



The Role of Logistics in Enhancing E-Commerce Competitiveness

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ABSTRACT

The rapid growth of e-commerce has intensified competition among online retailers, making efficient logistics a critical factor for organizational success. This study investigates the role of logistics in enhancing e-commerce competitiveness by examining current practices, technological adoption, and employee perceptions within the sector. A descriptive research design was employed to systematically capture insights into logistics operations, including inventory management, warehousing, transportation, and last-mile delivery. The study population comprised employees working in e-commerce companies with active warehouse and logistics operations, including warehouse staff, logistics managers, procurement personnel, and operations executives. Using purposive sampling, a total of 112 respondents were selected to ensure representation across different roles, experience levels, and organizational functions. Data were collected through structured questionnaires and analyzed using descriptive statistics such as frequencies, percentages, and cross-tabulations to identify patterns in logistics practices and their perceived impact on competitiveness. Findings indicate that a majority of respondents recognize logistics as a critical driver of operational efficiency, customer satisfaction, and market competitiveness. The study highlights the importance of integrating advanced logistics technologies and strategic supply chain management to achieve sustained competitive advantage in the rapidly evolving e-commerce landscape.

Keywords: *E-Commerce, Logistics, Supply Chain Management, Delivery Efficiency, Customer Satisfaction.*

I. INTRODUCTION

The rapid evolution of technology and the widespread adoption of the internet have fundamentally transformed the way businesses operate, with e-commerce emerging as a dominant force in global trade. The convenience of online shopping, combined with the accessibility of digital platforms, has created an environment where consumer expectations are higher than ever. In this competitive

landscape, logistics has become a critical determinant of success, as it directly influences the speed, reliability, and cost-effectiveness of delivering goods to end consumers. Efficient logistics management not only ensures the smooth movement of products from manufacturers to warehouses and ultimately to customers but also serves as a strategic differentiator that enhances a company's competitive edge in the e-commerce sector. E-commerce logistics encompasses a wide array of functions, including inventory management, order processing, warehousing, transportation, and last-mile delivery. Each of these components plays a crucial role in ensuring that the right products reach the right customers at the right time. For instance, accurate inventory management prevents stockouts and overstocking, thereby reducing operational costs and improving service levels.

Similarly, streamlined warehousing practices enable quick order fulfillment, which is particularly important in an era where same-day and next-day delivery options are increasingly expected by consumers. Moreover, advancements in technology, such as warehouse automation, predictive analytics, and route optimization, have revolutionized logistics processes, allowing e-commerce companies to enhance efficiency, reduce errors, and improve delivery speed. The importance of logistics in e-commerce extends beyond operational efficiency. It has a direct impact on customer satisfaction and loyalty, which are critical factors in maintaining competitiveness. In today's digital marketplace, consumers have access to multiple options and can easily switch to competitors if their expectations are not met. Timely and reliable deliveries, transparent tracking systems and hassle-free return processes contribute significantly to positive customer experiences. By prioritizing logistics excellence, e-commerce firms can build trust, foster repeat purchases, and strengthen brand reputation, all of which are essential for sustaining long-term growth.

Furthermore, logistics plays a pivotal role in enabling e-commerce companies to expand their market reach. Efficient supply chain networks allow businesses to serve customers across geographies, including remote and underserved regions, thereby tapping into new revenue streams. Cross-border e-commerce, which is experiencing exponential growth, relies heavily on robust logistics solutions to navigate international shipping regulations, customs clearance, and currency differences. Companies that can efficiently manage these complexities gain a significant competitive advantage over those with limited logistical capabilities. The integration of digital technologies into logistics operations has further enhanced the strategic role of supply chain management in e-commerce competitiveness. Tools such as artificial intelligence, machine learning, and Internet of Things (IoT) devices facilitate real-time monitoring, predictive maintenance, and demand forecasting. These innovations enable companies to anticipate market trends, optimize inventory levels, and proactively address potential disruptions, thereby reducing costs and improving service quality.

