INVENTORY MANAGEMENT PRACTICES AND ITS IMPACT ON PERFORMANCE AMONG MANUFACTURING INDUSTRY SETTING IN KULIM INDUSTRIAL PARK

KOMATHI A/P BALAKISNAN

MASTER OF SCIENCE
UNIVERSITI UTARA MALAYSIA
AUGUST 2024

INVENTORY MANAGEMENT PRACTICES AND ITS IMPACT ON PERFORMANCE AMONG MANUFACTURING INDUSTRY SETTING IN KULIM INDUSTRIAL PARK

By

KOMATHI A/P BALAKISNAN

Thesis Submitted to
Collage of Business,
Universiti Utara Malaysia,
in Fulfilment of the Requirement for the Master of Science
(Transportation and Logistics Management)

Kolej Perniagaan
(College of Business)
Universiti Utara Malaysia

PERAKUAN KERJA TESIS / DISERTASI
(Certification of thesis / dissertation)

Kami, yang bertandatangan, memperakukan bahawa
(We, the undersigned, certify that)

KOMATHI A/P BALAKISNAN

calon untuk Ijazah MASTER OF SCIENCE (TRANSPORTATION & LOGISTICS MANAGEMENT)
(candidate for the degree of)

telah mengemukakan tesis / disertasi yang bertajuk:
(has presented his/her thesis / dissertation of the following title)

INVENTORY MANAGEMENT PRACTICES AND ITS IMPACT ON PERFORMANCE AMONG MANUFACTURING INDUSTRY SETTING IN KULIM INDUSTRIAL PARK

seperti yang tercatat di muka surat tajuk dan kulit tesis / disertasi.
(as it appears on the title page and front cover of the thesis / dissertation).

Bahawa tesis/disertasi tersebut boleh diterima dari segi bentuk serta kandungan dan meliputi bidang ilmu dengan memuaskan, sebagaimana yang ditunjukkan oleh calon dalam ujian lisan yang diadakan pada: **06 Ogos 2024.**
(That the said thesis/dissertation is acceptable in form and content and displays a satisfactory knowledge of the field of study as demonstrated by the candidate through an oral examination held on: ***06 August 2024.***

Pengerusi Viva *(Chairman for Viva)*	: **Assoc. Prof. Dr. Herman Shah bin Anuar**	Tandatangan *(Signature)*	
Pemeriksa Dalam *(Internal Examiner)*	: **Assoc. Prof. Dr. Herman Shah bin Anuar**	Tandatangan *(Signature)*	
Pemeriksa Dalam *(Internal Examiner)*	: **Dr. Nooraini binti Ismail**	Tandatangan *(Signature)*	

Tarikh: **06 Ogos 2024**
Date:

Nama Pelajar
(Name of Student) : Komathi a/p Balakisnan

Tajuk Tesis / Disertasi
(Title of the Thesis / Dissertation) : Inventory Management Practices and ITS Impact on Performance Among Manufacturing Industry Setting in Kulim Industrial Park

Program Pengajian
(Programme of Study) : Master of Science (Transportation & Logistics Management)

Nama Penyelia/Penyelia-penyelia
(Name of Supervisor/Supervisors) : Dr. Fariza binti Ahmad Mahyadin@Mahidin

Tandatangan

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

Tandatangan

PERMISSION TO USE

In presenting this thesis in fulfilment of the requirements for a Post Graduate degree from the Universiti Utara Malaysia (UUM), I agree that the library of this university may make it freely available for inspection. I further agree that permission for copying this thesis in any manner, in whole or in part, for scholarly purposes may be granted by my supervisor(s) or in their absence, by the Director of Postgraduate Studies Unit, College of Business where I did my thesis. It is understood that any copying or publication or use of this thesis or parts of it for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the UUM in any scholarly use which may be made of any material in my thesis.

Request for permission to copy or to make other use of materials in this thesis in whole or in part should be addressed to:

Director of Postgraduate Studies Unit, College of Business
Universiti Utara Malaysia
06010 UUM Sintok
Kedah Darul Aman

ABSTRACT

This study investigates the impact of inventory management practices on performance within manufacturing settings in Kulim Industrial Park. Its focus on main four inventory management practices which is Real-Time Inventory Tracking (RTIT), Just-In-Time (JIT), Vendor-Managed Inventory (VMI), and Safety Stock (SS). The goal was to evaluate how these practices impacted Inventory Management Performance and offering practical recommendations to enhance operational efficiency and gain a competitive edge in the manufacturing industry. The research adopts a quantitative approach, collecting data through structured questionnaires distributed to 304 employees in various manufacturing firms within Kulim Hi-Tech Park. Proportional stratified sampling divided the population into four industrial phase zones, ensuring that each group was represented in the sample according to its proportion in the overall population. This approach improved the accuracy and representativeness of the study's findings. Statistical analysis using SPSS version 28.0 was conducted, employing descriptive statistics, correlation, and regression analyses to examine the relationships between inventory practices and performance metrics. The study found that RTIT, VMI, and SS significantly enhance IMP by improving real-time visibility, fostering better supplier collaboration, and providing a safety buffer against demand fluctuations. In contrast, JIT did not show a statistically significant impact on IMP, possibly due to challenges like supply chain disruptions and demand variability that affect its effectiveness in this context. This finding provided manufacturers with strategies to improve accuracy, reduce costs, and optimize resource utilization, thereby contributing to increased operational efficiency and a competitive edge. However, this study is limited to manufacturing firms in Kulim Industrial Park which may not be representative of other regions or industries. Additionally, the study does not explore detailed financial or operational performance metrics but focuses on specific inventory management practices. Future studies should investigate these financial and operational aspects.

Keywords: Real-Time Inventory Tracking, Safety Stock, Just-In-Time, Vendor-Managed Inventory, Inventory Management, Performance

ABSTRAK

Kajian ini mengkaji impak amalan pengurusan inventori terhadap prestasi dalam sektor pengilangan di Kulim Industrial Park. Fokusnya adalah kepada empat amalan pengurusan inventori utama iaitu Pengesanan Inventori Masa Nyata, Just-In-Time, Inventori yang Dikendalikan Vendor, dan Stok Keselamatan. Matlamatnya adalah untuk menilai bagaimana amalan ini mempengaruhi Prestasi Pengurusan Inventori dan memberikan cadangan praktikal untuk meningkatkan kecekapan operasi serta memperoleh kelebihan kompetitif dalam sektor pengilangan. Penyelidikan ini menggunakan pendekatan kuantitatif, dengan mengumpulkan data melalui soal selidik berstruktur yang diedarkan kepada 304 pekerja di pelbagai sektor pengilangan dalam Kulim Hi-Tech Park. Pengambilan sampel stratifikasi berproporsi membahagikan populasi kepada empat zon fasa industri, memastikan setiap kumpulan diwakili dalam sampel mengikut perkadaran dalam keseluruhan populasi. Pendekatan ini meningkatkan ketepatan dan wakilan penemuan kajian. Analisis statistik menggunakan SPSS, dengan menganalisis statistik deskriptif, korelasi, dan analisis regresi untuk memeriksa hubungan antara amalan inventori dan metrik prestasi. Kajian mendapati bahawa Pengesanan Inventori Masa Nyata, Inventori yang Dikendalikan Vendor, dan Stok Keselamatan secara signifikan meningkatkan prestasi inventori dengan meningkatkan keterlihatan masa nyata, memupuk kerjasama pembekal yang lebih baik, dan menyediakan penampan keselamatan terhadap fluktuasi permintaan. Sebaliknya, Just-In-Time tidak menunjukkan kesan yang signifikan secara statistik terhadap prestasi, mungkin disebabkan oleh cabaran seperti gangguan rantaian bekalan dan variabiliti permintaan yang mempengaruhi keberkesanannya dalam konteks ini. Penemuan ini memberikan strategi kepada pengeluar untuk meningkatkan ketepatan, mengurangkan kos, dan mengoptimumkan penggunaan sumber, seterusnya menyumbang kepada peningkatan kecekapan operasi dan kelebihan kompetitif. Walau bagaimanapun, kajian ini terhad kepada firma pembuatan di Taman Perindustrian Kulim yang mungkin tidak mewakili kawasan atau industri lain. Selain itu, kajian ini tidak meneroka metrik prestasi kewangan atau operasi yang terperinci tetapi memfokuskan kepada amalan pengurusan inventori tertentu. Kajian masa depan harus menyiasat aspek kewangan dan operasi ini.

Kata kunci: Pengesanan Inventori Masa Nyata, Stok Keselamatan, Just-In-Time, Inventori yang Dikendalikan Vendor, Pengurusan Inventori

ACKNOWLEDGEMENTS

First and foremost, I would like to express my heartfelt gratitude to my research paper supervisor and lecturer, Dr. Fariza, for her outstanding guidance, motivation, support, and the invaluable time she committed throughout the preparation of this research paper.

Next, wish to thank the School of Technology Management & Logistics (STML) and the College of Business (COB) at University Utara Malaysia (UUM) for their collaboration and for providing all the essential information and resources needed to complete my research paper.

Additionally, I am deeply grateful to my parents for their unwavering emotional and physical support during this journey. Their encouragement has been fundamental to my efforts.

Lastly, I would like to extend my sincere appreciation to the company that provided all the information, which was crucial for ensuring the quality and comprehensiveness of my research paper.

Sincerely,

Komathi Balakisnan

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATION

JIT	Just-In-Time
VMI	Vendor-Managed Inventory
TCA	Transaction Cost Analysis Theory (TCA)
EOQ	Economic Order Quantity Theory (EOQ)
RBV	Resource-Based View
RFID	Radio Frequency Identification
WIP	Work In Progress

CHAPTER ONE

INTRODUCTION

1.0 Introduction

This chapter introduces the study of inventory management practices and their impact on inventory management performance among manufacturing firms in Kulim Industrial Park. It covers the background of the study, identifies the research problem, and outlines the research questions and objectives. The chapter also defines the scope and significance of the study, provides definitions of key terms, and explains the organization of the study.

1.1 Background of the Study

In the dynamic manufacturing sector, efficient inventory management is essential for achieving success and maintaining a competitive advantage. According to Hidayat & Saleh (2020), inventory management involves planning, organizing, and controlling inventory to minimize investment while balancing supply and demand. Manufacturing companies generally keep inventory to meet future demands, including raw materials, work-in-progress (semi-finished goods), and finished products. Raw material inventory comprises items bought from suppliers that are subsequently processed and converted into finished products during manufacturing process (Patel & Diwedi, 2024). The consistent supply of inventory to production is crucial for maintaining the efficiency of the production process (Hutasoit & Sitompul, 2021). This is particularly crucial for manufacturing companies that often operate on tight budgets and margins. Ensuring a steady flow of inventory, companies can avoid disruptions in production, minimize downtime, and optimize resource utilization.

In manufacturing, efficient inventory management is pivotal for maintaining operational efficiency and financial health. Although profitability is a key consideration, paying attention to internal factors like inventory turnover rates is equally important. Financial statements and ratios are valuable tools for assessing a manufacturing company's performance (Juliani et al., 2023). Return On Assets (ROA) and Return on Investment (ROI) measure a company's capacity to produce profits from its internal assets and capital investments (Kristiana & Karnasi, 2023). A high inventory turnover rate indicates efficient utilization of resources and effective inventory management in manufacturing (Rahayu & Ilham, 2023). By analyzing these, manufacturing firms can identify areas for improvement in inventory management practices as its directly linked to a company's profitability.

Efficient inventory management not only guarantees that businesses maintain optimal inventory levels promptly but also enhances customer satisfaction. Implementing efficient inventory control practice and order management method is vital for organizations to cut costs, enhance service quality and efficiency, and ultimately maximize profits (Nakhaeinejad et al., 2023). Ogah et al. (2022) stress the significance of efficient raw material management for maintaining production stability, meeting customer demands, and ensuring long-term profitability. This highlights the essential role of inventory management in guaranteeing the availability of raw materials for production, thereby preventing delays in order fulfillment and ensuring customer satisfaction. Delay in order fulfillment, as highlighted by Heydari et al. (2020), can disappoint customers and negatively impact satisfaction levels.

Additionally, as pointed out by Kanike (2023), inconsistency in product availability caused by inventory mismanagement can lead to customer dissatisfaction, ultimately affecting the

company's competitiveness and profitability. Efficient inventory management practices achieve a balance between having too much and too little inventory and ensuring a consistent optimization of inventory levels. Rashid and Rasheed (2023) highlighted that effective inventory management practices are essential for improved performance, as they mitigate issues such as surplus storage, inventory inaccuracies, obsolete stock, and wasteful expenditure. Efficient inventory management practices play a crucial role in manufacturing systems, contributing to overall effectiveness and productivity (Gulino, 2021). Muchaendepi et al. (2019) highlighted various inventory management systems utilized by manufacturing companies, such as Vendor-Managed Inventory (VMI), Material Requirements Planning (MRP), ABC analysis, Just-In-Time (JIT), and Economic Order Quantity (EOQ), which significantly impact performance.

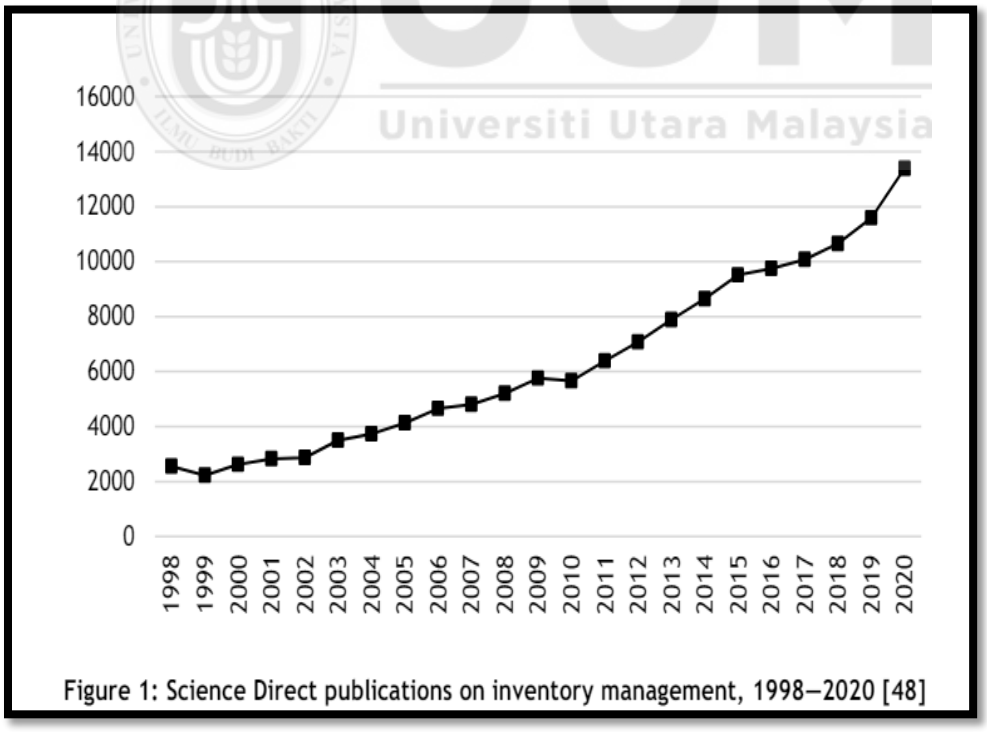

Figure 1.1
Science Direct Publication from 1998 to 2020
Source: Munyaka & Yadavalli, 2022

In recent years, research interest in inventory management has grown significantly. As evidenced by Munyaka & Yadavalli (2022), the number of articles published in Science Direct increase from 2,500 in 1998 to nearly 14,000 in 2020, reflecting a substantial increase around 82% over the 22-years period. The background of this study provides a comprehensive overview of past research conducted in the field of inventory management.

Overall, these new systems with advancement in technology and globalization, have transformed inventory management over the years. Effective inventory management fosters visibility of available inventory, enabling informed decision-making, streamlined operations, and adaptability to fluctuations in demand or supply chain disruptions. Additionally, it helps companies mitigate risks associated with economic changes, market fluctuations, and unpredictable demand, thereby promoting operational efficiency and enhancing customer satisfaction (Abolghasemi et al., 2020).

1.2 Problem Statement

Manufacturing firms face critical inventory management challenges, primarily dealing with shortages and excess inventory. Opoku et al. (2020) highlighted that inadequate inventory practices can lead to a range of negative outcomes, particularly inventory shortages and excess inventory issues. These challenges heavily influence the operational performance of manufacturing companies.

Inventory shortage are well-known obstacles to business success, especially for companies dealing with emergency products or services (Shi, 2022). When demand unexpectedly exceeds forecasts, companies often struggle to maintain adequate inventory levels, leading to shortage. Pauliina Hanninen (2024) emphasizes the difficulties in inventory

management, especially when unexpected demand exceeds forecasts, leading to inventory shortage. These shortage can have several negative effects which lead to lost sales, increased expenses for rush orders, and reputational damage due to customer dissatisfaction (Conley el al., 2019).

