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**THE ROLE OF SEAPORT INFRASTRUCTURE IN ENHANCING
LOGISTICS PERFORMANCE AND ECONOMIC GROWTH IN NIGERIA'S
MANUFACTURING SECTOR.**

BY



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LOGISTICS PERFORMANCE AND ECONOMIC GROWTH IN NIGERIA'S
MANUFACTURING SECTOR.**



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School of Technology Management and Logistics
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In Fulfilment of the Requirement for the Degree of Doctor of Philosophy**



Kolej Perniagaan
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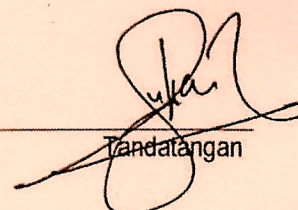
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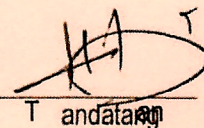
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ABSTRACT

This study emphasizes the importance of seaport infrastructure in enhancing logistics performance and driving economic growth within Nigeria's manufacturing sector. While improved port facilities are recognized as crucial, a research gap exists regarding the specific impacts of current seaport infrastructure on logistics efficiency and economic outcomes in Nigeria. This research investigates how seaport infrastructure influences logistics performance and economic growth in the Nigeria's manufacturing sector. To achieve this objective, a methodology employing a triangulation research approach was used, combining quantitative and qualitative methods. It involves analyzing cross-sectional panel data from 71 manufacturing firms listed on the Nigeria Exchange Group, with 11 firms purposively selected based on their consistent operations from 2012 to 2022. The study utilized E-Views version 12.0 for data analysis. Key findings reveal a significant positive relationship between logistics performance and economic growth, indicating that better logistics efficiency boosts economic output. Additionally, the study highlights that inadequate seaport infrastructure hinders logistics efficiency and significantly affects the relationship between logistics performance and economic growth. The recommendations stress the need for the Nigerian government to prioritize investments in port facilities, including necessary upgrades, improved transport connectivity, and the adoption of modern technologies. Furthermore, the study encourages manufacturers to collaborate with logistics providers to optimize their supply chain operations. It contributes valuable empirical evidence on the pivotal role of seaport infrastructure in facilitating trade and economic activities, underscoring the importance of strategic investments to strengthen Nigeria's manufacturing sector. These findings provide a foundation for policymakers and industry stakeholders to enhance logistics efficiency and drive sustainable economic growth in Nigeria.

Keywords: Seaport infrastructure; Logistics performance; Economic growth; Manufacturing sector; Nigeria

ABSTRAK

Kajian ini menekankan kepentingan infrastruktur pelabuhan laut dalam meningkatkan prestasi logistik dan memacu pertumbuhan ekonomi dalam sektor perkilangan di Nigeria. Walaupun kemudahan pelabuhan yang lebih baik diiktiraf sebagai penting, terdapat jurang penyelidikan mengenai impak khusus infrastruktur pelabuhan laut semasa terhadap kecekapan logistik dan hasil ekonomi di Nigeria. Kajian ini dijalankan untuk menyiasat bagaimana infrastruktur pelabuhan laut mempengaruhi prestasi logistik dan pertumbuhan ekonomi dalam sektor perkilangan. Bagi mencapai objektif ini, satu metodologi yang menggunakan pendekatan penyelidikan triangulasi telah digunakan, menggabungkan kaedah kuantitatif dan kualitatif. Ia melibatkan analisis data panel keratan rentas daripada 71 syarikat perkilangan yang tersenarai di Nigeria Exchange Group, dan 11 syarikat telah dipilih berdasarkan operasi konsisten mereka dari tahun 2012 hingga 2022. Kajian ini menggunakan E-Views versi 12.0 untuk menganalisis data. Penemuan utama menunjukkan hubungan positif yang signifikan antara prestasi logistik dan pertumbuhan ekonomi, yang menunjukkan bahawa kecekapan logistik yang lebih baik meningkatkan hasil ekonomi. Selain itu, kajian ini menunjukkan bahawa infrastruktur pelabuhan laut yang tidak mencukupi menghalang kecekapan logistik dan memainkan peranan penting dalam mempengaruhi hubungan antara prestasi logistik dan pertumbuhan ekonomi. Syor daripada kajian ini menekankan keperluan bagi kerajaan Nigeria untuk mengutamakan pelaburan dalam kemudahan pelabuhan, termasuk naik taraf yang diperlukan, penambahbaikan hubungan pengangkutan, dan penerimaan teknologi moden. Di samping itu, kajian ini menggalakkan pengeluaran untuk bekerjasama dengan penyedia logistik bagi mengoptimumkan operasi rantai bekalan mereka. Kajian ini menyumbang bukti empirikal yang bernilai mengenai peranan penting infrastruktur pelabuhan laut dalam memudahkan perdagangan dan aktiviti ekonomi, serta menekankan keperluan untuk pelaburan strategik bagi memperkukuhkan sektor perkilangan di Nigeria. Penemuan ini memberikan asas untuk pembuat dasar dan pemegang kepentingan industri meningkatkan kecekapan logistik dan mendorong pertumbuhan ekonomi mampan di Nigeria.

Keywords: Infrastruktur pelabuhan laut; Prestasi logistik; Pertumbuhan ekonomi; Sektor perkilangan; Nigeria

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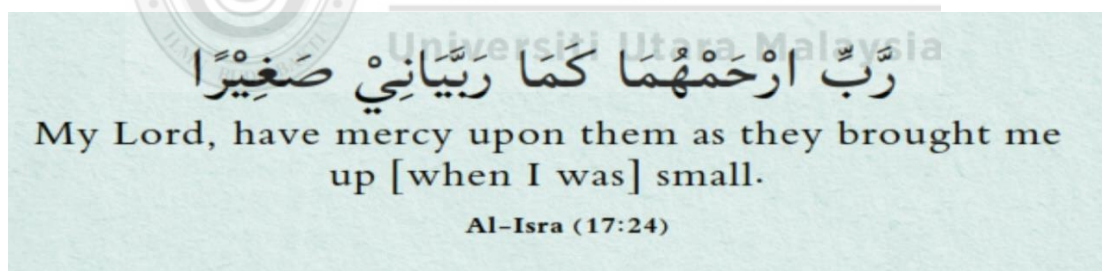
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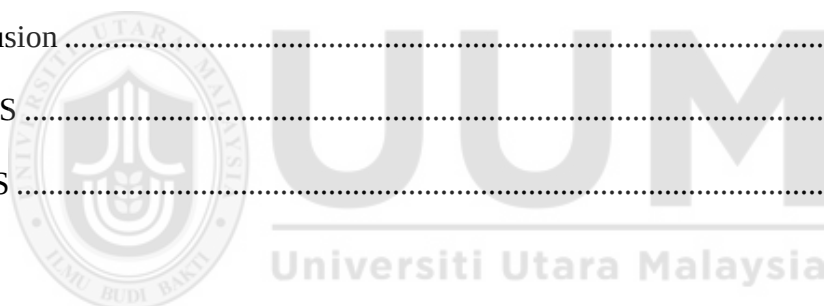
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LIST OF ABBREVIATIONS

ADF	Augmented Dicker-fuller
AfCFTA	African Continental Free Trade Area
AHP	Analytic Hierarchy Process
ANPV	Anticipated Net Present Value
ARDL	Autoregressive Distributed Lag
ATR	Average True Range
CBN	Central Bank of Nigeria
CPM	Critical Path Method
CUR	Current Ratio
DAR	Debt-Assets Ratio
DEA	Data Envelopment Analysis
DER	Debt Equity Ratio
DHL	Dalsey, Hillblom, and Lynn
DT	Delivery Time
EBITDA	Earnings before interest, taxes, depreciation, and amortization
ECM	Error Correction Model
EDB	Ease of Doing Business
EPS	Earnings Per Share
EU	European Union
FDI	Foreign Direct Investment
FEM	Fixed Effect Model
FTZ	Foreign Trade Zones

GARCH	Generalized Autoregressive Conditional Heteroskedasticity
GDP	Gross Domestic Product
GLM	General Linear Model
GNP	Gross National Product
ICT	Information and Communication Technology
IDX	Indonesia Stock Exchange
IMF	International Monetary Fund
IPO	Initial Public Offerings
IPS	Im-Pesaran-Shin
IT	Inventory Turnover
JIT	Just-in-Time
KPI	Key Performance Index
LDTA	Long-Term Debt to Total Assets
LLC	Levin-Lin-Chu
LPI	Logistics Performance Index
LPI	Logistics Performance Index
MAN	Manufacturers Association of Nigeria
MNCs	Multinational Corporations
MPI	Malmquist Productivity Index
MRP	Materials Requirements Planning
MSEs	Micro And Small Enterprises
MSR	Maritime Silk Road
NGX	Nigerian Exchange Limited

