further analysis and decision-making in the manufacturing industry, such as helping identify areas for improvement and success in the study.

Besides, the researcher applied the validity test to foster confidence in the outcomes and enable informed decision-making based on sound and dependable evidence (Finger et al., 2023). The "Table of Critical Values: Pearson Correlation's r" plays a crucial role in testing, offering a framework to assess statistical significance in correlation coefficients. By employing this table, researchers strengthen the robustness and credibility of findings. In this study, the researcher utilised this table to validate a questionnaire across four variables (critical success factors, customer focus, supplier quality management, and 3PL), confirming the validity of questions through correlation values above a critical threshold.

The researcher also used Cronbach's Alpha coefficient to assess the reliability of variables: Critical Success Factors, Customer Focus, Supplier Quality Management, and 3PL. The findings showed that the variable 3PL had the highest reliability with strong internal consistency, with a value of 0.856. Then, the variable supplier quality management showed

acceptance reliability with moderate internal consistency, with values of 0.718 and 0.737. However, the variable of customer focus showed slightly lower reliability, with a value of 0.663. From these points, it still demonstrated moderate internal consistency for the variable customer focus. Overall, the research instrument was considered reliable, and the findings strengthened the study's validity.

Furthermore, the researcher used factor analysis to identify underlying factors in the dataset related to critical success factors in green warehouse and inventory management. The findings showed that Factor 1 represents a strong correlation among variables related to 3PL. Then, Factor 2 was associated with supplier quality management, and one customer focus variable (CF5) also showed some correlation with this factor. Factor 3 represented the customer focus factor, with three strongly related variables. Lastly, Factor 4 captured the relationship between two variables related to supplier quality management with another dimension factor. Overall, the factor analysis (rotated component matrix) gave important insights for the researcher into how the data is structured and how different variables are related.

5.2.1 To determine the critical success factors that contribute to implementing and maintaining a green warehouse and inventory management in the manufacturing industry

This section presented the discussion on the research objective of the critical success factors that contribute to implementing and maintaining a green warehouse and inventory management in the manufacturing industry. To achieve this research objective, the researcher considered three pivotal variables that play a crucial role in determining the success of green warehousing and inventory management in manufacturing. These three variables, namely customer focus, supplier quality management, and 3PL, were analysed to gauge their impact on achieving environmentally friendly and efficient warehouse operations.

The Mean CF, measuring the level of customer focus, was determined to be an impressive 4.3023, indicating the pronounced importance placed on customer-centric approaches in green warehousing and inventory management initiatives. The preceding research also emphasised that green warehouses focusing on customers can use their

sustainability endeavours as a competitive edge, drawing in environmentally aware consumers and nurturing enduring customer allegiance (Handfield et al., 2019). Besides, as mentioned by Pagell et al. (2018), green warehouses that prioritised customers work closely with suppliers and customers, enhancing communication, responsiveness, and flexibility across the entire supply chain.

In addition, the Mean SQM, representing the efficacy of supplier quality management practices, was found to be 4.3, underscoring the significance of maintaining high standards in sourcing and vendor relationships to ensure sustainable and top-quality products and services. According to Yan et al. (2020), the implementation of sustainable inventory management practices not only strengthened supplier quality management but also promoted collaboration between suppliers and warehouse operators. This collaborative approach enhances communication, streamlines operations, and reduces lead times, all of which contribute to improved supplier quality management within the supply chain context.

Furthermore, the Mean TPL, reflecting the effectiveness of 3PL, exhibited a remarkable score of 4.1582, signifying the vital role that external logistics partners play in facilitating eco-friendly warehousing and streamlining inventory processes in the manufacturing industry. Collaborating with 3PL helped businesses to meet their environmental sustainability objectives by managing inventory effectively and enhancing visibility across the supply chain (Paulraj et al., 2019). According to Awasthi et al. (2019), 3PL could provide modern inventory management methods like predicting demand, optimising safety stock, and tracking inventory in real-time. It would help organisations to enhance inventory accuracy, minimise stockouts, and reduce excess inventory levels.

Interestingly, an extensive review of the existing literature initially identified and emphasised three core critical success factors. However, through a factor analysis, the researcher has unearthed a new and previously undiscovered factor: Environmental Resource Management (ERM). The Mean ERM, calculated to be 4.2909, highlights the importance of effectively managing environmental resources within warehouse operations and inventory management. This finding implied that companies and organisations in the manufacturing industry must recognise and integrate sustainable practices that address environmental risks

and resource usage to achieve long-term success and resilience in the face of changing global dynamics.

5.2.2 To measure the level of the success factor in green warehouse and inventory management

Another objective of this study attempted to measure the level of the success factor in green warehouse and inventory management. Four specific factors were considered for evaluation, ranked as follows: customer focus, supplier quality management, ERM, and 3PL. Table 5.1 show the Level of Success Factor for Each Critical Success Factor.

Level of Success Factor	Critical Success Factors
First	Customer Focus
Second	Supplier Quality Management
Third	ERM
Fourth	3PL

Table 5.1: Level of Success Factor for Each Critical Success Factor

Based on Table 5.1 above, the first level, which showed the highest level in the success factor, was the customer focus. The mean values of these success factors were analysed over different periods to provide a comprehensive comparison with previous research findings. In 2022, the customer focus variable was observed to have a mean value of 4.11 (Uddin, Bhuiyan, Kumar, Haque & Sahabuddin, 2022), whereas this study reported a slightly higher mean value of 4.30. It indicates that, over time, there has been a slight increase in the level of customer focus, suggesting an improvement in the prioritisation of customer-centric aspects in green warehouse and inventory management. According to Handfield et al. (2019), researchers also emphasised that green warehouses with a customer-centric approach can utilise their sustainability efforts to gain a competitive edge.

The second level was supplier quality management. It showed that the mean value in the researcher's study conducted in 2020 was 4.34 (Tarigan, Tanuwijaya & Siagian, 2020), whereas, in this research, the mean value was 4.30. It demonstrated a consistent level of supplier quality management over time, as the slight decrease in the mean value could be considered negligible and indicated a stable performance in this area. According to Chen et al. (2019), when warehouses adopt eco-friendly practices like using energy-efficient lighting, cutting down waste, and managing hazardous materials carefully, they enhance suppliers' performance and ability to control product quality.