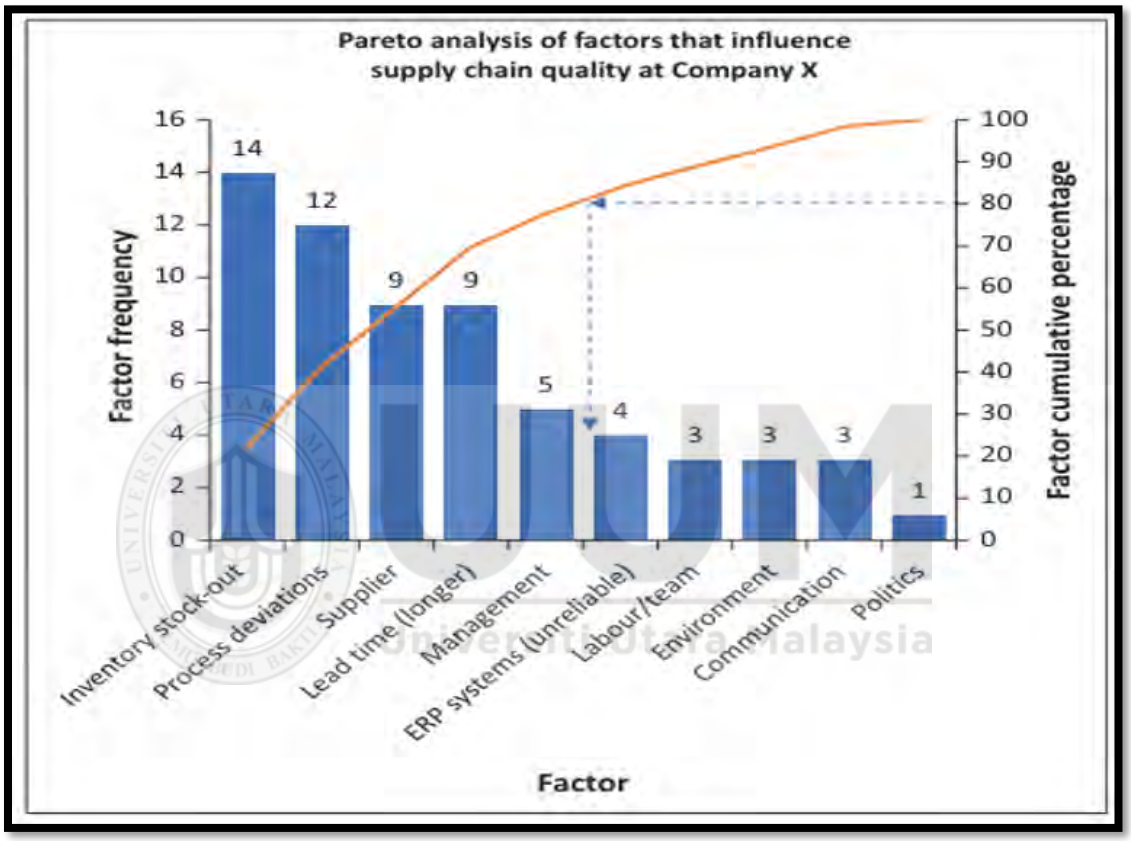

Figure 1.2
Pareto Chart Analysis, 2024
Source: Selepe & Makinde, 2024

The research conducted by Selepe & Makinde (2024), focus on identifying and addressing factors that degrade supply chain quality in a steel manufacturing organization. Through this, they utilized a Pareto chart to analysis these factors by their level of impact. Figure 1.2 showed result which revealed shortage are the most critical issue affecting supply chain quality. This finding emphasizes the importance of implementing targeted practices to

mitigate the negative consequences of stock-outs. By prioritizing solutions to address shortages, organizations can enhance their supply chain resilience and maintain a competitive advantage (Selepe & Makinde, 2024). Addressing shortages involves optimizing inventory management practices to ensure adequate stock levels and prevent disruptions. Continuous monitoring and proactive adjustments to inventory can further safeguard against the adverse impacts of shortages on production and delivery schedules.

Forecasting future demand is crucial for inventory control, but many companies fail to integrate it effectively into their inventory level decisions (Prak et al, 2019). Accurate forecasting is closely tied to meeting demand, as unexpected increases in demand beyond forecasts can result in shortage (Kourentzes et al., 2020). These disruptions occur when there are unexpected issues within supply chain, and it prevent the on-time delivery of raw materials to produce finish goods which leading to inventory shortage as companies are unable to fulfill customer orders.

Beside this, excess inventory presents significant challenges for manufacturing companies as well. It ties up financial resources and valuable warehouse space, which limits cash flow and reduces storage capacity for other products. Excessive inventory poses a significant risk for companies with surplus production capacity, as it can result in increased holding costs and higher potential for obsolescence (Ubabudu et al., 2024). Although maintaining extra inventory as Safety Stock can help address the risk of shortage, it also raises the cost of excessive inventory. In the Fast-Moving Consumer Goods (FMCG) industry, carefully managing safety stock levels is crucial to balancing demand and supply (Dincer & Turgay, 2023). This ensures that there's adequate inventory to fulfil demand without having too much excess that could lead to increased holding costs, wastage, and tied-up capital.

The case study for TVF Footwear highlighted a consistent issue of overstocking in November 2021. The inventory of 12,259 units significantly exceeded the demand of 7,483 units, resulting in an excess of 4,776 units, or about 63.8% more than needed. This overstocking led to increased financial strain and unnecessary spending on non-essential items (Lestari & Handayati, 2022). The luxury brand "Burberry" disposed its excess inventory, with the cost of physically destroying finished goods amounting to £28.6 million in the year 2018 (compared to £26.9 million in 2017), including £10.4 million for beauty inventory (Lee Park et al, 2021). Furthermore, FGH Ltd coal producer in Indonesia faced inventory issues in 2020 due to uncertain demand for coal which they decided to keep lots of inventory, which caused too much stock because they didn't have a Safety Stock Policy (Nugroho et al., 2021). Balancing between enough inventory to meet demand and avoiding overstocking remains a major challenge for manufacturers.

Maintaining excess inventory incurs additional costs, such as storage fees, insurance, and maintenance expenses. Tadayonrad and Balle Ndiaye (2023) emphasize the connection between overestimating demand and the accumulation of excess inventory. When forecasting leads to producing more than necessary, it results in surplus products sitting idle in warehouses, representing excess inventory. This surplus triggers investments in storage facilities to accommodate the unutilized stock, tying up capital that could be used more effectively elsewhere.

Addressing these challenges effectively requires a deep understanding of how inventory management affects overall performance in manufacturing. Even though it is widely accepted that effective inventory management is crucial for operational success, there remains a significant gap in research regarding the impact of different inventory practices

on its management performance. By investigating relationship between independent variable and dependent variable, this research seeks to identify the effective practices of inventory management for manufacturing sector. This research is urgently needed to fill the existing knowledge gap and offer practical insights. By doing so, manufacturing firms can boost operational efficiency, cut costs, and improve their competitive advantage. This research will help to identity strong inventory management practices that can be widely adopted in the industry, leading to better performance and sustainability in manufacturing.

1.3 Research Questions

By addressing these research questions, the study aims to fulfill its research objectives.

1. What is the impact of Real-time Inventory Tracking on Inventory Management Performance among manufacturing industry?

2. What is the impact of JIT on Inventory Management Performance among manufacturing industry?

3. What is the impact of VMI on Inventory Management Performance among manufacturing industry?

4. What is the impact of Safety Stock on Inventory Management Performance among manufacturing industry?

5. Which practice demonstrates the most significant impact on inventory management performance among manufacturing industry?

1.4 Research Objectives

The study's research objectives are directly aligned with the research questions to ensure that the paper achieves its intended goals and objectives. Specifically, the following have been identified:

1. To identify the impact of Real-Time Inventory Tracking on Inventory Management Performance among manufacturing industries.

2. To examine the impact of Just-In-Time on Inventory Management Performance among manufacturing industries.

3. To analyze the impact of Vendor-Managed Inventory on Inventory Management Performance among manufacturing industry.

4. To investigate the impact of Safety Stock on Inventory Management Performance among manufacturing industry.

5. To determine the inventory management practice that demonstrates the most significant impact on inventory management performance among manufacturing industry.

1.5 Scope of the Study

This research investigates inventory management practices and their influence on inventory management performance within the manufacturing industry. It focuses on understanding the various practices employed by manufacturing firms, including Real-time Inventory Tracking, Safety Stock, Just-In-Time, and Vendor-Managed Inventory and their impact on key performance metrics. Comprehensive analysis of how these practices is impact the inventory performance and in their effectiveness in maintaining ideal inventory

levels, preventing inventory shortage, reducing costs, and improving order processing lead time.

The research conducted at Kulim Hi-Technology Park (KHTP), located in Kedah. KHTP offers 4,200 acres of development and strategically positioned with support facilities and human resources tailored for high-tech manufacturing and Research and Development (R&D) activities (Abidin et al., 2013). As a high-technology park, KHTP provides a unique environment for examining inventory management practices and offers meaningful insights into effective practices and opportunities for improvement within the manufacturing sector. By examining a diverse range of manufacturing companies within this park, this research aims to offer valuable understanding into effective inventory practices and opportunities for improvement in performance within the manufacturing sector.

1.6 Significance of Study

These findings contribute significantly to the effective implementation of inventory management practices in the manufacturing industry. The manufacturing sector holds a critical position within the economy due to its substantial contributions to both GDP and export revenues. However, for manufacturing companies to sustain their competitiveness and ensure continued success, they must continuously enhance their performance, particularly in inventory management. Effective inventory management enables company to maintain ideal inventory levels to fulfil demand while minimizing surplus inventory and related costs. Its offer valuable knowledge on how inventory practices influence key

performance indicators like shortage, inventory carrying costs, and order fulfillment lead time.

This research provides valuable guidance for the manufacturing industry to improve their inventory management practices. By applying the study's findings, companies can adjust inventory levels, optimize safety stock to reduce supply chain risks, streamline production, and manage inventory more efficiently. This optimization leads to increased profitability through reduced carrying costs and minimized lost sales opportunities. By reducing carrying costs related with excess inventory such as handling and storing fee, companies can improve their bottom line. Additionally, minimizing lost sales opportunities due to shortage or delay in order fulfillment can help maximize revenue generation and enhance customer satisfaction. Moreover, by optimizing inventory management practices, companies can achieve greater operational efficiency and resilience. Streamlining production processes and managing inventory more efficiently can lead to cost savings and improved resource utilization, contributing to overall business performance.

Furthermore, this study provides a substantial contribution to quantitative research methodologies. It offers valuable insights and approaches for conducting research in inventory management, which can be particularly beneficial for students and researchers interested in quantitative methods. This study offers a comprehensive analysis of inventory management practices and their effects on diverse effectiveness metrics.

1.7 Definition of Key Terms

Real-Time Inventory Tracking - The term 'Real-Time' means that the inventory tracking system operates at the same speed as a real clock, ensuring minimal delay in capturing and

processing inventory data, crucial for effective process control and integration with enterprise systems (Musana et al., 2020).

Safety Stock - Additional inventory keep to minimizing the shortage resulting from demand variability, allowing companies to minimize inefficiencies, reduce working capital requirements, and optimize inventory turnover (Radasanu, 2016).

Just-In-Time - Principle of ordering inventory only as needed, rather than maintaining large inventories of stock (Rodríguez & Obed, 2023)

Vendor-Managed Inventory --Collaboration principles wherein the supplier maintains inventory levels within agreed limits and replenishing the inventory levels of their buyer's (Van den Bogaert & Van Jaarsveld, 2022).

Inventories - Items held during regular business operations, meant to be used or consumed in producing items for sale (Sunday & Joseph, 2017).

Inventory Management- Deciding the right amount of inventory to keep and where to store it to ensure smooth production without shortages (Sharma & Arya, 2016).

1.8 Organization of Study

The study is organized into five chapters to effectively address the research objectives and present the findings. Chapter 1 introduces the research background, problem statement, research questions, objectives, scope, and significance of the study. Chapter 2 conducts a comprehensive literature review, focusing on inventory management performance, inventory management practices, and the underlying theories and conceptual frameworks. Chapter 3 describes the methodology employed in the research, including research design, population and sampling methods, data collection procedures, and analysis techniques.

Chapter 4 presents the data analysis and findings, covering various statistical analyses such as normality, reliability, correlation and regression. Finally, Chapter 5 concludes the study by summarizing the findings, discussing limitations, outlining implications, and providing recommendations for future research.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter seeks to present a comprehensive overview of the impact of various inventory management practices on inventory management performance within the manufacturing industry. It's specifically concentrates on Real-Time Inventory Tracking, Vendor-Managed Inventory, Just-In-Time and Safety Stock management practice. These practices are essential which used by manufacturing firms to streamline their operations. This chapter thoroughly examines existing research to reveal the relationships between inventory management practices and their influence on performance metrics in manufacturing operations.

2.2 Overview and Empirical Review of Inventory Management Performance

Inventory management performance is significance in manufacturing operations, indicating how efficiently companies manage and regulate their inventory to fulfil demand while reduce cost and maximizing operational efficiency. Orobia et al. (2020) underscore the significance of updated knowledge and skills in inventory management, which directly impact financial performance by cutting expenses and improving productivity. With effective inventory management, stock shortages can be avoided, and deliveries can be made on time (Erlangga et al., 2022). This enhances inventory management performance by improving operational efficiency, reducing downtime, and increasing customer satisfaction. Karim (2018) highlights that effective inventory management able to enhance company's financial performance, whereas poor management practices may lead to

increased losses, ultimately impacting financial outcomes negatively. Therefore, optimizing inventory management practices important for long-term financial success.

Rashid & Rasheed (2023) stress the importance of avoiding common inventory issues such as stockpile-ups, inaccuracies, obsolete inventory, and wastage. By addressing these challenges, companies can maintain effective inventory management practices and minimize financial risks of inventory management inefficiencies. Moreover, efficient inventory management goes beyond mitigating risks; it contributes to resource optimization, enhances competitiveness, and reduces operational costs (Chalotra, 2013). Golas (2020) highlights a direct relationship between inventory management efficiency and financial outcomes, as demonstrated by panel regression models and specifically, improvements in inventory management are associated with higher Returns On operating Assets (Return on Assets). Breivik (2019) highlights the importance of inventory turnover as the key metric for assessing inventory performance. A higher inventory turnover ratio indicates greater efficiency, as it signifies lower inventory levels needed to support sales. Ke et al. (2022) underscore the idea by emphasizing that higher inventory turnover leads to lower inventory levels required for the same level of sales, resulting in enhanced efficiency.

Empirical evidence supports a positive correlation between higher turnover ratios and improved inventory management performance. However, Zhang & Zheng (2022) caution that longer turnover days in inventory management can have adverse effects. This includes increased holding costs, higher risk of obsolescence, reduced cash flow, lower profit margins, and decreased flexibility, all of which negatively impact overall inventory management performance for manufacturing companies. Tanzanian beverage

manufacturers, especially those in Mwanza City, face market competition due to poor inventory control systems (Mbugi & Lutego, 2022). To address this challenge, they must adopt more efficient techniques for regulating and managing inventory. Overall, these discoveries emphasize how crucial it is for manufacturing industry to adopt right inventory practices to improve their financial performance and operational efficiency.

2.2.1 Issues in Inventory Management Performance

Inadequate inventory management on the production floor can lead to either surplus or shortages of raw materials, thereby indirectly impacting the company's overall business performance (Ooi, 2017). Excess inventory levels impact procurement performance by tying up capital, which in turn affects cash flow, leading to reduced efficiency, and operational disruption (Koin et al., 2014).

Issues in inventory management performance encompass various challenges and their implications, as evidenced by recent literature. Seth et al. (2020) highlights the relationship between inventory turnover and the Cash Conversion Cycle (CCC). They note that an increase in inventory days outstanding indicates slower turnover, resulting in a longer CCC. Conversely, a shorter CCC signifies efficient inventory management, with quicker sales and faster cash inflows. Uncertainty in demand emerges as a significant hurdle for inventory managers, particularly in the Fast-Moving Consumer Goods sector (Nemtajela & Mbohwa, 2017). This uncertainty leads to fluctuating inventory levels, supply chain disruptions, customer dissatisfaction, and increased costs, thereby impacting inventory management performance.

Furthermore, Inventory Record Inaccuracy (IRI) is identified as a critical issue affecting inventory management performance (Shabani et al., 2021). Inventory record inaccuracy (IRI) refers to discrepancies between the recorded quantity in a company's inventory management system and the actual physical quantity available (Shabani et al., 2021). IRI leads to redundant or delayed replenishments, higher financial costs, non-financial losses such as customer dissatisfaction, and hinders operational efficiency (Hofstra et al., 2022). These findings underscore managing inventory effectively involves addressing a range of challenges such as turnover, demand uncertainty, and record accuracy to enhance overall performance.

2.3 Overview and Empirical Review of Inventory Management Practices

Effective inventory management, facilitated by adoption of inventory management systems, is critical for businesses to minimize cost, maximize profits, and fulfil demands by ensuring the right quantity and quality of inventory available at the right time and place (Ngugi & Cherotich, 2019). To ensure proper inventory management, it's essential to adopt inventory management systems. Without effective inventory management practices, businesses face the possibility of encountering lost sales, as well as inventory control systems such as zero-inventory systems and backorder inventory control systems (Esmaili et al., 2019). In zero-inventory systems, if demand exceeds available inventory, the item is marked as unavailable, leading to lost sales. In a backorder system, when demand exceeds inventory, customers can place orders that are backlogged until inventory is replenished. Inventory management ensures a seamless flow of materials through production and warehouses by overseeing manufacturing and purchasing, ultimately aiming to maintain continuous operations and add value throughout the process (Jonsson & Mattsson, 2008).

Enhancing inventory management practices leads to notable advancements in the supply chain system (Boche et al., 2020). Inventory control systems encompass tools and procedures designed to oversee inventory levels and mitigate discrepancies between supply and demand, thereby reducing risks of both overstocking and understocking (Karamshetty et al., 2022). Effective inventory control allows businesses to keep the right number of spare parts and raw materials on hand for uninterrupted production, reducing unnecessary ordering and storage costs and ultimately cutting operating expenses (Mawonde et al., 2024). Efficient inventory management (IM) has the potential to drive increased revenue and profitability (Alam et al., 2024).

2.3.1 Inventory Management Practices

Inventory management is essential within manufacturing operations, as it directly affects efficiency, cost-effectiveness, and customer satisfaction. This literature review examines key inventory management practices in manufacturing, including Real-Time Inventory Tracking, JIT, VMI and Safety Stock. Each practice is analyzed in implementation strategies and impacts on inventory management performance of manufacturing.

2.3.1.1 Real-Time Inventory Tracking (RTIT)

According to Mondol (2021), inventory tracking is the primary method used for monitoring and managing inventories, ensuring stock availability is maintained before depletion occurs. This practice is a fundamental inventory management practice that involves continuously monitoring and updating inventory levels as transactions occur in real-time. Without accurate tracking and real-time information, managing material flow in

manufacturing becomes challenging, making it difficult for inventory control to align with Just-in-Time (JIT) principles (Wang et al., 2020). Implementing a real-time inventory management system ensures that supply warehouses are efficiently handled, and inventory levels are continuously monitored (Da Silva et al., 2019). Various tracking methods rely on technologies like Radio Frequency Identification (RFID), Global Positioning System (GPS), Near Field Communication (NFC) and Real-Time Locating System (RTLS) to monitor real-time tracking (M'hand et al., 2019). It is enabling diverse applications such as inventory management, navigation, contactless payments, and real-time tracking.