Additionally, the use of data analytics allows firms to gain insights into customer behavior, delivery patterns, and operational bottlenecks, supporting informed decision-making and continuous improvement in logistics performance. Sustainability has also emerged as an important consideration in e-commerce logistics. Consumers are increasingly conscious of the environmental impact of their purchases and prefer companies that adopt eco-friendly delivery solutions. Logistics strategies such as route optimization, electric delivery vehicles, and eco-friendly packaging not only reduce carbon

emissions but also enhance brand image and attract environmentally aware customers. As a result, logistics is no longer merely a back-end operational function; it has become a strategic tool for differentiating e-commerce firms in a competitive marketplace. In conclusion, the role of logistics in e-commerce competitiveness is multifaceted, encompassing operational efficiency, customer satisfaction, market expansion, technological integration, and sustainability. Companies that invest in robust and innovative logistics systems are better positioned to meet consumer expectations, reduce costs, and gain a sustainable competitive advantage. As the e-commerce industry continues to grow and evolve, logistics will remain a key driver of success, shaping the future of online retail and influencing the overall competitiveness of businesses in this dynamic sector.

II. LITERATURE REVIEW

Chen, Xia et al., (2024) Logistics route planning using the conventional method is impeded by cumbersome processes. Our research delves into logistics management's potential for multi-objective optimization by taking into accounts not only the standard route and time efficiency indices, but also shelf safety and stability. We maximize objective functions for internal route planning, scheduling timeliness, and shelf stability and safety using particle swarm optimization (PSO). Next, we use PSO to find the best routes for different orders of demand, and finally, we optimize the last path to satisfy real demand by applying dynamic programming and spline function limitations. Based on the empirical data, the suggested solution approach shows a 10% improvement in total distance consumption and beats other calculating methods like genetic algorithm (GA) and simulated annealing (SA). Additional real-world testing show that the study's approach optimizes deployment efficiently, which benefits all five order types.

Yangınlar, Gözde et al., (2024) the purpose of this research is to identify the function of logistics 4.0 in the connection between e-commerce marketing competence and company performance. Logistics 4.0 capacity mediates the link between e-commerce marketing and firm performance, according to our theoretical framework that is based on dynamic capability theory and built on top of the literature. We put our theories to the test using survey results from 553 people in the electronics, textiles, logistics, and white goods industries. Structural equation modeling is used to assess the data. Based on the empirical data, it can be concluded that logistics 4.0 capacity mediates the favorable association between e-commerce marketing and company success. Improved on-time deliveries and more efficient supply chain procedures are two ways in which the capabilities of logistics 4.0 boost a company's success. Our findings stress the need of bolstering the company's e-commerce marketing ROI with Logistics 4.0 capabilities, which include human capital, management tools, and technological know-how. By boosting company agility, on-time delivery, efficiency, flexibility, and responsiveness to clients, Logistics 4.0's capabilities boost the effect of e-commerce marketing on firm success. By determining how Logistics 4.0 mediates the connection between e-commerce marketing and performance, this research adds to the literature on firm performance.

Gomes, Alysson et al., (2023) Businesses in the retail sector can't succeed without effective logistics management. Businesses need to adopt effective logistics strategies to meet consumer demands, save expenses, and stay ahead of the competition as online shopping becomes more prevalent. To assist

businesses improve their logistics operations and thrive in a cutthroat industry, this article provides a thorough review of e-commerce logistics management, highlighting possibilities, threats, tactics, and solutions. A literature review, a process of systematically analyzing previously published scientific publications on a certain subject, was used in this study. To undertake a thorough and critical evaluation of information pertaining to logistics management, the research adheres to a five-step procedure. Managing order volume and storage, properly monitoring inventory, and guaranteeing prompt shipment and delivery are just a few of the notable logistics management difficulties that e-commerce enterprises have, according to the literature analysis. The research assessed a selection of 70 papers. Investing in infrastructure, transportation management systems, inventory management methods, delivery route optimization, and new technology like delivery drones and robots may help businesses overcome these issues. By using these technologies, logistics process efficiency, error reduction, and customer satisfaction may be greatly improved. Businesses may increase sales and customer loyalty over the long run by providing a streamlined shopping experience for their consumers via more effective logistical strategies.