While the third level was ERM, which showed the mean value in 2022 was 3.11 (Nareswari, Bramanti, Gunawan, Kunaifi & Negoro, 2022), significantly lower than the mean value of 4.29 obtained in this research. This substantial increase in the mean value suggested a notable enhancement in implementing environmentally friendly practices and resource management within the green warehouse and inventory management context.

Lastly, the fourth level is 3PL, the mean value in the previous research conducted in 2017 was 3.33 (Özoglu & Buyukkeklik, 2017), while this research recorded a mean value of 4.16. The study conducted by Van Hoek et al. (2019) underscored that 3PL enhanced the efficiency of the supply chain by utilising their specialised knowledge in effectively managing transportation. This considerable increase in the mean value indicated a significant improvement in the effectiveness of 3PL utilisation, potentially leading to enhanced operational efficiency and cost-effectiveness.

In short, the comparison with the previous research findings emphasised the progress made in various success factors within green warehouse and inventory management. While customer focus and supplier quality management have remained relatively stable, there has been remarkable growth in environmental resource management and 3PL. These findings underscored the importance of sustainable and efficient practices in modern warehousing and inventory management systems.

5.3 Contribution of the Study

After this study's result findings, some contributions on the theoretical and practical aspects will be discussed and proposed. As known, the theoretical contributions examine how this study has covered the identified gaps and added value to the knowledge of green warehouses and inventory. Besides, the practical contributions address the contribution to encourage the manufacturing industry to adopt green practices to enhance their warehouse and inventory in Malaysia.

5.3.1 Theoretical Contributions

In terms of theoretical contributions, the researcher focuses on a few key areas. First, the researcher enriched the existing literature and theory on green warehouse and inventory management. This research offered new insights that can inform the development of theoretical linking green warehouse and inventory after the researcher identified critical success factors within a manufacturing industry domain. At the same time, businesses and policymakers can utilise these findings to enhance their environmental sustainability initiatives and drive the adoption of greener practices in warehouses and inventory.

Besides, the researcher has figured out and provided a new contribution of critical success factors after conducting factor analysis (rotated component metrics). The new contribution factor of Environmental Resource Management (ERM) aligns with the theory of green warehouse and inventory management by emphasising the integration of sustainable practices in the warehousing and inventory processes. It emphasised the theory by providing insights into how eco-friendly strategies, such as energy-efficient operations, waste reduction, and environmentally responsible material handling, can be incorporated to achieve more sustainable supply chain operations.

Next, the study contributed to quantitative research in supply chain management after serving as a practical example of conducting quantitative studies domain. The methodology and data analysis techniques interested the researcher in exploring supply chain topics (green warehouse and inventory) using quantitative approaches. From these points, the research improved, enabled more robust comparison, and facilitated cumulative knowledge growth in a green warehouse and inventory management.

Overall, the theoretical contributions not only advance academic knowledge. At the same time, it could know real-world implications, fostering sustainable business practices and contributing to the global efforts aimed at reducing the environmental impact supply chain.

5.3.2 Practical Contributions

In terms of practical contributions, this research offered practical benefits for the manufacturing industry by focusing on sustainable warehouse and inventory management. It identified important critical success factors (customer focus, supplier quality management, and 3PL) that could help the business to improve its green warehouse and inventory. After using insights, the company could reduce waste, use resources more efficiently, and reduce the environmental impact. From these points, it contributed to a greener and more sustainable business landscape and helped businesses save costs and become more competitive in the market.

Besides, the company's adopting eco-friendly practices enhanced its reputation in terms of warehouse and inventory and can attract environmentally conscious customers and investors. For instance, consumers could become more environmentally aware and prefer products and services from socially responsible businesses. From these points, the company could embrace sustainability to boost customer loyalty and create new market opportunities for companies in the manufacturing industry.

The practical contributions supported efforts to create a more environmentally friendly and responsible business environment in Malaysia. After focusing on green warehouse and inventory management, the business could enhance its operations, reduce its environmental impact, and thrive in an increasingly eco-conscious market. At the same time, collaboration among businesses, policymakers, and consumers became the key to driving meaningful change and building a sustainable future for the manufacturing industry in green warehouses and inventory.

5.4 Limitation

In this study, the research provides some limitations that need to be considered when interpreting its findings and conducting further research. The researcher has analysed two limitations against the entire study from these points. Firstly, the limitation of the study is focusing on a specific industry or region, such as the manufacturing industry in Malaysia. This

study provides valuable insights for business operations in this context, and the researcher discovers the findings may not be fully generalisable to other industries or countries with different operational structures, regulations or market dynamics. For instance, green warehouse and inventory management practices can vary significantly across industries and regions, which could influence the relevance and applicability of the identified success factors. From these points, the researcher thinks that encompassing a broader range of industries and geographical locations would be beneficial to enhance study findings for further research.

Another limitation that research discovered in this study is related study lies in the reliance on quantitative data and analysis. Quantitative research provides valuable statistical insights but may not capture the full spectrum of factors influencing green warehouses and inventory. For instance, the research aspect related to organisational culture, employee behaviour, and managerial decision-making, which can significantly impact sustainability initiatives, may not be adequately explored through quantitative methods alone. From these points, the qualitative research method might complement the quantitative findings by providing a deeper understanding of the underlying motivations, challenges, and contextual factors affecting the implementation of green practices.

5.5 Recommendation for Future Research

The researcher suggested the green initiative is essential in embracing and disseminating sustainable practices and is crucial for creating a more resilient, eco-friendly, and socially responsible business environment in Malaysia, particularly in the context of green warehousing and inventory management. One promising direction involves a comparative analysis of green initiatives across small, medium, and large companies in Malaysia, focusing specifically on their warehouse and inventory practices. This investigation could uncover how different company sizes integrate sustainable principles into their warehousing operations, exploring whether size influences the adoption of energy-efficient technologies, waste reduction measures, and eco-friendly packaging materials.

