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**ENHANCING WAREHOUSE EFFICIENCY THROUGH EFFECTIVE  
INVENTORY MANAGEMENT PRACTICES IN PAKISTAN**



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## ABSTRACT

In light of a noticeable gap in existing research that specifically addresses the combined impact of Just-in-Time inventory management, Supplier Partnership Management, and Information Technology on warehouse efficiency in Pakistan, this study aims to fill this void by conducting a comprehensive investigation. The primary focus is to understand how the integration of these three critical factors influences warehouse operations in the Pakistani context. The research collected data from 136 supply chain participants across diverse industries, including healthcare, retail, and manufacturing, through a structured questionnaire. Rigorous analytical methodologies, including statistical tests such as correlation and regression analysis using SPSS Software, were employed to evaluate hypotheses and determine the significance of these variables on warehouse efficiency. Results from the study unequivocally demonstrate that effective inventory management practices, encompassing Just-in-Time tactics, supplier partnership management, and modern information technology, significantly enhance warehouse efficiency in specific sectors of Pakistan. While the findings provide valuable insights, the study also underscores the importance of future research endeavors to broaden the temporal scope, diversify sector emphasis, and explore potential mediating variables such as the Inventory Management System. This thesis not only contributes to academic discourse but also equips professionals with actionable ideas to optimize warehouse operations amidst the evolving economic landscape of Pakistan.

**Key Words:** *Inventory Management Practices, Just-in-Time (JIT), Supplier Partnership Management (SPM), Information Technology (IT), Warehouse Efficiency.*

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# Chapter 1

## INTRODUCTION

### 1. Background

#### 1.1 Warehouse Efficiency

In the contemporary and rapidly evolving commercial landscape, warehouses serve a purpose beyond being mere large structures for corporations to store their merchandise. Consider them as pivotal centres that facilitate the efficient management, storage, and distribution of goods for firms (Perkumienė et al., 2022). In light of rapid technological advancements and altering consumer purchasing patterns, warehouses have evolved into indispensable facilities that serve purposes beyond the storage of goods. Envision possessing an immense warehouse. Now, the focus is not solely on the act of placing boxes one on top of another; it entails effectively overseeing the boxes, meticulously monitoring the inflow and outflow, ensuring timely order fulfilment, and accurately dispatching items to their designated destinations. This is the standard practice of contemporary warehouses. In countries such as Pakistan, where the business environment is still evolving, these warehouses play a vital role (Jaehrling, 2018). They assist firms in adapting to these changes, maintaining competitiveness, and enhancing customer service.

It is important to emphasise that a strategically located and efficiently operated warehouse benefits not only the business that utilises it. It provides advantages to the entire supply chain. Efficient management of a warehouse facilitates expedited delivery of products to clients, minimises wastage, and results in cost savings for enterprises. The notion is supported by a study conducted by Ardito et al. (2019), highlighting the indirect benefits of efficient warehouse management on areas such as marketing, by assuring timely availability of products. Operating a warehouse in a country such as Pakistan might be challenging. There exist numerous obstacles. Occasionally, alterations to the laws and legislation can complicate operations. In certain instances, the infrastructure may be less developed compared to other locations, hence posing difficulties in terms of storage and transportation. Furthermore, given the frequent fluctuations in people's requirements and desires, businesses require highly efficient warehouses to effectively adapt. Ensuring the efficient functioning of warehouses in Pakistan is not just advisable, but rather imperative for businesses to thrive in this particular setting.

## **1.2 The Importance of Inventory Management Practices**

According to Sawik (2020), inventory management is an essential component of conducting business operations. It serves as the pillar that ensures seamless transitions from the purchase phase to the distribution phase. To get to the heart of the matter, it is about striking the appropriate balance: having sufficient stock to satisfy the requirements of the customers without overstocking and holding up cash in an unnecessary manner. To achieve this equilibrium, strategic planning, intelligent decision-making, and the use of relevant technologies are all necessary components. It is necessary for organisations to have a solid understanding of the difficulties involved in inventory management in order to maintain their competitiveness and profitability. Not only does this entail identifying the ideal stock levels, but it also requires taking into consideration a variety of aspects, including changes in demand, the dependability of suppliers, and lead times. Further investigation into this study reveals that there are three key aspects of inventory management that are highlighted by this research. Each of these dimensions plays a significant part in determining how firms handle their inventory, how they keep expenses under control, and how they provide value to their customers.

### **1.2.1 Just-in-Time (JIT)**

A strategically important inventory management technique known as Just-In-Time (JIT) places an emphasis on the manufacturing of items or the acquisition of materials at the precise moment when they are required in the manufacturing process or in accordance with the expectations of the customer. The Just-In-Time (JIT) methodology, which has its origins in the Japanese manufacturing philosophy, is designed to minimise the expenses associated with retaining inventory, decrease waste, and improve operational efficiency by synchronising the manufacturing procedures with real-time demand. (Sugimori et al., 1977) as well as (Madanhire & Mbohwa, 2016) Just-In-Time (JIT) inventory management places an emphasis on the detection of excess stocks that are not immediately required. This is accomplished by monitoring inventory levels throughout the production process.

Because of its capability to streamline operations, enhance the quality of products, and increase profitability, just-in-time (JIT) has gained widespread recognition in the context of the global economy. On the other hand, when JIT is applied to certain regions or countries like Pakistan, the execution and impact of JIT may differ due to the fact that different socio-economic, cultural, and infrastructure elements are at play. Pakistan, which has a rapidly expanding industrial sector, is confronted with issues that are associated with inefficiencies in



its supply chain, variable market needs, and fluctuating pricing of raw materials. Within the context of such a scenario, Just-in-Time (JIT) can function as a strategic instrument to optimise inventory levels, minimise carrying costs, and react quickly to changes in market dynamics. Companies are able to reduce the danger of storing an excessive amount of inventory by ensuring that commodities are acquired or manufactured just in time. This allows the companies to free up cash for use in other productive endeavours.

### **1.2.2 Supplier Partnership Management**

In the complex environment of modern-day global business, the relationship that exists between a firm and its suppliers has emerged as a crucial factor in determining the level of success that the firm achieves. According to (Siagian, et al. 2020), the ultimate essence resides in the creation of long-lasting and creative collaborations, which goes beyond basic transactions altogether. One of the most important aspects of Supplier Partnership Management is the establishment of partnerships that are founded on open communication, common objectives, and mutual trust. The establishment of such core collaborations paves the path for a multitude of operational benefits. As we delve deeper, we find that when companies make the cultivation of these genuine connections a priority, they invariably streamline their operations. The results of this simplification can be seen in a variety of ways, including improved punctuality of deliveries and increased efficiency throughout the supply chain. Additionally, the ripple effects of such relationships can be seen across financial means, with the potential for significant cost efficiencies and savings. This is because of the opportunity for collaboration.

When we take a closer look at the particular business environment in Pakistan, we observe an environment that is completely saturated with unique difficulties. These challenges include a wide range of regulatory variables, complexities throughout the supply chain, and a market landscape that is constantly shifting. Taking all of this into consideration, it is of the utmost need for companies operating in Pakistan to cultivate robust partnerships with their respective suppliers. Companies operating in this environment are aware that maintaining a positive working relationship with their suppliers is not merely advantageous; it is absolutely necessary. By placing their full attention on these partnerships and working to expand them, firms in Pakistan will be able to deal with obstacles, seize new opportunities, and maintain consistent growth in an environment that is always evolving.

### **1.2.3 Information Technology**

Over the past few years, Pakistan, along with a great number of other countries, has watched the significant influence that the digital revolution has had on the landscape of its corporate environment. The emergence of information technology (IT) as a vital tool for companies to achieve superior operational performance is at the heart of this change (Sanders et al., 2021). As Pakistan navigates its ever-changing economic and technical landscape, information technology stands out as a crucial enabler, transforming old commercial procedures and strategies. In Pakistan, businesses have gained access to a spectrum of tools which provide capabilities that were previously thought to be unbearable. This access was made possible by the incorporation of advanced information technology solutions and platforms. One of the most important developments is the accessibility of real-time analytics, which gives firms instant insights into the levels of inventory, the behaviours of customers, and trends in the marketplace. Access to such realtime data enables businesses to make well-informed decisions in a timely manner, allowing them to modify their strategy in response to shifting market conditions.

Furthermore, it is possible for organisations to forecast future demands, optimise inventory levels, and manage potential hazards by utilising predictive insights that are produced from sophisticated information technology systems. In addition, the capabilities of automation that current information technology solutions provide have completely transformed the inventory management methods that are utilised inside Pakistan's commercial environment. Businesses are able to more effectively manage resources, minimise the number of errors that are caused by manual labour, and increase overall production when they automate repetitive processes. This automation is not limited to inventory management; rather, it affects many different aspects of business operations, ranging from the administration of customer relationships to the many processes involved in procurement. In addition, the use of information technology becomes of the utmost importance in the environment of Pakistan, where companies frequently face issues such as changing demands from the marketplace, disruptions in supply chain operations, and the complexity of regulatory requirements. When firms adopt strategies that are driven by information technology, they are able to handle these issues more successfully, which ensures agility, resilience, and continuous growth in a market that is notoriously competitive.

The purpose of this study is to gain an understanding of the ways in which particular inventory management strategies influence the efficiency of warehouses in Pakistan's dynamic market. As a result of this, it provides essential recommendations for companies who are striving to achieve excellence in their operations. In order to facilitate a more comprehensive comprehension of the dynamics of the supply chain in Pakistan, the study will investigate the complex link that exists among inventory management and the efficiency of warehouse operations. For the purpose of optimising warehouse operations and improving the overall efficiency of the supply chain, it is essential to have a solid understanding of these complications.

### **1.3 Research Gap**

Acknowledging the significance of efficient inventory management for warehouse operations, this research identifies a conspicuous research gap regarding the specific dynamics of Just-In-Time (JIT), Supplier Partnership Management (SPM), and Information Technology (IT) within the context of Pakistan. While previous studies have individually examined each of these components, there is a distinct lack of comprehensive research that investigates the interplay among them and their collective impact on warehouses in Pakistan. The foundation for this research gap is drawn from the study conducted by (Gitau et al., 2016) titled "The Effect of Inventory Management Practices on the Operational Performance of Warehouse Firms in Mombasa County." Gitau's work has shed light on the need for a holistic exploration of how these techniques influence the efficiency of enterprises in Pakistan in managing their warehouses. Moreover, the existing gap in literature is not solely limited to the absence of comprehensive studies on JIT, SPM, and IT integration but extends to the dearth of research addressing the unique cultural, legislative, and operational challenges confronted by businesses in Pakistan. This emphasizes the necessity for a more concentrated research effort to delve into these distinctive elements and comprehend their impact on the implementation and outcomes of inventory management methods. By addressing this research gap, the study aspires to contribute significantly to a better understanding of the nuanced significance of warehouse efficiency within the specific context of Pakistan.

## **1.4 Problem Statement**

In the dynamic landscape of Pakistan's market, ensuring warehouse efficiency is imperative for sustainable business operations. While the significance of effective inventory management, encompassing Just-In-Time (JIT), Supplier Partnership Management, and Information Technology (IT), is widely acknowledged globally, a research gap persists regarding their collective influence within the specific cultural and operational context of Pakistan. This research gap is illuminated by (Gitau et al., 2016), titled "The Effect of Inventory Management Practices on the Operational Performance of Warehouse Firms in Mombasa County," emphasizing the need for a comprehensive exploration of how JIT, Supplier Partnership Management, and IT collectively impact warehouse efficiency. This study seeks to address the identified deficiency by systematically examining the correlations among JIT, SPM, and IT concerning warehouse efficiency in Pakistan. The primary objective is to identify specific factors influencing the operational performance of warehouses.