Akıl, Siber & Ungan, Mustafa. (2022) the number of logistical activities related to online shopping has been increasing at a fast pace due to recent technological breakthroughs, globalization, and the COVID-19 epidemic. Nevertheless, the literature assessment for this study revealed that research on the quality of commerce logistics services is scarce. We hope that our research will help to close that knowledge gap. Its goal is to determine what aspects of e-commerce logistics service quality impact customers' happiness. Finding out if there is a correlation between happy online shoppers and repeat business is another area of study. A web-based poll was used to gather data from 1,562 Turkish e-commerce clients. Structural equation modeling was used to analyze the data. Customer satisfaction was shown to be positively impacted by timeliness, order condition, order correctness, and management of order discrepancies. Additionally, there was a good correlation between happy customers and loyal ones.

Kim, Jinsung et al., (2021) Cutthroat rivalry has emerged as a result of COVID-19's rapid expansion of the e-commerce business. Firms respond to the fierce rivalry in the e-commerce sector by offering logistical services, which help them stay ahead of the competition. Additionally, ESG initiatives undertaken by e-commerce firms are gaining traction as customers prioritize sustainability in their product and service selections. As a result, we set out to research the characteristics of competitive e-commerce from an ESG standpoint in the logistics industry in order to provide solutions for distinction. Using a conjoint analysis, we determined how crucial each ESG factor was to the logistics process. Consequently, we discovered that e-commerce consumers rank ESG activities as follows: distribution in the social with 9.866 percent, partnership in the governance with 9.63 percent, operation of the distribution center with 8.570 percent, packaging with 8.320 percent, operation of the distribution center with 8.262%, purchasing with 8.200 percent, and distribution with 7.153 percent. Therefore, we proposed ESG methods including win-win collaboration, transparency about the working conditions in distribution and delivery centers, creation of a common logistics platform, prevention of COVID-19, and education of customers about the importance of eco-friendly delivery.

Erceg, Aleksandar & Damoska Sekuloska, Jovanka. (2019) Companies have been "forced" to alter their logistics strategies due to changes in the field brought about by recent technological advancements and the proliferation of e-commerce. The flip side of the coin is the transition and new advancements in logistics service providers. Customer service and turnaround time are becoming just as important as pricing when it comes to competing in today's market. This may be affected by the introduction of contemporary logistical practices. That is why logistics service companies throughout the world are seen as partners in business, and the connection between the two is no different. Since a result of technological advancements, the e-logistics idea has grown in popularity since it facilitates supply chain participants' ability to share and see information transparently. Since a result, e-logistics's ability to exchange information with its partners is crucial, since it might impact their competitiveness. Using various digital technologies for business, this study aims to demonstrate how the correct logistics service provider in today's supply chain may help organizations achieve and sustain competitiveness. This paper summarises the findings from a literature study and attempts to predict how e-logistics and e-SCM would affect a business's ability to compete. This research uses DHL as an example to show how e-logistics may help businesses get an edge in the market. According to the findings, businesses may boost their competitiveness in the modern market by using smart logistics operators. Logistics service providers will have to evolve with the times in order to adapt to the new trend, which is characterized by new competitors, a focus on customer experience, and technological cooperation rather than competition. Companies may increase their competitiveness and reap additional advantages from the usage of contemporary technical tools and solutions if they improve their operations in one of the areas listed before.

III. RESEARCH METHODOLOGY

Research Design

This study employed a descriptive research design to investigate the role of logistics in enhancing e-commerce competitiveness. The descriptive design was selected because it allows for a systematic examination of current practices, perceptions, and technological adoption in logistics within e-commerce firms. This design is suitable for analyzing relationships between logistics efficiency and competitiveness and for providing a clear snapshot of the current state of logistics management in the sector.

Population and Sample

The population for this study consisted of employees working in e-commerce companies with active logistics and warehouse operations, including warehouse staff, logistics managers, procurement personnel, and operations executives. Using purposive sampling, a total of 112 respondents were selected to ensure representation across different roles, experience levels, and organizational functions. This sample size was considered adequate to provide reliable insights into logistics practices and their impact on competitiveness.

Data Collection Method

Primary data were collected using a structured questionnaire comprising both closed-ended and Likert-scale questions. The questionnaire was designed to capture demographic details (gender, age, and job role), logistics practices, adoption of advanced technologies, and perceptions regarding the impact of logistics on e-commerce competitiveness. Secondary data were obtained from organizational reports, industry publications, and relevant academic literature to provide contextual understanding and support data interpretation.