NPA	Nigeria's Ports Authority
NPM	Net Profit Margin
OE	Organizational Efficiency
OECD	Organization of Economic Community and Development
OLS	Ordinary Least Squares
PBV	Price to Book Value
PCA	Principal Component Analysis
PEBEC	Presidential Enabling Business Environment Council
PERT	Project Evaluation and Review Techniques
PLS-SEM	Partial Least Squares Structural Equation Modelling
PP	Philip Perron
PPE	Property, Plant, and Equipment
PPP	Public Private Partnership
ProKnow-C	Knowledge Development Process – Constructivist
Q_Q Plots	Quantile-Quantile Plots
R & D	Research and Development
RBT	Resource-Based Theory
RegCo	Regulation Limited
RelCo	Real Estate Limited
REM	Random Effect Model
ROA	Return on Asset
ROI	Return on Investment
SC	Securities Commission

SCM	Supply Chain Management
SDTA	Short-Term Debt to Total Assets
SEM	Structural Equation Modelling
SFA	Stochastic Frontier Analysis
SPSS	Statistical Package for Social Sciences
SRA	Stepwise Regression Analysis
SWOT	Strength Weakness Opportunity and Threat
TC	Transportation Cost
TDTA	Total Debt to Total Assets
TEU	Twenty-Foot Equivalent Units
TOC	Theory of Constraints
TQM	Total Quality Management
UNCTAD	United Nations Conference on Trade and Development
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UPS	United Parcel Service
UUM	Universiti Utara Malaysia
VECM	Vector Error Correction Model
VIF	Variance Inflation Factor
WB	World Bank
WBG	World Bank Group
WDI	World Development Indicators
WTO	World Trade Organization

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

A country's manufacturing industry is the nerve center of invention, and it is this innovation that provides the goods and services that are essential for the expansion and prosperity of an economy. From the time that products and services start out as raw materials through to the time that they are delivered to the end user, the management of these products and services involves a vast range of different processes (Hasamon, 2021), as a consequence of this, nations all over the world are expanding their support for their respective manufacturing sectors as a strategy for promoting their national economic growth. (Haraguchi, Cheng, and Smeets 2017).

According to Munim and Schramm (2018), it should not come as a surprise that a competent logistics sector is today viewed everywhere as one of the primary enablers of progress. In earlier iterations of "Connecting to Compete," the emphasis was placed on the implementation of stricter policies that lead to improved logistical performance. These types of policies include regulating services (Adesunkanmi & Nurain, 2022), establishing an infrastructure for transit (Zhang & Cheng, 2023), enforcing rules, particularly those on foreign commodities (Deng & Zhang, 2020), and improving the quality of public-private-partnerships (PPP) (Ogwo & et al, 2016). The

first LPI report was issued in 2007 and since then, there has been a shift in emphasis on policy.

In the beginning, the primary focus of logistics policy was on facilitating trade and reducing roadblocks at international borders (Notteboom et al., 2021). Modern global logistics are becoming increasingly connected with local logistics (Ristovska et al., 2017). Policymakers and shareholders are concerned with widespread policies, including, spatial planning; training abilities and resources; supply chain economic and environmental viability; and supply chain resilience in the face of calamity or interruption (physical or digital) (Hasamon, 2021). The first quarter of 2021 saw around 12.3 million people gain work in the manufacturing sector globally, as reported by the United States Bureau of Labor Statistics (BLS) (2022). Compared to the same period in 2020, this number reflects a 6.34 percent increase.

Similarly, it is anticipated that the manufacturing sector will be the largest strength to GDP in the second quarter of 2021 in China, which is one of the economies that is expanding at the quickest rate in the globe (Trading Economic, 2021). In Nigeria, the manufacturing sector contributed 14.18 percent to Nigeria's GDP in the second quarter of 2021, above its contribution of 11.79 percent in the same period of 2020, as reported by the Nigeria National Bureau of Statistics [NBS] (2022). This shows how important the sector is for economic expansion and growth. (Anyalewechi, 2021).

The quality of a country's infrastructures has major impacts to the country's total logistics performance level (Riu, Liang, 2020). Higher logistics performance increases

seaborne trade, leading to more economic advancement (Munim & Schramm, 2018). They also put forward that the quality of the infrastructure in developing economies needs to be enhanced regularly as this will contribute to improved logistics performance, which will in turn lead to trade increased and economic advancement.

Seaport development in accordance with global trends in the sphere of maritime transportation infrastructure and logistics has a good influence on the port-region and maintaining the efficient operation to strengthen its competitiveness (Riu, Liang, 2020). This has a major positive influence on the wealth of the port-region. There appears to be a paradigm change occurring as Public-Private Partnerships (PPP) has become an essential instrument in the process of developing, managing, and running infrastructure (Almarri & Boussabaine, 2023). This contrasts with the traditional approach, which entails national or sub-national governments investing in seaports. (Notteboom et al., 2021) Maritime logistics companies have found infrastructure issues that could cause delays on main roads leading to seaports. The current focus on the development of rail infrastructure at seaports could ease the constraints that are stressing the road infrastructure in the area. (Chen et al., 2022)

In the past few years, considerable prominence has been placed on improving seaports, extending present ones, and improving current port efficiency and capacity. According to Lagoudis et al. (2014), countries have made large investments in their seaports, which has resulted in a significant percentage of their nations' GDP that

comes from manufacturing, in various percentages. For example, in the year 2020, the manufacturing sector was responsible for approximately 27% of China's GDP, 23% of Malaysia's GDP, 20% of Singapore's GDP, 19% of Japan's GDP, 17% of India's GDP, 11% of the US GDP, and 10% of the UK GDP (OECD, 2021).

In contrast, Nigeria has made few investments in seaport infrastructure over the course of the past decade. Research conducted by Edih et al., (2022) suggested that there are obstacles to be overcome before Nigeria can achieve optimal port operations and efficiency. The study also emphasizes the significance of effective operation of seaports in lowering overall transportation costs and making a positive contribution to economic expansion.

Despite pitiful investments made by the country in its infrastructure, the manufacturing industry in Nigeria has made significant contributions to GDP over the previous decade, and by 2020, it accounted for almost 10% of GDP (Edih et al., 2022). This result suggests that Nigeria might benefit from investing in infrastructure quality upgrading and the logistics performance operations to obtain higher yields in economic growth. This is like what other developing countries like China, Malaysia, and India have done to accomplish higher returns in economic growth. Notteboom *et al.*, (2013) in their book titled Port Economics, Management and Policy; opined that even though the resistance levels between throughput and employment are mostly less than 0.05 jobs per hundred tons, it is expected that the impacts of port throughput on domestic economic growth would be aided by improvements in infrastructure.

Seaports have been cited as major contributors to economic development. The term "economic benefits" often refers to consequences that can be measured in terms of their monetary value, whereas "economic impacts" refers to a wide variety of changes that are brought about by infrastructure investment projects.

However, most of these effects are not observable until the investments are made and the benefits are determined. Exercise known as ex-ante (which refers to prediction) is risky and typically results in erroneous evaluations. This indicates that port forecast models are usually off by a significant margin. The estimation of the economic impacts of investments is a topic that focuses on the effectiveness of transport infrastructure as a stimulus for indirect and induced gains. The bottom line is that this makes the estimation of these impacts difficult.

According to Notteboom, *et al.* (2013), the importance of these investments is determined by the magnitude and breadth of the changes that they bring about. The following are some of the most significant developments that have influenced seaports and maritime transport:

As a result of the cheap cost of labor in places like China and India, many corporations have relocated their manufacturing operations there, leading to a rise in the number of items moved by sea, since these nations now export their completed products to other markets. Considering this, logistics is becoming more crucial in the process of coordinating the subsequent complex distribution network. The growth of

offshore industries and the emergence of regional economies are behind the dramatic changes taking place at container ports throughout the globe. The data provided by the World Bank (2020) indicate an upward trend in the development of container traffic in 2008–2016. As a result, the volume of international trade is expanding year on year.

As a result of this, maritime transportation is crucial to international commerce. This contributed to a 1.9% increase in container port traffic in 2016, with a total of 699.7 million twenty-foot equivalent units (TEUs); this is according to a report by the United Nations Conference on Trade and Development (UNCTAD). In a comparable manner, most of the container ports that process traffic are in Asia, accounting for approximately 64 percent of the total, while only 16 percent was handled in Europe, 8 percent in North America, and 6 percent in developing America, in that order (UNCTAD 2022). Less than five percent was processed through the African and Oceanian regions. As a direct result of this, Asian ports maintain their position at the top of the global list in terms of the volume of traffic and the quality of the terminals. (Kahyarara 2020) cited in (Mlambo, 2021)

As pointed out by Hlali (2023), several international terminal operatives have advanced their activities to shape and frame their operations. These businesses include those with close relations to shipping organizations. According to the findings of several statistical surveys, the economies of Asian countries are uniquely positioned to reap the benefits of this marriage within the global economy.