Moreover, one of the recommendations provided is delving into the determinants of successful green warehousing and inventory management within distinct company categories may reveal critical success factors unique to each size category, shedding light on the roles of financial resources, organisational culture, and leadership commitment in achieving sustainable

logistics operations. Understanding the interplay between employee attitudes and the implementation of green warehousing and inventory practices while considering the varying approaches of different company sizes offers valuable insights into fostering environmentally conscious behaviours among warehouse staff.

Additionally, the researcher recommended investigating governmental policies' impact on green warehousing initiatives and evaluating their alignment with company practices, which can provide insights into the regulatory landscape that shapes sustainable logistics. This research could highlight how government regulations influence decisions related to energy-efficient warehousing technologies, carbon emissions reduction in transportation, and sustainable sourcing practices.

The researcher suggested that future research can analyse the financial implications of incorporating green principles into warehouse and inventory operations across different company sizes can address concerns about profitability. It could unveil how sustainable logistics practices impact costs, revenue generation, and overall financial performance. Furthermore, exploring communication strategies that companies of varying sizes employ to communicate their green warehousing and inventory initiatives to stakeholders can offer insights into enhancing transparency and accountability in supply chain sustainability.

Lastly, the researcher also suggests investigating the role of innovation in driving successful green warehousing and inventory management within different company sizes. It can shed light on adopting technologies such as smart inventory tracking systems, renewable energy integration, and data analytics for optimising warehouse efficiency. By aligning sustainability goals with innovative practices, companies can reduce their environmental footprint while achieving better inventory management outcomes.

5.6 Future Research

After conducting the limitation of the study, the research has analysed and suggested future research based on two limitations mentioned previously. Firstly, the research should focus on investigating the variations of these practices across different industries, and geographical location is essential for diverse operational structures, regulations, and market dynamics. For instance, the research can employ a mixed-method approach that will provide a comprehensive understanding of the contextual factors influencing critical success factors in different contexts.

Next, the researcher should gain a deeper comprehension of the implementation process, and future research should prioritise the role of organisational culture, employee behaviour, or managerial decision-making. For instance, qualitative methods such as interviews can offer insights into the non-quantifiable aspects affecting sustainability initiatives. Overall, the researcher can address these research limitations and provide future studies that can contribute valuable insights to the broader field of sustainability while overcoming the limitations of the previous research.

Lastly, the researcher suggests evaluating critical success factors that can help measure the firm's performance. However, due to the limited three-month study period, there may need to be more time to assess the firm's overall performance fully. The researcher will review long-term financial and operational goals. Despite the time constraint, the researcher believes that analysing critical success factors can motivate the organisation to improve its overall performance sustainability. Future research could consider a longer study duration and include more performance metrics for a comprehensive evaluation.

5.7 Conclusion

In conclusion, this study has aimed to determine the critical success factors for implementing and maintaining green warehouse and inventory management in the manufacturing industry, particularly in Malaysia. The research has identified three pivotal success factors: customer focus, supplier quality management, and 3PL, which significantly impact the effectiveness of green warehousing and inventory practices. These factors have been examined through a quantitative approach, utilising surveys and statistical analysis.

The study found that customer focus, supplier quality management, and 3PL play essential roles in achieving environmentally friendly and efficient warehouse operations. Companies that prioritise customer-centric approaches can use sustainability as a competitive advantage, while effective supplier quality management enhances collaboration and communication throughout the supply chain. Moreover, collaboration with 3PL partners aids in meeting sustainability objectives and improving operational efficiency.

A new contribution emerged from the factor analysis, revealing the importance of ERM. This factor emphasises the integration of sustainable practices to manage environmental risks and resource usage within warehouse operations and inventory management. It involves the

adoption of strategies and approaches that minimise environmental impact, reduce resource consumption, and promote long-term viability. This finding underscores the need to address environmental challenges and resource consumption for long-term success in green warehousing.

Furthermore, the study's practical contributions extended to the manufacturing industry in Malaysia. By focusing on sustainable practices, businesses can improve their warehouse efficiency, reduce waste, and enhance their reputation among environmentally conscious customers and investors. The findings also emphasised the evolving nature of these success factors over time, with ERM and 3PL gaining prominence in recent years.

While the research offers valuable insights, there are limitations to consider, such as the industry-specific focus and the reliance on quantitative methods. Future research can explore these factors in various industries and regions and incorporate qualitative methods to capture different aspects of green warehousing. Additionally, examining the financial implications of sustainable practices and the impact of governmental policies on green initiatives would provide further insights.

Lastly, this study sheds light on the critical success factors that contribute to green warehouse and inventory management in the manufacturing industry. By understanding and implementing these factors, businesses can foster sustainability, enhance operational efficiency, and contribute to a more environmentally responsible business landscape.