Variables

The study focused on both independent and dependent variables. The independent variables included logistics practices such as inventory management, warehouse efficiency, transportation methods, and the use of advanced logistics technologies. The dependent variable was the competitiveness of e-commerce firms, measured through factors such as customer satisfaction, delivery efficiency, market reach, and operational cost optimization.

Data Analysis Techniques

Data were analyzed using descriptive statistics, including frequency counts, percentages, and mean scores, to summarize the demographic profile of respondents, the adoption of logistics practices, and perceptions of impact. Cross-tabulations were employed to examine relationships between demographic variables and perceptions of logistics impact. Graphical representations such as bar charts and pie charts were used to illustrate key findings.

IV. DATA ANALYSIS AND INTERPRETATION

Table 1: Distribution of Respondents by Gender

Gender	Frequency	Percentage
Male	62	55.36%
Female	50	44.64%
Total	112	100%

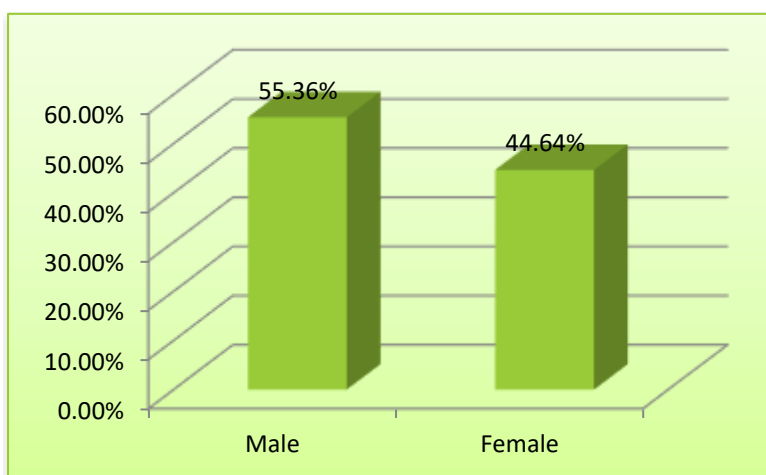


Figure 1: Distribution of Respondents by Gender

Table 1 presents the distribution of respondents by gender in the study, revealing that out of a total sample of 112 participants, 62 respondents (55.36%) were male, while 50 respondents (44.64%) were female. This indicates a slightly higher representation of male employees in the selected e-commerce companies with active logistics operations. The near-balanced gender distribution suggests that both male and female employees play significant roles in the logistics and operational functions of e-commerce organizations. Such diversity is important as it reflects inclusivity in the workforce and allows for a broader perspective on logistics practices and their impact on e-commerce competitiveness. The relatively even proportion of male and female respondents also enhances the reliability of the study's findings, as it reduces the likelihood of gender bias in responses. Overall, this distribution provides a representative overview of the workforce demographics involved in e-commerce logistics activities

Table 2: Distribution of Respondents by Age Group

Age Group (Years)	Frequency	Percentage
18–25	28	25.00%
26–35	42	37.50%
36–45	26	23.21%
46+	16	14.29%
Total	112	100%