Emphasizing the utilization of RFID-enabled sensors, Dev et al. (2019) underscore their role in providing real-time information for production logistics control within the supply chain. Passive RFID tags fixed to each item offer comprehensive visibility of the location of each item in real-time, covering the entirety of the space (Caro & Sadr, 2019). The utilization of information systems, specifically RFID, serves as a solution to the challenges of monitoring inventory logistics for effective inventory control (Erlangga et al., 2022). This ensures that inventory management is conducted in real-time, preventing both excess and shortages, and generates valuable information for decision-making.

2.3.1.2 Just-in-Time (JIT)

JIT practice, rooted in principles developed by Sakichi Toyoda and Taiichi Ohno at Toyota, implemented in Toyota Production System (TPS), widely adopted across industries including manufacturing (Anoop & Muhammed, 2020). Beside this several major companies, including Honda, GE, Boeing, Lockheed Martin, Hewlett-Packard, IBM,

McDonald's, Volvo Group, Zara, and many more, attribute their success in part to the adoption of JIT practices (Choi et al., 2023). JIT deliveries from suppliers necessitate close collaboration and a JIT link, alongside systems like kanban, ensuring a seamless pull system (Thomas et al., 2023). JIT methodology facilitates buffer minimization and optimizes inventory utilization, resulting in decreased operational costs (Kabzhassarova et al., 2021). Just-In-Time methodology in healthcare manufacturing offers advantages if carefully managed through reliable forecasting, supplier relationships, and lessons learned from events like the COVID-19 pandemic but requires ongoing evaluation to balance its benefits and risks effectively (Balkhi et al., 2022).

2.3.1.3 Vendor-Managed Inventory (VMI)

VMI is a strategic method in which suppliers take charge of managing inventory levels directly at the customer's location. Vendor-Managed Inventory (VMI) improves inventory management by cutting lead times and costs. It's backed by supply chain theories like principal-agent and transaction cost theory, and benefits from concepts like just-in-time and zero-inventory theory (Zhao, 2019). Saad & Bahadori (2019) describe VMI as a system where suppliers produce and store large batches of products near the manufacturing site, delivering smaller, more frequent batches to meet demand effectively. This shift in supply chain dynamics places suppliers in the role of inventory managers, as highlighted by Van den Bogaert & Van Jaarsveld (2022) leading to streamlined logistics and closer alignment between suppliers and buyers. The rapid growth of China's manufacturing sector can be assigned to the widespread implementation of Vendor-Managed Inventory (VMI) practices, which have significantly improved supply chain performance (Zhao, 2019).

While theoretical analyses support the potential benefits of VMI, empirical studies like Zhao et al. (2019) highlight instances of dissatisfaction leading to the termination of VMI partnerships. However, VMI grants suppliers decision-making control over inventory monitoring, restocking, and deliveries, resulting in cost reduction and improved workload coordination (De Maio and Laganà, 2020).

2.3.1.4 Safety Stock (SS)

Safety stock refers to additional inventory maintained to mitigate the risk of shortage due to unpredictable demand fluctuations or delays in supply, ensuring businesses can reliably meet customer orders amid uncertain forecasts or disruptions in the supply chain (Chinello et al., 2020).Safety Stock serves as a commonly adopted tactic in supply chain inventory management to address uncertainties in both demand and supply, with the primary objective of avoiding inventory stock-outs (Goncalves & Cortez, 2020). Buffer stock, serving as a safety net against uncertainties, enables manufacturers to fulfill customer demand promptly, even amidst fluctuations or disruptions in supply or production (Hadian, Farughi & Rasay, 2021). Radasanu (2016) underscores that optimizing Safety Stock levels enables companies to balance inventory costs and minimize shortage risks, thereby enhancing efficiency and increasing inventory turnover. In the plastics production sector, minimizing shortage and maintaining smooth operations are achieved through strategic management of Safety Stock as a buffer against unforeseen demand variations or supply chain disruptions (Vargas et al., 2023). Given the challenges in demand forecasting, an additional quantity is stored in the warehouse as Safety Stock to accommodate unexpected

demand fluctuations or address issues like production failures or transportation damages (Gisbert, 2022).

2.3.2 Empirical Review of Inventory Management Practices

Table 2.1
Empirical Review Table

Author's name	Research Title	Findings
Govuzela (2023)	Contributions of Just-in-Time (JIT) Approach Toward Inventory Costs, Inventory Management, and Business Performance: Perspectives from Two Case Studies in a South African Environment	The JIT implementation at Hewlett-Packard resulted in a 75% inventory reduction, 30-50% labor and space savings, WIP costs cut from 22 days to 1 day, 100% production increase, 30% scrap reduction, 79-80% rework reduction, 50% throughput time reduction, and a 20% increase in shipments.
Silva et al (2022)	A hybrid bi-objective optimization approach for joint determination of safety stock and safety time buffers in multi-item single-stage industrial supply chains.	Optimizing safety stock parameters, particularly by combining safety stock with safety time, led to significant cost reductions (up to 24.6%) and improvements in service levels (up to 13.33%).
Immaculate et al. (2020)	An Empirical Study on Inventory Management.	Effective inventory management practices, such as using tools like EOQ analysis and ABC analysis, are crucial for optimizing inventory levels. The relationship between inventory management performance and practices underscores the importance of aligning inventory practices with business objectives to achieve sustainable growth and competitive advantage.

Table 2.1 (continued)

Muchaendepi et al. (2019)	Impact of Inventory Management Strategies on Financial Performance of SMEs in the Manufacturing Sector of Harare.	The study's findings demonstrate that 93% of respondents recognized the positive impact of implemented inventory management practices on the financial performance of manufacturing SMEs. Moreover, the research highlights that 70% majority of respondents in the Harare manufacturing sector reported the adoption of Just-In-Time (JIT) methods among SMEs.
Atnafu & Balda (2018)	The impact of inventory management practice on firms' competitiveness and organizational performance: Empirical evidence from micro and small enterprises in Ethiopia.	This study's results suggest that increased implementation of practices such as ABC analysis, EOQ decision-making, VMI, and JIT techniques can contribute to a stronger competitive edge and improved overall organizational performance. Direct Impact of Inventory Management Practices: These practices have a significant direct positive impact on competitive advantage (coefficient = 0.594) and organizational performance (coefficient = 0.438)
Sumrit (2020).	Supplier selection for vendor-managed inventory in healthcare using fuzzy multi-criteria decision-making approach	VMI implementation in healthcare manufacturing lead to 30% reduction in stock levels for medical and pharmaceutical products. Additionally, studies have shown that successful VMI practices can result in higher repeated rates, improved service levels for customers, and reduced inventory costs for suppliers.

2.4 Theoretical Review of Inventory management

Inventory management is crucial for the smooth operation and success of manufacturing industries. To understand its complexities and underscore its importance, this study related to three underpinning theories.

2.4.1 Transaction Cost Analysis Theory (TCA)

Collins and Patrick (2021) argue that focusing on lowering inventory management expenses is key to reducing overall supply chain costs while simultaneously improving service quality for both internal and external customers. This approach provides a robust framework for efficiently managing operations, especially under challenging external transaction conditions (Schmidt and Wagner, 2019). Specifically applied to inventory management, TCA theory suggests that when companies decide whether to produce goods internally or outsource production, they consider various transaction costs. These expenses, encompassing elements such as uncertainty and transaction volume, hold significant sway in shaping organizations' inventory management practices and, consequently, affect the overall performance of their supply chain (Ketokivi & Mahoney, 2020). In essence, TCA theory help manufacturing to make decisions about inventory management practices by considering the cost associated with different choices.

2.4.2 Economic Order Quantity Theory (EOQ)

The EOQ model, among the oldest techniques in inventory management, is essential from an economic perspective and it calculates the optimal quantity for a company to store, aiming to minimize inventory costs associated with holding, ordering, and shortages (Emar

et al,2021). Particularly crucial for companies with limited assets, it ensures accurate ordering to efficiently manage inventory. Arslan & Turkay (2013) have highlighted the EOQ model's significance in inventory management, emphasizing its role in minimizing total costs. Singh et al (2020) further emphasizes the simplicity and effectiveness of the EOQ model in identifying the ideal order quantity. Moreover, Konstantaras et al. (2019) have introduced advancements to the EOQ model, integrating supplier reliability considerations and back-order scenarios. This enhancement reflects real-world inventory management scenarios, where uncertainties in supplier reliability and customer demand often occur. Overall, the EOQ theory improves Inventory Management Performance by reducing costs, increasing efficiency, and managing uncertainties in inventory management.

2.4.3 Resource-Based View (RBV) Theory

RBV highlights the crucial role of strategic resources and capabilities in gaining a competitive edge. In their work, Gibson et al. (2021) highlight the necessity for firms to expand the resources to sustain presence in the business landscape. This expansion of resources aligns with the RBV's focus on leveraging and integrating resources to achieve superior performance. Furthermore, Valaei (2022) research underscores the importance of the RBV in understanding how resources and capabilities shape the performance and strategy of Small and Medium-sized Enterprises (SMEs). In the context of inventory management, RBV suggests that organizations can achieve superior performance by effectively leveraging and integrating resources such as technology, information systems, and managerial capabilities to align with their strategic objectives. By undertaking this

approach, organizations can optimize their inventory management practices, leading to a competitive advantage in the market.

2.5 Proposed Hypothesis

a. Real-Time Inventory Tracking Practice Impact on Inventory Management Performance

Utilizing real-time tracking technologies such as IoT devices, RFID tags, and barcode scanners, manufacturers can optimize their inventory management processes, lower expenses, and enhance overall operational efficiency (Dutta, 2020). Having a reliable tracking system is crucial for effectively managing inventory and minimizing the occurrence of lost or stolen items (Helo & Shamsuzzoha, 2020). Real-Time Inventory Tracking, facilitated by technologies like RFID, optimizes inventory management by improving accuracy, fastening fulfillment process, and offer real-time visibility, resulting in fewer errors, faster decision-making, reduced shortage, optimized inventory levels, and improved operational efficiency and customer satisfaction. (Mondol, 2021). Based on above, hypotheses summarized as follows:

H1: Real-Time Inventory Tracking (RTIT) practice has a significant and positive impact on inventory management performance by real-time visibility.

b. Just-In-Time practice Impact on Inventory Management Performance

JIT ensures manufacturing efficiency, quality, and customer satisfaction by producing goods precisely when needed, without excess inventory or delays. Reducing inventories through the elimination of safety stock, a fundamental component of JIT inventory management, facilitates improved production planning, shorter lead times, and decreased

carrying costs (Wanziga, 2019; Ubabudu et al., 2024). Manufacturers embracing JIT principles expect to see improvements in financial performance due to reduced inventory costs and enhanced operational efficiency (Lyu et al., 2020). Based on above, hypotheses summarized as follows:

H2: Just-In-Time (JIT) management practice has a significant and positive impact on inventory management performance by reduce inventory carrying costs.

c. Vendor-Managed Inventory practice Impact on Inventory Management Performance

Beheshti et al. (2020) underscore how VMI has evolved into a competitive tool embraced by various stakeholders, including retailers, suppliers, and manufacturers, in cutting down inventory management expenses and enhancing supply chain effectiveness. Wettasinghe & Luong (2020) provide evidence supporting the positive impacts of VMI on the entire supply chain, emphasizing cost reduction and improved workload coordination as key benefits, indicating its potential to optimize overall performance. VMI successfully reduces costs by optimizing inventory levels and improving supply chain efficiency, leading to lower operational expenses and enhanced customer service levels (Ernawati, 2021). Based on above, hypotheses summarized as follows:

H3: Vendor-Managed Inventory (VMI) has a significant and positive impact on inventory management performance by reduce inventory costs.

d. Safety Stock practice Impact on Inventory Management Performance

This practice involves setting the right quantity of safety stock and arranging

replenishments to ensure there are enough inventory levels to absorb fluctuations in demand or interruptions in the supply chain, while also minimizing unnecessary inventory costs (Barros, Cortez, & Carvalho, 2021). Furthermore, Sarkar et al (2019) emphasize the crucial role of safety stock in averting backorders and safeguarding a company's reputation. They highlight the safety factor enables businesses to strike an optimal equilibrium between controlling inventory expenses and reducing the likelihood of shortage, ensuring timely fulfillment of customer demands while enhancing overall inventory management practices. Based on above, hypotheses summarized as follows:

H4: Safety Stock (SS) practice has a significant and positive impact on inventory management performance by reduce risk of shortage.

2.6 Research Framework

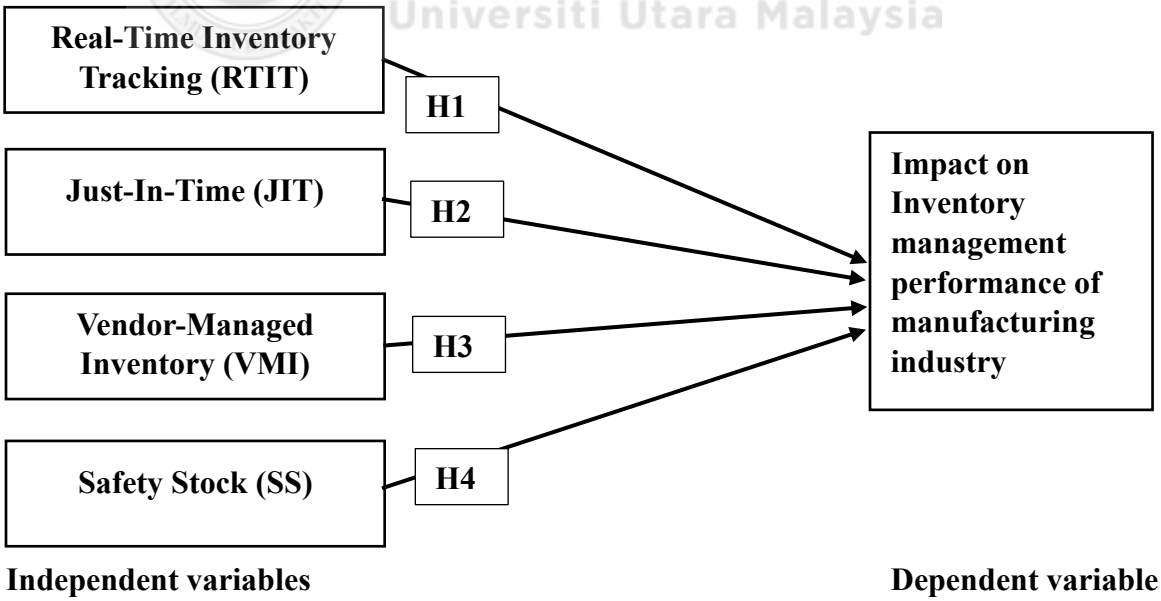

Figure 2.1
Research Framework
Source: Researcher's Own Construct, 2024

This framework seeks to fill a gap in the current literature by consolidating all four inventory management practices Real-Time Inventory Tracking, Vendor-Managed Inventory (VMI), Just-In-Time (JIT), and Safety Stock (SS) within a single study. It serves as a roadmap for researchers to understand how various inventory management practices affect inventory management performance within the manufacturing industry. Here's a simplified version of the conceptual framework.

2.7 Chapter Summary

The literature review provides a comprehensive analysis of how various inventory management practices impact performance in the manufacturing industry. It defines inventory management performance and explores factors affecting it, emphasizing its critical role in enhancing operational efficiency and financial success. Key inventory management practices such as RTIT, JIT, VMI, and SS are thoroughly examined by past research, highlighting their significance in optimizing operations and minimizing costs. Moreover, the chapter proposes hypotheses that establish potential relationships between inventory management practices and performance, serving as a basis for further research.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology used to examine the relationship between inventory management practices and inventory management performance within the manufacturing industry. It systematically evaluates the study's objectives, identifying the target audience, explaining the sample design, discussing the selection of data collection tools, assessing their reliability, describing the data collection method, and detailing the data analysis techniques.

3.2 Research Design

A well-planned research design serves as a roadmap, guiding researchers in systematically collecting, analyzing, and interpreting data to effectively address research questions (Asenahabi, 2019). It acts as a bridge between the research problem and data to generate meaningful insights and valid conclusions. Qualitative research relies on interviews to gather insights about specific companies (Lobe et al., 2020) and quantitative research employs surveys to collect data from a larger sample of respondents (Story & Tait, 2019). This study adopts a quantitative research strategy, primarily focusing on hypothesis testing. Quantitative research involves collecting data from participants by selecting a representative sample and aiming for generalization (Habib, 2021).

Quantitative research encompasses various methods, including primary and secondary data collection. Primary data involves gathering unique information directly from respondents

through structured questionnaires (Thomas et al., 2018), while secondary data utilizes existing sources such as databases (Atmowardoyo, 2018). Primary and secondary data collecting methods are the two basic categories into which data collection techniques are typically classified. Figure 3.1: illustrates some examples of these methods for both primary and secondary data (Taherdoost, 2021).

Figure 3.1
Primary and Secondary Data Collection Methods
Source: Taherdoost, 2021

From above methods, choose structured questionnaire as the primary data collection method. This approach aims to gather direct opinion from manufacturing firms workers regarding their inventory management practices and performance outcomes. By collecting firsthand information, the reliability and accuracy of the findings are enhanced. These

insights used to test hypothesis through quantitative research methods (Ahmad et al., 2019). Through hypothesis testing, the study aims to evaluate whether the proposed relationships between selected four inventory management practices and inventory management performance such as enhanced operational efficiency, lowered inventory costs, and minimized shortage risks are valid within the manufacturing sector.

3.3 Research Population, Sample, and Unit of Analysis

3.3.1 Research Population

The research population refers to the specific group of entities or individuals targeted for investigation in the study. Ampadu (2017) elaborates that a population encompasses all the individual units or members of the specific group that the research is concerned with and aims to study. According to Kulim Technology Park Corporation (2023), the total workforce consists of 34,000 individuals. This workforce has been selected as the sample population for the study. Focusing on the KHTP area offers several advantages, such as its central location within the North Corridor Economic Region, accessible via Butterworth-Kulim Expressway (BKE), 26 km to North Butterworth Container Terminal (NBCT), 40 km to Penang International Airport, Bayan Lepas, easy accessibility via expressways, and proximity to seaports and airports (Kulim Technology Park Corporation, 2023). These employees are chosen as the focus of the study because they are directly engaged in various manufacturing activities and inventory management practices as part of their operations.