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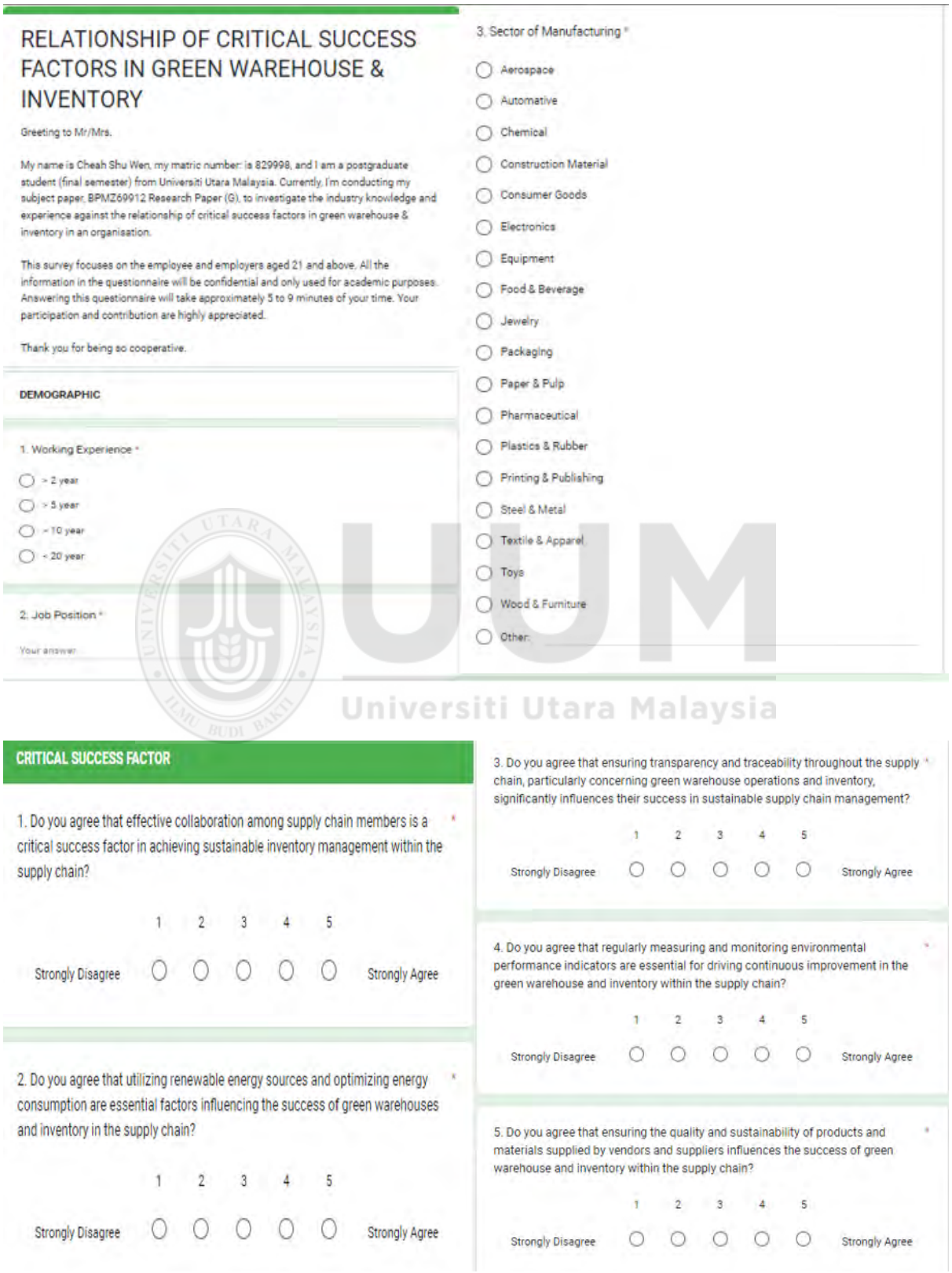
Appendix A: Questionnaire



RELATIONSHIP OF CRITICAL SUCCESS FACTORS IN GREEN WAREHOUSE & INVENTORY

Greeting to Mr/Mrs.

My name is Cheah Shu Wen, my matric number: is 829998, and I am a postgraduate student (final semester) from Universiti Utara Malaysia. Currently, I'm conducting my subject paper, BPMZ69912 Research Paper (G), to investigate the industry knowledge and experience against the relationship of critical success factors in green warehouse & inventory in an organisation.

This survey focuses on the employee and employers aged 21 and above. All the information in the questionnaire will be confidential and only used for academic purposes. Answering this questionnaire will take approximately 5 to 9 minutes of your time. Your participation and contribution are highly appreciated.

Thank you for being so cooperative.

DEMOGRAPHIC

1. Working Experience *

- > 2 year
- > 5 year
- > 10 year
- > 20 year

2. Job Position *

Your answer

3. Sector of Manufacturing *

- Aerospace
- Automative
- Chemical
- Construction Material
- Consumer Goods
- Electronics
- Equipment
- Food & Beverage
- Jewelry
- Packaging
- Paper & Pulp
- Pharmaceutical
- Plastics & Rubber
- Printing & Publishing
- Steel & Metal
- Textile & Apparel
- Toys
- Wood & Furniture
- Other:

CRITICAL SUCCESS FACTOR

1. Do you agree that effective collaboration among supply chain members is a critical success factor in achieving sustainable inventory management within the supply chain? *

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

2. Do you agree that utilizing renewable energy sources and optimizing energy consumption are essential factors influencing the success of green warehouses and inventory in the supply chain? *

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

3. Do you agree that ensuring transparency and traceability throughout the supply chain, particularly concerning green warehouse operations and inventory, significantly influences their success in sustainable supply chain management? *

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

4. Do you agree that regularly measuring and monitoring environmental performance indicators are essential for driving continuous improvement in the green warehouse and inventory within the supply chain? *

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

5. Do you agree that ensuring the quality and sustainability of products and materials supplied by vendors and suppliers influences the success of green warehouse and inventory within the supply chain? *

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

CUSTOMER FOCUS

1. Do you agree that a strong customer focus in a green warehouse leads to improved green warehouse and inventory? *

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

2. Do you agree that green warehouses prioritising customer needs positively influence green warehouses and inventory? *

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

3. Do you agree that green warehouses that prioritise customer satisfaction experience better supply chains? *

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

4. Do you agree that green warehouses that align their inventory management strategies with customer demands achieve higher supply chain performance? *

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

5. Do you agree that the customer-focused variable in green warehouse operations directly influences the organisation? *

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

SUPPLIER QUALITY MANAGEMENT

1. Do you agree that green warehouse practices significantly impact supplier quality management, improving the supply chain? *

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

2. Do you agree that sustainable inventory management techniques ensure supplier quality and positively affect warehouse operation? *

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

3. Do you agree that energy-efficient operations and waste reduction contribute to enhanced supplier quality management and, ultimately, a more effective supply chain? *