In 2016, more containers were moved via Shanghai and Singapore than through any other port on the globe. In terms of the volume of goods that pass through them, these ports are the busiest in the world. The consistent and sustained rise in international shipping is due to several causes, including the movement of industries, artificial growth of economies in developing countries, and the improvement of supply chain logistics. After this, the push for increased globalization of production systems is met with more strictly controlled consumption patterns and the need for a cost-to-quality ratio due to several reasons:

a. As a result, the proliferation of large ships and seaports are an indication of the globalization of the logistics industry, which is supported by all quantitative and qualitative statistical grids. Containerization has emerged as the primary force behind globalization due to the proliferation of various production, mutation, and differentiation systems. According to research conducted on the world's 20 most important container seaports from 2012 to 2016, there are 14 Asian ports. Shanghai and Singapore continue to hold the top two spots, selling 37.1million and 30.9million, respectively. In addition, just three seaports in Europe made it onto the list: Rotterdam, Antwerp, and Hamburg. In comparison, the United States had two (Los Angeles and Long Beach), while the United Arab Emirates had one (Dubai seaport). According to Lloyd's list, Table 1 shows that between 2016 and 2022, none of the leading 20 seaports are in the Mediterranean or Africa. By adopting a multi-container system to maximize the efficiency of their container ship rotations, China and Singapore have solidified their position as global containerization centers.

Table 1.1*Ranking of 20 Major World Seaports 2012-2016.*

Rank	Port	Country	2016 (Millions TEU)
1	Shanghai	China	37.1
2	Singapore	Singapore	30.9
3	Shenzhen	China	23.9
4	Ningbo	China	21.5
5	Busan	Korea	19.8
6	Hong Kong	China	19.8
7	Qingdao	China	18.3
8	Jebel Ali Port	Dubai	15.7
9	Tianjin Port	China	14.5
10	Rotterdam	Netherlands	12.4
11	Antwerp	Belgium	10.4
12	Kaohsiung	Taiwan	10.3
13	Hamburg	Germany	8.9
14	L. Angeles	USA	8.9
15	Tanjung Pelepas	Malaysia	8.5
16	Xiamen	China	8.2
17	Long Beach	USA	6.8
18	Guangzhou	China	7.7
19	Dalian	China	7.1
20	Laem Chabang	Thailand	7.1

Source: Lloyd's List Containers, 2016

Between the years 2017 and 2022, an analysis of the major 20 container seaports revealed some interesting trends. Asia, although with some healthy competition

between its ports, still has 14 out of 20 ports on the ladder. Shanghai and Singapore retain the top spot, with Shanghai handling 47.3 million containers and Singapore handling 37.3 million containers. A significant improvement of about 10 million and 7 million containers addition, respectively. European retains seaports (Rotterdam, Antwerp, and Hamburg), the United States (Los Angeles and Long Beach), and one port from the UAE, Jebel Ali Port (Dubai). This data highlights the dominance of Asian seaports in the global containerization industry. Again, the Mediterranean and African regions did not have any ports in the major 20 ports list in 2022.

The rise of Asian seaports as major players in the container industry can be attributed to several factors. Primarily, the Asian continent is home to most of the world production, with many goods being exported via sea. This huge volume of manufacturing inevitably leads to a bigger need for container shipping, culminating in the rise of Asian seaports. Additionally, the strategic placement of Asian seaports plays a key part in their success. Ports like Shanghai and Singapore are strategically positioned along key trade routes, making them ideal trans-shipment centers for products transiting between different areas. These ports serve as important gateways for connecting seaports to over 120 countries, facilitating global trade and commerce. Furthermore, the continuous investment in infrastructure and technological advancements in Asian seaports has contributed to their growth and efficiency. Ports like Shanghai have undergone substantial expansion over the years, extending their capacity and strengthening their handling skills. (SHIPHUB report 2023).

This drive to renovation and innovation has helped Asian seaports to handle bigger volumes of containers and manage the ever-increasing size of container ships. On the other hand, the low participation of European and American seaports in the big 20 ports list illustrates the shifting dynamics of global trade. While European ports like Rotterdam, Antwerp, and Hamburg still maintain their prominence, the rise of Asian seaports has changed the balance of power in the container sector. This shift can be linked to the economic expansion and modernization of Asian countries, which has led to a rise in their proportion of world trade as shown in the table below.



Table 1.2*Ranking of Major World Seaports 2017- 2022*

Rank	Port	Country	2022 (Million TEUs)
1	Shanghai	China	47.3
2	Singapore	Singapore	37.3
3	Ningbo-Zhoushan Port	China	28.8
4	Shenzhen Port,	China	27.7
5	Guangzhou Port	China	25.9
6	Busan Port	S.Korea	21.9
7	Hong Kong Port	H.Kong	19.8
8	Qingdao	China	19.3
9	Tianjin Port	China	17.5
10	Jebel Ali Port,	Dubai	14.0
11	Rotterdam Port	Netherland	13.8
12	Port of Antwerp	Belgium	12.1
13	L. Angeles Port	USA	10.8
14	Long Beach Port	USA	8.1
15	Hamburg Port	Germany	7.9
16	Tanjung Pelepas Port,	Malaysia	7.8
17	Port Klang	Malaysia	7.5
18	Jawaharlal Nehru Port	India	7.4
19	Port of Colombo	Sri-Lanka	6.9
20	Kaohsiung Port,	Taiwan	7.8

Source: Lloyd's List of Containers, 2022

b. Over the last few decades, the shipping sector has been subjected to some significant technological advancements to attain economies of scale and increase overall efficiency. These shifts have been brought about by several variables, the most notable of which are the development of larger ships, the rise of more specialization, and the implementation of automation. Due to these developments, ports are under increasing pressure to modernize and enhance their infrastructure to keep up with the latest industry trends:

Increase in ship size: The maritime industry has been undergoing several significant technical shifts, one of which is an increase in ship size. The 1990s marked the beginning of a trend towards larger boats, such as post-Panamax container ships, which have continued into the present day. This increase in ship size makes it possible to take advantage of economies of scale because larger ships can carry more cargo, which in turn lowers the cost of transportation (Gavalas *et al.*, 2022).

Ship Specialization: The increasing level of ship specialization has another significant impact. Container ships, bulk carriers, vehicle carriers, and cruise ships are just examples of the several types of ships that need specially designed port terminal facilities to fulfill their requirements (Gavalas *et al.*, 2022). This specialization ensures effective handling and storage of freight, which enhances total operating efficiency.

Automation: The implementation of automation is a trend that has been prevalent recently in the maritime industry. The inclusion of both hardware and software

innovations into shipping companies' operations has made it possible for these businesses to become more efficient because of recent technological advances. Automation can expedite procedures, enhance productivity, and eliminate the need for physical contact, all of which are particularly crucial considering the COVID-19 pandemic (Gavalas *et al.*, 2022). Automation can also lower the risk of human error.

The maritime industry is also embracing green technology as a big trend, which is a positive development. The growing awareness of environmental problems among the general population has resulted in greater emphasis being placed on the reduction of emissions and the adoption of sustainable practices. This involves the utilization of alternative fuels, energy-efficient technologies, and environmentally friendly ship designs to lessen the damaging impact that the sector has on the surrounding environment. (Asaleye *et al.*, 2021).

Analytics of Big Data and Predictive Models: The shipping business creates a huge amount of data, which, if appropriately analyzed, can be extremely beneficial. Many facets of maritime shipping can be completely transformed by the implementation of big data and predictive analytics. Consequently, data-driven insights and their usage can improve decision-making, increase operational efficiency, and save costs in a variety of contexts, such as route planning and optimizing fuel use.

The Rise of Robotics and Self-Driving Ships: Another key development that will shape the future of shipping is the increasing usage of robotics and autonomous

technology. Vehicles capable of driving themselves, such as cars, trucks, and ships, are now being researched, developed, and evaluated. Even while completely autonomous ships are not yet commonplace, the shipping industry is investigating the potential safety, productivity, and cost-saving benefits that could result from the implementation of autonomous technology.

Port facilities have required repairs and improvements due to the technological shifts and industry developments in the maritime industry. Ports are required to transform so that they can accommodate vessels of greater size, provide specialized infrastructure, and implement automation technology. Industry can improve its efficiency, lower its expenses, and keep up with the rising requirements of global trade if it adopts these technological innovations.

In summary, the maritime shipping business has undergone considerable changes in terms of technology, some of which include an increase in the size of ships, an increase in the amount of specialization, the adoption of automation, and an emphasis on green technology. Because of these shifts, ports are under increasing amounts of pressure to modernize and enhance their infrastructure to match the shifting trends. For the sector to improve productivity, lower its impact on the environment, and fulfill the requirements of a global trade landscape that is continually shifting, it must embrace technological innovations.

c. Organizational changes. Large seaport shipping corporations and terminal operators that have participated in strategic relationships in addition to mergers and acquisitions now exert a growing amount of influence and control over the maritime and port industries. Their goal is to achieve some degree of vertical and horizontal integration, the result of which will be an increase in the transportation chain's efficiency. A selected number of ports have been successful in establishing inland terminals. The value-added, employment levels, taxation income, and return on investment are some of the variables that are typically utilized to evaluate the economic benefits of seaport on an aggregate basis. These indicators are necessary for deciding to invest in the expansion of a port. (Notteboom *et al.*, 2013).

