Siber Journal of Transportation and Logistic (SJTL)
E-ISSN: 2987-1050
P-ISSN: 2987-1026
+62 822 1012 3600 https://research.e-siber.org siberpublisher.info@gmail.com
DOI: https://doi.org/10.38035/sjtl.v2i4

Optimization of Logistics Warehouse in Supporting E-Commerce and Increasing MSME Sales: A Literature Review

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Abstract: The rapid growth of e-commerce in Indonesia has encouraged Micro, Small, and Medium Enterprises (MSMEs) to adapt to more efficient distribution and logistics systems. Optimizing logistics warehouses is a crucial factor in supporting smooth supply chains, accelerating delivery, and increasing customer satisfaction. This literature review aims to identify relevant logistics warehouse optimization strategies in the context of MSME digitalization and the development of e-commerce. This article discusses the basic concepts of warehouse management, the application of technologies such as warehouse management systems (WMS), automation, and logistics integration with e-commerce platforms. In addition, the challenges faced by MSMEs in logistics management and solutions that can be applied to improve operational efficiency are also examined. The results of the review show that collaboration between MSMEs, logistics providers, and the use of digital technology play a significant role in increasing the competitiveness of MSMEs in the digital economy era.

Keywords: Logistics Warehouse, E-Commerce, Msmes, Optimization, Distribution System

INTRODUCTION

In recent years, advances in digital technology have fundamentally changed consumer behavior patterns and business dynamics, especially in the e-commerce sector. This development is not only seen in developed countries, but is also growing rapidly in developing countries such as Indonesia. Online buying and selling transactions are now increasingly widely accepted, providing convenience, speed, and opening up great opportunities for various business actors, including Micro, Small, and Medium Enterprises (MSMEs). MSMEs have a very important role in the structure of the national economy. According to data from the Ministry of Cooperatives and SMEs, the MSME sector contributes more than 60% to Gross Domestic Product (GDP) and absorbs most of the workforce in Indonesia. However, MSMEs often face obstacles in expanding market access, especially related to efficiency in logistics and product distribution. Along with the increasing volume of transactions through e-commerce, the existence of a reliable, fast, and efficient

logistics system is becoming increasingly crucial to support the growth and sustainability of MSMEs in the digital era.

One important aspect of the logistics system that often gets less attention, but is very important in determining the smooth distribution of products, is warehouse management. Warehouses not only function as a place to store goods, but also as a center for controlling the flow of goods, stock management, and order delivery. Unoptimized warehouse management can cause various problems, such as late delivery, errors in order fulfillment, and increased operational costs, which overall have a negative impact on customer satisfaction and the reputation of MSME businesses (Hansopaheluwakan, 2015).

Optimizing logistics warehouses in the context of e-commerce is not only about increasing storage capacity, but also about implementing sophisticated technology, strategic planning, and flexible managerial approaches in accordance with market dynamics. Implementation of a warehouse management system (WMS), automation of operational processes, integration with digital platforms, and utilization of data as a basis for decision making are some of the strategies that have begun to be adopted by business actors to increase efficiency and accuracy in warehouse management (Kappauf et al., 2011).

This literature review was compiled with the aim of analyzing various literature related to the vital role of logistics warehouses in supporting e-commerce operations and their impact on increasing sales and the competitiveness of MSMEs. This study seeks to provide a comprehensive overview of warehouse optimization strategies that can be implemented by MSMEs to overcome challenges in the digital era. By integrating theoretical approaches and real practices from various sources, it is hoped that the results of this study can be the basis for further research and as a reference for MSMEs and policy makers in designing more efficient and sustainable logistics systems.

The problem of stockpiling goods in the warehouse is often a serious challenge for logistics management, especially for small and medium enterprises (SMEs) that do not yet have a well-organized inventory management system. This accumulation not only disrupts operational effectiveness, but also has the potential to cause losses due to damaged goods, increased storage costs, and decreased productivity. Therefore, a strategic approach is needed that can increase the efficiency of warehouse management and prevent the accumulation of unnecessary goods (Silalahi, 2015).