## **1.5 Research Questions**

1. What is the impact of implementing Just-In-Time (JIT) inventory management on warehouse efficiency in Pakistani warehouses?
2. How does supplier partnership management affect warehouse efficiency in Pakistan?
3. What is the impact of information technology on improving warehouse efficiency within the distinct operational context of warehouses in Pakistan?

## **1.6 Research Objectives**

1. To determine the effect that Just-In-Time (JIT) inventory management has on the warehouse efficiency within Pakistan.
2. To analyse the extent supplier partnership management affects warehouse efficiency in Pakistan.
3. To determine the manner in which information technology impacts warehouse efficiency in Pakistani warehouses.

## **1.7 Significance of Study**

This study significantly contributes to both academic and corporate communities in Pakistan by addressing a substantial gap in existing knowledge. The findings offer strategic recommendations to enhance warehouse operations, empowering businesses with informed decisions related to just-in-time, information technology, and supplier partnership management. This leads to increased productivity, reduced operational costs, and a competitive edge in Pakistan's rapidly changing market conditions. In Pakistan's dynamic business environment marked by swift consumer shifts and intense rivalry, achieving operational excellence is crucial. The study's insights into customized inventory management strategies tailored to Pakistan's context can aid companies in maintaining superior operational performance.

Additionally, the research aims to make a substantial contribution to academic literature on supply chain management, specifically addressing cultural, regulatory, and operational challenges in the Pakistani context. By investigating the intricate relationships among inventory management practices and warehouse efficiency, the study fills a significant gap in existing literature. It provides a comprehensive understanding of the interdependencies between just-in-time, supplier partnerships, and information technology. The practical implications derived from the study aim to facilitate more efficient decision-making for decision-makers and inventory managers in Pakistani businesses, particularly in implementing JIT strategies, developing supplier partnerships, and utilizing information technology to enhance warehouse efficiency.

## Chapter 2

### LITERATURE REVIEW

#### 2.1 Warehouse Efficiency

(Richards, 2011) asserts that warehouses are an essential component of the modern supply chain of today. The present trend implies that there will be an increase in fluctuations in the market, an expansion in the variety of products, and an overall decrease in lead times, all of which will have a substantial impact on the functions that warehouses do. There are many different activities that take place within warehouses, and each of these activities requires a unique set of facilities, workers, and equipment. This is done with the intention of improving efficiency and ensuring a secure place to work. (Rushton, 2010) highlights the fact that warehouse operations frequently account for a significant amount of the total expenditures associated with the supply chain management. The managers of warehouses are under a lot of pressure to improve customer service while simultaneously lowering expenses and inventory levels, increasing efficiency and accuracy, and reducing costs. It was (Richards, 2011). It is essential to have efficient warehouse management in order to achieve optimum standards of services and cost-effectiveness, which in turn contributes to improved inventory management efficiency. The nature of warehouses is diverse, and they are categorized according to the sort of product they store, the stage they are in the supply chain, the geographical location, and the purpose they perform.

According to (Jermittiparsert et al. 2019), efficient warehouse processes require extensive strategic planning and management. This includes the management of inbound flow, the allocation of inventory to locations, the processing of products, the allocation of orders to stocks, the batching and releasing of orders, the selection of orders, the packing of orders, value-added logistics, and freight. Within the context of this operational landscape, several kinds of warehouses serve a variety of various functions. A manufacturing warehouse is a facility that preserves raw materials, semi-finished products, and finished goods inside production facilities. On the other hand, a contract warehouse functions as a point of distribution for a number of clients. According to (Jermittiparsert et al. 2019), the efficiency of the warehouse is an important factor that is measured using a variety of metrics. It is possible to evaluate the success of material handling activities by using these indicators, which are classified as processes and stocking efficiencies. This evaluation is carried out regardless of whether the operations include manual labor, automated processes, or a combination of the

two. In accordance with (Karim et al. 2021), warehouse efficiency is a mixture of measures that primarily concentrate on quantifying the capacity of the warehouse storage space. (Jermisittiparsert et al. 2019; Kithinji, 2015) have provided essential measures that can be utilized to evaluate the effectiveness of warehouse efficiency. It is important to note that these measures can. The capacity to follow the movement of stock units, the simplicity of stocktaking procedures, the optimization of the use of readily available space in warehouses, the improvement of data preciseness in inventories, the mitigation of inventory theft, and the enhancement of cycle counting are all included in these measures.

(Emmett, 2011) offers a classification that encompasses procedures such as products receiving, in which a store manager is required to describe the specifications of the packing, the number of things that are contained within each carton, and any mandatory labelling requirements. Putting items away in the storage area, selecting orders, picking or packing them, and sending out goods are some of the other tasks that are performed. According to (Emmett, 2011), these classifications are completely necessary in order to achieve operational efficiency in the warehouse. According to (Emmett, 2005), the operational environment of warehousing is shaped by a sequence of core actions. These activities include receiving, putting away, picking, and dispatching. In addition, (Richards, 2011) suggests that warehouses may be able to provide supplemental tasks such as pre-receipt, restocking, and value-added services, depending on the specific layouts and process designs of the warehouses. As (Quader & Castillo-Villar, 2018) point out, the picking process is an extremely resource-intensive operation, consuming a significant amount of the total operating costs, which can range anywhere from fifty percent to seventy-five percent. This highlights the crucial role that the picking process plays.

The work by (Bentz, 2017) brings light on the complexities of overall picking process by indicating that the time spent travelling to the site of the product accounts for roughly half of the overall time spent picking. The following types of storage equipment are utilized in warehouses: block stacking, double-deep racking, adjustable pallet racking, narrow aisle racking, drive-in racking, and push-back racking, as explained by (Richards, 2011). These types of storage equipment are developed to meet the specific operational requirements of the warehouse. When it comes to the management of materials in accordance with the FIFO (first-in, first-out) principle, the existing layout of the warehouse has both a single selective rack and a drive-in rack. The latter is experiencing difficulties in this regard. In response to this issue, (Bartholdi et al. 2014) investigate flow racking as a potential solution. They highlight the fact

that flow racking has the ability to overcome FIFO concerns, despite the fact that it has a restricted storage level due to weight constraints. According to (Richards, 2011), the ideal plan for a warehouse is one that maximizes the use of space while simultaneously minimizing the amount of time spent travelling and the number of touchpoints that occur during operations. To do this, it is vital to incorporate all operational areas into the design phase, with each region being given the appropriate amount of space.

When tackling shorter periods of intense demand as well as high peak-to-average inventory ratios, (Frazelle, 2002) provides an additional crucial viewpoint on warehouse design. He suggests that the dimensions of the warehouse should closely coincide with the average inventory level. This is especially recommended when dealing with the situation described above. These findings, when taken together, contribute to a full understanding of warehouse operations, which in turn guides the development of an effective and efficient warehouse design for enhanced efficiency. Warehouse operations are an essential component of supply chain management (SCM), serving as an essential link that guarantees customers receive the appropriate goods at the appropriate time and at the appropriate price (Faber et al., 2013). Warehouse operations serve a critical function with regard to SCM. The relevance of warehouse operations has increased as a result of the changing environment, which is characterized by reduced lead times, dynamic fluctuations in client demand, and a larger product range. Warehouses are currently confronted with the issue of properly picking and assembling a wide variety of customer orders while also efficiently keeping a variety of items (Rouwenhorst et al., 2000; Baker and Canessa, 2009; Hubner et al., 2016). The high construction and operating expenses that are connected with warehouse operations are a significant contributor to the notion that warehouse operations are considered a burden (Bartholdi and Hackman, 2010). Due to this attitude, warehouse operations have become increasingly important.

(De Koster et al., 2007; Baker & Canessa, 2009), underline the fact that warehouse operations account for approximately one quarter of the entire logistics cost within the supply chain. This is in recognition of the significant impact that warehouse operations have on overall logistics costs. As a consequence of this, businesses are constantly encouraged to reduce expenses and improve the efficiency of their warehouse operations. While simultaneously addressing difficulties that could contribute to delayed or inaccurate deliveries, strategies include reducing inventory levels and improving stock turnover (De Koster et al., 2007). The goal of these strategies is to improve customer service levels (Huertas et al., 2007). As a result



of the introduction of new information technology, warehouse operations have undergone a metamorphosis that has made them more efficient. Warehouses have been given the ability to store and track information as a result of the installation of ERP systems (enterprise resource planning) along with warehouse management systems (WMS), which has made it possible for warehouses to handle and coordinate operations in a timelier and resource-efficient manner (Faber et al., 2002). Warehouses play an important role as intermediaries in the supply chains, which has an effect on both the costs and the services that are provided (Faber et al., 2013). The maintenance of warehouses serves a variety of purposes, including the alignment of supply with customer demand, the consolidation of products to reduce transportation costs, the efficient management of distribution processes, and the facilitation of the postponement of product differentiation through the configuration of generic goods nearer to the the client (Bartholdi and Hackman, 2010; Faber et al., 2013).

Several academics have produced frameworks with the intention of improving the planning aspects of warehouse efficiency. (Gu et al. 2007) presented a single classification framework that was developed with the intention of addressing a variety of difficulties that are associated with the efficiency of warehouses. This model not only provides an overview of the historical development of the research of these concerns, but it also places an emphasis on the interconnection that exists between the many challenges. In their research, (Gu et al. 2007) investigated the development of difficulties related to warehouse efficiency. They illustrated historical progress and key findings within the framework that was proposed. On behalf of this basis, (Custodio & Machado, 2020) investigated automated warehouse procedures within a conceptual framework that was comparable to the one described above. Significant changes have occurred in the warehousing business as a result of the proliferation of e-commerce, mass customization, omnichannel distribution of goods, and the just-in-time methodology. For this reason, warehouses have progressively turned to automation in order to keep up with the tremendous progress that has taken place.

An innovative structure for a flexible digital warehouse was proposed by (Custodio & Machado, 2020) with the intention of addressing the issues that are posed by the changing landscape of the industry. Within the context of an automated warehouse, this framework is centered around the integration of many aspects to achieve flexibility. These factors include the utilization of automated instruments, data-gathering techniques, and management alternatives. The framework that has been developed incorporates a variety of activities that are related with satisfying the requirements of customers. These activities include choosing or filling of orders

(batches) and the collection of various items from storage in preparation for shipment. The implementation of these all-encompassing solutions individually and jointly contributes to the overall efficiency improvement of warehouse operations.

Significant research has been conducted by a large number of academics in the field of warehouse and inventory management, which has resulted in the contribution of unique insights that have helped to improve operational efficiency. For example, (Altarazi et al. 2010) developed a decision-making tool that is based on simulation and makes use of Arena software to evaluate warehouse models. The incorporation of essential elements into the model, such as dimensions, rack placements, and rack dimensions, makes it possible for this tool to support the best assessment of labor requirements and the efficient utilization of warehouse space. (Janssens et al., 2011) conducted a separate investigation in which they developed a linear programming (LP) framework for inventory management along with cost analysis. This model provides a methodical approach to decision-making. As an additional point of interest, (Lerher et al., 2013) investigated the field of multiple goal optimization for warehouses. They utilized a genetic algorithm in order to discover Pareto optimal solutions. Their mathematical model, which is based on goals such as minimizing travel time, reducing expenses, and maximizing warehouse quality, is a tribute to the many different aspects that are involved in warehouse management. Within the garment sector in India, (Shetty et al. 2016) focused their attention on finding ways to maximize the utilization of storage racks in terms of space. Through the utilization of an LP model that takes into account box dimensions, product quantities, and manufacturing values, the authors were able to proficiently optimize the number of racks that were utilized. Additionally, they created an optimized solution by utilizing ABC analysis in order to consecutively distribute resources.