Since the 2007 edition, summary of the score for the whole collection, of over 160 countries, have remained similar, which is a sign of the reliable character of the data that underlies the rankings. The minor convergence of scores between 2007 and 2014 was attributed in the 2014 edition to an apparent improvement in the trade-supporting infrastructure of low- and middle-income countries, as well as, to a lesser extent, enhancements in their logistics services, customs, and border administration. This line of thinking was applicable to most countries on the list. In 2016, however, the top-bottom gap expanded. The top 10 countries received the highest average scores ever recorded (4.13 on a scale from 1 to 5), while the countries that ranked the lowest received the lowest ratings since 2007 for their performance. World Bank Group (2018) maintained that the spread between the best and the most awful performers continued to narrow in 2018. The worst ten countries earned an unprecedented high of

2.08, while the top 10 countries had an average score that was lower than it had ever been: 4.03. The top ten rankings in 2018 were dominated by high-income nations, including eight countries from Europe and two from Asia (Japan, and Singapore). These countries have historically held a dominant position in the supply chain industry. With a total score of 4.20, Germany comes in first place. Sweden is second with 4.00, while Finland is tenth with 3.97.

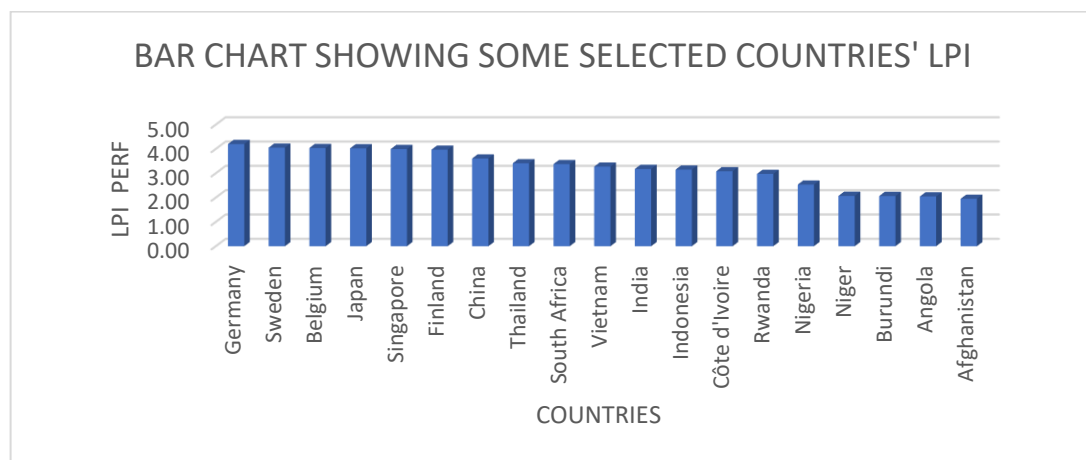
The top 10 least developed countries are comprised solely of low- and middle-income nations primarily located in Africa or other remote regions. As a direct consequence of military conflict, natural disasters, and political unrest, the economic state of some nations is precarious. Other countries are entirely encircled by land, which, due to geography or economies of scale, makes it difficult for them to connect to entire supply networks globally. Countries like Afghanistan secured a rank of 160th on the Human Development Index with a score of 1.95, below countries such as Angola (2.05), Niger (2.07), and Burundi (2.06). India ranked 44th scoring 3.18, Indonesia 46th with a score of 3.15, and emerging economies such as Vietnam ranked 39th with a score of 3.27 and the Republic of Côte d'Ivoire ranked 50th with a score of 3.08 are the top scorers among lower-middle-income countries. Numerous of these nations have access to water or are strategically located near major transportation centers. China, which is currently ranked 26th with a score of 3.61, Thailand, 32nd with a score of 3.41, and South Africa, ranked 33rd with a score of 3.38, lead the category of high-performing upper-middle-income nations. Additionally, Romania, Croatia, and

Bulgaria made substantial strides forward. East and West African nations have the lowest revenues, according to the most recent edition.

Specifically, the Logistics Performance Index (LPI), (2018) reveals that in Africa, South Africa has the best performance when it comes to the trade logistics involved. The country received a score of 3.38 on the LPI in 2018. The next two countries with the highest LPI scores were Côte d'Ivoire and Rwanda who scores 3.08 and 2.97, respectively. Burundi, Angola, and Niger conversely had the worst performance in terms of trade logistics across the African continent. According to the projections made in the analysis that was completed in 2018, it was anticipated that the value of the global logistics market will be close to Eight Quadrillion, Six Hundred Trillion US Dollars (\$8,600,000,000,000,000.00) (WBG (World Bank Group), 2018). In that year, North America was the second largest region, accounting for about two trillion United States dollars. After recovering from the COVID-19 pandemic in 2021, the global logistics business had an approximate market size of €8.43 trillion (9.53 billion U.S. dollars). It is projected that the logistics industry would be worth over 13.7 billion euros by 2027 (WBG, 2021). The ranking of some countries' logistics performance indicators (LPI) across the globe is displayed in the table below.

Table 1.3*LPI by Countries in 2018*

S/N	Country	Overall LPI Score	Rank	% Of the highest performer
1	Germany	4.2	1	100.0
2	Sweden	4.0	2	95.4
3	Belgium	4.0	3	94.9
4	Japan	4.0	5	94.5
5	Singapore	4.0	7	93.6
6	Finland	4.0	10	92.7
7	China	3.6	26	81.4
8	Thailand	3.4	32	75.3
9	South Africa	3.4	33	74.2
10	Vietnam	3.3	39	71.0
11	India	3.2	44	68.0
12	Indonesia	3.2	46	67.2
13	Côte d'Ivoire	3.1	50	65.0
14	Rwanda	3.0	57	61.7
15	Nigeria	2.5	110	47.9
16	Niger	2.1	157	33.4
17	Burundi	2.1	158	33.2
18	Angola	2.1	159	32.7
19	Afghanistan	2.0	160	29.6

Source: *World Bank Group, 2018***Figure 1.1** *Chart Showing LPI of Some Selected Countries*

Gani (2017) states that the transportation network and infrastructure must be in place for the industrial sector to engage successfully and sustainably. As such, Nigeria's manufacturing industry's logistics sector has suffered repeated setbacks, making it difficult to create and facilitate the seamless movement of raw materials and produced goods. Logistics management, a subset of supply chain management, plans, organizes, executes, and supervises the complete and timely flow of products, services, and relevant data from origin to consumption to meet consumer needs, according to Amin and Shahwan 2020. Logistics management includes storing goods, services, and information. Logistics management solutions help manufacturing companies operate better (James & Inyang, 2022). Supply chain management remains a key component of economic growth. (Abdu et al., 2021)

Transport and logistics services enable local economic growth and worldwide commerce. Logistics, service quality, and efficacy affect international commerce, according to Devlin and Yee (2005). Logistics infrastructure and operational procedures may hinder global trade integration; hence logistics service quality can affect international trade efficiency.

However, Lakshman et al. (2001) found that improved trade-related logistics and a more liberalized economic climate can increase trade volume, scope, and scale in distribution and production. Good logistics services strengthen regional economic component links. It also links local and international economies. Producers prioritize cost-effective, timely delivery of their goods to buyers. Efficient transportation and

logistics networks promote the interconnection of numerous domestic productive sectors, such as agriculture, industry, agro-food, and tourism.

Logistics supports and sustains economic activity, even if its contribution to a country's output is not as competitive as other sectors. The OECD and WTO (2013) report a strong link between national growth and transport and logistics system improvements. This facilitates international trade. International trade becomes easier under certain situations, bringing economic and social advantages. Transport and logistics help enterprises import and export goods and services and perform other international trade operations. (Cho & Ha, 2009)

The preservation of an open global economic system and the growth in the quantity and effectiveness of support structures like logistics services are prerequisites for the expansion of international commerce and the desire of many countries to quicken integration into the world trading system. As a result, the development of support systems like logistics services will be essential to the expansion of global trade and the aspirations of many nations to quicken the integration of the global trading system. Limited border coordination, ineffective customs clearance at ports, fragmented and poor-quality transportation infrastructure, expensive and infrequent shipping (via long, indirect shipping routes), terminal handling and clearance delays, a lack of cool storage facilities at ports, and an inability to certify product quality are all problems that international trade must deal with.

Trade liberalization will keep pressuring nations to take part in a world that is becoming more globalized with more market possibilities and profit from this participation to achieve more globalization. A country's ability to participate in trade with fewer restrictions and cheaper prices may depend on how much its domestic and international logistical service businesses have developed. Korinek and Sourdin (2011) believed that improving logistics services might shape trade facilitation in the future. A significant scientific question is how logistics service expansion affects business. This topic requires greater study since empirical studies from this viewpoint are few.

Information technology was formerly used exclusively for administrative purposes, with a focus on mechanization. It is different now. Globalization, intense competition, and the development and advancement of information technologies have changed information system use from administrative automation to strategic automation, which directly affects value production (Ouafae & Laila, 2019). Information technology advancements have contributed to this shift in information system utilization. Information technology has changed how information systems are used today. These factors affect strategic and managerial activities more than operational operations, hence Bakar, Jaafar, and Faisal (2016) say they have a considerable influence on a firm's competitive edge. These elements affect a company's actions more than they affect its activities.