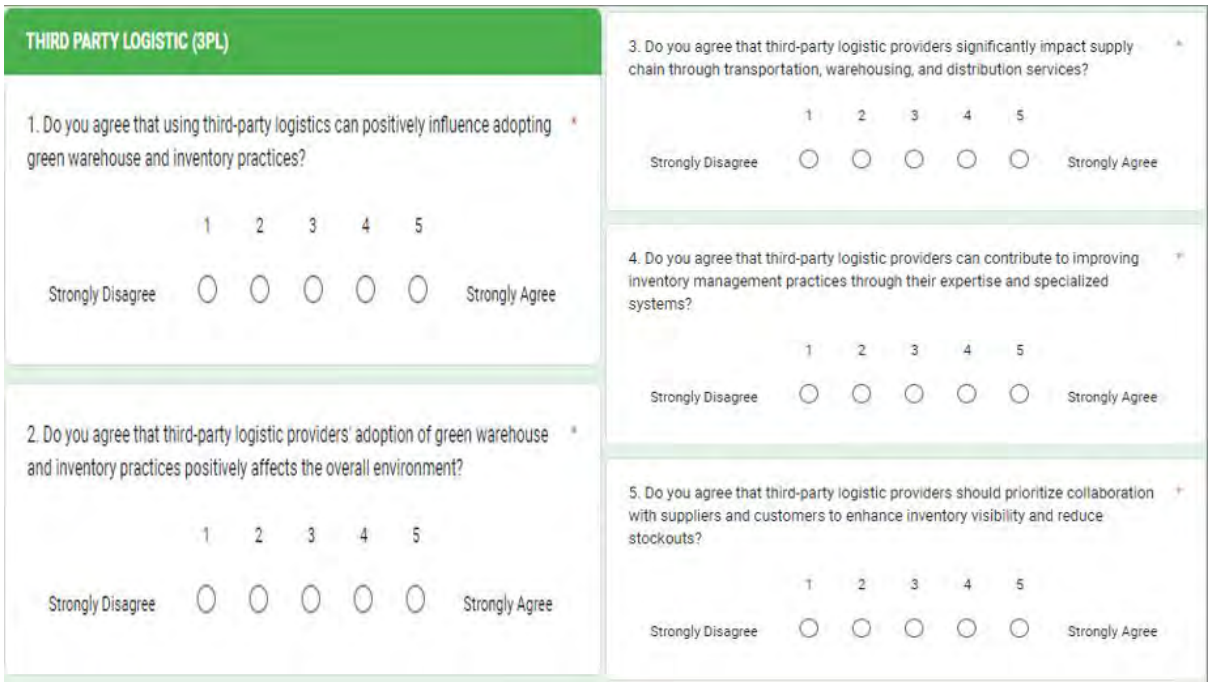
	1	2	3	4	5	
Strongly Disagree	○	○	○	○	○	Strongly Agree

4. Do you agree that efficient inventory control systems prioritising sustainability and environmental considerations influence supplier quality management? *

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

5. Do you agree that integrating green practices within the warehouse and implementing effective inventory management techniques positively impact supplier quality in the organisation? *

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



THIRD PARTY LOGISTIC (3PL)

1. Do you agree that using third-party logistics can positively influence adopting green warehouse and inventory practices? *

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

2. Do you agree that third-party logistic providers' adoption of green warehouse and inventory practices positively affects the overall environment? *

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

3. Do you agree that third-party logistic providers significantly impact supply chain through transportation, warehousing, and distribution services? *

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

4. Do you agree that third-party logistic providers can contribute to improving inventory management practices through their expertise and specialized systems? *

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

5. Do you agree that third-party logistic providers should prioritize collaboration with suppliers and customers to enhance inventory visibility and reduce stockouts? *

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

Appendix B: SPSS Analysis Output

I. Descriptive Statistics

Working Experience

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	< 20 year	13	11.8	11.8	11.8
	> 10 year	26	23.6	23.6	35.5
	> 2 year	24	21.8	21.8	57.3
	> 5 year	47	42.7	42.7	100.0
	Total	110	100.0	100.0	

Job Position

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Assistant Logistics Manager	1	.9	.9	.9
	Assistant Operation Manager	1	.9	.9	1.8
	Assistant Procurement Manager	1	.9	.9	2.7
	Assistant Production Manager	1	.9	.9	3.6
	Assistant Purchasing Manager	1	.9	.9	4.5
	Assistant Sourcing Manager	1	.9	.9	5.5
	Assistant Transportation Manager	1	.9	.9	6.4
	Assistant Vendor Manager	1	.9	.9	7.3
	Buyer	1	.9	.9	8.2
	Chief Operation Director	1	.9	.9	9.1
	Customer Relations & Material Planning Specialist	1	.9	.9	10.0
	Customs and Compliance Specialist	1	.9	.9	10.9
	cycle count team lead scm	1	.9	.9	11.8
	Demand Forecasting Manager	1	.9	.9	12.7
	Demand Planner	1	.9	.9	13.6
	Distribution Manager	1	.9	.9	14.5
	Engineer	2	1.8	1.8	16.4
	Executive	1	.9	.9	17.3
	Executive, Inventory	1	.9	.9	18.2
	Forecasting Analyst	1	.9	.9	19.1
	Freight Forwarder	1	.9	.9	20.0
	General manager	1	.9	.9	20.9
	Inventory Analyst	1	.9	.9	21.8
	Inventory Control Executive	1	.9	.9	22.7
	Inventory Control Specialist	1	.9	.9	23.6
	Inventory Exevutive	1	.9	.9	24.5
	Logistics Coordinator	3	2.7	2.7	27.3