The first step that can be taken is to implement an information technology-based inventory management system. The use of stock management software or applications can help business actors monitor the quantity and movement of goods in real-time. With an automated system, recording of incoming and outgoing goods becomes more accurate and procurement of goods can be adjusted to real needs. In addition, this system can help set minimum and maximum inventory limits so that procurement of goods is not excessive. Furthermore, product classification using the ABC method is also a very useful strategy. Through this method, goods are divided based on their value and speed of turnover: category A products have high turnover and high value, category B has medium rotation, and category C tends to have low value and turnover. With this grouping, storage space management becomes more efficient because products that are frequently issued are placed in more strategic locations. Stock management strategies can also be strengthened by implementing the First In First Out (FIFO) and First Expired First Out (FEFO) principles. FIFO is used to ensure that goods that come in first will be prioritized for issuance, while FEFO regulates that products with a shorter shelf life are immediately sent first. Both of these approaches are effective in maintaining healthy product rotation and preventing the accumulation of products that are no longer suitable for use, (Ching et al., 2019) ,(Susanto, Subagio, et al., 2024), and (Alamri & Syntetos, 2018).

Periodic inventory audits, or stock opname, are also very important to do in order to find out the actual condition of the goods. Through this activity, business actors can identify goods that are piling up and no longer moving. These goods can then be targeted for promotion, sold at a discount, or even removed from the system if they are no longer relevant. Periodic audits can also prevent discrepancies between system data and real conditions in the field. In addition, the implementation of the cross-docking method can be a solution to streamline the distribution process. This concept allows goods from suppliers to be distributed directly to customers without the need for long-term storage in the warehouse. Thus, storage time can be reduced and warehouse capacity can be utilized for goods that really need to be stored (Toomey, 2012).

Optimization also includes rearranging the warehouse layout to be more functional and in accordance with the workflow. An efficient layout design allows the flow of goods to be more organized, speeds up the process of picking goods, and avoids congestion or accumulation in certain areas. Utilization of vertical space such as tiered shelves can also be a solution to overcome space limitations (Power, 2005).

Then, planning stock requirements based on demand analysis (demand forecasting) is very important to prevent overstock. By relying on historical data and sales trends, business actors can be more careful in determining the number of goods to be ordered or produced, so that procurement becomes more targeted. If storage needs exceed the capacity available, business actors can also collaborate with third parties or logistics service providers (third-party logistics/3PL). By using external storage facilities, SMEs can maintain smooth distribution of goods without having to burden their main warehouse (Apostolov, 2021).

The increase in cargo shipments is one of the real impacts of the development of the digital era and the increasing use of e-commerce, especially among MSMEs. Along with changes in consumer behavior who now prefer online transactions, the need for fast and efficient logistics services is also increasing. This has caused the volume of goods shipments both domestic and international to experience a significant spike in recent years (Hadi & Purwati, 2020), (Susanto, Saribanon, et al., 2024).

This trend has created new challenges, especially in the logistics handling process in warehouses. Many distribution centers now face a much greater workload due to increased shipping frequency, more diverse types of goods, and pressure to meet shipping requests in a short time. As a result, logistics warehouses are experiencing congestion that not only disrupts workflow but also slows down the process of picking, sorting, and shipping goods.

One of the main causes of congestion is the lack of an integrated and technology-based warehouse management system. Many business actors, especially MSMEs, still rely on manual processes that are less efficient in dealing with high volumes of goods. In addition, the waiting time between the arrival of goods and the shipping process to consumers also often triggers a buildup of goods in the warehouse, especially at certain times such as promo seasons or big days (Egwu et al., 2021), (Cultrera & Brédart, 2016).

The demand for instant delivery such as same-day delivery and next-day delivery also exacerbates the workload in warehouses. To meet these fast services, logistics providers often have to store large amounts of stock in strategic locations, which actually reduces storage capacity and slows down the distribution process if not handled properly. In situations like this, the role of the warehouse changes from simply a place to store goods to a complex logistics activity center. When the system is unable to accommodate the surge in demand, there will be disruptions in services such as late deliveries, errors in orders, and increased operational costs due to the high need for additional labor and storage space (Saragih et al., 2020), (Archetti & Peirano, 2020).

To overcome this problem, various efforts have begun to be implemented. Among them are the use of a digital warehouse management system (WMS), automation of work

processes through technology such as conveyors and scanners, and the development of small-scale distribution centers near consumer locations (micro-fulfillment centers). This strategy is intended to increase efficiency and reduce density in central warehouses (Dede & Çengel, 2020), (Anggorowati, 2018).