Information technology optimizes structural links between logistics chain activities and participants, boosting collaboration between organizations. Information systems enable the removal of existing interfaces. Businesses are perceived as parts of a network or logistical chain that share information. Businesses are components, not autonomous entities. This is particularly important since these partners are in various countries.

At the time, supply chains extend beyond international borders and are reliant on connections with partners and suppliers; the efficiency of these networks is increasingly dependent on their ability to innovate and adapt to changing circumstances. The potential for total end-to-end digitalization of information flows is the motivation behind this innovation, which has led to the invention and development of several tools and technical solutions that are particularly created for the field of telecommunications. The participants in the supply chain are provided with access to the information that is being exchanged in this manner. This information may then be used to enhance both how operations are carried out and the efficiency with which logistics are carried out. Therefore, logistics reflects the processes of information flow from raw material (intended to become a consumable good) to the point of consumption, controlling and planning the process cost-effectively to maximize productivity through the utilization of storage and inventory facilities (Agbede & Faseesin, 2021).

Based on several different criteria that apply to Nigeria's logistics system, Adeyemo (2015) concluded that Nigeria's logistics system is insufficient to sustain acceptable growth. According to Victor (2015), inefficient logistics systems might result in the loss of essential supplies if the company's supply chain schedule is not adhered to. This can be a costly mistake. The manufacturer suffers a loss of income because of this situation.

In addition, when logistics efficiency is bad, it hurts both final consumers and the producers. This is because manufacturers suffer a loss in earnings when crucial materials do not arrive at the expected time. Hausman, Lee, and Subramanian (2012) state that economies that are still developing are slipping further and further behind. In his view, this is because wealthy nations' advanced logistics systems have increased the chance of selling to markets all over the world and have drawn direct investment from other countries.

During the past couple of decades, the area of the economy known as "logistics" in Nigeria has been subject to tremendous development and modification. The increasing relevance of it has led to a dynamic increase in the quality of logistics managers and employees, both in terms of the duties they take, and the breadth of their jobs (James & Inyang, 2022). Its expanding significance has resulted in a dynamic improvement in the quality of logistics managers and workers. The lack of adequate infrastructure in Nigeria has acted as a barrier to the expansion of the logistics industry in that nation. Delays in delivery times, bottlenecks for international shipments, insufficient

capabilities for monitoring and tracing, and inadequate quality and competence in logistics are all examples of challenges that affect the growth prospects of firms involved in logistics and transportation.

However, there is a lack of accurate industry data and statistics, so staying current on the most recent improvements in the multiple facets of logistics and supply chain that are present in the nation has always been a significant struggle. Logistics and supply chains are Nigeria's fastest-growing businesses, as noted by Agbede and Faseesin (2021). Despite the business's infancy. It was anticipated that the logistics industry in Nigeria would reach 250 billion naira (\$696 million) in 2018, which is an increase of 50 billion from 2017. According to the reports published by The Vanguard., this information came from the 2018 Logistics and Supply Chain Industry In 2018, Nigeria's Logistics Performance ranking was 112 and its Ease of Doing Business (EDB) ranking, was 145 out of 190 nations. The improvement of railway and aviation infrastructure, the development of ties with other nations, the expansion of the industrial and export sectors, and the emergence of e-commerce are all elements that are contributing to the current boom in Nigeria's logistics industry. In addition, the rise of e-commerce is a contributing factor. Because of this, the objective of this thesis would be to research the elements that affect the degree of logistics performance within Nigeria's economy, with a special emphasis on the manufacturing industry.

1.2 Problem Statement

The logistics performance in Nigeria's manufacturing sector is currently facing significant challenges, primarily due to inadequate seaport infrastructure. This deficiency not only undermines the efficiency of logistics operations but also stifles economic growth, indicating a critical gap in understanding the intricate relationship between seaport infrastructure and logistics performance. The need for targeted investments and improvements in logistics support is paramount, as the current state of seaport facilities significantly hinders the sector's potential.

Hausman, et al., (2013), argued that the logistics industry is the fundamental industry and an essential pillar in the process of promoting the growth of any economy. The logistics industry serves as the link between production and consumption and between rural and urban settings. According to Munim and Schramm (2018), the growth of the logistics business has substantial implications for breaking down boundaries between areas and connecting social production and the consumption of inhabitants. The logistics performance index is a ranking system by the World Bank to evaluate nations based on their logistics performance. It evaluates aspects such as the effectiveness of customs, the quality of the infrastructure, and the timeliness of shipments, etc. According to Celebi (2019), higher levels of logistics performance are related to higher levels of economic development. Although performing sub-optimally in Africa and Nigeria, the use of logistics operations in the manufacturing industry has become

vital to economic growth and the creation of employment opportunities. (Gani, 2017; Mlambo, 2021; Oyeyemi, 2021 & Muazu, 2019).

Despite various initiatives aimed at enhancing the logistics sector, there remains an insufficient exploration of how these efforts specifically impact seaport infrastructure and its subsequent effect on economic growth. Previous studies have highlighted that logistics performance is a key enabler of economic advancement; however, they often overlook the specific mechanisms through which seaport infrastructure influences this relationship. For instance, while it is acknowledged that improved logistics can lead to increased economic output, the direct correlation between investments in seaport facilities and enhancements in logistics performance requires further investigation.

The existing literature suggests that many developing countries, including Nigeria, have not sufficiently invested in their port infrastructure compared to their counterparts like China and Malaysia, which have seen significant returns on their investments (Lagoudis et al., 2014). This lack of investment creates a pressing need for research that explicitly outlines how infrastructural deficiencies impact logistics performance and economic growth.

The challenges associated with suboptimal logistics performance in Nigeria can be categorized into several key areas:

- a. **Inadequate Infrastructure:** The current state of seaport facilities is insufficient to handle growing trade volumes effectively, leading to delays and increased operational costs. The lack of modern cargo handling equipment and outdated facilities exacerbates this issue.
- b. **Congestion:** Overcrowded ports result in longer turnaround times for vessels, negatively impacting supply chain efficiency. This congestion is often caused by insufficient docking facilities and poor traffic management systems both within and leading to the ports.
- c. **Lack of Modern Technology:** The absence of advanced technologies in port operations limits operational efficiency and responsiveness to market demands. Many ports operate with outdated systems that do not integrate well with modern supply chain practices.

To mitigate these challenges, several approaches can be adopted, including:

- a. **Investment in Infrastructure:** Enhancing port facilities through modernization and expansion can alleviate congestion and improve service delivery. Investments should focus on expanding docking capacities, upgrading cargo handling equipment, and improving logistical connectivity to hinterland transport networks.
- b. **Public-Private Partnerships (PPP):** Engaging private sector stakeholders in port management can lead to innovative solutions and efficient resource allocation.

PPPs can provide the necessary capital for infrastructure development while ensuring accountability and operational efficiency.

- c. Policy Reforms: Implementing regulatory frameworks that support infrastructure development and streamline logistics operations is essential. Policies should encourage investment in port facilities and facilitate smoother customs processes to enhance trade flows.

By implementing the above issues outlined, the Impact of Seaport Infrastructure on Logistics Performance and Economic Growth can be better understood. Seaport infrastructure significantly influences logistics performance by determining the efficiency of cargo handling, transportation speed, and overall supply chain effectiveness. Improved infrastructure not only facilitates smoother trade flows but also enhances the competitiveness of the manufacturing sector. Research indicates that countries with robust port infrastructure experience higher levels of economic growth due to increased export capabilities and reduced transportation costs (Munim & Schramm, 2018; Riu & Liang, 2020).

In Nigeria, where the manufacturing sector contributed above 10% to the GDP in 2021 (NBS, 2022), enhancing seaport facilities could yield substantial economic benefits. The potential for increased trade volumes resulting from improved logistics performance underscores the necessity for strategic investments in port infrastructure. The manufacturing industry in Nigeria is an extremely important contributor to the

growth and expansion of the country's economy (Adesunkanmi & Nurain, 2022). It is well recognized that the efficiency of this sector's logistics operations, which includes activities such as transportation, warehousing, and distribution, has a substantial impact on both the overall competitiveness and productivity of this sector (Erkan, 2014).

The impact of seaport infrastructure, logistics, and economic growth extends to other areas within a nation's economy. These variables have a significant influence on Gross Domestic Product (GDP), Foreign Direct Investment (FDI), employment levels, trade, and balance of payments. Seaport infrastructure efficiently facilitates the transportation of commodities via the use of various buildings, machinery, and logistical systems. The infrastructure comprises many components such as docks, cranes, terminals, storage facilities, road, and rail connections, among others. A robust seaport infrastructure plays a crucial role in facilitating the transit of goods, leading to a reduction in logistics expenses and the promotion of global trade. Logistics efficiency includes the evaluation of transportation, inventory management, storage, and information transmission processes. An efficient logistics system enhances the expediency of shipping processes, reduces lead times, and enhances the competitiveness of the supply chain.