(Hanafi et al. 2017) made a significant contribution by developing a novel stochastic Multiple Criteria Decision Analysis (MCDA) model. This model was used to determine the sites of emergency warehouses in China in the event of natural catastrophes. The Elimination and Choice Expressing Reality (ELECTRE)-II methods were incorporated into their approach in order to ensure the most effective selection of emergency warehouses. These methods took into account a variety of factors, including congestion, stock-holding capacities, ecological suitability for preserving supplies for relief, separation to disaster-prone areas, and financial considerations. (Kordos et al. 2020) presented the practical use of genetic algorithms to enhance discontinuous placement of goods and optimize order-picking routes inside a warehouse environment. This was done in an effort to further warehouse optimization

approaches aimed at improving the efficiency of warehouse operations. Their approach provides a comprehensive definition of the costs that are connected with each product placement. These costs are expressed as the total lengths of the order-picking routes that have been optimized. Kordos and his colleagues offered a nuanced strategy for improving the operational efficiency of the warehouse by concentrating on the optimal synchronization of the processes of placing products and order-picking.

In a separate but related endeavor, (Islam et al., 2021) developed a comprehensive prediction framework for ready-made garments warehouses by utilizing a grey model that was based on particle swarm optimization. A full examination of Key Performance Indicators (KPIs) that included cost, time, productivity, and quality was incorporated into this forward-thinking strategy. The authors were able to utilize grey-based models, which allowed them to not only anticipate but also proactively optimize the performance of the warehouse. There is reason to believe that this forward-looking methodology has the potential to improve decision-making and strategy formulation within the ever-changing context of warehouse management. The findings of this research collectively shed light on the ever-changing environment of warehouse optimization. Genetic algorithms and models of prediction are becoming increasingly important tools for fine-tuning specific parts of warehouse operations. When it comes to the quest of sustainable excellence in warehouse performance, the incorporation of modern optimization techniques not only contributes to increased efficiency in operations but also to the improvement of decision-making that is guided by relevant information. Individually and collectively, these methodological innovations and analytical techniques highlight the utmost significance of warehouse efficiency. Not only do they provide a contribution to the enhancement of operational performance, but they also reveal opportunities for substantial cost savings in the management of warehouses and inventory.

## **2.2 Inventory Management Practices**

It is essential to have an inventory management method that is efficient as well as effective in order to maximize the performance of a company by ensuring that materials and supplies are utilized in a prudent manner. Furthermore, it involves the supervision of the storage spaces, supplies, and accessibility of things, with the objective of ensuring that there is sufficient supply without an excessive surplus (Ogbo, 2014). It is possible to ensure that resources are available at the proper time and location by ensuring that appropriate volumes and varieties of stocks are continually maintained. The goal of every inventory policy, as

emphasized by (Brigham et al., 2005), is to maintain consistent quantities of high-quality commodities in order to satisfy the requirements of the customers while simultaneously reducing the expenses associated with carrying inventory. On the basis of Hedrick et al. (2008), the appropriate management of stock is of the utmost importance for optimizing earnings. This is especially true for small enterprises, which may not be able to resist the financial setbacks that are the result of bad inventory management procedures.

In light of the fact that the cement business in Kenya is of significant economic importance, (Edwin et al., 2015) conducted an investigation with the purpose of determining the effect that inventory management has on the profitability of the industry. The turnover of inventories, inventory conversions period, levels of inventory, storage expenses, company size, overall profit margin, return on assets, and company expansion were some of the variables that were taken into consideration in the study. The findings suggested that there was a negative correlation between profitability and inventory turnover, the amount of time it took to convert inventory, and expenditures on storage. According to the findings of Anichebe et al. (2013), even businesses that appeared to adhere to the principles of proper inventory management occasionally experienced inventory inadequacy difficulties. These issues had a detrimental impact on the manufacturing operations of the companies and led to inadequate product supplies. The consequent result of this scarcity was to have a negative impact on their overall efficacy and profitability. According to the findings of the study, there is a considerable connection between efficient inventory management and the efficiency of firm operations. In a similar vein, Koin et al. (2014) highlighted the significance of inventory management in relation to the performance of the company. According to the findings of their investigation, the factors that greatly influenced the efficiency of the supply chain in the manufacturing sector were the inventory management technique and the connections with the suppliers.

On the other hand, order management as well as warehouse management have a moderate impact on the efficiency of the supply chain. Previous studies on the connection between Inventory Management Practices (IMPs) and organizational performance have pointed to a considerable and varied connection (Deloof, 2003; Koumanakos, 2008; Shah and Shin, 2007; Jonsson and Mattsson, 2008; Capkun et al., 2009). These studies have repeatedly indicated that there is a significant connection between the two. The research conducted by (Deloof, 2003) on Belgian companies that were not involved in the financial sector revealed a significant and unfavorable correlation among gross operating income with the overall number of stocking days. The results of the study suggested that managers may increase shareholder

value by intentionally lowering the total number of inventory days to an acceptable minimum. This would be a relatively small amount of time. Companies with the largest inventory ratios were more likely to have poor financial performance, according to the findings of Boute et al. (2006), who conducted an analysis of the manufacturing sector in Belgium and investigated the influence of minimizing inventory on financial performance. Consequently, this highlights the fact that greater inventory ratios may be symptomatic of poorer financial success.

(Fullerton et al. 2003; Demeter, 2003), found a substantial correlation between a high inventory turnover and a greater return on sales. This finding is in line with what was previously stated. On the other hand, research conducted by (Chen et al., 2005; Chen et al., 2007) discovered that large inventory levels were associated with poorly performing stock returns over the long run. It was noted by (Koumanakos, 2008) that a higher inventory level is associated with a lower rate of returns. On the other hand, Koliass et al. (2011) discovered that there is a negative association between the inventory turnover ratio and gross margin. (Garcia-Teruel & Martinez-Solano, 2007) brought attention to the potential for value creation that would be available to managers through the reduction of inventory and the number of days that accounts were outstanding. In addition, (Shah et al., 2007) highlighted the direct and considerable impact that inventory reduction has on the performance of an organization. According to the findings of (Panigrahi, 2013) analysis, there is a negative correlation among the inventory conversion period (ICP) and the profitability of a company. This means that a rise in the number of days that the ICP is in effect correlates to a higher level of profitability, and vice versa.

(Elsayed & Wahba, 2016) provided insightful information on the affect of inventory to sales ratio on company performance. They observed that the ratio had a negative impact during the early growth and maturity phases, but that it had a favorable and significant coefficient during the rapid development or revival stages with the organization. On the basis of this, (Jonsson & Mattsson, 2008) came to the conclusion that the planning performance of Material Requirements Planning (MRP) approaches was considerably influenced by the selection and review frequency of safety stocks and lead times. At the same time, it was determined that the selection and assessment of order points, evaluation frequencies, and run-out intervals are all essential components of Reorder Point (ROP) systems. All of this highlights the significance of making strategic decisions when it comes to identifying and managing lead times and safety stocks in order to ensure efficient inventory planning.

(Khan & Bosgraaf, 2009) believe that the successful application of inventory management procedures requires integration into the daily activities that are carried out by personnel of the firm. Within the context of this integration, the introduction of stock management methods into normal tasks is intended to be seamless. Customers engage with the inventory control or management systems interface that is associated to acquisition whenever they express a desire to place an order for a piece of product or piece of equipment. Through the use of this procedure, the stock system is able to ascertain if the asset that is being requested is already in excess or whether it is necessary to acquire it in accordance with the amount purchase agreements that are already in place with suppliers. (Wild, 2017) highlights the fact that utilizing an inventory management system to supervise the purchase and use of stock or goods contributes to the control of the organization while also aiding employees in the execution of work responsibilities that are related to assets. Taking this strategic approach helps to cultivate a workflow and assets management system that is tailored to the requirements of the firm.

There is a thorough process that begins with the acquisition of stocks, (Schwartz & Rivera, 2010). The inventory management system functions as a comprehensive procedure. Following that, it moves on via the process of redistribution of capital and comes to a conclusion when a commodity is discontinued. This system communicates with a wide range of personnel that are engaged in a variety of management and control disciplines that are associated with the implementation, direction, and maintenance duties of assets throughout the business. As an additional point of interest, its influence extends to the domains of corporate management and finance throughout the entire organizational structure. The inventory management system, in its most fundamental sense, serves as a cohesive and integrated component of the operations that are carried out by the business. It is designed to correlate with the myriad of duties that employees have across a variety of areas. A workflow that is optimized and effective asset management throughout the company are both contributed to by the seamless incorporation of inventory management methods into daily operations. The results of (Khan & Bosgraaf, 2009), which support the idea that good inventory management is inextricably tied to its absorption into everyday organizational operations, are supported by this technique, which has been found to be consistent with those findings.

Ogbo et al. (2014) using data collected from Seven-Up Bottling Business located in Nile Mile, Enugu, conducted a study to investigate the impact that an effective stock management plan has on the overall performance of the firm. This experiment was carried out

by the researchers in order to emphasize how important it is for the bottling company to have an efficient inventory control system. There were a total of 83 people who participated in this research as part of the sample. In the study, it was discovered that firms have the potential to achieve greater sales performance and decreased operational costs through the implementation of good inventory management procedures. This may be accomplished by utilizing straightforward ways for storing and retrieving products. Moreover, the investigation revealed a connection between the viability of operations, the significance of inventory control management in responding organization-specific client questions, and the execution of approaches that are cost-effective in order to improve the return on investment of the company. The findings highlighted how important it is to emphasize the significance of recognizing efficient inventory management as an essential component of organizational management. According to the findings of the study (Ogbo et al., 2014), it was suggested that businesses implement inventory management strategies that are ideal for their operations. The significance of this realization lies in the fact that to enhance the overall performance of an organization, it is essential for firms to prioritize and put into action effective strategies for inventory management.

### **2.3 Just-In-Time (JIT)**

Within the context of the corrugated package industries in India, the research paper by Upadhye et al. (2015) investigated the difficulties and repercussions that are associated with implementing Just-In-Time (JIT). The research was conducted by means of a survey approach, which was used to collect primary data, and regression analysis was utilized for the purpose of data interpretation. The findings of the study demonstrated that JIT had a positive influence on the overall performance of the company. In a manner that is analogous, (Chaudhari & Patel, 2015) conducted an empirical investigation to determine the extent to which JIT is being used and the effects it has on manufacturing organizations. Based on their study of the relevant literature, they highlighted JIT as a system and philosophy that is well recognized for enhancing manufacturing excellence. After making a modest adjustment to the setting, Kaswan et al. (2019) conducted research to evaluate the impact that JIT plays in influencing the processes of decision-making related to the health care industry in India. There was a positive association between the implementation of JIT and the performance of the company, which was supported by their empirical findings.

A case study technique was utilized by Forza et al., (2016) in order to investigate the consequences of JIT on the performance of a company. This was done in order to further emphasize the importance of JIT within the Indian environment. Their empirical findings made it abundantly clear that there is a positive connection between JIT as a method of inventory management and the overall success of the company. Turning our focus to Pakistan, Qureshi et al. (2013) carried out an interesting study that focused on the important aspects that are pivotal for the implementation of JIT within the cement business. Using information obtained from four hundred operations managers through the use of interviews and questionnaires, their study highlighted the positive and significant influence that JIT has on the performance of the company. In addition, the research highlighted the critical role that top management commitment has in the deployment of the JIT system. In a different piece of research, (Kariuki, 2017) investigated the wider range of inventory management strategies and the impact such strategies have on the performance of organizations, with Laikipia County serving as the setting for the investigation. The Just-In-Time (JIT) methodology emerged as a significant contributor among the strategies that were investigated. It facilitated improved conversation or communication, building relationships, cost-effectiveness, and operational flexibility within organizations.