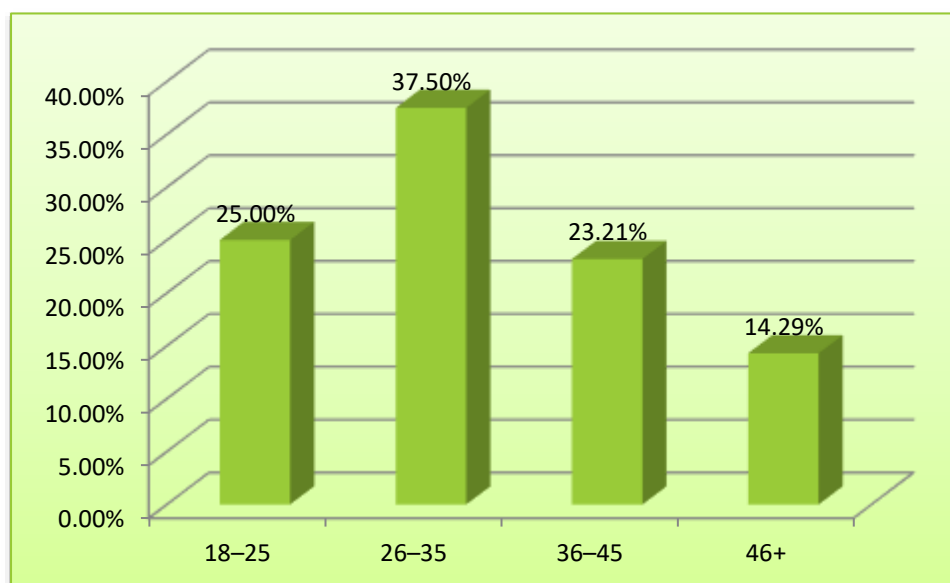


Figure 2: Distribution of Respondents by Age Group

Table 2 illustrates the distribution of respondents based on age groups. Among the total of 112 participants, the majority, 42 respondents (37.50%), fall within the 26–35 years age bracket, indicating that young adults form the largest segment of employees engaged in e-commerce logistics and operational activities. The 18–25 years group accounts for 28 respondents (25.00%), representing the entry-level or early-career workforce, while 26 respondents (23.21%) belong to the

36–45 years group, suggesting the presence of experienced professionals contributing to strategic and managerial logistics functions. The smallest segment, 16 respondents (14.29%), is aged 46 years and above, highlighting those senior or long-tenured employees constitute a minor portion of the workforce. This age distribution suggests a balanced mix of youthful energy, mid-career expertise, and experienced oversight, which can enhance overall efficiency, decision-making, and adaptability in e-commerce logistics operations, thereby supporting competitive performance.

Table 3: Distribution by Job Role

Job Role	Frequency	Percentage
Warehouse Staff	38	33.93%
Logistics/Delivery Manager	24	21.43%
Inventory/Procurement Staff	28	25.00%
Operations Executive	22	19.64%
Total	112	100%

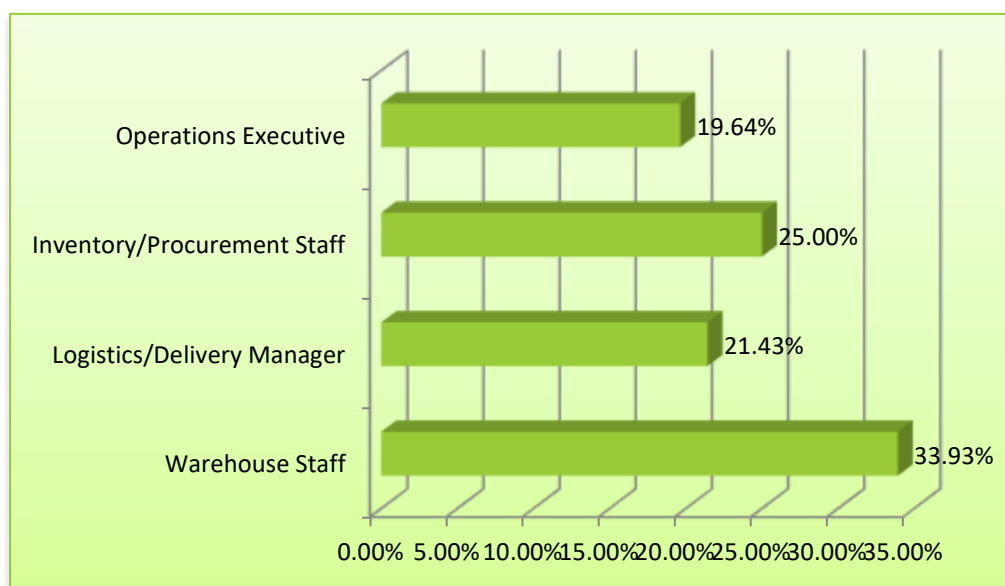


Figure 3: Distribution by Job Role

Table 3 presents the distribution of respondents according to their job roles within e-commerce companies. Out of 112 participants, the largest group, 38 respondents (33.93%), is warehouse staff, highlighting the critical role of operational personnel in handling day-to-day logistics activities, including inventory management, packaging, and order fulfillment. Inventory and procurement staff constitutes 28 respondents (25.00%), reflecting their essential contribution to maintaining stock levels, managing supplier relationships, and ensuring smooth supply chain operations. Logistics and delivery managers account for 24 respondents (21.43%), representing the managerial workforce responsible for planning, coordinating, and optimizing transportation and distribution activities. Finally, operations executives, with 22 respondents (19.64%), are involved in strategic decision-making and process improvements across logistics functions. The distribution indicates a well-