According to the findings of Ekaputra, Wahjono, and Suhartono (2019), it is argued that robust seaport infrastructure plays a crucial role in fostering economic development. According to the studies, seaports play a crucial role as entry points for

global industry, contributing to the reduction of logistical costs and serving as a magnet for foreign direct investment. Foreign direct investment (FDI) contributes to economic development by providing financial resources, technological advancements, and job opportunities. The study conducted by Osei-Assibey and Boateng (2019) titled "Transport Infrastructure, Logistics Performance, and Foreign Direct Investment: Evidence from Sub-Saharan Africa" revealed a positive correlation. According to the authors, the proposition put out is that enhancements in seaport infrastructure and logistics have the potential to reduce transportation costs and enhance the dependability of supply chains, thereby fostering international investment.

The augmentation of commercial activity contributes to job creation, thereby emphasizing the significance of seaport infrastructure and logistics on employment. Liu, Ye, and Zhang (2019) conducted a study titled "Seaport Infrastructure and Regional Economic Growth: Evidence from Chinese Cities," which demonstrates that seaport infrastructure has a positive impact on employment. According to scholarly discourse, a well-developed seaport infrastructure has been widely acknowledged to have a positive impact on several aspects such as shipping, storage, and employment in the logistics sector, contributing to the overall economic growth.

Furthermore, the influence of seaport logistics and infrastructure on trade balance should be considered. The presence of well-developed marine port infrastructure has the potential to reduce logistical expenses, increase trade activities, and enhance

overall competitiveness. According to Tsai's (2019) research titled "Seaport Infrastructure, Export Performance, and Economic Growth: Evidence from Asian Economies," it is determined that seaport infrastructure has a positive impact on export levels. Based on empirical evidence, it has been shown that the performance of exports has a significant influence on overall economic growth. Enhancing trade competitiveness and balance may be achieved via improved logistics, which include expedited clearance processes and reduced duration of stays.

Similarly, the presence of maritime infrastructure and the efficiency of logistical systems have a significant influence on the balance of payments. An efficient marine port infrastructure plays a crucial role in facilitating exports, reducing import costs, and enhancing the overall trade balance. The study conducted by Hashemi and Rad (2018), titled "Logistics Performance, International Trade, and Economic Growth: A Panel Data Approach," provides empirical evidence in favor of the positive impact of logistics performance on international trade and the balance of payments.

The impact of seaport infrastructure, logistics, and economic development on various economic indicators such as GDP, FDI, employment, trade, and payments has been widely studied. Numerous writers have shown these interconnections. The development of seaport infrastructure and logistics has been shown to have a positive impact on attracting Foreign Direct Investment (FDI), creating job opportunities, improving the trade balance, and contributing to the overall balance of payments. To

facilitate long-term economic growth, it is essential for governing bodies to provide resources for the enhancement of marine infrastructure and logistics.

Logistics Performance Index (LPI, 2023) data, on the other hand, reaffirmed the deficient performance of logistics operations in Nigeria on a maximum scale of 5%. The LPI, 2023 is a trade performance rating system that ranks by countries based on the efficiency and effectiveness of their trade logistics. In the report "Connecting to Compete 2023: Trade Logistics in an Uncertain Global Economy," Nigeria ranked 88th out of 139 countries evaluated. On the other hand, South Africa emerged as continental leaders, placing 19th with 3.4%, Egypt 57th with 3.1%, Botswana 57th with 3.1%, Namibia 66th, Benin Republic 66th, Djibouti 79th, Rwanda 73rd, and Benin Republic 66th. Nigeria, together with the Democratic Republic of Congo, Guinea Bissau, and Mali, all share 88th place on the Index with a performance score of 2.6%. The United Nations Development Program's Human Development Index concurs with the LPI's findings that nations with a high score on the LPI also have a high score on the HDI.

Considering these performances within the continent and the global environment, the government of Nigeria has recognized the importance of logistics performance in economic growth.

As a result, the government has undertaken a variety of programs and policies to solve difficulties with infrastructure and expedite trade procedures. For instance, in 2016,

the Presidential Enabling Business Environment Council (PEBEC) was founded to make it easier to conduct business in Nigeria by enacting various reforms, such as those about logistics and trade facilitation. In 2005, the National Trading Platform and Single Window System were formed and included the establishment of a National Single Window System. This platform's goal is to provide a consolidated and user-friendly interface for all documents and procedures about trading. The Single Window system assists in the simplification and automation of processes, the reduction of paperwork, the enhancement of customs efficiency, and the promotion of speedier cargo clearance. The development of road infrastructure, the completion of rail transport projects, the establishment of a national trading platform and a single window system, investments in port infrastructure, and the formation of public-private partnerships (PPPs), among other initiatives, are all on the agenda. These government programs attempt to enhance Nigeria's logistics performance, streamline trade procedures, decrease transaction costs, and solve the infrastructural gaps that currently exist in the country.

Despite these commendable efforts, which are aimed at addressing the challenges, the problem of poor port infrastructure, poor road network, poor air transport infrastructure, and poor railway infrastructure persists which has led to poor logistics performance, with its attendant consequences on growth improvement, high inflation, and unemployment. Previous studies by Ogwo and Godswill (2017), Gani (2017), Duzbaievna Sharapiyeva, et al. (2019), Shikur (2022), and a host of others have investigated the separate relationships between logistics performance, port

infrastructure, and economic growth. However, there is a lack of studies that specifically examine how seaport infrastructure affects the relationship between logistical performance and economic development in Nigeria's manufacturing sector.

Studies that have been conducted to investigate port infrastructure's roles in the expansion of the economy in Nigeria have mostly concentrated on the port's contribution to the ease of commerce, the generating of income, and the creation of job opportunities. However, research on the possible impact that seaport infrastructure may have as a moderating variable between logistics performance and economic growth in the manufacturing sector is lacking. It is essential to understand this moderating attribute because it sheds light on how seaport infrastructure may boost or hamper the influence of logistics performance on economic growth, particularly in the manufacturing sector in Nigeria.

Additionally, there is a dearth of empirical research on the causal relationship between logistics performance and industrial sector development in Nigeria's economy. While many studies have examined logistics performance in the broader context of trade facilitation and supply chain management, they often fail to conduct a thorough examination of the manufacturing sector or account for the unique challenges and dynamics faced by this industry.

The identified research problem aligns with current trends in the maritime transportation sector, where there is a global emphasis on enhancing port capabilities to meet rising trade demands. As international shipping continues to grow, efficient

logistical frameworks become increasingly critical. This study addresses a meaningful gap in the field by focusing on how specific infrastructural improvements at Nigeria's seaports can directly enhance logistics performance and contribute to economic growth.

This study is necessary as it provides empirical evidence regarding the role of seaport infrastructure in enhancing logistics performance within Nigeria's manufacturing sector. By investigating this relationship, the research aims to contribute to a better understanding of logistical frameworks and their economic implications.

Similarly, this study will highlight its importance by demonstrating how strategic investments in seaport infrastructure can lead to improved logistics outcomes, fostering economic growth. The findings are expected to inform policymakers and industry stakeholders about effective strategies for enhancing logistical efficiency through targeted infrastructural investments.

The insights gained from this study will not only fill existing gaps in knowledge but also pave the way for future research endeavors focused on maritime transportation and logistics optimization. By establishing a clear link between seaport infrastructure and economic growth, this research will encourage further exploration into related areas such as supply chain resilience, technological advancements in port operations, and regional economic development strategies.

In summary, the backdrop of Nigeria brings possibilities and difficulties that are one of a kind and need specialized attention. It is possible for several factors, including a lack of suitable port infrastructure, congestion, operational inefficiencies, and regulatory restraints, to have a substantial influence on the performance of the logistics sector, which in turn can impede the expansion of the manufacturing industry. Hence, the need for research that addresses these contextual elements and explores the unique influence of seaport infrastructure on the nexus between logistics performance and economic growth in Nigeria's manufacturing sector. Also, it contributed majorly to the current literature on logistics performance, port infrastructure, and economic growth in developing nations, many of which are projected to face the same demographic and economic challenges.

1.3 Research Questions

In a bid to address the statement in the preceding section, the study proposes the following research questions, which help to guide the process of analysis:

- i. To what extent does Infrastructure (Port Investment) moderate the relationship between logistics performance and economic growth in Nigeria's manufacturing sector?
- ii. How do transportation costs (TC) negatively impact economic growth in Nigeria's manufacturing sector?

- iii. How does the delivery time of goods (DT) adversely affect economic growth in Nigeria's manufacturing sector?
- iv. What impact does inventory turnover (IT) have on economic growth in Nigeria's manufacturing sector?
- v. How does return on assets (ROA) influence economic growth in Nigeria's manufacturing sector?