	Logistics Executive	2	1.8	1.8	29.1
	LOGISTICS MANAGER	1	.9	.9	30.0
	manager	1	.9	.9	30.9
	Manager	3	2.7	2.7	33.6
	Manufacturing Material Coordinator	1	.9	.9	34.5
	Material Management Executive	1	.9	.9	35.5
	Material Manager	1	.9	.9	36.4
	Material Planner	1	.9	.9	37.3
	Officer, Inventory	1	.9	.9	38.2
	Operation Analyst	1	.9	.9	39.1
	Operations Director	1	.9	.9	40.0
	Operations Manager	1	.9	.9	40.9
	Order Fulfillment Specialist	1	.9	.9	41.8
	Packaging Engineer	1	.9	.9	42.7
	Planner	1	.9	.9	43.6
	Planner, Operation	1	.9	.9	44.5
	Printing head	1	.9	.9	45.5
	Procurement Manager	2	1.8	1.8	47.3
	Procurement Specialist	1	.9	.9	48.2
	Product Quality Assurance Engineer	1	.9	.9	49.1
	Production Assistant	1	.9	.9	50.0
	Production Executive	1	.9	.9	50.9
	Production Head	1	.9	.9	51.8
	Production Leader	1	.9	.9	52.7
	Production Planner	1	.9	.9	53.6
	Production Planning Clerk	1	.9	.9	54.5
	Production Planning Executive	1	.9	.9	55.5
	Production Process Technician	1	.9	.9	56.4
	Production Scheduler	1	.9	.9	57.3
	Production Supervisor	1	.9	.9	58.2
	Production Supervisor Technician	1	.9	.9	59.1
	Purchasing Executive	1	.9	.9	60.0
	Purchasing Executive II	1	.9	.9	60.9
	Purchasing Manager	1	.9	.9	61.8
	Purchasing Officer	1	.9	.9	62.7
	QA Automate Tester	1	.9	.9	63.6
	QA Executive	1	.9	.9	64.5
	Quality & Training Lead	1	.9	.9	65.5
	Quality Assurance Consultant	1	.9	.9	66.4
	Quality Assurance Executive	1	.9	.9	67.3
	Quality Controller	1	.9	.9	68.2
	Quality Engineer	1	.9	.9	69.1
	SC Mgr	1	.9	.9	70.0
	Section Head	1	.9	.9	70.9
	Senior Logitics Executive	1	.9	.9	71.8
	Senior manager	1	.9	.9	72.7

	SENIOR PRINTING MANAGER	1	.9	.9	73.6
	Senior Production Engineer	1	.9	.9	74.5
	Senior Purchasing Executive	1	.9	.9	75.5
	Senior Quality Assurance Executive	1	.9	.9	76.4
	Service Engineer	1	.9	.9	77.3
	Sourcing Manager	1	.9	.9	78.2
	Sr Engineer	1	.9	.9	79.1
	Strategic Sourcing Analyst	1	.9	.9	80.0
	Supplier Development Engineer	1	.9	.9	80.9
	Supplier Relationship Executive	1	.9	.9	81.8
	Supplier Relationship Manager	1	.9	.9	82.7
	Supply Chain Analyst	1	.9	.9	83.6
	Supply Chain Coordinator	1	.9	.9	84.5
	Supply Chain Executive	1	.9	.9	85.5
	Supply Chain Lead	1	.9	.9	86.4
	Supply Chain Manager	1	.9	.9	87.3
	Supply Chain Planner	1	.9	.9	88.2
	Supply Chain Risk Analyst	1	.9	.9	89.1
	Transportation Analyst	1	.9	.9	90.0
	Transportation Manager	1	.9	.9	90.9
	Vendor Manager	1	.9	.9	91.8
	Warehouse Assistant Supervisor	1	.9	.9	92.7
	Warehouse Executive	3	2.7	2.7	95.5
	Warehouse Manager	2	1.8	1.8	97.3
	Warehouse Supervisor	3	2.7	2.7	100.0
	Total	110	100.0	100.0	

Sector of Manufacturing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Automative	7	6.4	6.4	6.4
	CAN MANUFACTURER	1	.9	.9	7.3
	Chemical	7	6.4	6.4	13.6
	Construction Material	6	5.5	5.5	19.1
	Consumer Goods	17	15.5	15.5	34.5
	Electronics	18	16.4	16.4	50.9
	Equipment	8	7.3	7.3	58.2
	Food & Beverage	11	10.0	10.0	68.2
	Jewelry	2	1.8	1.8	70.0
	Manufacturing	1	.9	.9	70.9
	Packaging	11	10.0	10.0	80.9
	Paper & Pulp	5	4.5	4.5	85.5
	Pharmaceutical	1	.9	.9	86.4
	Plastics & Rubber	5	4.5	4.5	90.9
	Steel & Metal	4	3.6	3.6	94.5

	Textile & Apparel	1	.9	.9	95.5
	Wood & Furniture	5	4.5	4.5	100.0
	Total	110	100.0	100.0	

Descriptive Statistics (Critical Success Factors)

	N	Minimum	Maximum	Mean	Std. Deviation
CSF1	110	3	5	4.20	.424
CSF2	110	3	5	4.21	.451
CSF3	110	3	5	4.30	.583
CSF4	110	3	5	4.27	.573
CSF5	110	2	5	4.32	.605
Valid N (listwise)	110				

Descriptive Statistics (Customer Focus)

	N	Minimum	Maximum	Mean	Std. Deviation
CF1	110	3	5	4.30	.517
CF2	110	2	5	4.31	.571
CF3	110	2	5	4.26	.601
CF4	110	2	5	4.34	.579
CF5	110	3	5	4.27	.557
Valid N (listwise)	110				

Descriptive Statistics (Supplier Quality Management)

	N	Minimum	Maximum	Mean	Std. Deviation
SQM1	110	2	5	4.26	.631
SQM2	110	3	5	4.36	.570
SQM3	110	3	5	4.32	.557
SQM4	110	3	5	4.26	.501
SQM5	110	2	5	4.30	.614
Valid N (listwise)	110				

Descriptive Statistics (3PL)

	N	Minimum	Maximum	Mean	Std. Deviation
TPL1	110	2	5	4.18	.756
TPL2	110	2	5	4.22	.696

TPL3	110	2	5	4.14	.710
TPL4	110	1	5	4.11	.721
TPL5	110	2	5	4.15	.618
Valid N (listwise)	110				

II. Normality

Tests of Normality (Critical Success Factors)

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CSF1	.472	110	<.001	.548	110	<.001
CSF2	.451	110	<.001	.596	110	<.001
CSF3	.333	110	<.001	.742	110	<.001
CSF4	.347	110	<.001	.736	110	<.001
CSF5	.319	110	<.001	.738	110	<.001

a. Lilliefors Significance Correction

Tests of Normality (Customer Focus)

