

Technological Environment and Supply Chain Effectiveness of Logistics Firms in Rivers State

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Abstract: *The study examines technology and supply chain effectiveness of logistics firms in Rivers State. The researcher adopted a cross sectional survey design in this study. The population comprises of 107 employees of 10 logistics firms in River state. The study was a census study. Descriptive and inferential statistics were employed to analyse the data for this study. A structured questionnaire was distributed to the sample elements. The spearman rank order correlation coefficient was used in analyzing the earlier state hypotheses. Technological environment was related directly to the measure of the the dependent variable, supply chain effectiveness which was measured with supply chain responsiveness, lead time, customer satisfaction and service quality. The Spearman rank order correlation coefficient was used in analyzing the earlier state hypotheses. The findings revealed a relationship between technological environment and supply chain effectiveness. The recommends the use of technology to enhance responsiveness, best lead time, higher customer satisfaction and service quality.*

Keywords: *Technological Environment, Supply Chain Effectiveness, Supply Chain Responsiveness, Lead Time, Customer Satisfaction, Service Quality*

1.0 Introduction

Many nations have been striving for high-quality development by promoting supply chain competitiveness through innovation and technology development. Organizations are interested in effective supply chain management to make sure that customers receive goods and services efficiently, to help businesses plan for future demand, to cut costs, to work with partners and suppliers for higher market demand, and reduced inventory and storage expenses. The supply chain process is the degree to which supply chain partners collaborate to embrace novel technologies, procedures, and practices in order to increase operational efficiency, and maximise joint performance (Sodero et al., 2013; Liu et al., 2016; Wong and Ngai, 2019).

Effective supply chain management aids in sustaining accurate inventory records, lowering wastage, restructuring business procedures, improving risk management, dropping transport costs, developing better associations with vendors and suppliers, improving customer service and product quality, and lowering the risk of recalls and lawsuits. The majority of prior research has focused on product innovation, despite the significance of supply chain process innovation, but there has been a significant increase in global trade, which has led to more intricate supply networks.

In the last ten years, emerging technologies like as artificial intelligence, neural networks, and machine learning have transformed logistics. There is a demand for increased delivery times, cheaper products, and better ways of connecting with the environment (Haslam. College of Business, 2023). Since technology is now replacing human labour across a wide range of supply chain activities, giving businesses more freedom to operate wherever they choose, and the emergence of new technologies for manufacturing and operating supply chains is creating opportunities for relocating production closer to markets and making supply chains more effective, the location of low-cost labour that previously shaped the global supply chains has changed intensely (Gandhi, 2022).

Robots are currently employed in the supply chain to move goods and commodities within a warehouse and during shipment. However, as artificial intelligence technologies advance, machines are now used for picking and packing orders, automating heavy loading tasks, and significantly improving the precision and mobility of industrial robots while aiding in safety, allowing for a new generation of collaborative robots that can work alongside humans rather than being cordoned off in a separate safety zone. Several researches on technology and supply chain have been conducted, but there has been a shortage of empirical work on the influence of technology on supply chain of the logistics enterprises in Rivers State, therefore this study fills that gap.

Statement of Problems

The growth of the Nigerian logistics business is being delayed by obstacles, and recent global events have exacerbated the problem. Various government regulations have wreaked havoc on the business throughout the years. The sector was subject to government interference, fee imposition at any time, and weak infrastructure compounded issues. There are terrible road conditions, power disruptions, and transportation networks. Because Nigeria's economy is volatile, logistics companies must pay a variety of taxes, the bulk of which are unofficial and there are numerous untrustworthy drivers, making running a logistics company challenging (Kwik - Africa Delivery Technologies SAS, 2020).

Many businesses, especially those producing non-essential commodities, have been hurt by the slowdown in retail and trade activity as the majority of finished goods transit via the sector to end customers. Major events like natural disasters, terrorism, and political unrest have also made the supply chain vulnerable. Examples of this susceptibility include the 2003 northeast blackout, the west-coast port strike in 2002, the oil pipeline explosion in Nigeria's Niger Delta, the Oil Workers' Union strike in 2016, a significant fire disaster, and other natural disasters. Ineffective management of internal and external supply chain networks may be the cause of numerous more supply chain disruptions, particularly in downstream logistics operations in Nigeria (Akanle, Adebayo, & Adetayo, 2014).