3.3.2 Research Sample

According to Evans, Hastings, and Peacock (2000), sample size is the number of

observations in a sample. The study utilizes the sample size determination method by Krejcie and Morgan (1970). Figure 3.2 shows the sample size determination for a population. It clearly indicates that a sample size of 368 is appropriate for a population of more than 9,000. Thus, given the workforce of 34,000 at Kulim Hi-Tech Park, a sample size of 368 is considered appropriate for this study.

Table for Determining Sample Size from a Given Population

N	S	N	S	N	S
10	10	220	140	1200	291
15	14	230	144	1300	297
20	19	240	148	1400	302
25	24	250	152	1500	306
30	28	260	155	1600	310
35	32	270	159	1700	313
40	36	280	162	1800	317
45	40	290	165	1900	320
50	44	300	169	2000	322
55	48	320	175	2200	327
60	52	340	181	2400	331
65	56	360	186	2600	335
70	59	380	191	2800	338
75	63	400	196	3000	341
80	66	420	201	3500	346
85	70	440	205	4000	351
90	73	460	210	4500	354
95	76	480	214	5000	357
100	80	500	217	6000	361
110	86	550	226	7000	364
120	92	600	234	8000	367
130	97	650	242	9000	368

Krejcie and Morgan (1970) sample determination table. Source: Krejcie and Morgan (1970).

Figure 3.2
Sample Determination Table
Source: Krejcie and Morgan (1970)

In this research, proportional stratified sampling was used to select manufacturing companies from the Kulim Industrial Park. The industrial park was divided into four phases, each containing a different number of manufacturing companies. The total sample size of 368 was proportionally distributed among the four industrial phases according to their relative sizes. The phases were defined as follows: Phase 1 with 16 manufacturing companies, Phase 2 with 9 manufacturing companies, Phase 3 with 10 manufacturing

companies, and Phase 4 with 8 manufacturing companies (Kulim Technology Park corporation, 2023).

The proportion of companies in each phase was calculated to determine the sample size by multiplying each proportion by the total sample size of 368. The resulting sample sizes were rounded to the nearest whole number to ensure practicality in the sampling process as per Table 3.1. After rounding, the total sample size was verified to ensure it summed to 368, ensuring that the sample accurately reflected the distribution of companies across the different industrial zones within the Kulim Industrial Park. Within each phase, companies were randomly selected, ensuring every company had an equal chance of being included.

Table 3.1
Proportional Stratified Sampling Method

Industrial Zone Phase	Number of Companies	Sample Size (Proportional to 368)	Rounded Sample Size (workforce)
Phase 1	16	(16/42) *368=140.19	140
Phase 2	8	(8/42) *368 = 70.09	70
Phase 3	10	(10/42) *368= 87.61	88
Phase 4	8	(8/42) *368 = 70.09	70
Total	**42**		**368**

3.3.3 Unit of Analysis

The unit of analysis in this study is specifically focused on individuals directly involved in inventory management within manufacturing firms. This includes workers in logistics, warehouse or inventory-related departments who are responsible for implementing inventory management practices. By targeting these individuals, the research aims to assess the actual impact of inventory management practices on performance within the manufacturing industry. By excluding individuals from non-related departments, the study

maintains its focus and ensures that insights are accurately captured within the context of inventory management practices, without any distractions or weakening of the research's core objectives.

3.4 Sampling Method

Probability sampling is selected for this research due to its ability to provide a representative sample of manufacturing firms within the Kulim Industrial Park. This method ensures that each manufacturing firm has an equal chance of being selected, reducing bias and allowing for statistically reliable conclusions about inventory management practices and their impact on performance. According to Schreuder et al. (2001), probability sampling guarantees that every member of the population has a chance of being selected for the sample, and the probability of each possible sample can be determined.

3.5 Questionnaire Preparation

Questionnaire developed to collecting primary data from manufacturing firms form Kulim Industrial Park Area. There will be two sections in the questionnaire where first section starts with an introduction, demographic information will collect data on respondents' gender, education, ethnic, position and working experience. This demographic data will use for analyzing responses. Second section designed to gather the data on dependent and independent variable which evaluating inventory management practices and their effects on performance outcomes. Each section containing statements aligned with the research hypothesis.

3.5.1 Measurement of Variables

Table 3.2 presents survey items designed to evaluate the effects of Real-Time Inventory Tracking (RTIT) on inventory management performance. The eight items focus on various aspects of RTIT, particularly through RFID technology. These items explore how RTIT helps prevent inventory loss and misplacement, improves stock control, reduces human errors, increases time efficiency and providing a comprehensive view of its benefits and challenges.

a. Independent variable 1 - Real-Time Inventory Tracking (RTIT)

Table 3.2
Measurement for Real-Time Inventory Tracking (RTIT) - (8 items)

Dimension	Items	Related Source
RTIT1	Real-time inventory tracking prevents inventory loss.	Adapted according to Shien et al. (2021) & Ying et al. (2021)
RTIT2	Real-time inventory tracking prevents inventory misplacement.	
RTIT3	Real-time inventory tracking provides better stock control.	
RTIT4	Real-time inventory tacking using RFID reduces human errors.	
RTIT5	Real-time inventory tracking reduce time spent for tracking material.	
RTIT6	With real-time tracking, staff can quickly verify inventory levels without manual count.	
RTIT7	Implementing RFID technology for real-time inventory tracking can be costly.	
RTIT8	Real-time inventory tracking improves inventory accuracy levels in manufacturing processes.	

b. Independent variable 2 -Just-In-Time (JIT)

Table 3.3 outlines the survey items used to evaluate Just-In-Time (JIT) management practices. Totals have 7 items to examine the impact of JIT on various aspects of inventory management, including material production timing, inventory levels, space requirements for storage, and holding costs. Additionally, the items assess how JIT affects material flow and addresses potential risks such as inventory shortages during sudden increases in demand. This comprehensive evaluation helps in understanding how JIT practices contribute to efficiency and cost-effectiveness in inventory management.

Table 3.3
Measurement for Just-In-Time (JIT) - (7 items)

Dimension	Items	Related Source
JIT1	JIT ensures material are produced and delivered when needed.	Adapted according to Okolocha & Udegbunam, (2024) & Coslett (2022).
JIT2	JIT ensures we have the right level of inventory.	
JIT3	JIT avoiding excess stock.	
JIT4	JIT effectively reduces space requirements for inventory storage.	
JIT5	JIT system has effectively minimized inventory holding cost.	
JIT6	JIT practice improve material flow.	
JIT7	JIT practice can lead to inventory shortages during sudden demand increase.	

c. Independent variable 3 - Vendor-Managed Inventory (VMI)

Table 3.4 outlines the survey items used to evaluate Vendor-Managed Inventory (VMI). These items focus on how VMI impacts various financial aspects, such as reducing manufacturing expenses, material handling costs, and storage fees. Additionally, they explore the effect of VMI on administrative costs and address challenges related to data sharing and communication between buyers and suppliers. This comprehensive assessment aims to provide a thorough understanding of the economic benefits and potential difficulties associated with VMI practices.

Table 3.4
Measurement for Vendor-Managed Inventory (VMI) - (8 items)

Dimension	Items	Related Source
VMI1	VMI reduces manufacturing expenses by lowering inventory holding cost.	Adapted according to Bernal & Quiton (2024), Claassen et al. (2008) & Dong et al. (2007)
VMI2	VMI decreases material handling cost by transferring inventory management to suppliers.	
VMI3	VMI reduce storage fees by storing materials at supplier's location.	
VMI4	VMI minimize administrative cost by assigning administrative tasks to suppliers.	
VMI5	VMI shift inventory control to suppliers.	
VMI6	VMI reducing buyer decision-making in inventory management.	
VMI7	VMI cause data sharing challenges between buyers and suppliers	
VMI8	VMI cause communication challenges between buyers and suppliers	

d. Independent variable 3 - Safety Stock (SS)

Table 3.5 details the survey items used to measure Safety Stock (SS) practices. These items are designed to assess the effectiveness of safety stock in preventing inventory shortages and ensuring consistent order fulfillment, even during unexpected demand fluctuations. They evaluate how safety stock helps maintain manufacturing capacity without interruptions and examines its role in mitigating disruptions within the supply chain. By covering these aspects, the items aim to provide a thorough understanding of how safety stock practices contribute to stable inventory management and support overall operational efficiency.

Table 3.5
Measurement for - Safety Stock (SS) (7 items)

Dimension	Items	Related Source
SS1	Keeping safety stock prevent inventory shortage.	Adapted according to Oloo (2023) & Gambino (2020).
SS2	Safety stock maintains order fulfillment during unexpected demand fluctuations.	
SS3	Safety stock maintains customer satisfaction by prevent shortage.	
SS4	Safety stock ensure that manufacturing can operate at full capacity without interruption.	
SS5	To mitigate supply business interruption, our company relies on its internal safety stock.	
SS6	To mitigate supply business interruption, our company relies on supplier's safety stock.	
SS7	Safety stock helps manufacturers quickly adjust to changes in market demand.	

e. Dependent variable - Impact of Inventory Management Practices (IMP)

Table 3.6 presents items for evaluating the Impact of Inventory Management Practices (IMP). These items assess how various inventory management practices influence financial performance, affect inventory levels, and improve order fulfillment. Additionally, they explore the importance of continuous monitoring and the use of software in enhancing inventory accuracy. This comprehensive evaluation aims to provide insights into how effective inventory management practices contribute to overall operational success and efficiency.

Table 3.6
Measurement for - Impact of Inventory Management Practices (IMP) (6 items)

Dimension	Items	Related Source
IMP1	Inventory management practices help to improve our company's financial performance.	Adapted according to Dadić & Ribarić (2020) and Garti (2023)
IMP2	Effective inventory management practices help prevent excess inventory.	
IMP3	Effective Inventory management practices prevent inventory shortages.	
IMP4	Inventory management practices lead to faster order fulfillment.	
IMP5	Continues inventory level monitoring are crucial for effective inventory management.	
IMP6	Using software for inventory management positively impacts inventory accuracy.	

3.6 Scale Type Used

Likert scales will be employed to measure respondents' agreement or disagreement with various statements related to different inventory management practices. Likert scales,

commonly used in surveys, measure attitudes by asking respondents to rate their agreement level with statements on a scale from "strongly disagree" to "strongly agree" (Kriksciuniene et al, 2019). According to Sandiford and Ap (2003), today researchers often define Likert scales as measuring agreement levels, original Likert scale developed in the 1930s to measured respondents' approval from “Strongly Disapprove” to “Strongly Approve”. For this study researcher choose to utilize a six-point Likert scale from "strongly disagree" to "strongly agree” which without midpoint option.

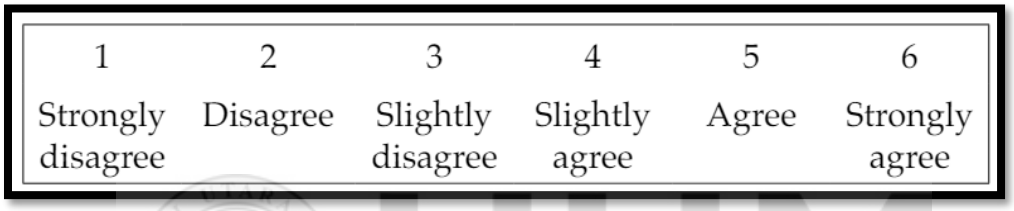

Figure 3.3
6-point Likert scale
Source: Nemoto & Beglar (2014)

The midpoint in Likert scales can be interpreted differently by respondents, including as "neither agree nor disagree," "undecided," or "no opinion," potentially understood differently by respondents especially when not clearly defined (South et al., 2022). Croasmun and Ostrom (2011) indicate that including or excluding a neutral option can significantly impact data, particularly when determining opinions in a population. Augustin (2020) suggests using a six-point Likert scale for more reliable results compared to a five-point scale. Therefore, this study excludes the midpoint option.

3.7 Data Collection Methods (Survey)

In the data collection method, utilize Google Forms to create a questionnaire for employees at Kulim Industrial Park. After questionnaire formulated, distribute the survey link via

communication channels such as WhatsApp, LinkedIn, and email. This method facilitates efficient data collection and provides flexibility for respondents to complete the survey at their convenience. By using Google Forms and digital distribution able to collect data in smooth way and improve the survey experience for Kulim Industrial Park employees. This data collection phase took about one month, allowing sufficient time for distributing the survey and gathering responses.

3.8 Statistical Methods

In research, statistical methods are essential for analyzing and interpreting the collected data. The data collected from the questionnaire underwent coding and analysis utilizing the Statistical Package for the Social Sciences (SPSS) version 28.0. IBM SPSS provides advanced statistical analysis and ensuring accuracy in results. IBM SPSS provides powerful tools for statistical analysis, machine learning, text analysis, and handling large datasets, all with an easy-to-use interface (Milovanovic & Perisic, 2020). Applied three main statistical methods to analyze the data, including Descriptive Analysis, Correlation Analysis, and Regression Analysis. Each analysis provides a unique perspective on the relationship between inventory management practices and performance outcomes in the manufacturing industry.

Descriptive analysis in this study focused on calculating basic statistics such as Mean and Standard Deviation for both independent and dependent variables. This process aimed to provide a clear summary and understanding of each variable's characteristics before proceeding with further detailed analysis. The descriptive statistics used encompassed both measures of central tendency and measures of variability (Arkkelin, 2014). Pearson

correlation analysis will be conducted to examine the relationships between inventory management practices and performance metrics. Specifically, researchers will explore the correlations between variables such as Real-Time Inventory Tracking, Just-In-Time management, Vendor-Managed Inventory, Safety Stock, and Inventory Management Performance. This will help determine if there are significant associations between these variables. Regression analysis not only explores relationships between variables but also measures the impact of independent variables on a dependent variable. By this analysis able to identify which inventory management practices had a significant impact on performance.

3.9 Pilot Test

Wadood et al., (2021) suggest that pilot testing serves as a crucial tool in large-scale survey research, improving the questionnaire's reliability, validity, and practicality. According to Cooper and Schindler (2014), a respondent range of 25 to 100 is ideal for a pilot study. To ensure the questionnaire's clarity and suitability before wider distribution, a pilot study was conducted with 34 employees from Kulim Industrial Park. For this test, a prepared questionnaire was sent via WhatsApp and LinkedIn to 34 employees, and a reliability test was conducted with the data. Its purpose to identify and eliminate irrelevant or weak questions from the questionnaire (Aithal & Aithal, 2020).

3.9.1 Validity of Instrument

In this study, it's crucial to ensure that the survey questions are reliable and accurately measure all the variables. Experts from academia and industry should review and approve

the survey content (DeVellis, 2003). Thus, industry-experienced experts and academic experts were involved in validating the questionnaire. According to Gable and Wolf (1993), recommended to use between 2 and 20 experts for assessing the validity of an instrument. Therefore, feedback was gathered from one industry experts which is Assistant Material & Logistic Manager from Teleflex and one academic expert which is Assistant Professor from UUM. In a collaborative session, these two experts evaluated the questionnaire's clarity and relevance, identifying and discussing any unclear or irrelevant questions. Their inputs were crucial in suggesting modifications and deletions to refine the questionnaire.

Table 3.7
Panel of Experts

No	Background	Experts
1	Assistant Material & Logistic Manager, The Laryngeal Mask Company (Malaysia) Sdn. Bhd. (Teleflex).	Mrs Norliana Binti Abdullah
2	Assistant Professor, School of Business Management & Administrative Sciences, Universiti Utara Malaysia.	Dr Muhammad Imran

Industry expert insights helped to identify and amend questions that did not align with real-industry world scenarios. This ensured that the questionnaire now effectively addresses critical logistics principles such as RTIT, JIT, VMI, and SS. By prioritizing these relevant aspects, the goal was to enhance operational efficiency and establish a clearer evaluation framework for inventory management practices in real industry world settings.

From an academic perspective, the focus on clarity and precision guided the process of refining the questionnaire further. Academic expert advised for removing double-barrel

words and restructuring questions to focus on specific aspects of inventory management. Below Table 3.8 showed amendment of double parallel words. In the "After" section, each statement is divided into two separate questionnaire items, each focusing on a specific benefit or challenge. This separation avoids combining multiple ideas into one item, which can make it difficult for respondents to accurately answer the scale. By addressing each aspect individually, respondents can more easily indicate their agreement or disagreement to each specific benefit or challenge. This approach ensures that the survey captures accurate responses and provides clearer insights into respondents' views.

Table 3.8
Before and After: Clarifying Questionnaire Items

Before (Original Statement)	**After (Separated Questionnaire Items)**
Real-time inventory tracking through RFID prevents inventory loss or misplacement.	1. Real-time inventory tracking through RFID prevents inventory loss. 2. Real-time inventory tracking through RFID prevents inventory misplacement.
VMI cause data sharing and communication challenges between buyers and suppliers	1.VMI cause data sharing challenges between buyers and suppliers 2. VMI cause communication challenges between buyers and suppliers

These adjustments not only improved the questionnaire's clarity but also strengthened its suitability for rigorous academic research. By adhering to best practices in questionnaire design and data collection, the refined instrument now aligns effectively with academic standards.

3.9.2 Reliability Test

To verify the trustworthiness of the survey tool employed in this research, a reliability

assessment will be conducted. Reliability is determined through a pilot test by gathering data from 34 individuals who are not part of the main sample (Radhakrishna, 2007). The reliability assessment undertaken in this investigation aimed to assess the reliability of the measurement scales employed to evaluate various aspects of inventory management practices. These categories help to understand reliable of survey questionnaire (Reddy et al,2023).

Table 3.9
Cronbach's alpha Values (Nunnally, 1978)

Below 0.6: Poor internal consistency reliability
0.6 to 0.69: Acceptable internal consistency reliability
0.7 to 0.89: Good internal consistency reliability
0.9 and above: Excellent internal consistency reliability

Table 3.10
Reliability Results (Pilot test)

Variable	N of items	Cronbach's Alpha	N	Status
RTIT	8	0.634	34	Acceptable
JIT	7	0.723	34	Good
VMI	8	0.734	34	Good
SS	7	0.805	34	Good
IIMP	6	0.750	34	Good

Table 3.9 presents the interpretation of Cronbach's alpha values, which measure internal consistency reliability (Nunnally, 1978). Based on this, Table 3.10 reports the reliability results from the pilot test and interpreted as below.