1.4 Research Objectives

In agreement with the practical research questions as well as the problems stated above, the general objective of this study was to examine the moderating effect of Infrastructure on the relationship between logistics performance and economic growth in Nigeria's manufacturing sector. The specific objectives of the study, however, include but are not limited to the following:

- i. To measure the extent to which Infrastructure moderates the relationship between logistics performance and economic growth in Nigeria's manufacturing sector using Port Investment as a proxy.
- ii. To investigate the impact of high transportation costs (TC) on economic growth in Nigeria's manufacturing sector.
- iii. To analyze the effect of delivery time (DT) on economic growth in Nigeria's manufacturing sector.
- iv. To assess the effect of inventory turnover (IT) on economic growth in Nigeria's manufacturing sector.

- v. To evaluate the effect of return on assets (ROA) on economic growth in Nigeria's manufacturing sector.

1.5 Significance of the Study

Hausman, et al. (2013) said logistics drives economic growth. Munim and schramm (2018); Celebi (2019) says logistics efficiency boosts economic growth and jobs. Gani, 2017; Mlambo, 2021; Oyeyemi, 2021; Muazu, 2019 reiterated that industrial growth is vital to Nigeria's economy (Adesunkanmi & Nurain, 2022). However, logistics performance improves output (Erkan, 2014). Connecting to Compete 2023 put Nigeria 88th out of 139 nations in the Logistics Performance Index (LPI), behind South Africa, Rwanda, Ivory Coast, etc. Again, the UNDP's Human Development Index verifies the LPI's findings that high-LPI nations have high HDI scores. Poor LPI ratings lower Nigeria's HDI, but the industrial sector may boost it by hiring unemployed people. Ogwo and Godswill (2017), Gani (2017), Sharapiyeva et al. (2019), Shikur (2022), and others have studied logistics performance, port infrastructure, and economic growth. Few studies have examined how seaport infrastructure influences Nigeria's industrial logistics and economy.

In trade facilitation and supply chain management, logistics performance has been investigated, but manufacturing's challenges and dynamics have not. This moderating effect shows how seaport infrastructure may boost or suppress logistics performance on industrial growth and to increase GDP of Nigeria. Hence the need for this research

objective is to investigate how port infrastructure moderates the relationship between logistics performance and economic growth of the Manufacturing sector in Nigeria. In addition, it provides theoretical and practical insights into this relationship.

1.5.1 Theoretical Significance:

It accentuates the importance of continually enhancing the quality of port infrastructure in emerging nations to improve logistical performance, which would lead to a rise in maritime commerce and economic growth. The research highlights the moderating effect of maritime trade on the relationship between seaport infrastructure, logistics performance, and economic growth. It contributes to the corpus of previous knowledge by offering novel perspectives, concepts, and paradigms that can guide future research in this area.

1.5.2 Practical Significance:

Authorities and operators of seaports: The creation and upkeep of port infrastructure, a significant factor in our study, is directly the responsibility of these parties. They might be able to increase logistics performance and economic growth by investing in infrastructure with the help of the study's recommendations. Transportation of goods efficiently and effectively through the supply chain is ensured by logistics businesses and freight forwarders, which is another element in this study that relates to logistics performance. They might use the study's findings to guide their decision-making and assist them in pinpointing areas where logistics performance needs to be improved.

Manufacturing firms: The ultimate focus of this study is to increase economic growth in the manufacturing sector. Manufacturing companies can profit from the study's findings by using them to improve their supply chain management and operational processes. The results of the study may be utilized by manufacturing companies to improve their supply chain management and operational procedures, thereby contributing to the economic growth of the industry.

Government agencies: By using the study's findings to guide policy choices about infrastructure, logistics performance, and economic growth, government agencies in charge of trade and economic development could gain from it.

Investors: By identifying areas for investment in businesses and infrastructure that are expected to profit from improvements in infrastructure and logistics performance, investors in the logistics and manufacturing sectors could benefit from the study's findings. In addition, commodities forwarders, and businesses in the transportation and logistics industries can use the research's recommendations to enhance their decision-making processes and identify areas where they can improve their logistics performance.

1.6 Scope of the Study

The objective of this study is to determine whether there is a moderating impact that can be ascribed to seaport infrastructure on the link between logistics performance and

economic growth in Nigeria's manufacturing sector. The gross domestic product (GDP) of the manufacturing sector represents economic performance. Investments in the years covered were used to represent seaport infrastructure. The variables of transportation cost, delivery time of goods, return on assets, and inventory turnover stand as proxies for logistics performance.

This study investigates the impact of seaport infrastructure on logistics performance and economic growth in Nigeria's manufacturing sector, emphasizing the critical role that improved port facilities play in enhancing logistics efficiency. The research addresses the problem of inadequate seaport infrastructure, which hinders logistics performance and limits economic growth in the manufacturing sector. The objectives include analyzing how the seaport infrastructure affects logistics performance, exploring the relationship between logistics performance and economic growth, identifying necessary improvements in seaport infrastructure, and providing recommendations for policymakers and industry stakeholders.

The study covers the period from 2012 to 2022, utilizing a triangulation research approach that combines quantitative and qualitative methods. The population consists of 71 manufacturing firms listed on the Nigeria Exchange Group, from which 11 firms were purposively selected based on their consistent operations during the study period.

To this end, the researchers only make use of seaports that were operational throughout the time covered by this study. These seaports are Lagos, Apapa, and Tinian seaports, all of which are in Lagos State, Nigeria, which is also the epicenter of economic activities and the commercial hub of the country. According to reports by Africa Facts Zone 2022, Lagos state is responsible for approximately 30 percent of Nigeria's GDP, or approximately \$136 billion of the country's total \$500 billion GDP. As a result, Lagos has an economy that is larger than that of about 46 of the 54 countries that make up the continent of Africa, placing it as the continent's seventh largest. To this purpose, the selection of Lagos, the manufacturing companies, and operational Seaports which are all located in Lagos has made it adequate as the scope of this study.

The Nigerian Exchange Group (NGX Group), formerly known as the Nigerian Stock Exchange (NSE), is a prominent integrated market infrastructure in Africa, established in 1961. It serves as a critical platform for capital raising and trading in securities, significantly contributing to the financial landscape of Nigeria. Following its demutualization in 2021, NGX Group operates through three main subsidiaries: Nigerian Exchange Limited (NGX), NGX Regulation Limited (NGX RegCo), and NGX Real Estate Limited (NGX RelCo). This structure enhances its ability to provide a comprehensive range of services, including trading, regulation, and real estate management (Nigerian Exchange Group, 2021).

The NGX Group plays a vital role in the Nigerian economy for several reasons:

- i. Capital Formation: It facilitates the raising of capital for businesses through initial public offerings (IPOs) and other securities listings. This process is essential for funding corporate growth and innovation, which in turn stimulates economic development (Ogunleye, 2020).
- ii. Market Liquidity: By providing a platform for trading various securities—including equities, bonds, and exchange-traded products—the NGX enhances market liquidity. This liquidity is crucial for attracting both domestic and foreign investments, thereby fostering economic stability and growth (Ezeani & Okafor, 2022).
- iii. Regulatory Framework: The NGX RegCo ensures compliance with market regulations, promoting transparency and fairness in trading practices. This regulatory oversight builds investor confidence, which is essential for a thriving capital market (Ogunleye, 2020).
- iv. Economic Diversification: As Nigeria's economy heavily relies on oil exports, the NGX supports diversification by encouraging investments in various sectors. This diversification is vital for reducing vulnerability to oil price fluctuations and enhancing overall economic resilience (Ezeani & Okafor, 2022).

Companies listed on the NGX are considered important due to their contributions to the economy. This is because the NGX carries out a lot of activities that shape the life circle of the companies as a watchdog that provides adequate regulation and cover to those firms. Some of the activities are:

- i. **Diverse Sectors:** The exchange hosts firms from various sectors such as banking, telecommunications, consumer goods, and manufacturing. This diversity reflects the broader economic landscape and provides investors with multiple opportunities (Nigerian Exchange Group, 2021).
- ii. **Performance Indicators:** The performance of listed companies serves as a barometer for the overall health of the Nigerian economy. Investors closely monitor these companies' stock prices as indicators of economic trends and business viability (Ogunleye, 2020).
- iii. **Employment Generation:** Listed companies contribute significantly to job creation in Nigeria. As these firms grow and expand their operations through capital raised via the exchange, they create employment opportunities that bolster economic development (Ezeani & Okafor, 2022).

In summary, the Nigerian Exchange Group is integral to Nigeria's economic framework by facilitating capital formation, ensuring regulatory compliance, enhancing market liquidity, and supporting diverse industries. The companies registered under it are vital contributors to economic growth, making them an essential focus for any analysis or sample selection related to Nigeria's financial markets. Hence the justification for exploiting our population and sample from this robust database in a view to ensure the credibility of the study.

Data analysis is conducted using E-Views version 12.0 for robust statistical evaluation. The findings reveal a significant positive relationship between logistics

performance and economic growth, indicating that improvements in logistics performance leads to increased economic output. Furthermore, the study identifies that the current seaport infrastructure is inadequate, which hinders logistics efficiency. Importantly, it shows that seaport infrastructure plays a significant role in moderating the relationship between logistics performance and economic growth, highlighting its essential function in facilitating trade and economic activities.