rounded workforce with a blend of operational and managerial expertise, which is essential for efficient logistics management and enhancing the competitiveness of e-commerce firms in terms of delivery efficiency, customer satisfaction, and overall supply chain performance.

Table 4: Frequency of Using Advanced Logistics Technologies

Technology Use Frequency	Frequency	Percentage
Always	30	26.79%
Often	40	35.71%
Sometimes	28	25.00%
Rarely	10	8.93%
Never	4	3.57%
Total	112	100%

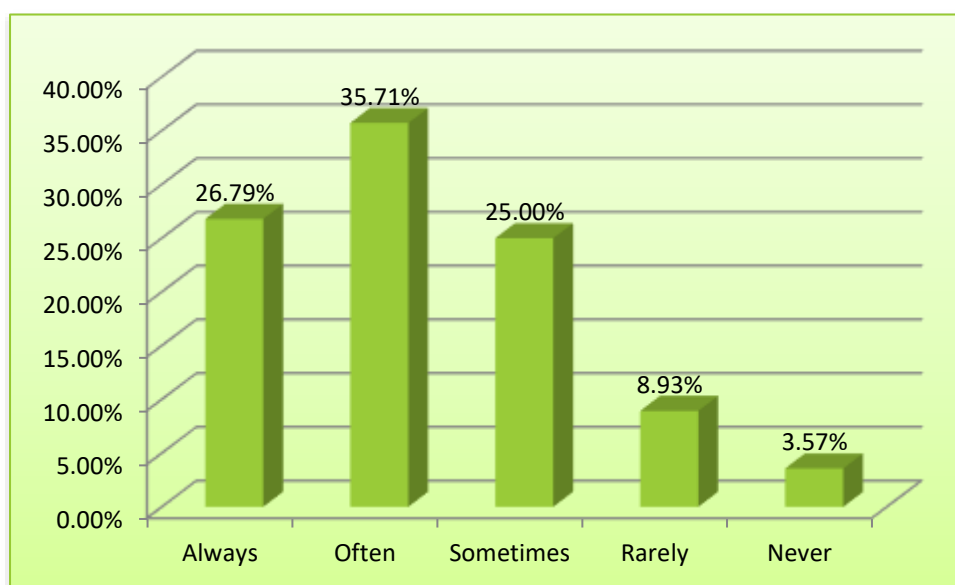


Figure 4: Frequency of Using Advanced Logistics Technologies

Table 4 illustrates the frequency of using advanced logistics technologies among respondents in e-commerce companies. Out of 112 participants, the largest group, 40 respondents (35.71%), reported using such technologies often, indicating a significant adoption of digital tools and systems for managing logistics operations. 30 respondents (26.79%) stated that they always use advanced technologies, reflecting a core segment of the workforce that consistently relies on innovations like warehouse management systems, route optimization software, and tracking tools. 28 respondents (25.00%) use these technologies sometimes, suggesting occasional or selective integration depending on operational needs. A smaller proportion, 10 respondents (8.93%), uses them rarely, while 4 respondents (3.57%) reported never using advanced logistics technologies, highlighting potential gaps in digital adoption. Overall, the table indicates a growing trend towards technology-driven logistics, which can enhance efficiency, reduce errors, and improve delivery performance, ultimately contributing to the competitiveness of e-commerce firms.