Table 3.10 showed Real Time Inventory Tracking (RTIT) with 8 items and a Cronbach's alpha of 0.634, falls into the "Acceptable internal consistency reliability " range. JIT (Just-in-Time), consisting of 7 items with a Cronbach's alpha of 0.723, is in the "Good" range,

suggesting reliable measurement of the construct. Similarly, Vendor-Managed Inventory (VMI) with 8 items and a Cronbach's alpha of 0.734, also demonstrates good internal consistency. The Safety Stock (SS) scale, comprising 7 items, demonstrates a Cronbach's alpha of 0.805, indicating a good level of internal consistency. Finally, IIMP, with 6 items and a Cronbach's alpha of 0.750, shows good internal consistency, confirming that the items are well-correlated and effectively measure the variables.

3.10 Chapter summary

This chapter outlines the research methodology employed to investigate inventory management practices and their impact on performance within the manufacturing industry. It describes the adoption of a quantitative strategy with hypothesis testing to analyze various inventory management practices, including the development of a structured questionnaire and the use of proportional stratified sampling for participant selection. The chapter also highlights the importance of pilot testing to ensure the reliability of the survey instrument. The pilot test results, summarized by Cronbach's alpha values, indicate that all variables are acceptable and good reliability. Overall, the chapter establishes a solid framework for analyzing how different inventory management practices affect operational performance, with pilot testing confirming the reliability of the measurement tools used in the study.

CHAPTER FOUR

ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the findings from a study on inventory management practices and their impact on Inventory Management Performance (IMP) in the manufacturing sector at Kulim Industrial Park. It begins with an overview of the response rate and participant demographics and continues with findings related to key variables. Using SPSS for data analysis which is descriptive, correlation, and regression analysis to highlight relationships between variables. The goal is to enhance understanding of effective inventory practices in manufacturing, providing insights into how specific practice influence inventory management performance. The chapter also discusses the practical implications of these findings for improving inventory management in the manufacturing sector.

4.2 Response Rate

Table 4.1
Planned vs. Actual Responses by Industrial Zone Phase

Industrial Zone Phase	Number of Companies	Planned Sample Size	Actual Responses	Response Rate (%)
Phase 1	16	140	120	85.70%
Phase 2	8	70	60	85.70%
Phase 3	10	88	82	93.20%
Phase 4	8	70	42	60.00%
Total	**42**	**368**	**304**	**82.60%**

The planned sample size was 368, but only 304 responses were received. The remaining 64 respondents did not respond to the survey. The response rates across different industrial zones in the study, indicating different levels of participation of survey. Phase 1 and Phase 2 achieved strong participation with response rates of 85.7%, gathering 120 and 60 responses respectively out of their planned sample sizes. Phase 3 showed even higher engagement at 93.2%, with 82 responses from 88 planned respondent. Phase 4 had a lower response rate of 60.0%, with 42 responses received out of 70 planned respondents. Overall, the study achieved an 82.6% response rate across all phases, indicating comprehensive participation and ensuring the reliability of the data collected from Kulim Industrial Park.

4.3 Demographic Characteristics

The purpose of this section is to provide detailed demographic information about the respondents participating in the study. This information includes their gender, level of education, race/ethnicity, position level, years of working experience and industry sector.

4.3.1 Gender

Table 4.2
Gender Representation of Respondents

Gender	Number of Respondents	Percentage of Total
Female	168	55.30%
Male	136	44.70%
Total	**304**	**100%**

The Table 4.2 shows that 55.3% of respondents were female, and 44.7% were male. This balance ensures a fair representation in the survey, making the findings more reliable and applicable across different perspectives. Including both genders allows for a

comprehensive understanding of how inventory management practices impact different groups. Including both men and women in the survey ensures that the results reflect the diverse perspectives and experiences within the manufacturing industry at Kulim Industrial Park.

4.3.2 Education Level

Table 4.3
Education Level of Respondents

Education Level	Count	Percentage of Total
High school or equivalent	42	13.80%
Diploma	109	35.90%
Bachelor's degree	120	39.50%
Master's degree	32	10.50%
Doctorate degree	1	0.30%
Grand Total	**304**	**100%**

Table 4.3 displays the educational backgrounds of respondents, revealing that 39.50% completed bachelor's degree, 35.90% have Diploma, 10.50% possess Master's degree, 13.80% have completed High school or equivalent, and balance 0.30% have achieved Doctorate degree. Understanding the educational backgrounds of respondents is crucial as it brings diverse perspectives to survey findings. This diversity allows for a comprehensive analysis of how different educational levels influence approaches to managing inventory.

4.3.3 Position Level

Table 4.4 provides a breakdown of respondents based on their position levels within the organization. There are 6 entry-level respondents, making up 1.97% of the total. Executives are 129 respondents which showed highest, representing 42.43%. Managers total 40

respondents, totaling 13.16%. Mid-level positions are represented by 29 respondents, totaling 9.54%. Senior-level roles have 100 respondents, totaling 32.89%. These findings highlight the diverse position levels in Kulim Industrial Park's manufacturing sector.

Table 4.4
Respondents Position Level

Position Level	Count	Percentage of Total
Entry-level	6	1.97%
Executive	129	42.43%
Manager	40	13.16%
Mid-level	29	9.54%
Senior-level	100	32.89%
Grand Total	**304**	**100%**

4.3.4 Working Experience

Table 4.5 categorizes respondents into five groups based on their years of experience: 11-20 years (28.62%), 1-5 years (17.76%), 6-10 years (34.54%), less than 1 year (4.28%), and more than 20 years (14.80%). This breakdown provides a comprehensive view of the distribution of respondents' experience levels within the context of the study, highlighting the diverse range of expertise and seniority among individuals who take part in this survey.

Table 4.5
Respondents Working Experience

Working Experience	Count	Percentage
11-20 years	87	28.62%
1-5 years	54	17.76%
6-10 years	105	34.54%
Less than 1 year	13	4.28%
More than 20 years	45	14.80%
Grand Total	**304**	**100%**

4.3.5. Industry Sector

Table 4.6
Respondents Industry Sector

Industry Sector	Count	Percentage
Electronics Manufacturing	89	29.27%
Food and Beverage	14	4.61%
Glass Manufacturing	9	2.96%
Healthcare	70	23.03%
Metal Manufacturing	6	1.97%
Plastics Product Manufacturing	26	8.55%
Semiconductor Manufacturing	70	23.03%
Solar Panel Manufacturing	20	6.58%
Grand Total	**304**	**100%**

Table 4.6 provides an overview of respondent distribution across various industry sectors within the study. Electronics Manufacturing leads with 29.27%, followed by Healthcare and Semiconductor Manufacturing, each at 23.03%. Food and Beverage represents 4.61%, Glass Manufacturing 2.96%, Metal Manufacturing 1.97%, Plastics Product Manufacturing 8.55%, and Solar Panel Manufacturing 6.58%. This diversity showcases how different sectors approach inventory management practices, offering insights into their operational impacts and strategies.

4.3.6 Respondents Main Inventory Practices

Manufacturing companies employ a variety of inventory management practices to balance supply and demand. This study explores the key inventory management practices used by these companies, emphasizing their frequency and strategic significance.

Table 4.7
Respondents Main Inventory Practices

Main Inventory Practice	Count	Percentage
Just-In-Time (JIT)	124	40.79%
Real-time Inventory Tracking (RTIT)	120	39.47%
Safety Stock (SS)	13	4.28%
Vendor-Managed Inventory (VMI)	47	15.46%
Grand Total	**304**	**100%**

Table 4.7 provides an overview of the primary inventory management practices employed by respondents. Just-In-Time (JIT) emerges as the most widely used method, with 40.79% of respondents implementing it efficiency. Secondly, Real-Time Inventory Tracking emerges as a widely utilized method, with 39.47% of respondents implementing it. Safety Stock, employed by 4.28% of respondents and Vendor-Managed Inventory (VMI) is chosen by 15.46% of respondents. These findings showed the businesses employ diverse inventory practices to manage inventory effectively, each addressing specific operational needs and challenges. In summary, Real-Time Inventory Tracking stands out as the primary method used by respondents due to its critical role in providing accurate and timely data essential for effective inventory management. Without this real-time information, manufacturing face challenges in efficiently managing their inventory and meeting customer demands.

4.4 Results of Analysis

Here's a summary of the key findings and their interpretation from the section on inventory management practices and their impact on Inventory Management Performance (IMP).

4.4.1 Normality of Data Distribution

Many statistical tests rely on the assumption that data follows a normal distribution (Oztuna, Elhan, & Tuccar, 2006). Failing to verify data's adherence to this normality test before applying parametric tests such as t-tests, analysis of variance (ANOVA), regression analysis, and correlation tests, can lead to inaccurate test conclusion (Ghasemi & Zahediasl, 2012). According to Nornadiah & Wah (2011), neglecting to conduct normality checks can significantly impact the reliability of study outcomes, potentially resulting in inaccurate interpretations and unreliable findings. Therefore, in this study, researcher performed a normality test before proceeding with further statistical tests.

Table 4.8
Data Normality Results

	Descriptive Statistics				
	N	**Skewness**		**Kurtosis**	
	Statistic	**Statistic**	**Std. Error**	**Statistic**	**Std. Error**
RTIT	304	-0.985	0.140	0.306	0.279
JIT	304	-0.711	0.140	-0.160	0.279
VMI	304	-0.688	0.140	0.060	0.279
SS	304	-0.908	0.140	0.163	0.279
IMP	304	-1.151	0.140	1.270	0.279

Table 4.8 presents the results of data normality assessments for variables RTIT, JIT, VMI, SS, and IMP. The descriptive statistics include skewness and kurtosis values, which provide insights into the shape and distribution of data for each variable. The use of skewness and kurtosis values to check normality is common in practice (Orcan, 2020). RTIT- (-0.985), JIT (-0.711), VMI (-0.688) , SS (-0.908) , and IMP (-1.151) exhibit negative skewness, indicating that their data distributions are skewed to the left. Kurtosis values for RTIT (0.306), JIT (-0.160), VMI (0.060), SS (0.163), and IMP (1.270) showed acceptable kurtosis range. These analyses confirm that all variables' distributions close to normal,

falling within the acceptable range for Skewness and Kurtosis values (±2). George & Mallery (2010) define normal distributions as having Skewness and Kurtosis values ranging from +2 to -2.

4.4.2 Descriptive Statistics Analysis

In this study, descriptive statistics were employed to calculate basic statistics, such as means and standard deviations, for both independent and dependent variables.

Table 4.9
Descriptive Statistics of Each Variable

Item Statistics			
Variable	**Mean**	**Std. Deviation**	**N**
RTIT	4.6168	0.76257	304
JIT	4.4713	0.90328	304
VMI	4.5029	0.72022	304
SS	4.5780	0.78390	304
IMP	4.6875	0.78345	304

The Table 4.9 presents descriptive statistics for five key variables RTIT, JIT, VMI, SS, and IMP. The descriptive statistics provide a clear picture of how respondents perceive different inventory management practices, highlighting areas of strong agreement and variability in opinions. In research, mean (average) and Standard Deviation (variability) is the key to understanding data. The mean is considered a measure of central tendency because it reflects the central or middle point of a distribution (Arkkelin, 2014). To analyze the study indicators, data were converted into mean scores on a scale from 1.00 to 5.00, where scores from 1.00 to 2.90 represent low levels, and scores from 3.00 to 5.00 represent high levels (Ampadu, 2017).

On the other hand, the Standard Deviation serves as a measure of variability, indicating the extent to which scores deviate from this central point (Arkkelin, 2014). A high standard deviation (SD) indicates that data points are spread out over a wide range, meaning there is more variability in the data. Conversely, a low SD means that data points are closer to the mean, showing less variability (Andrade, 2020).

Based on Table 4.9 it can be concluded that among the inventory management practices studied, Real Time Inventory Tracking (RTIT) had the highest mean score of 4.6168, indicating it is the most positively viewed practice. This is followed by Safety Stock (SS) with a mean score of 4.5780, Vendor-Managed Inventory (VMI) with a mean of 4.5029 and Just-In-Time (JIT) had lowest mean score which is 4.4713. Beside this, Inventory Management Performance (IMP) had the highest mean score of 4.6875, respondents generally hold a positive view on this.

In this study Just-In-Time (JIT) has the highest SD, it indicates that respondents have a wide range of opinions about this practice, with some rating it very high and others rating it very low. This high variability reflects diverse or mixed perceptions among respondents. In contrast, Vendor-Managed Inventory (VMI) has the lowest standard deviation (SD), indicating more consistent opinions among respondents. Most rated VMI similarly and resulting in less variability.

Overall, the findings indicate that all five variables have mean values above 4.00, which falls within the range of 3.00 to 5.00, indicating high levels. This means that respondents generally view all five variables positively. However, JIT shows more variability in perceptions, shows that its implementation and effectiveness can differ based on individual

experiences and challenges among respondents. These findings highlight the importance of these inventory management practices in improving operational efficiency and performance across various organizational settings in Kulim Hi-Tech Park.

4.4.3 Correlation Analysis

In this research using Pearson correlation which measure strength of this relationship between two variables.

Table 4.10
Results Correlation Analysis

Correlations

		RTIT	JIT	VMI	SS	IMP
RTIT	Pearson Correlation	1	.662**	.595**	.669**	.617**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000
	N	304	304	304	304	304
JIT	Pearson Correlation	.662**	1	.605**	.665**	.556**
	Sig. (2-tailed)	0.000		0.000	0.000	0.000
	N	304	304	304	304	304
VMI	Pearson Correlation	.595**	.605**	1	.607**	.557**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000
	N	304	304	304	304	304
SS	Pearson Correlation	.669**	.665**	.607**	1	.608**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000
	N	304	304	304	304	304
IMP	Pearson Correlation	.617**	.556**	.557**	.608**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	
	N	304	304	304	304	304

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

According to Ratner (2009), correlation coefficient measures the strength and direction of the linear relationship between two variables, ranging from +1 (perfect positive correlation) to -1 (perfect negative correlation), with 0 indicating no linear relationship. A higher value

of the correlation coefficient signifies a stronger relationship between the variables, while the sign indicates the direction of the association (Ratner, 2009). Table 4.11 provide a general guideline for interpreting the strength of the relationship indicated by the correlation coefficient.

Table 4.11
Interpretation of Correlation Coefficients (Schober et al. 2018)

Correlation Coefficient	Interpretation
0.00-0.10	Negligible correlation
0.11-0.39	Weak correlation
0.40-0.69	Moderate correlation
0.70-0.89	Strong correlation
0.90-1.00	Very strong correlation

Table 4.10 presents the correlation analysis results, showing the relationships between inventory management practices and Inventory Management Performance (IMP). The Pearson Correlation coefficients (r) indicate the strength and direction of the relationships, while the significance levels (p-values) indicate the statistical significance of these relationships (Sedgwick, 2012). According to Obilor & Amadi (2018), larger correlation coefficient (r) indicates a stronger relationship, while a smaller p-value (like 0.05 or 0.01) showing a more significant relationship.

The correlation analysis reveals a moderate positive relationship between Realtime Inventory Tracking and Inventory Management Performance, indicated by a Pearson Correlation coefficient of 0.617 and a significance level of 0.000. The significance level of 0.000 ($p < 0.01$) indicates that this relationship is statistically significant. This finding suggests that improvements in Realtime Inventory Tracking are associated with better Inventory Management Performance.

The correlation analysis reveals a moderate positive relationship between Just-in-Time (JIT) practices and Inventory Management Performance (IMP), indicated by a Pearson Correlation coefficient of 0.556. The significance level of 0.000 ($p < 0.01$) confirms that this correlation is statistically significant. This finding suggests that the implementation of JIT practices, which aim to reduce inventory levels and increase efficiency, is associated with improved Inventory Management Performance.

The correlation analysis reveals a strong positive relationship between Vendor-Managed Inventory (VMI) and Inventory Management Performance (IMP), indicated by a Pearson Correlation coefficient of 0.557 and a significance level of 0.000. This statistically significant finding ($p < 0.01$) suggests that higher levels of VMI are associated with significantly improved Inventory Management Performance.

The correlation analysis reveals a moderate positive relationship between Safety Stock (SS) levels and Inventory Management Performance (IMP), indicated by a Pearson Correlation coefficient of 0.608 and a significance level of 0.000. This statistically significant finding ($p < 0.01$) suggests that maintaining higher levels of Safety Stock is associated with improved Inventory Management Performance.

In summary, each practice shows statistically significant correlations ($p < 0.01$), suggesting that improvements in these areas tend to enhance overall inventory management performance.

4.4.4 Regression Analysis

Regression analysis measure the relationship between independent variables and a

dependent variable, measuring how changes in the independent variables correspond to changes in the dependent variable (Tyagi, Rane & Manry, 2022).

Table 4.12
Results of Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.691[a]	0.478	0.471	0.5699

a. Predictors: (Constant), SS, VMI, RTIT, JIT

Table 4.12 presents the results of a correlation analysis model summarizing the relationship between inventory management practices and an outcome variable. The model indicates a moderately correlation, with an R value of 0.691, suggesting that practices such as Safety Stock (SS), Vendor-Managed Inventory (VMI), Real-Time Inventory Tracking (RTIT), and Just-In-Time (JIT) are positively associated with the dependent variable.

The R-squared value of around 0.48 suggests that approximately 48% of the changes in the dependent variable can be explained by the inventory management practices examined, which is Safety Stock, Vendor-Managed Inventory, Real-Time Inventory Tracking, and Just-In-Time practices. It means this four inventory management practices together account for nearly half of the changes or behavior observed in the dependent variable. While this is a significant portion, it also indicates that other inventory management practices not included in this survey explain the remaining 52% of the variability. Thus, while these practices have a moderate influence on the dependent variable's behavior, considering additional practices will provide a more comprehensive understanding.

Table 4.13
ANOVA Results for Regression Analysis

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	88.869	4	22.217	68.406	<.001[b]
	Residual	97.110	299	0.325		
	Total	185.979	303			

a. Dependent Variable: IMP
b. Predictors: (Constant), SS, VMI, RTIT, JIT

The ANOVA Table 4.13 indicates that the regression model is statistically significant ($p < 0.001$). This means that the predictors (SS, VMI, RTIT, JIT) collectively have a significant effect on the dependent variable (IMP). The high F-statistic (68.406) and the low p-value suggest that the model provides a good fit to the data and that the predictors explain a significant change in the dependent variable.