Thus, although the trend of cargo shipping continues to increase as a consequence of digital and e-commerce advances, the challenges that arise, especially related to warehouse density, need to be responded to with technological innovation and adjustments to logistics infrastructure. Without adequate system updates, warehouse capacity will continue to be overwhelmed and could actually hinder the growth of the logistics and e-commerce sectors in the future (Aprilianti et al., 2023).

Based on the background of the problem above, the formulation of the problem is determined as follows: 1) Does e-commerce affect logistics warehouses? 2) Do UMKM sales affect logistics warehouses?

METHOD

This article was written using a literature review method that aims to collect, review, and analyze various relevant literature sources related to logistics warehouse optimization strategies in supporting the development of e-commerce and improving the sales performance of MSMEs. This method was chosen because it provides a strong theoretical basis by referring to the results of previous studies, existing theories, and best practices that have been applied in the fields of logistics and warehouse management. After being collected, all literature was analyzed descriptively-qualitatively. The analysis was carried out by grouping the contents based on main themes such as technology integration in warehouses, MSME distribution challenges, and logistics efficiency practices in e-commerce. The synthesis process was carried out to identify common threads between various studies so that a comprehensive understanding can be compiled regarding the strategic role of logistics warehouses in supporting the success of MSMEs amidst the rapid development of the digital economy. Through this approach, the article is expected to be able to provide comprehensive insights and become a reference for academics, business actors, and policymakers in designing an effective and adaptive logistics system to the needs of today's MSMEs and e-commerce. The primary rationale for doing qualitative analysis was the exploratory nature of the research (Susanto, Yuntina, et al., 2024).

RESULTS AND DISCUSSION

Result

Based on the results of the review of various literature sources, it can be identified that logistics warehouses play a very important role in supporting the e-commerce distribution system, especially in encouraging increased sales performance of MSMEs. Along with the increasing digital trade activity, the need for a fast, efficient, and adaptive logistics system is becoming increasingly urgent. In this case, the warehouse functions as the main node in the supply chain that needs to be managed strategically to respond to changing market dynamics.

One of the important findings in this study is the urgency of using a digital-based warehouse management system or Warehouse Management System (WMS). This system plays a role in systematic stock arrangement, speeding up the process of picking and packing goods and providing transparency to inventory movements. Several studies have shown that the implementation of WMS can increase operational efficiency, minimize errors in the shipping process, and speed up overall order handling. In addition to WMS, the integration of automation technology in the warehouse environment has also been shown to have a positive impact. Equipment such as barcode scanners, automatic conveyors, and sorting robots have

been widely used to replace manual processes. This automation not only speeds up the movement of goods but also increases accuracy and reduces the workload of human labor.

The study also found that the strategy of decentralized distribution through the development of micro-fulfillment centers is an increasingly popular solution. Small-scale warehouses located closer to end consumers help reduce shipping costs and speed up service times. Collaboration between e-commerce platforms and third-party logistics (3PL) service providers also encourages MSMEs to take advantage of this infrastructure without having to build it themselves. However, various literature also emphasizes that MSMEs still face several obstacles in terms of warehouse optimization, such as limited capital, low understanding of technology, and minimal access to modern logistics facilities. Many MSMEs still use traditional systems in managing goods, which makes the distribution process less efficient. Therefore, strategic interventions are needed in the form of training, provision of affordable technology solutions, and support from the government and related sectors so that MSMEs can transform logistically.

Overall, the results of this review indicate that warehouse optimization not only improves logistics flows but also increases the competitiveness of MSMEs amidst high competition in e-commerce. Technology collaboration, proper management, and involvement of all stakeholders are key to building an effective, resilient, and sustainable logistics system. The problem of density and accumulation of goods in logistics warehouses is an issue that often arises, especially during periods with high demand spikes such as big discount moments, national holidays, or as an impact of the rapid growth of the e-commerce sector. This condition not only hinders the smooth distribution, but also increases the burden of operational costs, increases the risk of damage to goods, and reduces customer satisfaction levels. Therefore, a comprehensive and integrated solution is needed to overcome this challenge.