Multisite manufacturing, where a number of independent entities participate in the production and delivery process, increasingly cutthroat marketing channels, such as independent computer dealers, the development of the global economy and the rise in demand for "local" products, and competitive pressures to deliver exceptional customer service, including prompt, reliable delivery, are some issues faced by supply chain firms. To address the issue of ineffectiveness, stakeholders in the logistics, transportation, and

supply chain industries must embrace use of technology to implement effective creative inventory management and distribution techniques, as well as form strategic relationships with players and intermediaries along the value chain (Osinubi & Nevin, 2023).

Aim and Objectives of the Study

The study investigates the relationship between technological environment and supply chain effectiveness of logistics firms in Rivers State. The specific objectives are to determine the relationship between:

1. Technological environment and responsiveness of the logistics firms in Rivers State.
2. Technological environment and lead time of the logistics firms in Rivers State.
3. Technological environment and customer satisfaction of the logistics firms in Rivers State.
4. Technological environment and quality service of the logistics firms in Rivers State.

Research Questions

1. How does the technological environment influence the responsiveness of the logistics firms in Rivers State.?
2. What is the association between the technological environment and lead time of the logistics firms in Rivers State.?
3. How does the technological environment relate to the customer satisfaction of the logistics firms in Rivers State.?
4. What is the bond between the technological environment and the quality services of the logistics firms in Rivers State.?

Research Hypotheses

Ho₁: There is no significant relationship between the technological environment and the responsiveness of the logistics firms in Rivers State.

Ho₂: There is no significant relationship between the technological environment and the lead time of the logistics firms in Rivers State.

Ho₃: There is no significant relationship between the technological environment and customer satisfaction of the logistics firms in Rivers State.

Ho₄: There is no significant relationship between the technological environment and the service quality of the logistics firms in Rivers State.