Table 4.14
Results for Regression Analysis

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	0.964	0.233		4.146	0.000
	RTIT	0.289	0.064	0.281	4.499	0.000
	JIT	0.083	0.054	0.096	1.534	0.126
	VMI	0.199	0.062	0.183	3.191	0.002
	SS	0.245	0.063	0.245	3.878	0.000

a. Dependent Variable: IMP

Table 4.14 showed results for multiple regression analysis with t-value and p-value for all variables. In the multiple regression analysis, each predictor variable's impact on the dependent variable (Inventory Management Performance) is examined. The p-values and t-values are crucial for determining their statistical significance. P-values should ideally

fall within the range of P (0.000) < α (0.05) for a statistically significant result. The decision criteria are if the p-value less than 0.050, the relationship is significant; if it is more than 0.050, the relationship is not significant (Purwanto, 2021). Regarding t-value decision criteria are if the t-value is greater than >1.96, the relationship is considered significant; if the t-value is less than 1.96, the relationship is not considered significant (Purwanto, 2021). A higher t-value generally means a more significant impact of the predictor on the outcome variable (Rubinfeld, 2000).

The t-value of 4.499 for RTIT means that the relationship between Real-Time Inventory Tracking and Inventory Management Performance is very strong. This value indicates that for every increase in RTIT, there is a significant positive impact on Inventory Management Performance. The p-value of 0.000 confirms that this relationship is statistically significant. Therefore, organizations that implement or enhance RTIT systems can expect significant improvements in how they manage their inventory.

The t-value of 1.534 indicates that the relationship between Just-In-Time (JIT) inventory practices and Inventory Management Performance (IMP) is weaker compared to other variables in the model. For each unit increase in Just-In-Time (JIT) inventory practices, the resulting change in Inventory Management Performance (IMP) is smaller. The p-value of 0.126 is greater than the typical significance level of 0.05, indicating that the observed relationship between JIT and IMP is not statistically significant in this study. This means that changes in JIT practices may not lead to any improvements in inventory management performance.

The t-value of 3.191 shows that Vendor-Managed Inventory (VMI) practices strongly influence Inventory Management Performance (IMP). This means that when organizations adopt or adjust VMI strategies, they can expect significant improvements in how they manage inventory. The p-value of 0.002 is less than the typical significance level of 0.05, confirming that this relationship is statistically significant. Implementing Vendor-Managed Inventory (VMI) directly improve its effectiveness in enhancing inventory management performance.

The t-value of 3.878, which is greater than 1.96, indicates a strong and significant relationship between Safety Stock management and Inventory Management Performance (IMP). This means that enhancing how Safety Stock is managed directly leads to improvements in IMP. The p-value of 0.000 is very low, indicating high statistical significance. Organizations that effectively manage their safety stock levels are likely to experience better inventory management performance.

4.5 Finding on Hypothesis

Based on the regression analysis findings, the following conclusions can be drawn regarding the hypothesis and the impact of each independent variable on Inventory Management Performance (IMP). Table 4.15 presents the results of testing four hypotheses about inventory management practices and their impact on inventory management performance (IMP). Hypothesis H1, which states that Real-Time Inventory Tracking (RTIT) improves performance by offering real-time visibility was accepted with a p-value of 0.000 which indicating a significant impact. Hypothesis H2, which suggests that Just-In-Time (JIT) management reduces inventory carrying costs and enhances performance

was not accepted as its p-value showed 0.126. Its more than p-value, which is 0.050, so that the relationship is not significant. Hypothesis H3, stating that Vendor- Managed Inventory (VMI) increases performance by lowering inventory costs was accepted with a p-value of 0.002, demonstrating a significant positive effect. Finally, Hypothesis H4, Safety Stock (SS) improves performance by reducing shortage risks was accepted with a p-value of 0.000, reflecting a significant positive impact.

Table 4.15
Results of Hypothesis

Hypothesis	Hypothesis Description	Hypothesis Decision	P-value
H1: RTIT->IMP	H1: Real-Time Inventory Tracking practice has a significant and positive impact on inventory management performance by real-time visibility.	Accepted	0.000
H2: JIT->IMP	H2: Just-In-Time (JIT) management practice has a significant and positive impact on inventory management performance by reduce inventory carrying costs.	Not Accepted	0.126
H3: VMI->IMP	H3: Vendor-Managed Inventory (VMI) has a significant and positive impact on inventory management performance by reduce inventory costs.	Accepted	0.002
H4: SS->IMP	H4: Safety stock practice has a significant and positive impact on inventory management performance by reduce risk of shortage.	Accepted	0.000

4.6 Chapter Summary

Chapter Four focuses on analyzing the collected data to evaluate the inventory management

practices in manufacturing firms within Kulim Industrial Park. The study achieved a high response rate of 82.6%, ensuring a robust dataset for analysis. The data collection included various demographic characteristics such as gender, work experience, and job roles to provide a comprehensive understanding of the sample population. Utilize descriptive, correlation, and regression statistical methods to analyze data. These analysis methods were crucial for discovering important connections among key inventory management practices: Safety Stock (SS), Vendor-Managed Inventory (VMI), Real-Time Inventory Tracking (RTIT), and Just-In-Time (JIT). It helped to reveal how these practices influence overall inventory management performance. These findings offer valuable insights into optimizing inventory practices, addressing inefficiencies, and improving operational performance in the manufacturing sector of Kulim Industrial Park.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Introduction

This chapter discuss the research findings regarding inventory management practices and their impact on inventory management performance among manufacturing firms in Kulim Industrial Park. It starts with a recap and summary of the study and highlighting the key findings. The chapter also looks at the contributions, implications, and limitations of the study, offering insights and suggesting future research directions. Finally, the chapter ends with a summary that recaps the entire research.

5.2 Recapitulation and Summary of the Study

Chapter One introduces the study on inventory management practices and their impact on performance among manufacturing firms in Kulim Industrial Park. It outlines the research problem, questions, and objectives, emphasizing the importance of efficient inventory management for operational success and profitability. The chapter also highlights the significance of various practices like RTIT, JIT, VMI, and SS. By addressing these practices, the study aims to provide insights into optimizing inventory levels and improving overall performance in the manufacturing sector.

Chapter Two provides a comprehensive exploration of various inventory management practices and their impact on performance in the manufacturing sector. It highlights the critical role of practices like Real-Time Inventory Tracking, Just-In-Time, Vendor-Managed Inventory and Safety Stock in enhancing operational efficiency and reducing

costs. The review underscores the importance of these practices in optimizing inventory levels, improving customer satisfaction, and achieving financial success. Additionally, the chapter sets the stage for further research by proposing hypotheses that examine the connections between these practices and the performance of inventory management.

Chapter Three presents a quantitative research methodology to examine how inventory management practices influence performance in the manufacturing sector. Using structured questionnaires and proportional stratified sampling, the study targets 304 employees across different phases of Kulim Industrial Park. Data analysis, conducted with SPSS, includes descriptive, correlation, and regression analyses to explore relationships. A pilot test ensures questionnaire reliability, validating the study's approach to gather insights on inventory management practices and their impact.

Chapter Four of the study on inventory management practices in Kulim Industrial Park utilizes advanced statistical methods SPSS for comprehensive analysis. The research employs descriptive statistics to outline the characteristics of inventory management practices and their impact on performance. Correlation analysis reveals the relationships between variables such as Real-Time Inventory Tracking (RTIT), Vendor-Managed Inventory (VMI), Safety Stock (SS), and Inventory Management Performance (IMP). Importantly, the study finds that Just-In-Time (JIT) management does not significantly affect IMP, contrasting with the significant positive impacts of RTIT, VMI, and SS. These practices are shown to enhance operational efficiency by providing timely inventory visibility, reducing costs, and minimizing the risks associated with shortage. This highlights the critical role of adopting RTIT, VMI, and SS practices in optimizing inventory management effectiveness within industrial settings like Kulim Industrial Park.

5.3 Discussion of Hypothesis Findings

Table 4.16
Results of research findings

Research Questions	Research Objectives	Hypothesis	Hypothesis Findings
What is the impact of Real-time Inventory Tracking on Inventory Management Performance among manufacturing industry?	To identify the impact of Real-Time Inventory Tracking on Inventory Management Performance among manufacturing industries.	Real-Time Inventory Tracking (RTIT) practice has a significant and positive impact on inventory management performance by real-time visibility.	Accepted
What is the impact of JIT on Inventory Management Performance among manufacturing industry?	To examine the impact of Just-In-Time on Inventory Management Performance among manufacturing industries.	Just-In-Time (JIT) management practice has a significant and positive impact on inventory management performance by reduce inventory carrying costs.	Not Accepted
What is the impact of VMI on Inventory Management Performance among manufacturing industry?	To analyze the impact of Vendor-Managed Inventory on Inventory Management Performance among manufacturing industry.	Vendor-Managed Inventory (VMI) has a significant and positive impact on inventory management performance by reduce inventory costs.	Accepted
What is the impact of Safety Stock on Inventory Management Performance among manufacturing industry?	To investigate the impact of Safety Stock on Inventory Management Performance among manufacturing industry.	Safety Stock (SS) practice has a significant and positive impact on inventory management performance by reduce risk of shortage.	Accepted

Each hypothesis is analyzed based on the regression results to provide a comprehensive understanding of how these practices contribute to enhancing operational efficiency and

overall performance within manufacturing contexts. This section elaborated on the results of this study for the hypothesis stated below.

a. Real-Time Inventory Tracking -> Impact on Inventory Management Performance

H1: Real-Time Inventory Tracking practice has a significant and positive impact on inventory management performance by real-time visibility.

The hypothesis suggests that implementing Real-Time Inventory Tracking (RTIT) improves inventory management performance by offering real-time visibility into inventory levels and movement. The regression analysis supports this hypothesis with a statistically significant positive coefficient ($B = 0.289$, $p < 0.05$). Firms that adopt RTIT typically improve their inventory management performance through better accuracy in monitoring inventory, reduced inventory shortage and more efficient use of resources (Erlangga et al., 2022).

Real-time data allows for proactive decision-making, such as timely restocking and effective inventory management, leading to increased operational efficiency and higher levels of customer satisfaction (Niaz, 2022). According to Odadi (2012) in previous study related real time inventory tracking significantly enhances business operations efficiency, with a mean value of 4.8333 and a standard deviation of 0.00722. This strong agreement and consistency among respondents support the hypothesis that Real-Time Inventory Tracking practices improve inventory management performance by providing real-time visibility and enhancing operational efficiency.

b. Just-In-Time -> Impact on Inventory Management Performance

H2: Just-In-Time (JIT) management practice has a significant and positive impact on inventory management performance by reducing inventory carrying costs.

The regression analysis did not find significant evidence supporting H2 (B = 0.083, p > 0.05). Although there was a positive coefficient (Beta = 0.096), the p-value (p > 0.05) indicates that the impact of JIT implementation on Inventory Management Performance (IMP), specifically in reducing inventory carrying costs, was not statistically significant in the studied manufacturing environment. This might be due to fluctuations in demand, disruptions in the supply chain, or insufficient coordination between production and delivery schedules. According to Siddiqui (2022), JIT inventory practice lead to challenges such as insufficient buffer stock for unexpected demand, dependency on timely supplier deliveries, potential failures if suppliers not support, limited flexibility due to lean inventory, and vulnerability to disruptions like natural disasters due to minimal stock level. Shortages of raw materials highlighted the challenges faced by JIT, which depends heavily on maintaining minimal inventory and timely deliveries during global disruptions (Balkhi et al., 2022).

Previous studies have highlighted significant challenges faced by Just-In-Time (JIT) inventory management during the COVID-19 pandemic. Zhu et al. (2020) noted that the medical supply chain's reliance on JIT exposed vulnerabilities during unexpected disruptions. During the COVID-19 pandemic, production in Asia experienced significant declines due to disruptions in supply chains (Purwanto, 2020). These challenges have lead some respondents to doubt whether JIT implementation effectively enhances Inventory

Management Performance (IMP) by reducing inventory carrying costs. Proposing future research should investigate JIT effectiveness across various industrial settings, which could provide valuable insights. The results might change and show a positive impact of JIT implementation in different scenarios.

c. Vendor-Managed Inventory -> Impact on Inventory Management Performance

H3: Vendor-Managed Inventory (VMI) has a significant and positive impact on inventory management performance by reducing inventory costs.

The hypothesis concerning Vendor-Managed Inventory (VMI) is supported by the regression analysis, showing a statistically significant positive impact on IMP ($B = 0.199$, $Beta = 0.183$, $p < 0.05$). VMI facilitates closer collaboration between manufacturers and suppliers, leading to improved inventory control, reduced holding costs, and enhanced supply chain responsiveness. The findings suggest that effective VMI implementation enables firms to streamline inventory management processes, minimize excess inventory, and optimize cash flow.

These benefits contribute to overall cost savings and operational efficiency, aligning with industry best practices in inventory management (Quiton, 2024). Previous research in healthcare manufacturing that implementing VMI can lead to a substantial reduction (up to 30%) in stock levels for medical and pharmaceutical products, minimizing excess inventory and associated holding costs (Sumrit, 2020). Successful VMI practices have also been associated with increased customer satisfaction, higher reorder rates, and reduced inventory costs for suppliers (Ernawati, 2021). These findings underscore benefits of VMI

across diverse sectors, aligning with the positive impacts observed in the hypothesis regarding inventory management performance.

d. Safety Stock -> Impact on Inventory Management Performance

H4: Safety Stock practice has a significant and positive impact on inventory management performance by reducing the risk of shortage.

The hypothesis related to Safety Stock (SS) practice is supported by the regression results, indicating a statistically significant positive impact on IMP ($B = 0.245$, $Beta = 0.245$, $p < 0.05$). Safety stock serves as a buffer against demand variability and supply chain disruptions, ensuring continuity in production and customer fulfillment. By maintaining adequate safety stock levels, firms can mitigate the risk of shortage, improve service reliability, and enhance overall operational resilience (Oloo, 2023).

This finding underscores the strategic importance of safety stock in maintaining high service levels and customer satisfaction, particularly in dynamic and unpredictable market environments. According to Ugwu (2023), previous studies on brewery companies in Southeast Nigeria have shown that implementing a safety stock strategy helps prevent shortage situations and contributes to higher customer retention rates ($t = 3.350$, $p < 0.05$). This finding supports H4, indicating that safety stock practice positively influences inventory management performance by reducing the risk of shortage.

5.4 Research Contributions

5.4.1 Contribution Towards Management Research

This study significantly contributes to management research in the manufacturing sector by highlighting the critical impact of specific inventory management practices on overall performance. This research provides actionable insights for manufacturing firms by identifying Real-Time Inventory Tracking, Vendor-Managed Inventory, and Safety Stock as key practices that enhance inventory management performance. It demonstrates that implementing these practices can lead to better accuracy in inventory monitoring, reduce inventory shortages and optimized resource allocation. Consequently, these improvements contribute to higher operational efficiency and increased customer satisfaction. The study's findings encourage manufacturing managers to invest in and prioritize these inventory management practices achieving better performance and competitive advantage.

5.4.2 Contribution Towards Theories

The research makes valuable contributions to several established theories in the field of inventory management and organizational studies. It supports Transaction Cost Analysis (TCA) Theory by showing RTIT and VMI practices reduce transaction costs through improved coordination and information sharing between suppliers and manufacturers. These practices improve efficiency by sharing real-time inventory data, thereby reducing costs associated with supply chain uncertainties. This aligns with TCA theory's objective of optimizing economic transactions through effective coordination and organizational efficiency (Ketokivi & Mahoney, 2020).

The findings align with Economic Order Quantity (EOQ) Theory by showing that maintaining sufficient Safety Stock optimizes inventory management costs. Safety Stock acts as a buffer against uncertainties in demand and supply, ensuring operational continuity and minimizing costs related to shortage or production disruptions (Gambino, 2020). Balancing order costs and holding costs, including the management of safety stock, helps businesses achieve efficient inventory management practices (Emar et al., 2021), supporting Transaction Cost Analysis (TCA) theory's goal of optimizing economic transactions through effective coordination and cost management.

Additionally, this study highlights that Vendor-Managed Inventory (VMI) and safety stock function as strategic assets that improve a firm's competitive advantage. VMI optimizes supply chain efficiency and ensures consistent product availability, aligning with Resource-Based View (RBV) Theory's emphasis on leveraging internal resources for strategic advantage. Similarly, maintaining safety stock aligns with RBV by enhancing operational resilience and mitigating risks, thereby supporting the firm's ability to maintain competitiveness in dynamic market environments.

5.4.3 Contribution Towards Policy Makers and Government Authorities

This research highlights the significance of effective inventory management practices, such as Real-Time Inventory Tracking (RTIT), Vendor-Managed Inventory (VMI), and maintaining Safety Stock, in enhancing regional economic performance. Policymakers can employ these findings to create policies that support the integration of these practices among domestic manufacturers. By this, can increase operational efficiency, reduce supply chain disruptions, and boost competitiveness, ultimately contributing to economic growth

and job creation. This strategic policy direction can also enhance export performance, solidifying the region's position in the global market.

Trade ministries and state authorities, including the Ministry of International Trade and Industry (MITI), can utilize this research to develop initiatives that encourage the adoption of advanced inventory management practices. These initiatives might involve offering technology incentives to facilitate the transition to modern inventory management, implementing training programs to improve the workforce skill, and providing substantial support for Research & Development (R&D) to foster innovation. Such targeted efforts can strengthen the manufacturing sector, driving broader economic growth and enhancing the region's competitiveness on a global scale.

5.5 Limitations of Study

The study's focus solely on specific area in manufacturing industries within Kulim Industrial Park. Manufacturing environments worldwide differ significantly due to diverse economic conditions, cultural influences, and regulatory frameworks. This diversion shape inventory management practices and outcomes differently. Although findings from Kulim manufacturing are valuable, they might not fully capture the complexities faced by manufacturing sectors in other regions or industrial settings. This geographic limitation underscores the need for caution when applying the study's findings to broader industrial contexts.

Secondly, the study focuses specifically on Real-Time Inventory Tracking, Just-In-Time, Vendor-Managed Inventory and Safety Stock as key inventory management practices.

However, it's crucial to acknowledge that beyond these practices, there exist several others such as FIFO (First In, First Out), ABC analysis, MRP (Material Requirements Planning), and EOQ (Economic Order Quantity), each playing significant roles in optimizing inventory performance.