One approach that can be taken is optimizing the warehouse layout. Systematically rearranging the warehouse layout allows the flow of goods and operational activities to take place more efficiently. This involves a clear division of work zones, such as the goods receipt area, storage, packaging, and shipping. Placing fast-moving products close to the goods in and out area can speed up the distribution process while avoiding congestion. The next step is the use of a digital-based warehouse management system (WMS). This system facilitates real-time stock monitoring, organizes the placement of goods, and streamlines the delivery flow. In addition, the application of stock rotation principles such as First In First Out (FIFO) through WMS also helps prevent the accumulation of non-moving goods, so that the allocation of storage space becomes more efficient and planned. Furthermore, the implementation of automation technology in the warehousing process is also key to reducing bottlenecks in the warehouse. The use of automated equipment such as conveyor systems, automated guided vehicles (AGVs), and barcode scanners can speed up the process of picking, sorting, and moving goods without relying too much on manual labor. This has a positive impact on the speed of service and the accuracy of inventory management.

Another important aspect is good scheduling related to the flow of incoming and outgoing goods. Careful logistics planning allows the warehouse to balance the time of receipt and delivery so that there is no sudden accumulation of goods. Active coordination between the warehouse and logistics partners is needed to ensure that the distribution of goods continues to run smoothly.

On a wider scale, the use of supporting warehouses such as micro-fulfillment centers can also be an effective solution. Small warehouses placed in strategic locations near end consumers are able to share the operational burden of the main warehouse. This not only helps reduce density but also speeds up delivery times and reduces logistics costs, especially for MSMEs. No less important is the use of historical data and demand trend analysis to

avoid overstocking. By making accurate projections, companies can determine the number and types of goods that need to be stored, so that space usage can be optimized and the risk of accumulation can be minimized. By integrating various strategies ranging from improving warehouse design, digitizing stock management, and automating work processes, to predictive analysis companies can reduce the risk of density and streamline the logistics flow. This ultimately contributes to lower operational costs and improved overall customer service.

Previous Research

Based on the problem formulation and research results above, previous research was determined as follows:

Table 1. Relevant Previous Research Results

No	Authors	Title	Result
1	(Zennaro et al., 2022)	Implementing E-commerce from a logistic perspective: Literature review and methodological framework	E-commerce is always more diffused as a selling channel around the whole world market, and its importance has increased and continues to increase with the COVID-19 pandemic emergency. It provides enterprises a lot of opportunities, as the importance of physical stores to sell goods is bypassed. However, it has also changed the role of logistics in the supply chain. For this reason, this work aims to identify the main logistics research areas related to e-commerce implementation and the factors and key performance indicators, that should be taken into account for each logistics research area, with particular attention to sustainable aspects.
2	(Jiang et al., 2021)	Sustainable management for fresh food E-commerce logistics services	The findings of this study are as follows. First, the qualities of personal contact, timeliness, and empathy in the fresh food e-commerce logistics service quality evaluation system have a significant positive impact on the fresh food e-commerce logistics service consumer satisfaction, but the delivery quality and information quality are not significant. Second, consumers' perceived importance of last-mile logistics services has a positive and significant impact on the consumer satisfaction of fresh food e-commerce logistics services. Moreover, as a moderating variable, its moderating effect has limitations: it only affects the relationship between information quality, timeliness quality, empathy quality, and consumer satisfaction. Finally, in the three evaluation dimensions of information quality, timeliness quality, and empathy quality, specific items that need to be further improved are identified. This study enriches and supplements the empirical research in the field of fresh food e-commerce logistics, and provides academic literature with a reference value for fresh food e-commerce logistics enterprises.
3	(Gomes et al., 2023)	Logistics management in e-commerce: challenges and opportunities	This article offers a comprehensive overview of logistics management in e-commerce, with a focus on identifying challenges, opportunities, strategies, and solutions that can help companies improve their logistics processes and succeed in a highly competitive market.
4	(Kawa & Światowiec-Szczepańska, 2021)	Logistics as a value in e-commerce and its influence on satisfaction in industries: a multilevel analysis	The logistics factors indicated and described in the paper differently affect the value for the customer. This value is subjective and dynamic. For this reason, the online seller should develop a system to create a

No	Authors	Title	Result
			sustainable value proposition. It is plausible due to the possibility of choosing the type of delivery, date of collection, and change thereof, as well as that of returning the product. Because of all this, the customer decides on the way of the order execution and creates the value chain.
5	(Medeiros et al., 2020)	Measurement of Logistics Service Quality of E-Commerce	The results of the application of the SEM evidenced that aspects related to reliability and assurance are significant for the perceived quality formation in e-commerce logistics services. The main contribution of this work focuses on the indication for e-commerce companies on aspects of the services that can be oriented, to improve the perception of the quality of the service provided, as well as, contribute to the expansion of the improvement of this service and economic efficiency of corporate activities.