2.0 Review of Related Literature

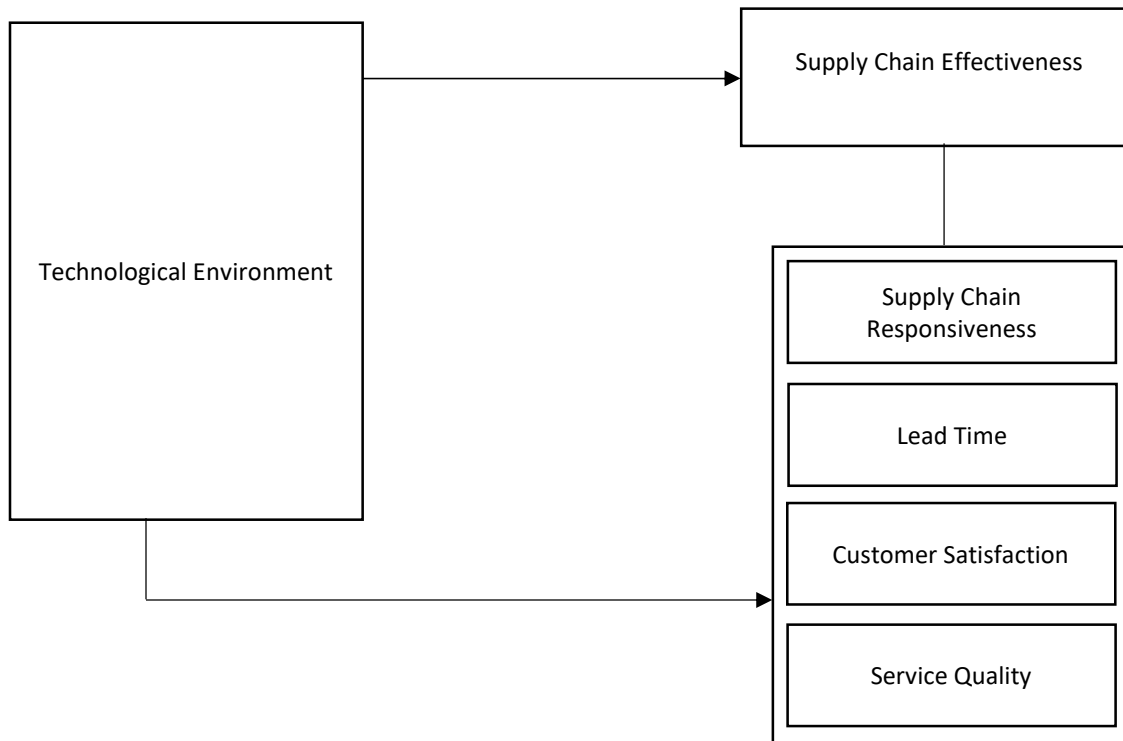


Figure1: A framework showing how technological environment is linked with supply chain effectiveness.

Source: Researcher Conceptualization

Theoretical Framework

The study was anchored the theory of constraints (TOC), a management concept that states that a small number of constraints prevents any controllable system from achieving more of its goals. It is a method for determining the biggest obstacle (or constraint) standing in the way of achieving a goal, and gradually removing that obstacle until it is no longer a hindrance. The Theory of Constraints takes a scientific approach to improvement. Any complex system, including manufacturing processes, is said to be composed of a number of interconnected activities, one of which acts as a constraint on the entire system.

Concept of Technological Environment

Ramey (2013) defines technology as "the tangible and intangible practical application of proven knowledge in a given field with the goal of creating and improving tools, materials, and processes." It is the use of knowledge to achieve real-world goals in a repeatable

manner. Technology can also refer to the products of human endeavour, which can include both tangible objects like utensils and machinery and software. Technology is essential in science, engineering, and daily life.

Technology has a wide range of meanings and it is used to carry out a variety of duties and can be described as tools and methods used to improve human capabilities and ease daily life (Ramey, 2023). Humans are an indispensable part of any technological system, as the use of technology permeates almost every aspect of life. It is a byproduct of human knowledge and consists of equipment, supplies, and systems used in the workplace for data security, communication, transportation, and other purposes. Technology is often employed to make items, but it may also be used to develop new products and services that benefit people and help businesses remain competitive. Companies employ technology to ensure that new products and services are delivered to clients on time and on budget, thereby providing them a competitive advantage.

Chain supply management generates enormous amounts of data every single day. Daily overall data usage from mobile devices including wearables, smartphones, and tablets is substantial. It needs sophisticated computational methods to collect, classify, clean, and analyze such massive data sets because of information available. Businesses use this data to acquire information and transform supply chain management through data science and analytics to have value and benefits for supply chain management in terms of quality control, cash flow, real-time deployment, warehouse efficiency, weather patterns, and predictive tactics. The use of modern software has had a tremendous impact on the entire supply chain industry. In order to stay competitive, logistics companies are integrating technology into their supply chain management systems. Businesses feel compelled to keep up with emerging technologies due to consumer demands for pricing and delivery speed as well as the rising popularity of customer rating measures.

The technology lay the groundwork for workers to perceive outcomes and solutions outside of their personal experiences, allowing for impartiality and inclusiveness in a wide range of disciplines and industries. Quickly and better diagnosis of problems by artificial intelligence cannot replace knowledge, when artificial intelligence discovers problems, people must still correct them (Noenickx, 2023). While some employees embrace artificial intelligence (AI) enthusiastically, some find it intimidating. However, generative AI will be present in the workplace, and experts believe its prevalence will encourage workers to use the technology in order to avoid falling behind. Workers should use artificial intelligence, and as they become more proficient and advantageous in executing their job.