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CF1	.392	110	<.001	.680	110	<.001
CF2	.351	110	<.001	.706	110	<.001
CF3	.333	110	<.001	.741	110	<.001
CF4	.338	110	<.001	.712	110	<.001
CF5	.361	110	<.001	.723	110	<.001

a. Lilliefors Significance Correction

Tests of Normality (Supplier Quality Management)

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
SQM1	.317	110	<.001	.736	110	<.001
SQM2	.329	110	<.001	.728	110	<.001
SQM3	.352	110	<.001	.721	110	<.001
SQM4	.410	110	<.001	.663	110	<.001
SQM5	.315	110	<.001	.747	110	<.001

a. Lilliefors Significance Correction

Tests of Normality (3PL)

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TPL1	.287	110	<.001	.774	110	<.001
TPL2	.313	110	<.001	.705	110	<.001

TPL3	.306	110	<.001	.771	110	<.001
TPL4	.313	110	<.001	.768	110	<.001
TPL5	.348	110	<.001	.703	110	<.001

a. Lilliefors Significance Correction

III. Validity

Correlations

		CSF1	CSF2	CSF3	CSF4	CSF5	CF1	CF2	CF3	CF4	CF5	SQM1	SQM2	SQM3	SQM4	SQM5	TPL1	TPL2	TPL3	TPL4	TPL5	Total
CSF1	Pearson Correlation	1	.595**	.274**	.264**	0.143	0.059	-0.106	-0.029	0.060	0.117	0.041	0.038	.194*	0.095	-0.021	-0.086	0.037	-0.061	-0.012	0.063	.207*
	Sig. (2-tailed)		0.000	0.004	0.005	0.136	0.543	0.270	0.765	0.535	0.225	0.669	0.694	0.042	0.323	0.826	0.373	0.699	0.527	0.901	0.513	0.030
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
CSF2	Pearson Correlation	.595**	1	.491**	.345**	.258**	0.161	0.103	0.099	0.044	0.100	0.062	0.165	.207*	.282**	0.103	-0.032	0.087	-0.004	-0.014	0.120	.352**
	Sig. (2-tailed)	0.000		0.000	0.000	0.006	0.092	0.284	0.302	0.645	0.301	0.517	0.084	0.030	0.003	0.286	0.742	0.365	0.968	0.882	0.211	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
CSF3	Pearson Correlation	.274**	.491**	1	.521**	.299**	0.094	0.105	0.165	0.052	0.000	0.107	0.110	.212*	.198*	0.131	-0.021	.199*	.188*	-0.035	0.158	.387**
	Sig. (2-tailed)	0.004	0.000		0.000	0.002	0.327	0.276	0.085	0.592	1.000	0.265	0.251	0.026	0.038	0.174	0.829	0.037	0.049	0.717	0.100	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
CSF4	Pearson Correlation	.264**	.345**	.521**	1	.303**	0.062	0.048	.269**	0.053	.253**	.231*	0.143	0.157	.227*	0.000	0.012	.240*	0.088	-0.095	0.120	.387**
	Sig. (2-tailed)	0.005	0.000	0.000		0.001	0.520	0.615	0.005	0.584	0.008	0.015	0.137	0.102	0.017	1.000	0.905	0.011	0.360	0.324	0.212	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
CSF5	Pearson Correlation	0.143	.258**	.299**	.303**	1	.250**	.350**	.449**	.216*	.203*	.331**	.273**	.268**	0.175	0.111	.294**	.444**	.261**	.235*	.390**	.608**
	Sig. (2-tailed)	0.136	0.006	0.002	0.001		0.009	0.000	0.000	0.024	0.033	0.000	0.004	0.005	0.068	0.248	0.002	0.000	0.006	0.013	0.000	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
CF1	Pearson Correlation	0.059	0.161	0.094	0.062	.250**	1	.274**	.304**	.304**	.319**	.206*	0.125	.239*	.330**	.234*	.188*	.301**	0.163	0.034	0.178	.451**
	Sig. (2-tailed)	0.543	0.092	0.327	0.520	0.009		0.004	0.001	0.001	0.001	0.031	0.195	0.012	0.000	0.014	0.049	0.001	0.090	0.721	0.063	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
CF2	Pearson Correlation	-0.106	0.103	0.105	0.048	.350**	.274**	1	.376**	.321**	.194*	.307**	.243*	.207*	0.130	.230*	.230*	.453**	.325**	.252**	.261**	.526**
	Sig. (2-tailed)	0.270	0.284	0.276	0.615	0.000	0.004		0.000	0.001	0.042	0.001	0.010	0.030	0.177	0.015	0.016	0.000	0.001	0.008	0.006	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
CF3	Pearson Correlation	-0.029	0.099	0.165	.269**	.449**	.304**	.376**	1	.323**	0.167	.348**	.280**	.213*	.224*	.231*	.257**	.410**	.195*	0.145	.340**	.564**
	Sig. (2-tailed)	0.765	0.302	0.085	0.005	0.000	0.001	0.000		0.001	0.081	0.000	0.003	0.026	0.019	0.015	0.007	0.000	0.042	0.131	0.000	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
CF4	Pearson Correlation	0.060	0.044	0.052	0.053	.216*	.304**	.321**	.323**	1	.253**	.408**	.293**	.348**	.261**	.333**	.320**	.454**	.356**	0.175	.400**	.586**
	Sig. (2-tailed)	0.535	0.645	0.592	0.584	0.024	0.001	0.001	0.001		0.008	0.000	0.002	0.000	0.006	0.000	0.001	0.000	0.000	0.068	0.000	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
CF5	Pearson Correlation	0.117	0.100	0.000	.253**	.203*	.319**	.194*	0.167	.253**	1	.499**	.291**	0.161	.233*	.215*	0.164	.319**	0.160	0.085	.283**	.478**
	Sig. (2-tailed)	0.225	0.301	1.000	0.008	0.033	0.001	0.042	0.081	0.008		0.000	0.002	0.093	0.014	0.024	0.086	0.001	0.094	0.377	0.003	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
SQM1	Pearson Correlation	0.041	0.062	0.107	.231*	.331**	.206*	.307**	.348**	.408**	.499**	1	.496**	.307**	.272**	.410**	.264**	.453**	.308**	0.178	.371**	.648**
	Sig. (2-tailed)	0.669	0.517	0.265	0.015	0.000	0.031	0.001	0.000	0.000	0.000		0.000	0.001	0.004	0.000	0.005	0.000	0.001	0.062	0.000	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