JIT implementation has been shown to correspond with improvements in cost, quality, efficacy, and reactivity to customer requests, according to previous study (Lawrence & Lewis, 1993). This correlation has been continuously confirmed. JIT has been thrust into the spotlight as a result of these characteristics, which have attracted the attention of academic publications as well as industrial professionals on a worldwide basis (Brown & Mitchell, 1991; Panizzolo et al., 2012). The principles of just-in-time (JIT) have spread beyond their industrial roots to influence a variety of industries, which includes healthcare facilities, public bodies, nonprofit enterprises, and schools and universities of varying scopes (Dowlatshahi & Taham, 2009; Hackman & Wageman, 1995). This can be seen as evidence of the adaptability and versatility of JIT. When compared to more conventional Total Quality Management (TQM) systems, which frequently focus an emphasis on outcomes, Just-In-Time (JIT) places a specific emphasis on the refinement of work processes. Just-in-time (JIT) tactics are utilized in the food sector to identify inefficiencies that extend from the acquisition of raw materials to the delivery of finished goods. This allows for the elimination of processes that do not contribute to the creation of value (Moya, 2016). In addition to providing further evidence that JIT is beneficial, He and Hayya (2002) conducted a survey that included food companies situated in the United



States and found that JIT production processes have a positive impact on the quality of food manufactured. For example, in the Indonesian setting, the use of JIT principles enabled food and beverage businesses to strengthen their competitive position by encouraging collaborative supply chain management activities (Jumady et al., 2016). This was accomplished by boosting the efficiency of their supply chain management.

(MacKelprang & Nair, 2010) highlighted the fact that different JIT techniques may not generate every category of performance results in the same way across the entire process. Under the Just-In-Time (JIT) paradigm, the push for stock reduction might create difficulties for sub-suppliers when it comes to meeting sudden order requests. According to (Kubasakova & Jagelcak, 2016), an organization that is dependent on several suppliers may find that it is unduly dependent on those providers in order to assure timely order fulfillment. This is especially true in a context where there is no inventory stocked. To add insult to injury, the pursuit of low inventory levels can inadvertently increase the frequency of replenishment and subsequent delivery. According to (Wu & Dunn, 1995), increasing activity can make traffic congestion worse, entailing the building of infrastructure which includes new roads, as well as leading to an increase in carbon emissions. According to the hypothesis put forth by these academics, the cost dynamics may favor retaining increased stock levels over regular replenishments through faster transportation ways. It is important to note that continuous shortages or unavailability of resources could potentially lead to interruptions, which could ultimately result in the cessation of operations.

## **2.4 Supplier Partnership Management**

(Saksrisathaporn et al., 2016), the strategic decisions of selecting a supply partner holds tremendous relevance in the arena of continuous help for emergency supplies, aiming eventually for the realization of a sustainable future. Developing strong and reliable supply chain alliances is a crucial approach for firms to successfully traverse difficult times (Tarigan et al., 2021). The research conducted by Tarigan et al. (2020) demonstrates how this collaborative approach promotes a sense of shared dedication between suppliers and customers. The hard conditions encountered by apparel makers in India during the COVID-19 epidemic emphasized the predominance of not sustainable SC partnerships, when 72.1% of customers, exerting strong bargaining power, refused to share the cost of textiles. As a result, suppliers began providing significant price reductions, emphasizing the necessity for increased sustainable methods of working together (Majumdar et al., 2020).

In the dense web of SC collaborations, trust emerges as a major determinant, where the trustworthiness of details offered by vendors and the completion of agreements contribute to a firm basis. Naghshineh et al. (2019) emphasize the significance of the trust factor in influencing supply chain partnerships. Strategic procurement, which involves the use of long-term partnerships and joint planning, is recognized as a crucial element that impacts a company's competitive edge (Tarigan et al., 2020). Moreover, SC relationships have a significant influence on the innovativeness of suppliers, since manufacturing organizations are able to achieve successful strategic procurement (Mandal, 2020). Within the framework of supplier-buyer collaboration, the formation of supply chain partnerships improves trust and enables the smooth satisfaction of product needs (Narayanan et al., 2015; Lee et al., 2020). The interaction of these aspects highlights the complex and ever-changing nature of supply chain partnerships in the wider corporate environment.

Creating a strategic supplier partnership (SSP) refers to the development of a long-lasting and strong relationship among an organization and its suppliers, as described by Koh et al. (2007). The collaborative framework described by (Agus & Hassan, 2008) emphasizes direct, long-term partnerships that involve mutual planning and cooperative efforts in problem-solving. The efficacy of a supply chain network is inherently dependent on the dynamics of relationships and coordination between the client and the provider. In the current dynamics of supply chains, where the practice of outsourcing and acquiring raw materials is prominent (van den Brink, 2019; Chen et al., 2019; Kembro et al., 2017), it is crucial to establish strong relationships with suppliers. The majority of supply chains that are closer to the source largely depend on these methods, which makes it necessary to make intentional efforts to strengthen collaborative connections. The strategic vendor partnership plays a crucial role in this situation, enabling both operational and strategic coordination while also improving the overall abilities of the firms involved. Li et al. (2005) highlights the crucial significance of SSP (Strategic Service Provision) in attaining organizational objectives. The authors contend that it is crucial to utilize strategic supplier alliances in order to address the complex and diverse difficulties faced by modern supply chains. These relationships enhance the formation of efficiency in operations, strategic objectives, and organizational skills. This is especially important considering the organization's reliance on outsourcing and procurement methods for obtaining raw materials. (Baqleh & Alateeq, 2023).

(Papakiriakopoulos et al., 2010) defined strategic supplier partnership (SSP) as a long-lasting and resilient association between an organization and its suppliers. This emphasizes the creation of extended and direct links with customers to facilitate cooperation in planning and joint problem-solving endeavors. Al-Shboul et al. (2017) emphasized the need of starting supplier partnerships to improve both operational and strategic efforts, thereby strengthening the necessary skills to achieve the firm's goals. Green Jr. et al. (2006) highlighted the crucial importance of a dominant supply chain in promoting successful collaborations with suppliers, within the context of optimal supply chain management. A crucial factor to evaluate is how effectively an organization's relationship with suppliers enhances the necessary skills and abilities. Multiple studies offer convincing data that establishes a strong connection between strategic sourcing techniques and enhanced supply chain results. In their study, Narasimhan et al. (2009) examined 215 enterprises in North America and found a strong positive correlation between strategic sourcing, which includes strategic subcontractors and supplier competence analysis, and the achievement of manufacturing objectives. The philosophy of strategic supplier relationship is a crucial component of the broader framework of supply chain management.

The components of strategic sourcing, as delineated by Kocabasoglu et al. (2006), cover the scope of supply management of networks within the firm's organizational structure, the synchronization of the supply network with other operational aspects, the exchange of information with suppliers, and the implementation of extensive supplier development activities. Furthermore, strategic sourcing has a substantial impact on the exchange and dissemination of details among vendors and retailers (Diabat et al., 2014). By integrating the distinct information possessed by vendors and retailers in different areas, a distinct body of knowledge is formed that can enhance the understanding of the firm and potentially enhance the identification of new products (Green et al., 2019). When retailers establish strategic supplier partnerships, they face several risks. These risks include the introduction of unproven products at selling points, the potential harm to the retailer's credibility if products fail to meet customer expectations, and the need to test new products to offer a diverse selection. This necessitates shops who have built partnerships with suppliers to showcase novel, untried products.

In their study, Andiç et al. (2012) emphasized that tactical supplier partnerships encompass various activities, including the procurement of products and services from suppliers. These partnerships have a significant impact on the vendor's system and operational

abilities, ultimately leading to an increase in firm value and the improvement of supply chain management (SCM) performance within an organization. Establishing strategic supplier alliances allows organizations to collaborate more efficiently with suppliers who are inclined to assume joint accountability for the efficacy of the items they deliver. Suppliers who are involved in the initial phases of product development provide businesses with significant options in design, assist in choosing the most effective methods and instruments, and add to strategic evaluations (Hsu et al., 2009). Hence, the integration of organizational approaches can be closely linked with supplier partnership to optimize processes and eradicate bottlenecks (Song et al., 2017). (Utami et al., 2019)

The notion of strategic supplier partnership, as defined by Lee et al. (2018), emphasizes the need for all stakeholders in supply chain management to proactively synchronize their operational abilities in order to achieve substantial and long-lasting benefits. This method of strategy is distinguished by straightforward and long-lasting communication, cooperative planning activities, and collaborative efforts to solve problems. The primary objective of strategic partnerships aims to create reciprocal benefits for all parties involved, promoting long-term involvement in technology, product, and market areas. Dubey et al. (2019) argue that strategic supplier partnerships enable organizations to improve operational efficiency by fostering strong collaborations with a specific set of important suppliers who jointly bear the burden for the success of products. Suppliers involved in the first phases of product development can provide cost-effective design solutions, assist in choosing the best equipment and technology, and actively take part in design evaluations. Strategic relationships enable firms to collaborate efficiently, streamline operations, and minimize inefficiencies, therefore optimizing the use of resources as well as time.

Furthermore, the creation of strategic alliances with suppliers is essential for developing a smart and robust supply chain. Abu Nimeh et al. (2018) and O'Brien (2018) stress the importance of a strong alliance among suppliers in a complex supply chain. The coalition acts as a fundamental basis for efficient cooperation, promoting a mutually beneficial connection between enterprises and their vendors in order to negotiate the intricacies of contemporary supply chain management. The significance of these collaborations lies in the ongoing pursuit of benefits and the dedication to long-term involvement in different aspects of the supply chain. (Shtawi et al., 2023)

The study conducted by Theodorakioglou et al. (2010) examined the complexities of managing the quality of vendors and buyers. The findings revealed a significant and positive relationship between managing vendors and the use of quality management methods. This correlation highlights the crucial significance of quality management methods in enabling the successful deployment of efficient supply chain management inside enterprises. (Teo et al. 2018) support this sentiment, suggesting that firms purposefully adopt and use quality management principles as a strategic approach to efficiently carry out supply chain management. In their study, Ryu et al. (2009) analyzed the interactions between participants in the supply chain, specifically focusing on the relationships between buyers and suppliers and how these relationships affect the performance of firms. The researchers used structural equation modeling to evaluate the linkages, based on data gathered via 141 buyer-supplier respondents in South Korea.

The results emphasized the crucial significance of each of the operational and strategic factors in shaping the buyer-supplier collaboration, ultimately impacting the entire success of the company. (Sánchez-Rodríguez et al. 2005) examined the importance of supplier development in influencing the performance of buying organizations. They used structural equation modelling (SEM) to explore this connection. By analyzing information from 306 manufacturing entities in Spain, the research revealed the significant influence of supplier development on the performance of firms, highlighting its crucial role in achieving sustainable growth. This discovery emphasizes the need of developing and improving associations with suppliers to strengthen the productivity and agility of purchasing companies in an environment of fierce competition, (Khan et al., 2022). Efficiently overseeing relationships with suppliers is of utmost importance in the domain of supply chain and logistics operations, quality control, risk mitigation, and innovation administration (Van Weele, 2014).

Companies aiming to leverage synergy effects prioritize the strategic search of an ideal supplier base, which encompasses both the quantity (i.e., the total number of vendors in specific places) and quality. Van Weele (2014), highlights the significant and varied significance of supplier relationship management in various areas. It emphasizes the crucial role it plays in shaping supply chain and logistics processes, as well as in ensuring quality, reducing risks, and promoting innovation within organizations.