Discussion

The rapid development of e-commerce has had a significant impact on the logistics system, especially in terms of warehouse management. For Micro, Small, and Medium Enterprises (MSMEs), the function of the warehouse has evolved from just a storage place to an important element in the supply chain that determines the speed, accuracy, and efficiency of distribution. Therefore, warehouse optimization efforts are a must to answer the challenges of modern distribution and strengthen the competitiveness of MSMEs in the digital economy. Based on the results of the literature review, several main approaches can be applied to optimize the function of the logistics warehouse. First, through the digitalization of warehouse management by utilizing Warehouse Management System (WMS) technology. This system facilitates real-time stock tracking, facilitates systematic arrangement of goods placement, and reduces the possibility of operational errors. Several studies have shown that the implementation of WMS can increase the accuracy of inventory management to almost perfect, as well as accelerate the order fulfillment process.

Furthermore, automation of warehouse activities is one of the effective solutions in anticipating the spike in goods volume due to the growth of e-commerce. The use of devices such as barcode scanners, automatic conveyor systems, and robotics has been widely adopted by large logistics companies to optimize productivity and reduce dependence on manual work. For MSMEs, the application of this technology can start with the use of simple cloud-based software or a scanning system that can speed up the process of recording incoming and outgoing goods. The third approach is to strategically rearrange the warehouse layout. Grouping goods based on their frequency of movement and efficient zoning design will speed up the process of picking and packing goods. Products that have high rotation should be placed in easily accessible locations, while goods that are rarely issued can be stored at the back. With this arrangement, the time and energy required in the distribution process can be minimized.

The fourth strategy involves decentralizing the distribution system through micro-fulfillment centers. Small warehouses located close to the endpoint of consumers can help reduce the burden on the main warehouse while speeding up the shipping process and lowering logistics costs. For MSMEs that have limited infrastructure, this strategy can be implemented through collaboration with third-party logistics providers or through community platforms that provide shared warehouse facilities. However, the adoption of these strategies is not without challenges. Many MSMEs still rely on conventional systems due to limited knowledge, skills, and access to technology and funding. Therefore, support from the government, digital platforms, and other supporting institutions is needed. This support can

be in the form of technical training, equipment and system subsidies, and inclusive logistics collaboration incentives.

Overall, optimizing logistics warehouses is an important component in supporting the efficiency of e-commerce distribution systems. With a collaborative approach involving technology, good management, and cross-sector support, MSMEs can improve their logistics capabilities and strengthen their position in the increasingly competitive digital market competition. In the context of modern industrialization and global economic integration, the logistics system plays a very important role in ensuring the smooth running of production and distribution activities. In it, the warehouse becomes a vital element that not only functions as a storage location, but also as a center for operational control of the flow of goods that supports the stability and efficiency of the industry.

One of the main functions of a warehouse in the industrial world is to balance the rhythm of production with market needs. In many cases, the goods produced are not always sent directly to customers. For this reason, the warehouse functions as a transit point that guarantees product availability until the right delivery time. This role is crucial in maintaining supply chain continuity and preventing disruptions that can hinder the production process. In addition, warehouses support operational efficiency by helping to manage stock systematically and accurately. A professionally managed warehouse system allows companies to avoid excess or shortage of stock, accelerate access to goods, and reduce overall logistics costs. Real-time stock information allows management to make data-based decisions in production and distribution planning.