Concept of Supply Chain Effectiveness

Supply chain management (SCM) is gaining popularity among researchers and business leaders alike. According to Huan et al., (2004), the SCM concept first appeared just before the 1960s. SCM research increased in the 1980s and accelerated in the 1990s (Huan et al., 2004). More firms are discovering that if they want to flourish, they must focus on their supply chain. According to Cooper et al (1997), top management recognized the importance of efficient supply chains in gaining a competitive advantage as early as 1997. Different firms have different opinions about what defines an efficient supply chain. The solutions can be classified into three types. The groups are performance, cost, and a

combination of performance and cost. High levels of delivery accuracy and customer satisfaction are two examples of performance definitions of efficiency.

One-third of the organizations analyzed incorporate both performance and cost focus in their definition and the most commonly used definition is based on performance (Pettersson, 2008). In terms of performance, 53 percent of the participating enterprises define an effective supply chain. Only 10% of companies are solely focused on costs. One company in the commodities industry group exemplifies how an effective supply chain keeps promises about timely delivery, the right quantity and quality, and the lowest cost (Pettersson, 2008), incorporating both the performance and cost focuses. An organization's supply chain efficiency influences whether it will succeed or fail. Businesses put a lot of effort into optimizing their supply chains to increase efficiency and visibility and reduce cost and risk. But very few companies know how to simply measure their success. The interrelated process that raw materials, components, and completed goods go through before being put together and sold to customers is known as the supply chain (Mckinsey & Company, 2023).

Procurement cost per order, time to market, transportation efficiency, and warehouse efficiency must all be prioritised for supply chain success (Kemp, 2018). Supply chain management is managing a product's whole production flow in order to maximise quality, delivery, customer experience, and profitability. For customers, the supply chain is the most visible "face" of the business. The more successful and efficient a company's supply chain management, the more it preserves its business reputation and long-term viability (IBM, 2023). Despite the fact that digitalization might be a workable solution to operational challenges faced by many enterprises and industries, few established firms have fully digitalized their end-to-end operations. The consequences of increased connectivity, automation, and other elements on technology, industry, and society are referred to as the Fourth Industrial Revolution (4IR). (Mckinsey & Company, 2023). Operations may become more productive, flexible, and time-sensitive with the help of digitization, which includes advanced analytics, automation, and machine learning; even while some progressive businesses have already benefited from digitalization, others are lagging behind, however, modern supply chain IT that improves demand forecasting and planning systems can make a big difference (Mckinsey & Company, 2023). The firms operations may become more productive, flexible, and time-sensitive with the help of digitization, which includes advanced analytics, automation, and machine learning (Mckinsey & Company, 2023).

Supply Chain Responsiveness

In the rapidly shifting market of today, it is challenging to compete without a supply chain that is very responsive. Customers are familiar with having easy access to products whenever and wherever they want them, and the freedom to easily cancel orders, return items with ease, and contact vendors. A flexible and responsive supply chain structure is required to attract and keep customers in a competitive industry (EnVista Thought Leadership, 2022). A responsive supply chain is one that can respond swiftly to changes in demand or other circumstances. This means that the supply chain can react swiftly to changes in consumer demand, market conditions, or other factors that may affect it.

Businesses must improve their supply chains in today's cutthroat business environment if they want to get client feedback. Operating system responsiveness, logistic process responsiveness, and supplier network responsiveness are the three sub-constructs of

supply chain responsiveness. Operational system responsiveness refers to a company's manufacturing system's capacity to adapt to changes in consumer demand. Both production and service operations are included. A crucial element of supply chain responsiveness, according to Duclos et al. (2003) and Lumnus et al. (2003), is responsiveness at each company in the chain. Logistics process responsiveness is the ability of an organization's external transformation, distribution, and storage system to adapt to changes in customer demand. According to Fawcett (1992), a responsive supply chain strategy requires a responsive logistical process as a key element. The actions involved in transforming commodities from suppliers to manufacturers to distribution centres to ultimate points of end users are included in logistics and distribution management (Ricker and Kalakota, 1999; Duclos et al, 2003;).

Lead time

The period of time between the start and finish of a certain task is referred to as lead time. It is a critical metric for all product-based businesses and is most commonly used in supply chain business. Any project, or task has a lead time, so it encompasses the time it takes for a contractor to accomplish their client commitments as well as the time it takes for management to allocate a task to an employee and the employee to execute it. In supply chain management, lead time simply refers to the length of time it takes a supplier company to have its goods ready for delivery.