SQM2	Pearson Correlation	0.038	0.165	0.110	0.143	.273**	0.125	.243*	.280**	.293**	.291**	.496**	1	.412**	.271**	.419**	0.143	.214*	0.103	-0.008	.291**	.504**
	Sig. (2-tailed)	0.694	0.084	0.251	0.137	0.004	0.195	0.010	0.003	0.002	0.002	0.000		0.000	0.004	0.000	0.136	0.025	0.284	0.933	0.002	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
SQM3	Pearson Correlation	.194*	.207*	.212*	0.157	.268**	.239*	.207*	.213*	.348**	0.161	.307**	.412**	1	.485**	.255**	0.144	.269**	.214*	0.073	.290**	.530**
	Sig. (2-tailed)	0.042	0.030	0.026	0.102	0.005	0.012	0.030	0.026	0.000	0.093	0.001	0.000		0.000	0.007	0.132	0.005	0.025	0.451	0.002	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
SQM4	Pearson Correlation	0.095	.282**	.198*	.227*	0.175	.330**	0.130	.224*	.261**	.233*	.272**	.271**	.485**	1	.277**	0.042	.228*	0.156	0.021	.230*	.470**
	Sig. (2-tailed)	0.323	0.003	0.038	0.017	0.068	0.000	0.177	0.019	0.006	0.014	0.004	0.004	0.000		0.003	0.664	0.016	0.104	0.826	0.015	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
SQM5	Pearson Correlation	-0.021	0.103	0.131	0.000	0.111	.234*	.230*	.231*	.333**	.215*	.410**	.419**	.255**	.277**	1	0.099	.210*	0.158	-0.012	.246**	.445**
	Sig. (2-tailed)	0.826	0.286	0.174	1.000	0.248	0.014	0.015	0.015	0.000	0.024	0.000	0.000	0.007	0.003		0.305	0.027	0.100	0.897	0.009	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
TPL1	Pearson Correlation	-0.086	-0.032	-0.021	0.012	.294**	.188*	.230*	.257**	.320**	0.164	.264**	0.143	0.144	0.042	0.099	1	.621**	.568**	.586**	.453**	.563**
	Sig. (2-tailed)	0.373	0.742	0.829	0.905	0.002	0.049	0.016	0.007	0.001	0.086	0.005	0.136	0.132	0.664	0.305		0.000	0.000	0.000	0.000	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
TPL2	Pearson Correlation	0.037	0.087	.199*	.240*	.444**	.301**	.453**	.410**	.454**	.319**	.453**	.214*	.269**	.228*	.210*	.621**	1	.571**	.391**	.629**	.763**
	Sig. (2-tailed)	0.699	0.365	0.037	0.011	0.000	0.001	0.000	0.000	0.000	0.001	0.000	0.025	0.005	0.016	0.027	0.000		0.000	0.000	0.000	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
TPL3	Pearson Correlation	-0.061	-0.004	.188*	0.088	.261**	0.163	.325**	.195*	.356**	0.160	.308**	0.103	.214*	0.156	0.158	.568**	.571**	1	.616**	.581**	.624**
	Sig. (2-tailed)	0.527	0.968	0.049	0.360	0.006	0.090	0.001	0.042	0.000	0.094	0.001	0.284	0.025	0.104	0.100	0.000	0.000		0.000	0.000	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
TPL4	Pearson Correlation	-0.012	-0.014	-0.035	-0.095	.235*	0.034	.252**	0.145	0.175	0.085	0.178	-0.008	0.073	0.021	-0.012	.586**	.391**	.616**	1	.437**	.444**
	Sig. (2-tailed)	0.901	0.882	0.717	0.324	0.013	0.721	0.008	0.131	0.068	0.377	0.062	0.933	0.451	0.826	0.897	0.000	0.000	0.000		0.000	0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
TPL5	Pearson Correlation	0.063	0.120	0.158	0.120	.390**	0.178	.261**	.340**	.400**	.283**	.371**	.291**	.290**	.230*	.246**	.453**	.629**	.581**	.437**	1	.690**
	Sig. (2-tailed)	0.513	0.211	0.100	0.212	0.000	0.063	0.006	0.000	0.000	0.003	0.000	0.002	0.002	0.015	0.009	0.000	0.000	0.000	0.000		0.000
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
Total	Pearson Correlation	.207*	.352**	.387**	.387**	.608**	.451**	.526**	.564**	.586**	.478**	.648**	.504**	.530**	.470**	.445**	.563**	.763**	.624**	.444**	.690**	1
	Sig. (2-tailed)	0.030	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	N	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110

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

*. Correlation is significant at the 0.05 level (2-tailed).

IV. Reliability

Reliability Statistics (Critical Success Factors)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.718	.729	5

Reliability Statistics (Customer Focus)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.663	.664	5

Reliability Statistics (Supplier Quality Management)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.737	.738	5

Reliability Statistics (3PL)

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.856	.857	5

V. Factor Analysis (Rotated Component Matrix)

Rotated Component Matrix[a]

	Component			
	1	2	3	4
TPL3	.831			
TPL4	.828			
TPL1	.789			
TPL5	.681			
TPL2	.672			
SQM1		.772		
SQM2		.770		
SQM5		.623		
CF5		.562		
CF1			.785	
CF3			.603	
CF2			.583	
CF4				
SQM4				.799
SQM3				.794

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.
a. Rotation converged in 6 iterations.

VI. Critical Success Factors (Mean)

Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
Mean CF	110	2.50	5.00	473.25	4.3023	.39651
Mean SQM	110	3.00	5.00	473.00	4.3000	.43736
Mean TPL	110	2.00	5.00	457.40	4.1582	.55922
Mean ERM	110	3.00	5.00	472.00	4.2909	.45626
Valid N (listwise)	110					