For the manufacturing industry, warehouses play an important role as the main traffic point for raw materials, semi-finished products, and finished goods. Logistics activities such as receiving goods, storing, processing, and shipping to customers are all centralized in the warehouse. If not handled properly, problems such as density or misalignment can have a direct impact on delays in production or delivery. Technological advances have driven the transformation of warehouses to become more sophisticated and digitally connected. The use of Warehouse Management Systems (WMS), the Internet of Things (IoT), and artificial intelligence (AI) allows companies to monitor the movement of goods directly, predict demand precisely, and automate processes to save time and energy. Warehouses are now an important element in the industry's digitalization strategy.

In the global arena, warehouses also play a strategic role in the international supply chain. Warehouses located in strategic locations such as ports, industrial areas, or near airports can speed up cross-border shipping, facilitate the consolidation of goods, and reduce export logistics costs. Furthermore, warehouses can participate in encouraging environmentally friendly industrial practices through the application of green logistics principles. The use of energy-efficient technology, waste management systems, and efficiency in building design are part of the industry's commitment to environmental sustainability. Overall, logistics warehouses function as the heart of the industrial supply chain. Their ability to streamline processes, accelerate distribution, and adapt to technology and market needs makes them an important pillar for the overall competitiveness of the industry.

Conceptual Framework

The framework of thinking has been determined based on the research results, past research, and the aforementioned debate.

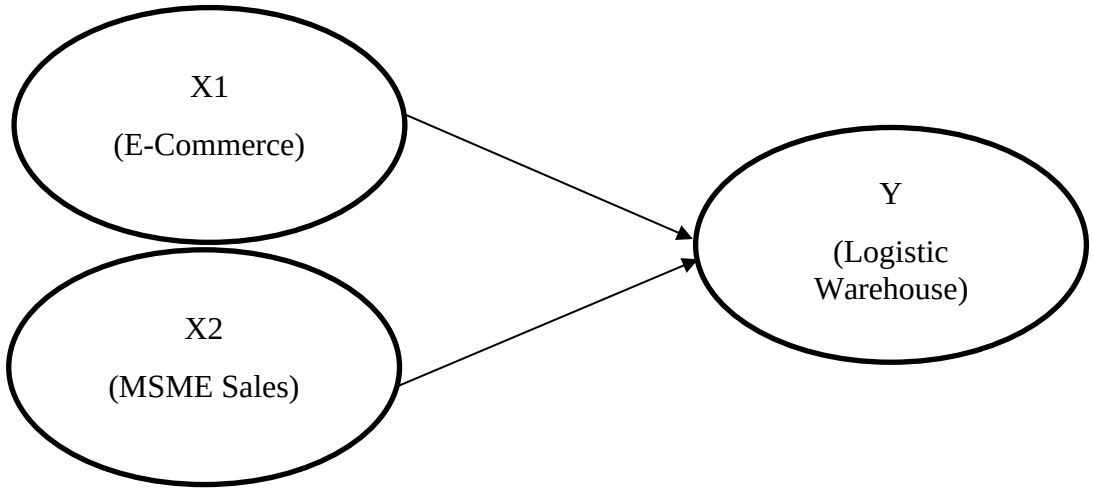

Figure 1. Conceptual Framework

CONCLUSION

From the results of the literature study conducted, it can be seen that the function of the logistics warehouse is very crucial in strengthening the distribution system in the e-commerce ecosystem and improving the sales performance of MSMEs. Amid the rapid development of digital transactions, the existence of a responsive, efficient, and integrated logistics system is becoming increasingly vital. Warehouses now not only function as a place to store goods but also become the center of logistics activities that have a major impact on the smoothness of the supply chain to consumers.

Warehouse optimization can be achieved through various approaches, including the use of digital technology such as the Warehouse Management System (WMS), the application of logistics process automation, rearranging more functional warehouse layouts, and the development of small-scale warehouses (micro-fulfillment centers) that bring stock closer to consumer locations. This strategy is significantly able to increase operational effectiveness, reduce congestion of goods in the warehouse, and accelerate distribution services.

However, MSMEs still face obstacles in adopting this strategy, mainly due to limited capital, technological infrastructure, and human resource competency. Therefore, an active role is needed from various stakeholders such as the government, logistics service providers, and digital platforms to provide facilities in the form of training, technology incentives, and building a supportive collaborative ecosystem.

Overall, increasing the efficiency of logistics warehouses through technology, modern management, and cross-sector collaboration will encourage MSMEs to become more resilient and competitive in facing the challenges of the ever-growing digital market.

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