Lead time is the time it takes from the start of a process to its completion (Kenton, 2022). The phrase can be found in almost any business; however, it is most typically used in purchasing, supply chain, procurement, and shipping tasks. Lead time is an important measure in many sectors. Lead time supply delay, which could have a severe impact on customer satisfaction, contractor dependency, and overall cost efficiencies. Shorter lead times often mean more efficient procedures, better revenue, and improved efficiency. Businesses that examine their lead times on a regular basis arm themselves with the information they need to create best practices and make improvements as needed.

Customer Satisfaction

Customer satisfaction reflects customers happiness with the goods or services provided by your business (Alaina, 2023). It evaluates whether a company's goods and services match or surpass those of its clients. According to Farris (2010), customer satisfaction is measured by how many consumers, or what proportion of all customers, report having had positive experiences with a company, its goods, or services. Customers contribute significantly to the relevance of a good or service, hence it is in the business' best interests to ensure customer satisfaction and foster client loyalty.

Increase repeat business by ensuring customer happiness with a data-centric approach to customer satisfaction, preventing a dissatisfied customer from switching to a competitor, identifying customer pain points and learning how to improve your product, service, or overall customer experience, monitoring and enhancing brand reputation by learning how likely customers are to recommend your business to a friend, and increasing customer trust by demonstrating that their feedback counts (Alaina, 2023). Customer satisfaction drives customer loyalty, helps reflect team performance, encourages repeat purchases, increases customer lifetime value and boosts customer acquisition. A data-centric approach to customer satisfaction saves an unhappy customer from leaving your

brand for a competitor, discover customer pain points and learn how to improve your product, service, or overall customer experience, drive repeat purchases by ensuring customer happiness, monitor and improve brand reputation by discovering how likely customers are to recommend your company to a friend and build customer trust by showing customers that their feedback matters (Alaina, 2023).

Service Quality

In today's modern, competitive, and globalized business world, the key point to sustaining a competitive advantage lies in the quality of service that companies could provide, which in turn will result in effective customer retention. It is essential for an organization to build positive relationships with target customers and deliver superior value over competitors (Kotler, 2009). An organization with high levels of service quality will exceed customer expectations, yet remain to increase long-term economic competitiveness and profitability. Service quality's contemporary conceptualization has its origins in the perceived expectancy-disconfirmation paradigm. Quality service definition is a multidimensional concept, different scholars interpret and evaluate the term differently and it is a complex construct that incorporates multiple attributes which may change rapidly and dramatically and facilitate precise measurement (Karatepe, 2013).

Empirical Review

The assimilation of open-standard inter-organizational information systems in high-tech supply chains is studied by Sodero, Rabinovich, & Sinha (2013). The study found that individual business open-standard inter-organizational information systems assimilation is influenced by supply chain asymmetry as well as OSIOS assimilation within supply chain tiers. The results also point to a mutually reinforcing dynamic in which firm supply chain dominance is both a driver and a byproduct of open-standard interorganizational information systems absorption..

Oyedipo et al., (2021) examine the incentives and barriers of supply chain collaboration in Nigeria to better understand this topic in developing countries. In-depth qualitative interviews with purchasing and supply chain managers in Nigeria's food and beverage manufacturing sector were conducted. The study's findings show how supply chain cooperation fails to work in a turbulent economy. Furthermore, show how digital and IT infrastructure may be used as a platform to facilitate collaboration and customer satisfaction.

Ampong (2022) creates and examines a conceptual model to illustrate the link between supply chain responsiveness and logistics companies' financial viability in the face of shifting price strategy conditions and dynamic client demand. Using primary data from 226 logistics companies in Ghana and moderated regression analysis, the proposed conceptual model is examined. The study's findings demonstrate that while high pricing or strong consumer dynamism has a negative impact on the connection, supply chain responsiveness has a positive relationship with financial performance.