This comprehensive approach acknowledges the interdependence between supplier relations and overall organizational strategies, recognizing their impact on multiple aspects of

operational excellence. Moreover, the strategic dimension of supplier collaboration goes beyond the simple transactional elements of procurement. Ocicka and Raźniewska (2015) emphasize the importance of balancing both quantity and quality while improving supplier bases. To achieve overall operational efficiency, it is important to carefully evaluate the number of suppliers in certain areas and make strategic decisions that create synergies. This process is known as the pursuit of an ideal supplier base. Furthermore, the notion of collaboration in supplier relationships goes beyond simple transactional exchanges. Wieteska (2011) highlights the cooperative aspect of partnerships, emphasizing the collective efforts to detect and reduce risks that arise from the shared management of commodities and information flows in the supply chain. (Tyszkiewicz et al, 2019) this approach to risk management emphasizes the importance of working together to address obstacles and inconsistencies in the supply chain, promoting the ability to recover quickly and adjust to changes.

## **2.5 Information Technology**

The key to promoting human-machine and machine-to-machine interactions is the integration of information technologies within warehouse operations. (Kalipi, 2018) provides a comprehensive analysis of warehousing management, outlining its main activities such as storing, sorting, and dispatching items. The author also highlights the importance of warehousing management in inventory forecasting. Nowadays, warehouses play a key role in connecting production and supply networks, thanks to technology advancements. Krauth et al. (2018) conducts a thorough analysis of the complexities of warehousing processes and administration, illuminating elements including the sheer number of processed commodities, the variety of technologies used, and the nuances of warehouse operations.

An influential model in this field is the Integral Logistics Information System, a unique approach towards business management that can track the whole lifecycle of products, data, and materials from production to final delivery by integrating all aspects of management. In their investigations into the potential uses of Low Power Wide Area Network (LPWAN) technologies, Manzoni et al. (2019), Di Renzone et al. (2020), Mangal et al. (2019), and Cameron et al. (2020) explore the realm of warehouse object monitoring and tracking. A better understanding of how these technologies can improve warehouse tracking and efficiency is a result of their combined efforts. Kang et al. (1997) explored the linear increase in the usage of computer-based solutions for logistics and warehouse management from 1993 to 1995 the Korean context. The modern warehouse would not be the same without these systems, which

include inventory management, sales, material movement, and demand forecasting. But medium-sized businesses still have a hard time affording to implement cutting-edge IT systems (Maane et al., 2022). A novel approach linked with warehouse management is introduced by Kim et al. (2016) in the arena of indoor positioning systems. This solution utilizes warehouse management tags to transmit essential data relating to goods availability, stocking time, delivery time, and inventory control.

An innovative approach to warehouse management that incorporates algorithms and artificial intelligence for storage planning, order delivery, and reception is provided by Zunic et al. (2018), which adds to the ongoing discussion in this field of study. Their method makes use of GPS technology and barcodes on pallets and shelves. Using ZigBee technology, sensors, a situation management system, and a wireless smart control system, Yao et al. (2014) offer an IoT-based autonomous solution for warehouse monitoring. Temperature, humidity, and heating are just a few of the environmental elements that this high-tech system can instantly monitor and regulate in a warehouse. Looking further afield, Au (2009) describes a survey that found that traditional SAP and WMS software packages combined with IoT were the most commonly used for warehouse operations in Malaysia. Radio frequency (RF) readers are widely used in many warehouse operations, including material management, shipping, route planning, and dispatch, (Jarašūnienė et al. 2023).

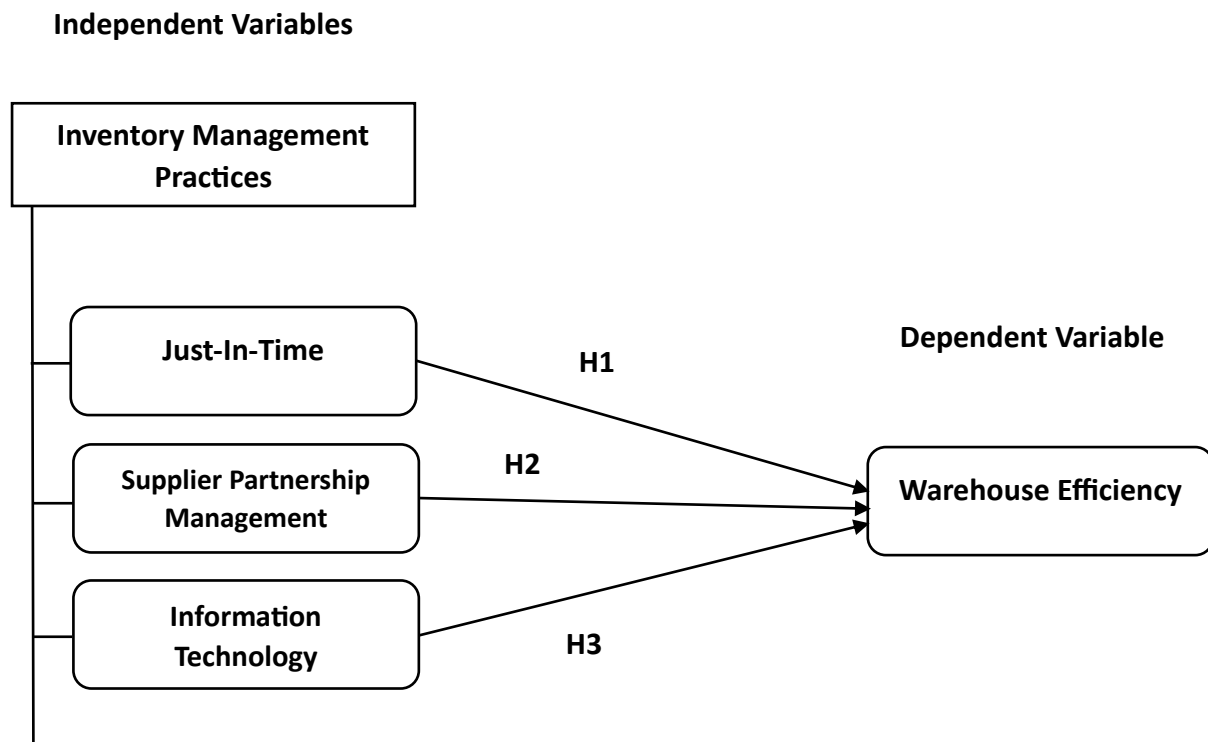
According to (Tarigan & Siagian's, 2020) analysis of organizational dynamics, the level of commitment from top management has a significant impact on how well ERP systems work. Their research shows that different parts of a company may work together more effectively when IT capabilities are strategically aligned with business operations. Optimal inventory levels and enhanced ERP performance are the inevitable outcomes of such integration. In support of this view, (Abdinnour & Saeed, 2015) highlighted how powerful information technology can revolutionize businesses by allowing them to learn from their internal and external surroundings. In order to stay ahead of the competition, companies can use this strategic use to launch new initiatives and adjust existing business strategies.

Automated systems are encouraged by the merging of inventory management approaches with cutting-edge information technology, according to Laosirihongthong et al. (2018). In addition to improving organizational efficiency, these solutions help boost overall performance indicators. An appropriate inventory balance adapted to organizational exigencies must be struck, according to Tarigan & Siagian (2020), who delve further into the relationship between

IT and inventory management. The balance is maintained when the capabilities of information technology are in sync with the overall strategies of the company. Mat et al. (2018) provides support for this idea by arguing that inventory management procedures are bound to become more effective as a result of ongoing IT advances. The findings of Mishra et al. (2013) corroborate this claim, since they found that IT skills are crucial for improving inventory efficiency, especially for industrial companies listed on stock markets. A comprehensive view of the company is required to achieve operational excellence, according to Fernando et al. (2020). In order to achieve and maintain maximum efficiency, inventory systems must be continuously reviewed and redesigned (Tarigan et al., 2022).



## 2.6 Theoretical Framework



## 2.7 Research Hypothesis

**H1:** There is a significant correlation between with Just-In-Time (JIT) practice and warehouse efficiency in Pakistan.

**H2:** There is a significant correlation between Supplier Partnership Management and the warehouse efficiency in Pakistan.

**H3:** There is a significant correlation between the integration of Information Technology and Warehouse Efficiency in Pakistan.

## Chapter 3

### RESEARCH METHODOLOGY

This section lays out the approach for the quantitative study that will examine how various industries in Pakistan's cities of Islamabad and Rawalpindi can improve their warehouse efficiency by using more effective inventory management practices.

#### 3.1 Research Approach

This study takes a quantitative standpoint in its examination of the study's subject "Enhancing Warehouse Efficiency through Effective Inventory Management Practices in Pakistan." Among the many benefits of this approach to research is its ability to methodically involve a bigger sample and to make in-depth data collection and analysis easier. A carefully crafted closed-ended survey questionnaire was used to gather information about inventory management techniques and warehouse efficiency in Pakistan. The questionnaire included a 5-point Likert scale to allow respondents to express their thoughts and opinions. Thanks to Google Forms, the survey could be easily distributed to as many people as needed.

This study uses a deductive research approach to either confirm or refute current theories and principles linked to inventory management methods and warehouse efficiency, which complements the quantitative methodology. This study employs a deductive approach to investigate Pakistani warehouse activities and inventory management systems in an effort to identify relevant underlying reasons, obstacles, and opportunities. The study aims to improve warehouse efficiency and inventory management practices in Pakistan by collecting structured data, analyzing it systematically, and drawing meaningful recommendations based on the findings. The research questions will be addressed, and new insights will be derived.

#### 3.2 Research Technique

For this study, the method that was utilized to collect data was extremely important in terms of maintaining accuracy while also decreasing errors. We were able to accomplish this by developing a questionnaire through the use of Google Forms, which made it feasible for participants to provide their responses. This questionnaire was divided into many sections: the first portion was designed to collect information about the respondents' demographics, and the remaining sections concentrated on both dependent and independent variables that were associated with the subject of our research. A Likert scale with five points was utilized so that the process of providing feedback may be simplified for the respondents. Within the context of

this scale, participants were able to rate the degree to which particular statements associated to their experiences or actions. The purpose of our questions being organized in this fashion was to ensure that the process of analysis would be uncomplicated and simple to understand. It is essential to note that all participants were given the assurance that their comments would be kept anonymous. This ensured that they were able to freely express their emotions, thoughts, and opinions.

### **3.3 Unit of Analysis**

Logistics experts, supply chain managers, procurement analysts, and warehouse managers in Pakistan make up the study's unit of analysis.

### **3.4 Population and Sampling**

#### **3.4.1 Population**

Given the emphasis of this research the encompassing population of interest consists of individuals who are active in warehouse management across a variety of businesses within the metropolitan areas of Islamabad and Rawalpindi. More specifically, the audience that has been aimed at is comprised of 210 individuals who are actively engaged in warehouse management roles across a variety of industries, including retail, healthcare, and manufacturing, and who are located in the cities of Rawalpindi and Islamabad. The selection criteria give preference to individuals holding the positions of warehouse manager, procurement analyst, supply chain managers, and Logistics professionals. This is because these individuals have the most practical experience with inventory management, efficiency metrics, problems, and opportunities for improvement in the warehouse environment.

Structured questionnaires were distributed to the professionals who were selected in order to guarantee a data gathering approach that was both complete and representative. This survey instrument, which was painstakingly created to capture thorough understandings and experiences, made it easier to collect priceless insights that were pertinent to the aims of the study. Taking advantage of the conveniences offered by technology, the questionnaire was made available online through Google Forms. This enabled the participation process to be streamlined and accommodate experts from a variety of places in Islamabad and Rawalpindi. Approximately 10-12 minutes were devoted by the participants to the completion of the questionnaire, which made a significant contribution to the empirical foundation of the study.