Table 5: Perceived Impact of Logistics on E-Commerce Competitiveness

Perception Level	Frequency	Percentage
Very High Impact	32	28.57%
High Impact	40	35.71%
Moderate Impact	22	19.64%
Low Impact	8	7.14%
No Impact	10	8.93%
Total	112	100%

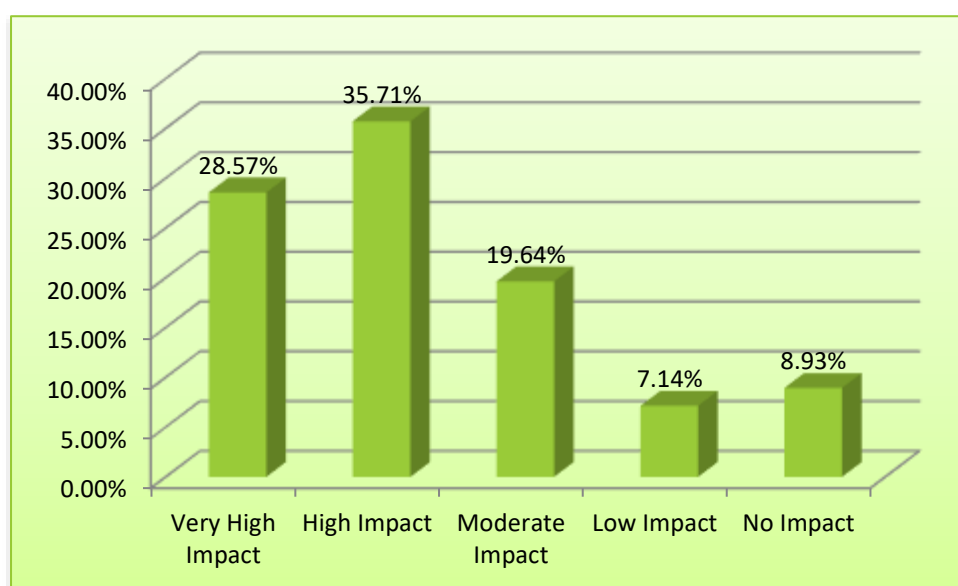
**Figure 5: Perceived Impact of Logistics on E-Commerce Competitiveness**

Table 5 presents the respondents' perceptions regarding the impact of logistics on e-commerce competitiveness. Out of the total 112 participants, 40 respondents (35.71%) perceive a high impact, while 32 respondents (28.57%) consider the impact to be very high. Combined, these figures indicate that a significant majority of employees recognize logistics as a critical factor in enhancing the competitiveness of e-commerce firms. 22 respondents (19.64%) reported a moderate impact, suggesting that while some employees acknowledge the importance of logistics, they may perceive other business functions, such as marketing or product development, as equally influential. A smaller proportion of respondents perceive a low impact (8 respondents, 7.14%) or no impact (10 respondents, 8.93%), highlighting that a minority may underestimate the strategic significance of logistics in overall organizational performance. These results underscore that effective logistics management—including inventory control, timely deliveries, advanced technology adoption, and streamlined supply chain operations—is widely regarded as essential for operational efficiency, improved customer satisfaction, and sustained market competitiveness.

Table 6: Cross-tabulation of Gender and Perceived Impact of Logistics

Gender	Very High Impact	High Impact	Moderate Impact	Low Impact	No Impact	Total
Male	18	24	12	4	4	62
Female	14	16	10	4	6	50
Total	32	40	22	8	10	112

Table 6 presents the relationship between gender and respondents' perceptions of the impact of logistics on e-commerce competitiveness. Out of 112 participants, 62 were male and 50 were female. Among males, 18 perceived a very high impact, 24 a high impact, 12 a moderate impact, 4 a low impact, and 4 no impact. Female respondents reported 14 very high, 16 high, 10 moderate, 4 low, and 6 no impact. The data suggest that both male and female respondents generally recognize the importance of logistics in enhancing competitiveness, with the majority indicating very high or high impact. Although there are slight differences between genders—for example, more males perceived high impact and more females reported no impact—the distribution indicates that gender does not drastically influence perceptions of logistics effectiveness. This balance suggests that insights drawn from the study reflect a broadly shared understanding across both genders regarding logistics' role in operational efficiency and customer satisfaction in e-commerce.