Akanyildirim, and Sirong 2003) investigated lead time possibilities in a manufacturer and retailer supply chain where the retailer employs the (R, Q) inventory policy: the retailer makes an order with the manufacturer, who initially pledges to deliver the order a lead

time later. The analysis concludes that the ideal lead time policy approximates the critical levels associated with the lead time policy.

The relationship between customer satisfaction, customer loyalty, product knowledge, business competitiveness, and other contributing factors is examined by Suchánek and Králová (2019). A questionnaire that was issued to respondents who were customers of the chosen companies was used for the survey. The relationships between the elements were modelled using a structural equation modeling technique. The research discovered that customer loyalty has an impact on product knowledge as well as direct effects on consumer expectations and product competitiveness. Customers with higher levels of loyalty have better product knowledge.

3.0 Methodology

The researcher adopted a cross sectional survey design in this study. The population comprises of 107 employees of 10 logistics firms in River state. The study was a census study Descriptive and inferential statistics were employed to analyse the data for this study. A structured questionnaire was distributed to the sample elements. The independent variable (technological environment was related directly to the measure of the the dependent variable, supply chain effectiveness which was measured with supply chain responsiveness, lead time, customer satisfaction and service quality. Each construct was measured with 5 items. The questionnaire items were rated on a 4-point Likert scale from 1-strongly disagreed, 2-disagree, 3-agree and 4-strongly agreed. The Spearman rank order correlation coefficient was used in analyzing the earlier state hypotheses.

4.0 Result

107-questionnaire were distributed, but only 105 (98.1%) copies were returned. The hypotheses test is undertaken at a 95% confidence interval and the decision rule is stated below.

Where $P < 0.05$ = Reject the null hypotheses

Where $P > 0.05$ = Accept the null hypotheses

Table 1: Correlations between Technology and Supply Chain Effectiveness

		Technology Environment	Supply Chain Responsiveness	Lead Time	Customer Satisfaction	Service Quality
Spearman's rho	Technology Environment	1.000	.600**	.525**	.505**	.602**
	Correlation Coefficient					
	Sig. (2-tailed)	.	.000	.000	.000	.000
	N	105	105	105	105	105
	Supply Chain Responsiveness	.600**	1.000	.576**	.516**	.524**
	Correlation Coefficient					
	Sig. (2-tailed)	.000	.	.000	.000	.000
	N	105	105	105	105	105
	Customer Satisfaction	.525**	.576**	1.000	.502**	.454**
	Correlation Coefficient					
	Sig. (2-tailed)	.000	.000	.	.000	.000
	N	105	105	105	105	105
Service Quality	.505**	.516**	.502**	1.000	.487**	
Correlation Coefficient						
Sig. (2-tailed)	.000	.000	.000	.	.000	
N	105	105	105	105	105	
Technical Growth	.602**	.524**	.454**	.487**	1.000	
Correlation Coefficient						
Sig. (2-tailed)	.000	.000	.000	.000	.	
N	105	105	105	105	105	

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

Technology Environment and Supply Chain Effectiveness (Test of 1 to 4)

Table 1 shows the relationship between technology environment and the measures of supply chain effectiveness (Supply Chain Responsiveness, Lead Time, Customer Satisfaction and Service Quality).

Technology Environment and Supply Chain Responsiveness: The result of the data analysis reveals that at a significant level $p \leq 0.05$ ($0.000 < 0.05$), $\rho = 0.600^{**}$. This

means that there is a significant connection between technology environment and supply chain responsiveness. The null hypothesis, H_{o1} , is rejected, and the alternate accepted.

Technology Environment and Lead Time: The result of the data analysis reveals that, at a significant level, $p \leq 0.05$ ($0.000 < 0.05$), $\rho = 0.525^{**}$. This means that there is a significant association between the technology environment and lead time. The null hypothesis, H_{o2} , is rejected, and the alternate accepted.

Technology Environment and Customer Satisfaction: The result of the data analysis reveal that at a significant level $p \leq 0.05$ ($0.000 < 0.05$), $r = 0.505^{**}$. This means that there is a significant link between technology environment and customer satisfaction. The null hypothesis, H_{o3} , is rejected, and the alternate accepted.