Finally, this study focuses on general inventory management performance as the dependent variable, providing a broad overview of inventory practices without addressing more specific performance metrics. This approach may overlook important aspects such as financial performance, including cost savings and return on investment, and operational performance, such as efficiency, productivity, and workflow impacts. Consequently, the findings may not fully capture the detailed effects of different inventory management practices on these critical areas, limiting the depth of understanding regarding their overall impact on organizational performance.

5.6 Suggestion for Further Research

To improve on this study and gain a deeper understanding of inventory management practices, future research should consider several key areas. Firstly, future study should expand its geographic scope to encompass multiple manufacturing cities, districts, states, or countries to providing a more comprehensive understanding of how inventory management practices operate under diverse economic, cultural, and regulatory conditions. Expanding the research to include different regions and various industrial settings would make the findings more applicable to a broader range of situations. Studying diverse manufacturing environments helps identify regional and industry-specific factors that

influence the effectiveness of different inventory management practices. This broader scope allows for comparisons and highlights best practices that are universally applicable.

Secondly, future research should also investigate additional inventory management practices which not covered in this study. Beyond Real-Time Inventory Tracking, Just-In-Time, Vendor-Managed Inventory, and Safety Stock, future research should delve into other crucial inventory management practices such as FIFO (First In, First Out), ABC analysis, MRP (Material Requirements Planning), and EOQ (Economic Order Quantity). These practices significantly enhance inventory performance but were not fully investigated in the current study. This expansion would offer a more comprehensive understanding across diverse manufacturing contexts, thereby enhancing insights into effective inventory management practices.

Lastly, future research should expand its scope to include specific performance metrics beyond general inventory management performance. Incorporating detailed measures of financial performance, such as cost savings and return on investment, as well as operational performance metrics like efficiency and productivity, would provide a more comprehensive view of how different inventory management practices influence various dimensions of performance. This broader approach would offer deeper insights into the specific effects of inventory practices, enhancing the relevance and applicability of the findings across different organizational contexts.

5.7 Conclusion

In conclusion, this study highlights the significant impact of Real-Time Inventory Tracking (RTIT), Vendor-Managed Inventory (VMI), and Safety Stock (SS) on enhancing inventory

management performance within manufacturing firms in Kulim Industrial Park. RTIT and VMI practices significantly improve visibility and control over inventory, leading to operational efficiency and cost reduction. SS helps mitigate risks associated with demand variability, ensuring continuity in production and customer satisfaction. However, the study found that JIT management did not significantly impact performance in this context, revealing challenges in its implementation. Acknowledging these limitations is crucial for interpreting the study's findings accurately and for guiding future research. Addressing these limitations in subsequent studies can lead to a more comprehensive and generalizable understanding of the impact of inventory management practices on manufacturing performance. In conclusion, addressing these suggestions for further research would enhance the depth and applicability of findings in inventory management studies.

References

Abidin, R., Abdullah, C. S., Hasnan, N., Mohtar, S., & Osman, N. (2013). The impact of technology parks services on the high technology industry: A case study on Kulim Hi-Tech Park.

Abolghasemi, M., Beh, E., Tarr, G., & Gerlach, R. (2020). Demand forecasting in supply chain: The impact of demand volatility in the presence of promotion. Computers & Industrial Engineering, 142, 106380.

Ahmad, S., Wasim, S., Irfan, S., Gogoi, S., Srivastava, A., & Farheen, Z. (2019). Qualitative v/s. quantitative research-a summarized review. population, 1(2), 2828-2832.

Aithal, A., & Aithal, P. S. (2020). Development and validation of survey questionnaire & experimental data–a systematical review-based statistical approach. International Journal of Management, Technology, and Social Sciences (IJMTS), 5(2), 233-251.

Alam, M. K., Thakur, O. A., & Islam, F. T. (2024). Inventory management systems of small and medium enterprises in Bangladesh. Rajagiri Management Journal, 18(1), 8-19.

Ampadu, H. K. K. (2017). Effect of inventory management practices on performance of small and medium-scale Entreprises in the cape coast metropolis (Doctoral dissertation, University of Cape Coast).

Andrade, C. (2020). Understanding the difference between standard deviation and standard error of the mean, and knowing when to use which. Indian Journal of Psychological Medicine, 42(4), 409-410.

Anoop, G. M., & Muhammed, V. S. (2020). A Brief Overview on Toyota Production System (TPS). International Journal for Research in Applied Science and Engineering Technology, 8(5), 2505-2509.

Arkkelin, D. (2014). Using SPSS to understand research and data analysis.

Arslan, M. C., & Turkay, M. (2013). EOQ revisited with sustainability considerations. Foundations of Computing and Decision Sciences, 38(4), 223-249.

Asenahabi, B. M. (2019). Basics of research design: A guide to selecting appropriate research design. International Journal of Contemporary Applied Research, 6(5), 76-89.

Atmowardoyo, H. (2018). Research Methods in TEFL Studies: Descriptive. Journal of Language Teaching and Research, 9(1), 197–204. http://dx.doi.org/10.17507/jltr.0901.25

Atnafu, D., & Balda, A. (2018). The impact of inventory management practice on firms' competitiveness and organizational performance: Empirical evidence from micro and small enterprises in Ethiopia. Cogent Business & Management, 5(1),1503219.

Augustin, C. L. (2020). A Comparison of Multiple Choice and Likert Scale Type Extension Program Evaluations. Journal of the NACAA, 13(2).

Balkhi, B., Alshahrani, A., & Khan, A. (2022). Just-in-time approach in healthcare inventory management: Does it really work? Saudi Pharmaceutical Journal, 30(12), 1830-1835.

Barros, J., Cortez, P., & Carvalho, M. S. (2021). A systematic literature review about dimensioning safety stock under uncertainties and risks in the procurement process. Operations Research Perspectives, 8, 100192.

Beheshti, H. M., Clelland, I. J., & Harrington, K. V. (2020). Competitive advantage with vendor managed inventory. Journal of Promotion Management, 26(6), 836-854.

Bernal, E. A., & Quiton, J. P. R. (2024). Vendor Management Inventory For Enhanced Supply Chain Performance Metrics Of Selected Manufacturing Companies. Ignatian International Journal for Multidisciplinary Research, 2(5), 375-385.

Boche, B., Mulugeta, T., & Gudeta, T. (2020). Assessment of inventory management practices at the Ethiopian pharmaceuticals supply agency, Addis Ababa, Ethiopia. Integrated Pharmacy Research and Practice, 175-183.

Breivik, J. (2019). Retail chain affiliation and time trend effects on inventory turnover in Norwegian SMEs. Cogent Business & Management, 6(1), 1604932.

Caro, F., & Sadr, R. (2019). The Internet of Things (IoT) in retail: Bridging supply and demand. Business Horizons, 62(1), 47-54.

Chalotra, V. (2013). Inventory management and small firms' growth: An analytical study in supply chain. Vision, 17(3), 213–222.

Cherotich, Y., & Y., Karanja, N.P. (2019). Influence of inventory management practices on performance of fast-moving consumer goods manufacturers in nairobi county, kenya. Int Journal of Social Sciences Management and Entrepreneurship 3(2): 17-35.

Chinello, E., Herbert-Hansen, Z. N. L., & Khalid, W. (2020). Assessment of the impact of inventory optimization drivers in a multi-echelon supply chain: Case of a toy manufacturer. Computers & Industrial Engineering, 141, 106232.

Choi, T. Y., Netland, T. H., Sanders, N., Sodhi, M. S., & Wagner, S. M. (2023). Just-in-time for supply chains in turbulent times. Production and Operations Management, 32(7), 2331-2340.

Claassen, M. J., Van Weele, A. J., & Van Raaij, E. M. (2008). Performance outcomes and success factors of vendor managed inventory (VMI). Supply Chain

Conley, K., Natarajarathinam, M,. Lu, W., & Rangan, S. (2019). Effect of Accounting Policies on Effectiveness of Inventory Management Strategies, Engineering. Management Journal, DOI: 10.1080/10429247.2019.1652056

Collins, M. M., & Patrick, N. (2021). Inventory Management Practices and the Performance of Milk Processing Firms in Kiambu County in Kenya. International Journal of Procurement and Supply Chain Management, 5(2), 650-664.

Cooper, D., Schindler, P., 2014. Business Research Methods. 12th Edition. New York, USA: McGraw-Hill Higher Education

Croasmun, J. T., & Ostrom, L. (2011). Using likert-type scales in the social sciences. Journal of adult education, 40(1), 19-22.

Da Silva, V. L., Kovaleski, J. L., & Pagani, R. N. (2019). Technology transfer in the supply chain oriented to industry 4.0: a literature review. Technology Analysis & Strategic Management, 31(5), 546-562.

Dadić, L., & Ribarić, H. M. (2020). Inventory management in bars and restaurants-employees' attitudes.

De Maio, A., & Laganà, D. (2020). The effectiveness of Vendor Managed Inventory in the last-mile delivery: an industrial application. Procedia Manufacturing, 42, 462-466.

Dev, N. K., Shankar, R., Gupta, R., & Dong, J. (2019). Multi-criteria evaluation of real-time key performance indicators of supply chain with consideration of big data architecture. Computers & Industrial Engineering, 128, 1076-1087.

DeVellis, R. F. (2003). Scale development: Theory and applications. Thousand Oaks: Sage Publications, Inc.

Dincer, K. F., & Turgay, S. (2023). Balancing Demand and Supply: Inventory Allocation in FMCG. Industrial Engineering and Innovation Management, 6(10), 41-49.

Dong, Y., Xu, K., & Dresner, M. (2007). Environmental determinants of VMI adoption: an exploratory analysis. Transportation Research Part E: Logistics and Transportation Review, 43(4), 355-369.

Dutta, G., Kumar, R., Sindhwani, R., & Singh, R. K. (2020). Digital transformation priorities of India's discrete manufacturing SMEs–a conceptual study in perspective of Industry 4.0. Competitiveness Review: An International Business Journal, 30(3), 289-314.

Emar, W., Al-Omari, Z. A., & Alharbi, S. (2021). Analysis of inventory management of slow-moving spare parts by using ABC techniques and EOQ model-a case study. Indonesian Journal of Electrical Engineering and Computer Science, 23(2), 1159-1169.

Erlangga, S. B., Yunita, A., & Satriana, S. R. (2022). Development of Automatic Real Time Inventory Monitoring System using RFID Technology in Warehouse. JOIV: International Journal on Informatics Visualization, 6(3), 636-642.

Ernawati, D., Pudji, E., Rahmawati, N., & Alfin, M. (2021, May). Bullwhip effect reduction using vendor managed inventory (VMI) method in supply chain of manufacturing company. In Journal of Physics: Conference Series (Vol. 1899, No. 1, p. 012082). IOP Publishing.

Esmaili, N., Norman, B. A., & Rajgopal, J. (2019). Exact analysis of (R,s,S) inventory control systems with lost sales and zero lead time. Naval Research Logistics (NRL), 66(2), 123–132. https://doi.org/10.1002/nav.21833

Gable, R. K., & Wolf, J. W. (1993). Instrument development in the affective domain: Measuring attitudes and values in corporate and school settings. Boston: Kluwer Academic.

Gardner Jr, E. S., & Diaz-Saiz, J. (2002). Seasonal adjustment of inventory demand series: a case study. International Journal of Forecasting, 18(1), 117-123.

George, D., & Mallery, P. (2010). SPSS for Windows step by step: A simple guide and reference, 17.0 update. Allyn & Bacon.

Gisbert J., M. (2022). Data analysis of the stock management of a manufacturing company (Master's thesis, Universitat Politècnica de Catalunya).

Golas. Z. (2020): Effect of inventory management on profitability: evidence from the Polish food: case study

Goncalves, J. N., Carvalho, M. S., & Cortez, P. (2020). Operations research models and methods for safety stock determination: A review. Operations Research Perspectives, 7, 100164.

Hadian, S. M., Farughi, H., & Rasay, H. (2021). Joint planning of maintenance, buffer stock and quality control for unreliable, imperfect manufacturing systems. Computers & Industrial Engineering, 157, 107304.

Hanninen, P. (2024). Improving inventory management efficiency: the impact of optimisation.

Helo, P., & Shamsuzzoha, A. H. M. (2020). Real-time supply chain—A blockchain architecture for project deliveries. Robotics and Computer-Integrated Manufacturing, 63, 101909. https://onlinelibrary.wiley.com/doi/10.1111/poms.13979industry: Case study.

Heydari, M., Lai, K. K., & Zhou, X. (2020). Creating sustainable order fulfillment processes through managing the risk: evidence from the disposable products industry. Sustainability, 12(7), 2871.

Hidayat, R., & Saleh, I. (2020). The importance of inventory management in pharmaceutical practice. Open Access Indonesia Journal of Social Sciences, 3(1), 80-84.

Hofstra, N., Spiliotopoulou, E., & de Leeuw, S. (2022). Ordering decisions under supply uncertainty and inventory record inaccuracy: an experimental investigation. Decision Sciences.

Hutasoit, D. R., & Sitompul, R. S. (2021). Analysis of Raw Material Inventory on the Sale of Hand-Woven Gloves at UD. Ulos Tarutung Twins. Jurnal Mantik, 4(4), 2499-2504.

Immaculate, P. S., Shalini, & Rajesh, R., & Raju, A. (2020). An Empirical Study on Inventory Management. Ilkogretim Online - Elementary Education Online, 19(3), 4445-4452. doi:10.17051/ilkonline.2020.03.735596

Jonsson, P., & Mattsson, S. A. (2008). Inventory management practices and their implications on perceived planning performance. International journal of production research, 46(7), 1787-1812.

Juliani, D. I., Karyatun, S., & Digdowiseiso, K. (2023). The Effect of Current Ratio, Total Asset Turnover And Debt To Equity Ratio On The Financial Performance Of Manufacturing Companies Listed On The Indonesia Stock Exchange For The 2016-2020 Period. Jurnal Syntax Admiration, 4(4), 630-643.

Kabzhassarova, M., Kulzhanova, A., Dikhanbayeva, D., Guney, M., & Turkyilmaz, A. (2021). Effect of Lean4. 0 on sustainability performance: a review. Procedia CIRP, 103, 73-78.

Kanike, U. K. (2023). Factors disrupting supply chain management in manufacturing industries. Journal of Supply Chain Management Science, 4(1-2), 1-24.

Karamshetty, V., De Vries, H., Van Wassenhove, L. N., Dewilde, S., Minnaard, W., Ongarora, D., & Yadav, P. (2022). Inventory management practices in private healthcare facilities in Nairobi County. Production and Operations Management, 31(2), 828-846.

Karim, N. A., Nawawi, A., & Salin, A. S. A. P. (2018). Inventory management effectiveness of a manufacturing company–Malaysian evidence. International Journal of Law and Management.

Ke, J. Y. F., Otto, J., & Han, C. (2022). Customer-Country diversification and inventory efficiency: Comparative evidence from the manufacturing sector during the pre-pandemic and the COVID-19 pandemic periods. Journal of Business Research, 148, 292-303.

Ketokivi, M., & Mahoney, J. T. (2020). Transaction cost economics as a theory of supply chain efficiency. Production and Operations Management, 29(4), 1011-1031.

Koin, V.R., Cheruiyot, G.K., Mwangangi, P, (2014). Effect of Inventory Management of the Supply Chain Effectiveness in the Manufacturing Industry in Kenya: A Case Study of Tata Chemicals Magadi. International Journal of Social Sciences Management and Entrepreneurship, pp. 189-202.

Konstantaras .I., Skouri K, Lagodimos AG (2019) EOQ with independent endogenous supply disruptions. Omega 83:96–106. https://doi.org/10.1016/j.omega.2018.02.006

Kourentzes, N., Trapero, J. R., & Barrow, D. K. (2020). Optimising forecasting models for inventory planning. International Journal of Production Economics, 225, 107597.

Krejcie, R.V., & Morgan, D.W., (1970). Determining Sample Size for Research Activities. Educational and Psychological Measurement.

Kriksciuniene, D., Sakalauskas, V., & Lewandowski, R. (2019). Evaluating the interdependent effect for Likert scale items. In Business Information Systems Workshops: BIS 2019 International Workshops, Seville, Spain, June 26–28, 2019, Revised Papers 22 (pp. 26-38). Springer International Publishing.

Kristiana, D., & Karnasi, R. (2023). The Effect of Working Capital on Return on Assets and Return on Equity. Syntax Idea, 5(10), 1843-1847.

Kulim Technology Park corporation. (2023). Company profile. https://www.khtp.com.my/wp-content/uploads/2023/05/Company-Profile-March-Edition-2023.pdf

Lee Park, C., Fracarolli Nunes, M., & Paiva, E. L. (2021). (Mis) managing overstock in luxury: Burning inventory and brand trust to the ground. Journal of Consumer Behaviour, 20(6), 1664-1674.

Lestari, N. F., & Handayati, Y. (2022). Analysis of Inventory Management in Order to Reduce Overstock (Case Study of TVF Footwear). International Journal of Current Science Research and Review, 5(09)..

Lobe, B., Morgan, D., & Hoffman, K. A. (2020). Qualitative Data Collection in an Era of Social.

Lyu, Z., Lin, P., Guo, D., & Huang, G. Q. (2020). Towards zero-warehousing smart manufacturing from zero-inventory just-in-time production. Robotics and Computer-Integrated Manufacturing, 64, 101932.

M'hand, M. A., Boulmakoul, A., Badir, H., & Lbath, A. (2019). A scalable real-time tracking and monitoring architecture for logistics and transport in RoRo terminals. Procedia Computer Science, 151, 218-225.

Mawonde, D., Nyoni, J., Mabwe, P., & Kamvumbi, L. (2024). An assessment of the effect of inventory control systems on organisational performance in the mining sector in Zimbabwe. Cogent Business & Management, 11(1), 2298535.

Mbugi, I. O., & Lutego, D. (2022). Effects of inventory control management systems on organization performance in Tanzania manufacturing industry-A case study of food and beverage manufacturing company in Mwanza city. International Journal of Engineering, Business and Management, 6(2), 56-69.

Milovanovic, M., & Perisic, J. (2020). Advantages and limitations of using SPSS in teaching statistics. Mefkon 2020 INNOVATION AS AN INITIATOR OF THE DEVELOPMENT "INNOVATIONS IN THE FUNCTION OF DEVELOPMENT", 274.