Table 7: Cross-tabulation of Age Group and Frequency of Using Advanced Logistics Technologies

Age Group	Always	Often	Sometimes	Rarely	Never	Total
18–25	6	10	8	3	1	28
26–35	12	16	10	3	1	42
36–45	8	8	6	2	2	26
46+	4	6	4	2	0	16
Total	30	40	28	10	4	112

Table 7 highlights how respondents of different age groups use advanced logistics technologies. Among the 18–25 age group, 6 always and 10 often used these technologies, while the majority in the 26–35 age group reported frequent use, with 12 always and 16 often. Respondents aged 36–45 and 46+ showed lower adoption, with fewer always using technology and more reporting sometimes or rarely using it. Overall, 30 participants always, 40 often, 28 sometimes, 10 rarely, and 4 never used advanced logistics tools. The table indicates that younger employees tend to adopt and utilize technology more frequently, reflecting greater familiarity and comfort with digital solutions. This trend suggests that technology adoption in e-commerce logistics may be influenced by age-related familiarity with digital systems, which in turn can affect operational efficiency, inventory management, and order fulfillment performance.

Table 8: Cross-tabulation of Job Role and Perceived Impact of Logistics

Job Role	Very High	High	Moderate	Low	No Impact	Total
Warehouse Staff	12	16	6	2	2	38
Logistics/Delivery Manager	8	10	4	2	0	24
Inventory/Procurement Staff	6	8	6	2	6	28
Operations Executive	6	6	6	2	2	22
Total	32	40	22	8	10	112

Table 8 examines perceptions of logistics impact across different job roles. Warehouse staff (38 respondents) largely reported high (16) or very high (12) impact, indicating their close involvement in day-to-day logistics operations. Logistics and delivery managers (24 respondents) similarly perceived high (10) and very high (8) impact, reflecting their strategic role in planning and overseeing logistics activities. Inventory/procurement staff showed more variation, with 6 perceiving very high, 8 high, 6 moderate, 2 low, and 6 no impact, suggesting that those less involved in direct operational tasks may perceive logistics impact differently. Operations executives (22 respondents) reported balanced perceptions across categories. The data imply that employees directly engaged with logistics processes perceive a stronger impact on competitiveness, whereas those with more administrative or indirect roles show varied assessments. Overall, the findings reinforce that operational involvement shapes perceptions of logistics' contribution to e-commerce efficiency.

Table 9: Pearson Correlation between Technology Use and Perceived Impact of Logistics

Variables	Technology Use Frequency	Perceived Impact of Logistics
Technology Use Frequency	1	0.48**
Perceived Impact of Logistics	0.48**	1

Table 9 shows a Pearson correlation of 0.48 between technology use frequency and the perceived impact of logistics, which is significant at the 0.01 level. This positive correlation indicates that employees who frequently use advanced logistics technologies are more likely to perceive logistics as highly influential in enhancing e-commerce competitiveness. It suggests that the integration of digital tools—such as inventory management systems, order tracking, and route optimization software—positively affects employees' recognition of logistics effectiveness. The finding highlights the strategic importance of adopting and consistently using technology to improve operational efficiency, accuracy, and delivery performance, ultimately strengthening the competitive position of e-commerce firms.

V. CONCLUSION

Logistics is the backbone of e-commerce competitiveness, influencing every stage of the customer journey from order placement to final delivery. Efficient logistics ensures timely and accurate fulfillment, which directly affects customer satisfaction, loyalty, and repeat purchases. In the highly competitive online retail environment, firms that excel in managing their supply chains can differentiate themselves through reliability, speed, and convenience, thereby gaining a significant

strategic advantage. The integration of digital technologies such as AI, IoT, and data analytics further strengthens logistics performance by enabling real-time tracking, predictive forecasting, and process optimization. Moreover, logistics facilitates market expansion by enabling companies to reach geographically diverse customers and manage the complexities of cross-border trade. Sustainable logistics practices, including eco-friendly transportation and packaging solutions, enhance brand reputation and meet the growing consumer demand for responsible business operations. In essence, logistics is no longer a support function but a strategic enabler that drives operational excellence, customer satisfaction, and long-term growth in e-commerce. Companies that invest in advanced, efficient, and sustainable logistics capabilities are better positioned to navigate market challenges, outperform competitors, and sustain success in the rapidly evolving digital marketplace.

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