### **3.4.2 Sampling**

To ensure that a research study proves effective, it is essential to pick the appropriate sample size and ensure that it appropriately represents the demographic or audience that is being studied. By making use of Morgan's Table as a guide, about 210 professionals who have been involved in warehouse management across a variety of industries in Islamabad and Rawalpindi were chosen for the purpose of including them in this study. At the same time, a sample size of roughly 136 people was selected for the purpose of collecting and evaluating data concerning the interplay between various study variables that are essential to warehouse efficiency and inventory management techniques in the geographical area of Pakistan.

### **3.4.3 Sampling Technique**

A sample strategy called judgmental sampling, or purposive sampling, was used in this investigation. Purposive sampling differs from random or systematic techniques in that it is intentional and grounded in the researcher's predetermined criteria. Under this method, a select group of specialists in inventory and warehouse management are enlisted to take part. Finding niche insights is the goal of this technique, which entails picking respondents according to their competence. This sample strategy was considered optimal because of the niche nature of the research and the need of hearing from people with first-hand knowledge of the field.

## **3.5 Data Collection and Data Analysis**

### **3.5.1 Data Collection Procedures**

Modifications were made to the questionnaires after their adaption to make them more user-friendly and to encourage honest and trustworthy responses from respondents. Sending structured questionnaires to warehouse management specialists in Islamabad and Rawalpindi from different sectors was the method of data collecting. Most of surveys were performed online using "Google Forms" to ensure accessibility. However, in order to gain more in-depth insights from a small number of respondents, offices or companies were visited for interviews. The outcomes and conclusions of the study were supported by the rigorous synchronization of the data collected from interviews and questionnaires. Specifically, the questionnaire was adapted from a study by Naomi Nduta Gitau entitled "The Effect of Inventory Management Practices on the Operational Performance of Warehouse Firms in Mombasa County." A total of 136 responses were submitted, and every response was included to ensure authenticity. We used IBM SPSS statistics to record and analyze all valid responses from the received surveys.

### **3.5.2 Data Analysis**

This study used quantitative methods, specifically a structured questionnaire, to collect data. The SPSS software was used to conduct regression and correlation analyses, among other analytical techniques, to determine the magnitude and trend of the relationship between warehouse efficiency (the dependent variable) and just-in-time (JIT), supplier partnership management, and information technology (the independent variables) . Both regression as well as correlation analyses are well-known and respected statistical methods for interpreting and analyzing data with high degrees of accuracy and reliability.

### **3.6 Scales and Measures**

The research objectives were carefully considered while designing the questionnaire to ensure it was both brief and easy to use, which would allow for efficient data collection. This survey asks about demographic information as well as a number of study-related factors, including just-in-time, information technology, supplier partnership management, and warehouse efficiency. All the components that are being studied are evaluated with a five-point Likert scale, with the following categories for the answers:

**1) Very large extent 2) Large extent 3) Moderate extent 4) Small extent 5) Very small extent**

## Chapter 4

### RESULT AND ANALYSIS

This section contains specifics regarding the descriptions of the findings of the study that were obtained from the various forms of analysis that were carried out.

#### 4.1 Demographics Analysis

Table 1 gives a summary of the 136 people who took part in the study, broken down by age, gender, level of education, and job title. Based on the data, it appears that the majority of participants fall within the age bracket of 23–32 (63.2%, n=86). The next largest age group is 18–23 (21.3%, n=29), followed by 32–37 (11.1%), and finally, 37 and up (4.4%, n=6). There are 107 males and 29 females, for a total of 78.7% and 21.3%, respectively. On the subject of education, 52.2% (n=71) of the participants have a Bachelor's degree, 45.6% (n=62) a Master's degree, 2.2% (n=3) a Diploma, and no one has a Ph.D. Among the many occupations represented in the workplace, you may find Supply Chain Officer (19.9%, n=27), Inventory Planner (16.9%, n=23), and Warehouse Manager (20.6%, n=28). This variety highlights the many different viewpoints and areas of competence within supply chain management.

**Table 1**

<i>Profile</i>	<i>Description</i>	<i>Frequency</i>	<i>Percentage</i>
<b>Age</b>	18-23	29	21.3
	23-32	86	63.2
	32-37	15	11.1
	37 or above	6	4.4
<b>Gender</b>	Female	29	21.3
	Male	107	78.7
<b>Educational Background</b>	Diploma	3	2.2
	Bachelors	71	52.2
	Masters	62	45.6
	Ph.D.	0	0
<b>Designation at Workplace</b>	Delivery planner	11	8.1
	Inventory Planner	23	16.9
	Logistics Associate	15	11.0
	Material Handler	10	7.4
	Procurement Analyst	22	16.2
	Supply Chain Officer	27	19.9
	Warehouse Manager	28	20.6

*Note: Demographic details of the participants (n= 136), Frequencies (f), Percentages (%), Mean (M) & Standard Deviation (SD).*

## 4.2 Reliability Analysis

**Table 2**

*Mean (M), Standard Deviation (SD) and Cronbach's Alpha Reliability Coefficient of subscales of Inventory Management Practices and Warehouse Efficiency (n=136).*

<i>Scale</i>	<i>Items</i>	<i>M</i>	<i>SD</i>	<i>α</i>	<i>Skew</i>	<i>Kurtosis</i>
Just-in-time (JIT)	5	13.96	4.56	0.91	0.20	0.41
Supplier Partnership Management	3	9.71	1.83	0.83	0.20	0.41
Information Technology	5	16.64	3.63	0.91	0.20	0.41
Warehouse Efficiency	5	16.48	3.52	0.85	0.20	0.41

*Note: α = Cronbach Alpha; M = Mean, SD = Standard Deviation*

Table 2 provides a comprehensive reliability analysis of Inventory Management Practices and Warehouse Efficiency subscales. The 5-item Just-in-time (JIT) subscale shows excellent internal consistency with a mean score of 13.96 and Cronbach's Alpha of 0.91. Assuming a normal distribution, JIT has a skewness of 0.20 and a kurtosis of 0.41. With a mean score of 9.71 and Cronbach's Alpha of 0.83, the three-item Supplier Partnership Management subscale shows excellent reliability. Similarly, this subscale has kurtosis and skewness values that are in line with normal distribution, at 0.41 and 0.20, respectively. Similar to the dependability of the JIT subscale, the five-item Information Technology subscale displays a Cronbach's Alpha of 0.91 and an average score of 16.64.

It has a consistent skewness value of 0.20 and a kurtosis value of 0.41. Last but not least, the 5-item Warehouse Efficiency subscale shows adequate internal consistency with a mean score of 16.48 and Cronbach's Alpha of 0.85. At 0.20 and 0.41, respectively, its skewness and kurtosis values show no change, confirming that it follows a normal distribution. Based on the findings, it can be concluded that the Cronbach's alpha values for the three subscales, namely Just-in-Time, Supplier Partnership Management, Information Technology, and the dependent variable Warehouse Efficiency, are all greater than 0.5, indicating that the scales demonstrate acceptable reliability.



### 4.3 Correlation Analysis

**Table 3**

*Pearson's correlation among the subscales of Inventory Management Practices and Warehouse Efficiency (n=136)*

Scale	Just-in-Time	Supplier Partnership Management	Information Technology	Warehouse Efficiency
Just-in-Time	1	0.48**	0.36**	0.45**
Supplier Partnership Management		1	0.62**	0.76**
Information Technology			1	0.77**
Warehouse Efficiency				1

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

The findings support the study's hypothesis, according to the correlation analysis demonstrated in table 3. In particular, the data show a positive correlation coefficient of 0.45, which is significant at the 0.01 level, in respect to H1, which indicates a significant association between JIT methods and warehouse efficiency in Pakistan. That there is a favorable and statistically significant relationship between JIT procedures and warehouse efficiency in Pakistan gives legitimacy to H1. association coefficient stands at 0.76, significant at the 0.01 level, supporting H2, which hypothesizes a significant association between Supplier Partnership Management and warehouse efficiency in Pakistan. The strong association between Supplier Partnership Management and warehouse efficiency strongly supports the acceptability of H2.

Finally, the observed correlation coefficient for H3, which postulates a substantial association between IT integration and warehouse efficiency in Pakistan, is 0.77, which is significant at the 0.01 level. In the context of Pakistan, this brings credibility to H3, which postulates a strong positive relationship between IT integration and warehouse efficiency. Overall, the correlation analysis provided empirical evidence that supported all three hypotheses (H1, H2, and H3). This means that JIT practices, Supplier Partnership Management, Information Technology, and warehouse efficiency in Pakistan are significantly correlated positively.

#### 4.4 Regression Analysis

**Table 4**

*Multiple regression analyses to find out the relationship between subscales of Inventory Management Practices and Warehouse Efficiency (n=136)*

Variables	$\beta$	SE	p	t	95% CI	
					LL	UL
Constant	-0.12	0.89	0.89	-0.13	-1.89	1.65
Just-in-Time	0.05	0.04	0.14	1.46	-0.02	0.13
Supplier Partnership Management	0.84	0.11	0.00	7.09	0.60	1.07
Information Technology	0.45	0.05	0.00	8.16	0.34	0.56

$$R=0.856, R^2=0.73 (F=120.6, p<0.001)$$

*Note: CI=Confidence Interval, UL=Upper Limit, LL= Lower Limit*

Based on the information provided by 136 participants, a multiple regression analysis was carried out in order to investigate the relationships that exist between Warehouse Efficiency and the various subscales of Inventory Management Practices. The results of this study are presented in Table 4. It was discovered that the constant term in the model was -0.12, but the fact that its p-value was 0.89, which is not significant, suggests that this baseline value does not have a major impact on Warehouse Efficiency. To be more specific, the Just-in-Time (JIT) variable did not exhibit a significant link with Warehouse Efficiency, as demonstrated by the fact that its p-value was 0.14. The opposite was true for both Supplier Partnership Management and Information Technology (IT), which both had strong positive relationships with Warehouse Efficiency.

The variable known as Supplier Partnership Management demonstrated a strong positive correlation, which was confirmed by a beta coefficient of 0.84, a p-value of 0.00, and a t-value of 7.09, with its 95% confidence range extending from 0.60 to 1.07. In a similar vein, the IT variable had a significant impact on Warehouse Efficiency, as demonstrated by its beta coefficient of 0.45, p-value of 0.00, and t-value of 8.16, in addition to a 95% confidence interval that ranged from 0.34 to 0.56. To summarize, the regression model displayed a robust fit, as

evidenced by a substantial F-value of 120.6 ( $p < 0.001$ ) and a ( $R^2$ ) value of 0.73. These values indicate that about 73% of the variability in Warehouse Efficiency can be determined by the variables that were examined.

#### 4.5 t-Test

**Table 5**

*T-test analysis on subscales of Inventory Practices and Warehouse Efficiency across gender (n=136).*

Scales	Male		Female		<i>t</i>	<i>p</i>	95% CI		Cohen's
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			<i>LL</i>	<i>UL</i>	<i>d</i>
Just-in-Time	13.95	4.4	14	5.06	0.04	0.96	-2.04	2.13	0.01
Supplier Partnership Management	9.66	1.87	9.88	1.68	0.56	0.57	-0.54	0.97	0.20
Information Technology	16.67	3.62	16.53	3.76	-0.17	0.85	-1.64	1.37	-0.06
Warehouse Efficiency	16.30	3.56	17.11	3.37	1.09	0.27	-0.65	2.26	0.39

*Note: CI=Confidence Interval, UL=Upper Limit, LL= Lower Limit, Male=107, Female=29*

A t-test analysis was carried out on a sample of 136 participants in order to determine whether or not there were any gender-based differences in inventory practices and warehouse efficiency. The results of this analysis are presented in Table 5. The Just-in-Time (JIT) scale revealed that male and female participants exhibited answers that were highly congruent with one another. This was demonstrated by a minimal t-value of 0.04 and a p-value of 0.96, both of which were not statistically significant. One could conclude from this that gender is unlikely to have a substantial impact in determining how JIT practices are implemented. In a similar vein, the Supplier Partnership Management scale uncovered insignificant gender differences, as evidenced by a t-value of 0.56 and a p-value of 0.57, along with a Cohen's d of 0.20.