Mondol, E. P. (2021). The impact of block chain and smart inventory system on supply chain performance at retail industry. International Journal of Computations, Information and Manufacturing (IJCIM), 1(1).

Muchaendepi, W., Mbohwa, C., & Kanyepe, J. (2019). Impact of Inventory Management Strategies on Financial Performance of SMEs in the Manufacturing Sector of Harare. Procedia Manufacturing, 33, 454-461.

Muchaendepi, W., Mbohwa, C., Hamandishe, T., & Kanyepe, J. (2019). Inventory management and performance of SMEs in the manufacturing sector of Harare. Procedia Manufacturing, 33, 454-461.

Munyaka, J. B., & Yadavalli, V. S. S. (2022). Inventory management concepts and implementations: a systematic review. South African Journal of Industrial Engineering, 33(2), 15-36.

Musana, E., Okello, W., & Basaza-Ejiri, A. H. (2020). Real time inventory tracking model in the distribution supply chain of Airtel airtime. International Journal of New Technology and Research, 6, 46-53.

Nakhaeinejad, M., Khademi Zare, H., Habibi, M., & Khodoomi, M. R. (2023). Improvement of multi-item order systems and inventory management models using optimal control theory. Transactions of the Institute of Measurement and Control, 45(1), 104-119. https://doi.org/10.1177/01423312221109724

Nemoto, T., & Beglar, D. (2014, November). Likert-scale questionnaires. In JALT 2013 conference proceedings (pp. 1-8).

Nemtajela, N., & Mbohwa, C. (2017). Relationship between inventory management and uncertain demand for fast moving consumer goods organisations. Procedia Manufacturing, 8, 699-706.

Ngugi, P. K., & Cherotich, Y. (2019). Influence of Inventory Management Practices on Performance of Fast-Moving Consumer Goods Manufacturers in Nairobi County, Kenya. International Journal of Social Sciences Management and Entrepreneurship, 3(2), 17-35.

Niaz, M. (2022). Revolutionizing Inventory Planning: Harnessing Digital Supply Data through Digitization to Optimize Storage Efficiency Pre-and Post-Pandemic. BULLET: Jurnal Multidisiplin Ilmu, 1(03).

Nugroho, T., Ardiansyah, M. N., & Muttaqin, P. S. (2023, February). Inventory policy design to minimize overstock and stockout of coal using periodic review power approximation method. In AIP Conference Proceedings (Vol. 2482, No. 1). AIP Publishing.

Obilor, E. I., & Amadi, E. C. (2018). Test for significance of Pearson's correlation coefficient. International Journal of Innovative Mathematics, Statistics & Energy Policies, 6(1), 11-23.

Odadi, G. O. (2012). Supply Chain Information Systems usage in inventory tracking among logistics service providers in Kenya (Doctoral dissertation, University of Nairobi,).

Ogah, M., Asiegbu, G., & Moradeyo, N. (2022). Effect of raw material inventory on operational performance in an emerging economy insight from the Nigerian manufacturing sector. International Journal on Recent Trends in Business and Tourism, 6(2), 31-43.

Oloo, A. O. (2023). Buffer Stock Practice and Supply Chain Leverage of Sugar Manufacturing Firms in Kenya. International Journal of Social Science and

Humanities Research (IJSSHR) ISSN 2959-7056 (o); 2959-7048 (p), 1(1), 169-170.

Ooi, C.W., Idrus, R., Abdullah, N.L. (2017). Extended ERP for Inventory Management: The Case of a Multi-National Manufacturing Company.

Opoku, R. K., Fiati, H. M., Kaku, G., Ankomah, J., & Agyemang, F. O. (2020). Inventory management practices and operational performance of manufacturing firms in Ghana. Advances in research, 21(10), 1-18.

Orcan, F. (2020). Parametric or non-parametric: Skewness to test normality for mean comparison. International Journal of Assessment Tools in Education, 7(2), 255-265.

Orobia, L. A., Nakibuuka, J., Bananuka, J., & Akisimire, R. (2020). Inventory management, managerial competence and financial performance of small businesses. Journal of Accounting in Emerging Economies, 10(3), 379-398.

Patel, M. T. S. D. S., & Diwedi, A. (2024). Inventory Management Technique in Manufacturing Industry.

Polit, D. F., Beck, C. T., & Owen, S. V. (2007). Focus on Research Methods Is the CVI an Acceptable Indicator of Content Validity? Appraisal and Recommendations. Researchin Nursing & Health, 30, 459–467.

Prak, D., & Teunter, R. (2019). A general method for addressing forecasting uncertainty in inventory models. International Journal of Forecasting, 35(1), 224-238.

Purwanto, A. (2020). The Covid-19 pandemic impact on industries performance: an explorative study of Indonesian companies. Journal of Critical Reviews.

Purwanto, A. (2021). Education research quantitative analysis for little respondents: comparing of Lisrel, Tetrad, GSCA, Amos, SmartPLS, WarpPLS, and SPSS. Jurnal Studi Guru Dan Pembelajaran, 4(2).

Radasanu, A. C. (2016). Inventory management, service level and safety stock. Journal of Public Administration, Finance and Law, (09), 145-153.

Radhakrishna, R. B. (2007). Tips for developing and testing questionnaires/instruments. The Journal of Extension, 45(1), 25.

Rahayu, M., & Ilham, R. N. (2023). The Influence Of Cash Turnover, Receivables Turnover And Inventory Turnover On The Economic Profitability Of Registered Pharmaceutical Companies On The Indonesian Stock Exchange Period 2017-2021. Journal of Accounting Research, Utility Finance and Digital Assets, 1(4), 336-341.

Rashid, A., & Rasheed, R. (2023). Mediation of Inventory Management in the Relationship Between Knowledge and Firm Performance. SAGE Open, 13(2), 21582440231164593. doi:10.1177/21582440231164593

Reddy, R. A., Sengupta, R., Jackson, B. M., & Lewis, C. (2023). Development of a new measure to check attitude towards water conservation☆. MethodsX, 10, 101992.

Rodríguez, V., & Obed, D. (2023). Small Business Lean Inventory Optimization. Manufacturing Engineering.

Rubinfeld, D. L. (2000). Reference guide on multiple regression. Reference manual on scientific evidence, 179, 425-469.

Saad, S. M., & Bahadori, R. (2019). Introducing a unique inventory control framework for centralized VMI and JIT production. IFAC-PapersOnLine, 52(13), 1045-1050

Sarkar, B., Guchhait, R., Sarkar, M., Pareek, S., & Kim, N. (2019). Impact of safety factors and setup time reduction in a two-echelon supply chain management. Robotics and computer-integrated manufacturing, 55, 250-258.

Schmidt C.G., & Wagner S.M. (2019). Blockchain and supply chain relations: a transaction cost theory perspective. J. Purch. Supply Manage. 2019 doi: 10.1016/j.pursup.2019.100552.

Schober, P., Boer, C., & Schwarte, L. A. (2018). Correlation coefficients: appropriate use and interpretation. Anesthesia & analgesia, 126(5), 1763-1768.

Schreuder, H. T., Gregoire, T. G., & Weyer, J. P. (2001). For what applications can probability and non-probability sampling be used?. Environmental Monitoring and Assessment, 66, 281-291.

Sedgwick, P. (2012). Pearson's correlation coefficient. Bmj, 345.

Selepe, R. L., & Makinde, O. A. (2024). Analysis of factors and solutions to poor supply chain quality in a manufacturing organisation. Journal of Transport and Supply Chain Management, 18, 989.

Seth, H., Chadha, S., Ruparel, N., Arora, P. K., & Sharma, S. K. (2020). Assessing working capital management efficiency of Indian manufacturing exporters. Managerial Finance, 46(8), 1061-1079.

Shabani, A., Maroti, G., de Leeuw, S., & Dullaert, W. (2021). Inventory record inaccuracy and store-level performance. International Journal of Production Economics, 235, 108111.

Sharma, A., & Arya, V. (2016). Study of inventory management in manufacturing industry. International Journal of Advanced Engineering and Global Technology, 4(03), 2012-2021.

Shi, J. (2022). Optimal continuous production-inventory systems subject to stockout risk. Annals of Operations Research, 317(2), 777-804.

Siddiqui, A. (2022). The Importance of Just in Time (JIT) Methodology and its Advantages in Health Care Quality Management Business–A Scoping Review. Biomedical Journal of Scientific & Technical Research, 42(1), 33317-33325.

Singh, T., Muduly, M. M., Asmita, N., Mallick, C., & Pattanayak, H. (2020). A note on an economic order quantity model with time-dependent demand, three-parameter Weibull distribution deterioration and permissible delay in payment. Journal of Statistics and Management Systems, 23(3), 643-662.

South, L., Saffo, D., Vitek, O., Dunne, C., & Borkin, M. A. (2022). Effective use of Likert scales in visualization evaluations: A systematic review. In Computer Graphics Forum (Vol. 41, No. 3, pp. 43-55).

Story, D., & Tait, A. (2019). Readers' toolbox (Survey Research). Anestheiosology, 130(2), 192–202.

Sumrit, D. (2020). Supplier selection for vendor-managed inventory in healthcare using fuzzy multi-criteria decision-making approach. Decision Science Letters, 9(2), 233-256.

Sunday, O., & Joseph, E. E. (2017). Inventory management and SMEs profitability. A study of furniture manufacturing, wholesale and eatery industry in Delta State, Nigeria. Journal of Finance and Accounting, 5(3), 75-79.

Tadayonrad, Y., & Balle Ndiaye, A. (2023). A new key performance indicator model for demand forecasting in inventory management considering supply chain reliability and seasonality, Supply Chain Analytics, 3 (100026), 1-15.

Taherdoost, H. (2021). Data Collection Methods and Tools for Research; A Step-by-Step Guide to Choose Data Collection Technique for Academic and Business Research Projects. International Journal of Academic Research in Management (IJARM), 10(1), 10-38.

Thomas Y. C., Torbjørn H. N., Nada S., ManMohan S. S., & Stephan M. Wagner (2023). Just-in-time for supply chains in turbulent times.

Thomas, D. B., Oenning, N. S. X., & Goulart, B. N. G. de. (2018). Essential aspects in the design of data collection instruments in primary health research. Revista CEFAC, 20(5), 657–664. https://doi.org/10.1590/1982-021620182053218

TSANG, K. K. (2012). The use of midpoint on Likert Scale: The implications for educational research.

Tyagi, K., Rane, C., & Manry, M. (2022). Regression analysis. In Artificial intelligence and machine learning for EDGE computing (pp. 53-63). Academic Press.

Ubabudu, M. C., Ozoemena, P. C., & Anam, B. E. (2024). Effectiveness of Inventory Management on the Profitability of Manufacturing Sectors in Nigeria Bottling Company, Kaduna. European Journal of Business and Innovation Research, 12(1), 1-14.

Valaei, N., Rezaei, S., Bressolles, G., & Dent, M. M. (2022). Indispensable components of creativity, innovation, and FMCG companies' competitive performance: a resource-based view (RBV) of the firm. Asia-Pacific Journal of Business Administration, 14(1), 1-26.

Van den Bogaert, J., & Van Jaarsveld, W. (2022). Vendor-managed inventory in practice: understanding and mitigating the impact of supplier heterogeneity. International journal of production research, 60(20), 6087-6103.

Vargas, C. V., Cerna, C. S., & Perez, A. F. (2023). Proposal to Improve Storage Management to Reduce Stock-Outs Through the Use of the Reorder Point, Safety Stock and 5S in the Plastic Sector.

Wadood, F., Akbar, F., & Ullah, I. (2021). The importance and essential steps of pilot testing in management studies: A quantitative survey results. Journal of Contemporary Issues in Business and Government Vol, 27(5).

Wang, M., Altaf, M. S., Al-Hussein, M., & Ma, Y. (2020). Framework for an IoT-based shop floor material management system for panelized homebuilding. International journal of construction management, 20(2), 130-145..

Wanziga, A. (2019). Inventory management techniques and organization performance; a case study of nice house of plastics.

Wettasinghe, J., & Luong, H. T. (2020). A vendor managed inventory policy with emergency orders. Journal of Industrial and Production Engineering, 37(2-3), 120-133.

Zhang, D., & Zheng, W. (2022). Does COVID-19 make the firms' performance worse? Evidence from the Chinese listed companies. Economic Analysis and Policy, 74, 560-570.

Zhao, R. (2019). A review on theoretical development of vendor-managed inventory in supply chain. American Journal of Industrial and Business Management, 9(4), 999-1010.

Zhao, X., Si, D., Zhu, W., Xie, J., & Shen, Z. J. (2019). Behaviors and performance improvement in a vendor-managed inventory program: An experimental study. Production and Operations Management, 28(7), 1818-1836.

Zhu, G., Chou, M. C., & Tsai, C. W. (2020). Lessons learned from the COVID-19 pandemic exposing the shortcomings of current supply chain operations: A long-term prescriptive offering. Sustainability, 12(14), 5858.

Appendix 1: Questionnaire

A Study regarding Inventory Management Practices and Its Impact on Performance among Manufacturing Industry setting in Kulim Industrial Park.

Dear Respondent,

I am currently pursuing a Master of Science in Logistics and Transportation Management and would greatly appreciate your participation in this survey. Your responses are crucial for the success of this research. The questionnaire will take approximately 30 minutes to complete. All responses will be kept strictly confidential and will be used exclusively for academic purposes. Should you have any questions regarding this study, please feel free to contact me using the details provided below. Thank you for your cooperation and the time you dedicate to completing this survey.

Komathi Balakisnan

School of Technology Management and Logistics (UUM)

Email: mathi_0609@yahoo.com

Section 1: Demographic Information

Please provide the following demographic information. Your responses will help us understand the diversity of our participants and analyze the data accurately.

1. Gender

- ⬭ Male
- ⬭ Female

2. Education Level

- ⬭ High school or equivalent
- ⬭ Diploma
- ⬭ Bachelor's degree
- ⬭ Master's degree
- ⬭ Doctorate degree

3. Race/Ethnicity

- ⬭ Malay
- ⬭ Chinese
- ⬭ Indian
- ⬭ Other:_____(please state)

4. Position Level

- ⬭ Entry-level
- ⬭ Mid-level
- ⬭ Senior-level
- ⬭ Executive
- ⬭ Manager

5. Working Experience

- ⬭ Less than 1 year
- ⬭ 1-5 years
- ⬭ 6-10 years
- ⬭ 11-20 years
- ⬭ More than 20 years

6. Industry Sector

- ⬭ Electronics Manufacturing
- ⬭ Food and Beverage
- ⬭ Glass Manufacturing
- ⬭ Healthcare
- ⬭ Metal Manufacturing
- ⬭ Plastics Product Manufacturing
- ⬭ Semiconductor Manufacturing
- ⬭ Solar Panel Manufacturing

7. Industrial Phase

- ⬭ Industrial Phase 1
- ⬭ Industrial Phase 2
- ⬭ Industrial Phase 3
- ⬭ Industrial Phase 4

Section 2: Inventory Practices and its impact on inventory management performance

8. Please choose the main inventory practice your company use

- ⬭ Real-time inventory tracking
- ⬭ Just-In-Time (JIT)
- ⬭ Vendor-Managed Inventory (VMI)
- ⬭ Safety Stock

Please indicate your level of agreement with the following statements related to inventory practices used in your company. Use the scale where 1 = Strongly Disagree, 2 =Disagree, 3 = Slightly Disagree, 4 = Slightly Agree, 5=Agree and 6=Strongly Agree

Real-time Inventory Tracking

9. Real-time inventory tracking prevents inventory loss.

1	**2**	**3**	**4**	**5**	**6**
⬭	⬭	⬭	⬭	⬭	⬭

10. Real-time inventory tracking prevents inventory misplacement.

1	**2**	**3**	**4**	**5**	**6**
⬭	⬭	⬭	⬭	⬭	⬭

11. Real-time inventory tracking provides better stock control.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

12. Real-time inventory tacking using RFID reduces human errors.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

13. Real-time inventory tracking reduce time spent for tracking material.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

14. With real- time tracking, staff can quickly verify inventory levels without manual count.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

15. Implementing RFID technology for real-time inventory tracking can be costly.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

16. Real-time inventory tracking improves inventory accuracy levels in manufacturing processes.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

Just-In-Time (JIT)

17. JIT ensures material are produced and delivered when needed.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

18. JIT ensures we have the right level of inventory.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

19. JIT avoiding excess stock.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

20. JIT effectively reduces space requirements for inventory storage.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

21. JIT system has effectively minimized inventory holding cost.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

22. JIT practice can lead to inventory shortages during sudden demand increase.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

23. JIT depends on timely material delivery from suppliers to ensure smooth production.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

Vendor-Managed Inventory (VMI)

24. VMI reduces manufacturing expenses by lowering inventory holding cost.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

25. VMI decreases material handling cost by transferring inventory management to suppliers.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

26. VMI reduce storage fees by storing materials at supplier's location.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

27. VMI minimize administrative cost by assigning administrative tasks to suppliers.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

28. VMI shift inventory control to suppliers.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

29. VMI reduce buyer decision-making in inventory management.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

30. VMI cause data sharing challenges between buyers and suppliers.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

31. VMI cause communication challenges between buyers and suppliers.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

Safety Stock Management

32. Keeping safety stock prevent inventory shortage.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

33. Safety stock maintains order fulfillment during unexpected demand fluctuations.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

34. Safety stock maintains customer satisfaction by prevent inventory shortage.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

35. Safety stock ensure that manufacturing can operate at full capacity without interruption.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

36. To mitigate supply business interruption, our company relies on its internal safety stock.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

37. To mitigate supply business interruption, our company relies on supplier's safety stock.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

38. Safety stock helps manufacturers quickly adjust to changes in market demand.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

Impact of Inventory Management Practices

39. Inventory management practices help to improve our company's financial performance.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

40. Effective inventory management practice help to prevent excess inventory.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

41. Effective inventory management practice help to prevent inventory shortage.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

42. Inventory management practices lead to faster order fulfillment.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

43. Continues inventory level monitoring are crucial for effective inventory management.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

44. Using software for inventory management positively impacts inventory accuracy.

1	2	3	4	5	6
⬭	⬭	⬭	⬭	⬭	⬭

-End of Questions-
Thank you for your time and cooperation in completing this questionnaire.