Technology Environment and Service Quality: The result of the data analysis reveals that at a significant level $p \leq 0.05$ ($0.000 < 0.05$), $\rho = 0.602^{**}$. This means that the technology environment is significantly related to service quality. The null hypothesis, H_{o4} , is rejected, and the alternate accepted.

5.0 Discussion of Findings

The data analysis above depicts that the technology environment has an association with supply chain effectiveness in Nigeria. The discussions of each hypothesis are specified below.

Technology Environment and Supply Chain Responsiveness

The results of the data analysis in Table 1 showed a strong relationship between technology environment and supply chain responsiveness. The P-value of 0.000 demonstrates a relationship exists between the technology environment and supply chain responsiveness, and the correlation value of 0.600 demonstrates a strong positive connection between the variables. This agrees with Wong & Ngai, (2019) that technology influences supply chain responsiveness and increases operational efficiency

This result is consistent with the findings of Sodero, Rabinovich, & Sinha (2013) that found out that technology in the form of individual business open-standard interorganizational information systems assimilation influences the supply chain effectiveness.

Technology Environment and Lead Time

The bivariate hypothesis 2 analysis showed a substantial and significant correlation between technology environment and lead time. The P-value of 0.000, and the correlation value of 0.525, demonstrates a moderately positive link between technology environment and lead time. The results support those of Ramey (2023) that assert that technology enhances business processes for improved human capabilities and ease life. It also agrees with Akanyildirim and Sirong (2003) that technology enhances knowledge of appropriate lead time in a manufacturer and retailer supply chain where the retailer employs the (R, Q) inventory policy.

Technology Environment and Customer Satisfaction

The analysis revealed a significant association between technology environment and customer satisfaction. The P-value of 0.000 and correlation value of 0.515 shows a moderately positive significant association between technology environment and customer satisfaction. This result is consistent with the study of Oyedipo et al., (2021) that how digital and IT infrastructure may be used as a platform to facilitate collaboration and satisfaction in organisations. It agrees with Alaina (2023) that a data-centric approach to customer satisfaction, through advanced technology, saves an unhappy customer from leaving your brand for a competitor.

Technology Environment and Service Quality

The results of the data analysis showed a strong relationship between technology environment and service quality. The P-value of 0.000 demonstrates a relationship exists between technology environment and service quality, and the correlation value of 0.600 demonstrates a strong positive connection between the variables. This result is consistent with the findings Noenickx (2023) that the usage of artificial intelligence increase efficiency and generate ideas and art of executing tasks and improve service quality effectively. It aligns with Osinubi. & Nevin (2023) that, to address the issue of ineffectiveness and better-quality service stakeholders in supply chain industries must embrace use of technology to implement effective creative inventory management and distribution techniques, as well as form strategic relationships with players and intermediaries along the value chain

6.0 Conclusion and Recommendations

The study examines technology environment and supply chain effectiveness of the logistics firms in Rivers State, Nigeria. Given the unprecedented challenges globally that affected the supply chain, the need to universally collaborate to embrace novel technologies, procedures, and practices in order to increase operational efficiency, and maximize joint performance becomes very important. The continuous advancement in technology has raised critical questions on citizens' supply chain responsiveness, lead time, customer satisfaction and their service quality, hence Achieving effectiveness would be an illusion or, at the very least, a futile exercise without adequate knowledge of how to use technology can be used improve chain supply effectiveness. The study found a strong correlation between technology environment and the measures of supply chain effectiveness and therefore conclude that technological environment plays a major role in enhancing supply chain effectiveness. It is this recommended that;

1. The logistics firms should be responsive to innovative technology for effective in operation.
2. The logistics firms should inculcate continuous effective technology in carrying out their businesses as such could improve client satisfaction.
3. The logistics firms should adopt a suitable technological environment to reduce Lead time supply delay and improve cost efficiencies.
4. The logistics firms should adopt innovative technology to improve service quality for a sustaining competitive advantage an effective customer retention.

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