Based on these data, it appears that the gender variable does not have a significant impact on Supplier Partnership Management within the scope of the study. In the same vein, the Information Technology scale provided more evidence that this trend was correct. It had a t-value of -0.17, a p-value of 0.85, and a Cohen's d of -0.06, which indicated that there were no significant gender-based differences. A t-value of 1.09 and a p-value of 0.27 were obtained

from the t-test in relation to Warehouse Efficiency. These results indicate that gender differences are not statistically significant, despite the fact that a modest effect size of 0.39 was found. In addition, the results of the t-test have significant ramifications. The fact that the p-values for all of the subscales, including JIT, Supplier Partnership Management, Information Technology, and Warehouse Efficiency, were not significant suggests that gender does not have a major influence on these particular aspects of Inventory Practices and Warehouse Efficiency within the context of Pakistan. This offers vital insights and lends credence to the idea that gender disparities might not be a significant factor in determining the manner in which these particular aspects of your research topic are affected.

## Chapter 5

### CONCLUSION AND RECOMMENDATIONS

#### 5.1 Discussion

The primary purpose of this research study was to conduct an in-depth investigation into the inventory management techniques that are contributing to the enhancement of warehouse efficiency within the specific context of Pakistan's retail, healthcare, and industrial industries. A Just-In-Time (JIT) inventory management system, a supplier partnership management system, and information technology were the three primary independent variables that were the focus of the research in order to accomplish this objective. For the purpose of determining the impact that these variables have on the dependent variable, warehouse efficiency, an empirical evaluation was implemented. A structured questionnaire was used as the major instrument for data collection in this study. The questionnaire was directed toward individuals of the supply chain who had expertise and experience in inventory management and warehousing methods across a variety of industries in Pakistan where the study was conducted. The implementation of this methodology ensured that the data acquired were not only pertinent but also indicative of the ground realities and complexities involved with warehouse operations in the sectors that were chosen. During the course of the research, a comprehensive analytical technique was utilized in order to determine the connections that exist between the independent variables indicated earlier and the effectiveness of the warehouse.

In order to test the hypotheses that were developed based on the objectives of the research, a number of different statistical analyses were carried out. In order to guarantee the reliability and validity of the interpretation of the findings, each hypothesis was examined in comparison to a preset significance threshold. According to the results of this research, the hypothesized connections between JIT inventory management, supplier partnership management, information technology, and warehouse efficiency in the context of Pakistan are supported by the data. We were able to provide empirical support for all of the assumptions that were presented at the beginning of the study by conducting a thorough analysis and interpretation of the data that was obtained. With the help of this empirical validation, it has been demonstrated that effective inventory management strategies, which include just-in-time (JIT), strategic supplier alliances, and technological integration, considerably improve warehouse efficiency in Pakistan's retail, healthcare, and industrial sectors.

## **5.2 Findings**

The study, conducted within the specific context of Pakistan's retail, healthcare, and industrial sectors, sought to investigate the impact of Just-In-Time (JIT) inventory management, supplier partnership management, and information technology on warehouse efficiency. Through an empirical evaluation employing a structured questionnaire administered to supply chain experts across various industries in Pakistan, the research aimed to discern the connections between the identified independent variables and the dependent variable, warehouse efficiency. The results revealed robust empirical support for the hypothesized relationships, indicating that JIT inventory management, supplier partnership management, and information technology significantly contribute to enhancing warehouse efficiency in Pakistan. The findings suggest that effective inventory management strategies, encompassing JIT methodologies, strategic supplier alliances, and technological integration, play a pivotal role in increasing productivity and reducing operational costs within the examined sectors. Despite the study's contributions, several limitations were acknowledged, including temporal constraints, a limited sample size, and a geographically confined scope. Future research opportunities were identified, recommending an extension of the research timeline, broader industry coverage to include the services sector, and an exploration of mediating effects, particularly focusing on the role of the Inventory Management System (IMS). In conclusion, the findings highlight the practical implications of implementing advanced inventory management techniques for warehouse efficiency in the unique business landscape of Pakistan. The study provides valuable insights for practitioners and policymakers, emphasizing the need for further exploration of mediating mechanisms to deepen theoretical and empirical knowledge in this field.

## **5.3 Conclusion**

In conclusion, the purpose of this research was to conduct an in-depth investigation into the crucial relationship that exists between the various methods of inventory management, specifically Just-In-Time (JIT) inventory management, supplier partnership management, and information technology, and the efficiency of warehouse operations within the specific functioning landscape of Pakistan's retail, healthcare, and industrial sectors. This study uncovered critical insights that support the inherent usefulness of strategic inventory management approaches in increasing warehouse productivity. These insights were discovered through the utilization of a painstakingly prepared questionnaire and stringent analytical

procedures. Despite the fact that the results of this inquiry provide strong empirical validation for the hypothesized links among the variables that were under examination, it is of the utmost importance to note the inherent constraints that were present throughout this research trip. As a result of limitations such as temporal restrictions, restricted geographic reach, and sample size, potential routes for future research endeavors that aim to extend and deepen the empirical knowledge of this field have been delineated.

This study highlights the possible benefits of combining a wider spectrum of methodological techniques, industry sectors, and temporal aspects in subsequent scholarly endeavors. In addition, the study highlights the potential benefits of doing so. In light of the fact that we are looking ahead to the future, there is an urgent requirement for academic endeavors to delve more deeply into the intricate complexities of the mediating mechanisms, such as the Inventory Management System (IMS), that are the foundation of the linkages that have been observed. Not only do such attempts have the potential to deepen the theoretical underpinnings of inventory management and warehouse efficiency, but they also have the potential to provide practitioners and policymakers with concrete insights that help stimulate operational excellence within Pakistan's varied industrial ecosystem.

#### **5.4 Research Limitations**

During the course of this study, a number of restrictions were encountered, which is a reflection of the fundamental limitations that researchers frequently confront. A confined time frame, a tiny sample size, and a limited geographic reach are some of the criteria that fall under this particular category of constraints. The study was subject to a number of limitations, one of which is the restricted amount of time that was available. It turned out that the time that was allotted was not enough to conduct a thorough investigation into the connections that exist between Just-In-Time inventory management, supplier partnership management, information technology, and warehouse efficiency. A more extensive time range would have made it easier to conduct a more comprehensive inquiry and would have made it possible to include respondents who came from a variety of different backgrounds. As a result of the study's exclusive concentration on the urban districts of Islamabad and Rawalpindi in Pakistan, another disadvantage is that the study is restricted by geographical limits. The limited breadth of this study may have consequences for the extent to which the findings can be generalized to a more comprehensive national context.

It is possible that a more nuanced understanding may have been obtained with the utilization of a wider geographical coverage that encompassed various regions within Pakistan. The fact that there were only 136 people who participated in the survey representing the supply chain that is related with the warehousing business in Pakistan is recognized as a restriction. It would have been better to have a bigger sample size, possibly reaching 300 respondents, in order to improve the level of richness and representation of the study. A sample that is more comprehensive has the potential to more accurately portray the complexities of the furniture sector in Pakistan. When looking at the current body of research on this subject, it became clear that the majority of the studies were cross-sectional. This was another constraint. Due to the absence of study designs that utilize mixed techniques or longitudinal research, the possibility for comparison analysis and temporal evaluations is severely limited. The incorporation of a wide variety of methodological techniques into future study in this field could be beneficial in terms of enhancing both the empirical and theoretical underpinnings.

### **5.5 Recommendations and Future Research**

Despite the fact that this study has thoroughly addressed a wide range of elements that are associated with the efficiency of warehouses in Pakistan, there are still opportunities for improvement that may be made to improve its efficiency and dependability. To be more specific, modifications to variables such as the research timeline, industry emphasis, sample size, and research technique could potentially improve the depth and breadth of the study. There is a possibility that the research process would be greatly improved by broadening the time frame of the study. A longer period of time would provide the researcher with more leeway to make adjustments and would make it easier to collect information from a wider variety of respondents, including those from a variety of social and professional backgrounds. An extension of this kind would not only make the study more accessible to a wider range of people, but it would also have the potential to stimulate involvement from a larger proportion of the population that had not been represented in the study before.

The study has focused on the healthcare, retail, and manufacturing sectors in Pakistan; however, it has neglected to investigate the services sector. This is because the study has chosen to concentrate on the manufacturing sector. The incorporation of the services sector into future research initiatives has the potential to yield significant insights and a more comprehensive understanding of the efficiency of warehouses across a variety of industrial verticals in Pakistan. As an additional point of interest, it is recommended that future research endeavors



take into consideration the possibility of investigating the mediating effects that exist between the identified independent variables, which are Just-in-Time inventory management, Supplier Partnership Management, and Information Technology, and the dependent variable, Warehouse Efficiency. To be more specific, the Inventory Management System (IMS) appears as a potential mediating variable that should be investigated.

The Intelligent Management System (IMS) is a highly developed software solution that enables real-time monitoring, automatic reordering, and improved decision-making capabilities. By analyzing the function that IMS plays as a mediator, it is possible to gain a better understanding of its influence on the optimization of Just-in-Time processes, the development of productive partnerships with suppliers, and ultimately the improvement of warehouse efficiency levels. The results of such research would add to a more sophisticated understanding of the intricate linkages that exist between these variables and would provide practitioners and policymakers together with insights that can be put into action directly.

## REFERENCES

- . D., & Tarigan, Z. J. H. (2022). Effect of ERP Implementation on Firm Performance Through Information Technology Capability and Inventory Management During the Covid-19 Pandemic. *Petra International Journal of Business Studies*, 5(2), 163–173. <https://doi.org/10.9744/ijbs.5.2.163-173>
- Baqleh, L. A., & Alateeq, M. M. (2023). THE IMPACT OF SUPPLY CHAIN MANAGEMENT PRACTICES ON COMPETITIVE ADVANTAGE: THE MODERATING ROLE OF BIG DATA ANALYTICS. In *International Journal of Professional Business Review* (Vol. 8, Issue 3). AOS-Estrategia and Inovacao. <https://doi.org/10.26668/businessreview/2023.v8i3.679>
- Brown & Mitchell. (1991). *Brown & Mitchell (1991). Global Perspectives on JIT: Academic and Practical Insights. International Journal of Production Economics*, 24, 193-203. 193–203.
- Chaudhari, S. N., & P. A. J. (n.d.). *JIT Implements in manufacturing industry – A Review*.
- Dowlatsahi & Taham. (2009). Dowlatsahi & Taham (2009). JIT in Non-Industrial Contexts: An Overview. *Public Administration Review*, 69(3), 464-475. *Public Administration Review*, 464–475.
- Filippini & Forza. (2016). An evaluation of just in time (JIT) implementation on manufacturing performance in Indian industry. *Journal of Asia Business Studies*, 8(3), 278–294. <https://doi.org/10.1108/JABS-09-2013-0051>
- Hackman & Wageman. (1995). Hackman & Wageman (1995). Beyond Manufacturing: JIT's Influence across Diverse Sectors. *Organization Science*, 6(1), 13-37. *Organization Science*, 13–37.
- He & Hayya. (2002). He & Hayya (2002). JIT and Food Quality: Insights from the US Market. *Food Control*, 13(8), 511-517. *Food Control*, 511–517.
- Jarašūnienė, A., Čižiūnienė, K., & Čereška, A. (2023). Research on Impact of IoT on Warehouse Management. *Sensors*, 23(4). <https://doi.org/10.3390/s23042213>
- Jumady, E., Tinggi, S., Ekonomi, I., Bongaya, M., Jusni, J., & Pono, M. (2016). The Effects of Integrative Supply Chain Management on the Just in Time and Competitiveness of the Food and Beverage Manufacturing Companies in Makassar Nurdin Brasit. *Scientific Research Journal (SCIRJ)*, IV, 25. [www.scirj.org](http://www.scirj.org)
- Kariuki. (2017). *Inventory Management Techniques and Organizational Performance: A Case of Laikipia County. African Journal of Business Management*, 11(8), 172-180. 11, 172–180.

- Kaswan, M. S., Rathi, R., & Singh, M. (2019). Just in time elements extraction and prioritization for health care unit using decision making approach. *International Journal of Quality and Reliability Management*, 36(7), 1243–1263. <https://doi.org/10.1108/IJQRM-08-2018-0208>
- Khan, M. A., Ahmed, N., & Irshad, M. (2022). Effect of Uncertainty, Supplier Involvement, Supplier Performance and Partnership Quality on Buyer-Supplier Relationship. *Market Forces*, 17(1), 41–58. <https://doi.org/10.51153/mf.v17i1.537>
- Kubasakova & Jagelcak. (2016). Kubasakova & Jagelcak (2016). Supplier Dynamics in JIT Environments. *International Journal of Production Economics*, 181, 102–113. *Journal of Production Economics*, 102–113.
- Lawrence & Lewis. (1993). JIT Principles: Enhancing Quality, Cost Efficiency, and Customer Responsiveness. *Journal of Operations Management*, 11(4), 379–394. *Journal of Operations Management*.
- MacKelprang, A. W., & Nair, A. (2010). Relationship between just-in-time manufacturing practices and performance: A meta-analytic investigation. *Journal of Operations Management*, 28(4), 283–302. <https://doi.org/10.1016/j.jom.2009.10.002>
- Madanhire, I., & Mbohwa, C. (2016). Application of just in time as a total quality management tool: the case of an aluminium foundry manufacturing. *Total Quality Management and Business Excellence*, 27(1–2), 184–197. <https://doi.org/10.1080/14783363.2014.969909>
- Moya. (2016). Moya et al. (2016). JIT in the Food Industry: Process Refinement and Value Addition. *Food Research International*, 89(Pt 1), 444–456. *Food Research International*, 444–456.
- Muhammad Shtawi, H. O., Abdul Rahim, M. K. I., & Abu Al-Rejal, H. M. E. (2023). Strategic Supplier Partnership and Customer Relationship and Sustainable Supply Chain Management: The Mediating Role of the ICT in the Jordanian Pharmaceutical Sector in Jordan. *Compendium by PaperASIA*, 39(6(b)), 34–47. [https://doi.org/10.59953/cpa.v39i6\(b\).37](https://doi.org/10.59953/cpa.v39i6(b).37)
- Panizzolo. (2012). Panizzolo et al. (2012). The Evolution and Impact of JIT: A Conte3. *Journal of Manufacturing Systems*, 464–473.
- Qureshi, M. I., Iftikhar, M., Bhatti, M. N., Shams, T., & Zaman, K. (2013). Critical elements in implementations of just-in-time management: Empirical study of cement industry in Pakistan. *SpringerPlus*, 2(1), 1–14. <https://doi.org/10.1186/2193-1801-2-645>
- Tarigan, Z. J. H., Siagian, H., & Jie, F. (2021). Impact of internal integration, supply chain partnership, supply chain agility, and supply chain resilience on

sustainable advantage. *Sustainability (Switzerland)*, 13(10).  
<https://doi.org/10.3390/su13105460>

- Tyszkiewicz, R., Pawlak-Wolanin, A., Markiewicz-Patkowska, J., Jandová, S., Oleśniewicz, P., Jáčová, H., & Tyszkiewicz, M. (2019). Innovative supplier partnership assessment model in a Polish trading enterprise. *E a M: Ekonomie a Management*, 22(3), 67–82. <https://doi.org/10.15240/tul/001/2019-3-005>
- Upadhye et al. (2015). (n.d.). *International Conference on Industrial Engineering and Operations Management (IEOM), 2015 3-5 March 2015, Hyatt Regency, Dubai, United Arab Emirates* (Upadhye et al. (2015), Ed.).
- Whidya Utami, C., Susanto, H., Septina, F., Maria Pujirahayu Sumaji, Y., & Pratama, I. (2019). Effect of Supply Chain Management Practices on Financial and Economic Sustainable Performance of Indonesian SMEs. In *Int. J Sup. Chain. Mgt* (Vol. 8, Issue 5). <http://excelingtech.co.uk/>
- Wu & Dunn. (1995). *Wu & Dunn (1995). Environmental Implications of JIT: Traffic, Infrastructure, and Emissions. Transportation Research Part D: Transport and Environment*, 3(6), 415-425.
- Tompkins, J. A. (1998). The challenge of warehousing. *The Warehouse Management Handbook*, 6.
- Gadde, L. E., & Snehota, I. (2020). *Industrial Networks*. Springer.
- Perkumienė, D., Reicher, R., & Jaroševičienė, I. (2022). The Role of Warehouses in the Supply Chain of E-commerce. *Sustainability*, 14(1), 151.
- Jonsson, P., & Mattsson, S.-A. (2008). Inventory management practices and their implications on perceived planning performance. *International Journal of Production*, 46(7), 5-28. <https://doi.org/10.1080/00207540600988071>
- Sanders, N. R., Ritzman, L. P., & Whang, S. (2021). *Operations management: An integrated approach*. Wiley.
- Simchi-Levi, D., Kaminsky, P., & Simchi-Levi, E. (2020). *Designing and Managing the Supply Chain: Concepts, Strategies, and Case Studies*. McGraw-Hill Education.
- Orobia, L.A., Nakibuuka, J., Bananuka, J. and Akisimire, R. (2020), “Inventory management, managerial competence and financial performance of small businesses”, *Journal of Accounting in Emerging Economies*, Vol. 10 No. 3, pp. 379-398.
- Stevenson, W.J. (2015), *Operations Management*, McGraw-Hill Education, New York.

- Deveshwar, A., & Dhawal, M. (2013). Inventory management delivering profits through stock management. World Trade Centre, Dubai: Ram University of Science and Technology.
- Ngubane, N., Mayekiso, S., Sikota, S., Fitshane, S., Matsoso, M., & Bruwer, J.-P. (2015). Inventory Management Systems used by Manufacturing Small Medium and Micro Enterprises in Cape Town. *Mediterranean Journal of Social Sciences*, 6(1), 382-390.
- Haslindah, A., Fadhli, M., & Mansyur, R. Pengaruh Implementasi Warehouse Management System Terhadap Inventory Control Finish Good Berbasis Barcode Pt. Dharana Inti Boga. 12, 2017.
- Ardito, L., Messeni Petruzzelli, A., Panniello, U., & Garavelli, A. C. (2019). Title of the Article. *Business Process Management Journal*, 25(5), 1234-1256.
- Tien, N. H., Anh, D. B. H., & Thuc, T. D. (2019). *Global Supply Chain and Logistics Management*. Academic Publications.
- Siagian, H.; Jade, K.; Tarigan, Z.J.H. The role of affective leadership in improving firm performance through the integrated internal system and external integration FMCG Industry. *Int. J. Data Netw. Sci.* 2020, 4, 365–372.
- Mandal, S. Impact of supplier innovativeness, top management support and strategic sourcing on supply chain resilience. *Int. J. Prod. Perform. Manag.* 2020.
- Sabirin, N. H. A., Fadhil, N. F. M., & Arifin, J. (2022). Information technology (IT) in agriculture sector: Issues and challenges. *Social and Management Research Journal*, 19(2), 111-137. <https://doi.org/10.24191/smrj.v19i2.19307>.
- Kithinji, F. M. (2015). Impact of information technology on inventory management in supermarkets in Nairobi City County. Doctoral dissertation. University of Nairobi.
- Banabakova, V., Latyshev, O., Georgiev, M., & Stoyanov, S. (2018). The Warehousing as an Element of Army Logistics System in Conditions of Arctics (from Experience of Bulgarian-Russian Cooperation).
- Tompkins, J. A. (1998). The challenge of warehousing. *The Warehouse Management Handbook*, 6.
- Nduta Gitau, N., & of Nairobi, U. (2016). *THE EFFECT OF INVENTORY MANAGEMENT PRACTICES ON OPERATIONAL PERFORMANCE OF WAREHOUSING FIRMS IN MOMBASA COUNTY BY NAOMI NDUTA GITAU*.

# Appendix

## RESEARCH QUESTIONNAIRE

### Section 1

**Name**

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**Email**

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**Age**

- 18-23
- 23-32
- 32-37
- 37 or above

**Gender**

Male

Female

**Educational Background**

- Ph.d
- Masters
- Bachelors
- Diploma

**Designation at Workplace**

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## Section 2

### Inventory Management Practices

Please use the provided scale to indicate the extent to which the following inventory management practices contribute to enhancing warehousing efficiency.

**Scale: 1) Very Large Extent | 2) Large Extent | 3) Moderate Extent | 4) Small Extent | 5) Very Small Extent**

<b>Just-In-Time Technique</b>	<b>Very Large Extent</b>	<b>Large Extent</b>	<b>Moderate Extent</b>	<b>Small Extent</b>	<b>Very Small Extent</b>
To reduce waste, the organization utilizes the Just-in-Time (JIT) system.	1	2	3	4	5
The company uses Just-in-Time (JIT) to have the right materials in the right place at the right time.	1	2	3	4	5
The company employs JIT to enhance the institution's return on investment.	1	2	3	4	5
The company utilizes a Just-in-Time stock control system.	1	2	3	4	5
The company employs the JIT technique to minimize raw material wastage.	1	2	3	4	5

### Section 3

#### Supplier Partnership Management

Supplier Partnership Management	Very Large Extent	Large Extent	Moderate Extent	Small Extent	Very Small Extent
The company prefers long-term relationships with suppliers.	1	2	3	4	5
High level of trust with suppliers.	1	2	3	4	5
Mutual information sharing and high level of effective communication.	1	2	3	4	5



## Section 4

### Information Technology

<b>Information Technology</b>	<b>Very Large Extent</b>	<b>Large Extent</b>	<b>Moderate Extent</b>	<b>Small Extent</b>	<b>Very Small Extent</b>
Review of inventory levels via softwares.	1	2	3	4	5
Determination of appropriate maximum and minimum inventory levels.	1	2	3	4	5
Setting the appropriate reorder level for stock.	1	2	3	4	5
Availability of adequate stock at all times.	1	2	3	4	5
Use of inventory management techniques to determine inventory levels.	1	2	3	4	5

## Section 5

### Warehouse Efficiency

<b>Warehouse Efficiency</b>	<b>Very Large Extent</b>	<b>Large Extent</b>	<b>Moderate Extent</b>	<b>Small Extent</b>	<b>Very Small Extent</b>
Improved labor productivity	1	2	3	4	5
Enhanced customer service	1	2	3	4	5
More efficient use of available warehouse space.	1	2	3	4	5
Makes inventory movements more standardized.	1	2	3	4	5
Faster inventory turns.	1	2	3	4	5

**Thank You!**

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