The research adopts the Resource-Based Theory (RBT) and the Theory of Constraints (TOC) to explain these relationships. RBT posits that a firm's resources and capabilities are critical determinants of its competitive advantage. In this context, seaport infrastructure is viewed as a vital resource that can enhance logistics performance by facilitating efficient cargo handling and reducing turnaround times. By investing in seaport infrastructure, Nigeria can leverage this resource to boost its manufacturing sector's competitiveness, leading to increased economic growth. Conversely, TOC focuses on identifying and addressing constraints that hinder a system's performance. Here, inadequate seaport infrastructure is identified as a primary constraint affecting logistics performance. By improving this constraint through targeted investments in port facilities, logistics efficiency can be enhanced, positively impacting economic growth. This research contributes valuable empirical evidence regarding the role of seaport infrastructure on logistics performance and economic growth, underscoring the need for strategic investments in port facilities to support Nigeria's manufacturing sector while offering practical recommendations for policymakers and industry stakeholders.

The scope of this study includes an examination of seaport infrastructure improvements, logistics performance metrics within Nigeria's manufacturing sector, and economic growth indicators related to manufacturing output. However, it excludes other sectors outside of manufacturing and international comparisons unless directly relevant to Nigeria's context.

Limitations include a geographical focus solely on Nigeria's manufacturing sector, a purposive sample size that may not fully represent all firms, reliance on secondary data which may affect accuracy, and a temporal scope that may not capture longer-term trends. Overall, this study aims to provide insights into how addressing infrastructural deficiencies can enhance logistics efficiency and drive economic growth in Nigeria.

The literature on the impacts of port infrastructure on port performance and its relative impact on Nigeria's economy (Njoku et al., 2021), the literature on the impact of port revenue performance on Nigeria's economic growth (Osadume, 2020), and the literature on the relationship between transport infrastructure, manufacturing sector performance, and the growth of the GDP in Nigeria (Ogwo, et al., 2016) will be consulted amongst others. The research aims to inform policymakers and industry stakeholders about the problems facing Nigeria's manufacturing sector and the role that seaport infrastructure plays in that sector's economic progress. The research also aims to add to the existing body of information about the role of seaport infrastructure in the development of Nigeria's industrial sector. The study's secondary objective is to

contribute to the literature on the importance of Nigeria's port infrastructure to the growth of the country's industrial sector.

1.7 Definition of Key Terms

Logistics performance: The effectiveness and efficiency of the transportation of products and people through supply chains (Mudronja *et al.*, 2020).

Transportation Cost: Cost associated with moving products and people from one location to another (Mlambo, 2021).

Infrastructure: The facilities and structures that facilitate the passage of products and people through s (Mudronja *et al.*, 2020).

Delivery Time of Goods: The amount of time it takes for products to be transported from one location to another (Mlambo, 2021).

Inventory turnover: A financial ratio that gauges the rate at which an organization sells its inventory (Mlambo, 2021)

ROA: Return on assets is a financial ratio used to determine the profitability of a company's assets. (Mlambo, 2021)

GDP: Gross Domestic Product, the total value of products and services produced over time by an economy (Mlambo, 2021).

1.8 Organization of the study

The organization of this study is structured into five comprehensive chapters, each focusing on different aspects of the role of seaport infrastructure in enhancing logistics performance and economic growth within Nigeria's manufacturing sector.

Chapter one provides the background of the study, outlining the significance of the manufacturing sector in Nigeria and the critical role of seaport infrastructure in facilitating logistics performance. It discusses the current state of infrastructure, its impact on economic growth, and the research gap that this study aims to address.

Chapter two covers a detailed review of existing literature on seaport infrastructure, logistics performance, and economic growth is presented. It summarizes empirical studies that highlight the relationship between port facilities and manufacturing efficiency, as well as the challenges faced by Nigeria's logistics sector.

Chapter three outlines the research design and methodology employed in the study. It describes the triangulation approach used to gather both quantitative and qualitative data from selected manufacturing firms. The chapter also details the analytical tools utilized for data analysis.

Chapter four presents the findings from the data analysis. It discusses key results regarding the relationship between seaport infrastructure and logistics performance, as

well as their implications for economic growth in Nigeria's manufacturing sector. The discussion highlights the importance of improved infrastructure for enhancing logistics efficiency.

Finally, **chapter five** is the discussion, conclusion, and recommendation. It summarizes the key findings of the study and provides recommendations for policymakers and stakeholders in Nigeria's manufacturing sector. It emphasizes the need for strategic investments in seaport infrastructure to foster better logistics performance and stimulate economic growth.



CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This chapter includes a review of the relevant literature on seaport infrastructures' logistics performance and economic development. The goal of the literature review is to identify any knowledge gaps already in existence and to provide the groundwork for the research questions, theories, and methods that appear in the following chapters of the thesis. It also includes doing a thorough search for pertinent literature and structuring the literature review to explore the moderating influence of seaport infrastructure on the link between logistics performance and economic growth in Nigeria's manufacturing sector.

2.1 Conceptual Review

In this section, reviews of topics that pertain to the dependent variables as well as the independent variables were conducted by the researcher

2.1.1 Economic Growth

According to Jayathilaka, et al. (2022), the term "economic growth" describes an increase in the number of products and services produced within an economy over a

specific time. They believed that economic growth and logistics performance are correlated; and that logistics performance can help economic growth by increasing the supply chain's efficiency and lowering costs. In addition, the expansion of the economy can contribute to improvements in the performance of logistics operations by driving up investment in technological advancements and physical infrastructure.

Technological innovation also plays a vital role in driving economic growth. The theory of creative destruction posits that innovation propels economic progress by replacing outdated industries with new ones (Cevik, S. 2024). Recent empirical evidence supports this notion, indicating that countries investing in research and development (R&D) experience substantial boosts in their GDP growth rates (Breton, 2024; IMF, 2024). The integration of advanced technologies into production processes enhances efficiency and creates new markets and opportunities for growth. Furthermore, the ongoing digital transformation has become an essential driver of economic performance. As economies increasingly rely on digital technologies, sectors such as e-commerce and information technology have witnessed exponential growth. The COVID-19 pandemic accelerated this trend, highlighting the necessity for businesses to adapt to digital platforms to remain competitive (World Bank, 2024). This shift not only fosters innovation but also improves access to markets for small and medium-sized enterprises (SMEs), which are crucial for job creation.

Another significant factor influencing economic growth is structural transformation within economies. As countries develop, they typically transition from agriculture-

based economies to industrialized and service-oriented economies. This shift often leads to increased productivity as resources are reallocated toward higher-value sectors (OECD, 2024). For example, Malaysia's transition towards a high-income economy illustrates how structural changes can enhance overall productivity and GDP composition over time. Urbanization plays a critical role in this structural change. The migration of populations from rural areas to urban centers facilitates greater labor specialization and access to essential services for sustaining economic growth (Hanushek & Wößmann, 2024; Breton, 2024). Urban areas tend to be hubs of innovation and entrepreneurship, further driving economic performance. Recent data from the OECD (2024) indicates that urbanization contributes significantly to GDP growth by fostering group effects that enhance productivity.

Macroeconomic stability is fundamental for fostering an environment conducive to sustained economic growth. The IMF emphasizes that prudent fiscal policies and stable monetary conditions are necessary for maintaining investor confidence and encouraging consumption (IMF, 2024). As inflation rates stabilize globally, projected to decline from an average of 6.9% in 2023 to approximately 5% in 2024, economies can better position themselves for robust growth trajectories (OECD, 2024). The interplay between fiscal policy and economic performance is evident in various case studies where targeted government spending has successfully stimulated growth during downturns. Countries that implemented stimulus packages during the pandemic have seen quicker recoveries compared to those that adopted austerity measures (World Bank, 2024).

A crucial aspect often overlooked in discussions about economic growth is the role of seaport investment in enhancing logistics performance. Seaports serve as vital infrastructure for international trade, acting as gateways that facilitate the movement of goods across borders. Investments in seaport infrastructure can significantly improve logistics performance by reducing transportation costs, minimizing delays, and optimizing supply chain processes (Bichou, 2014). For example, enhanced cargo handling capabilities at ports can lead to faster clearance times for goods, thereby reducing overall transaction costs for businesses engaged in international trade (Jean-Paul & Notteboom, 2019). Recent developments indicate Nigeria's commitment to improving its seaport infrastructure to enhance its logistics performance and stimulate economic growth. In April 2024, Nigeria secured a \$600 million investment from A.P. Moller-Maersk aimed at expanding port facilities across the country. This investment was announced during discussions between Nigerian President Bola Tinubu and Maersk's Chairman Robert Maersk Uggla at the World Economic Forum event in Saudi Arabia. President Tinubu emphasized that this initiative would modernize existing facilities and prepare ports to accommodate larger vessels, which is crucial for reducing congestion issues that currently impede business operations within the country.

The significance of this investment cannot be overstated; it represents a strategic move towards enhancing Nigeria's logistics capabilities. By enabling larger ships to dock directly at Nigerian ports rather than relying on transshipment operations, which

can be costly and inefficient. This investment aims to streamline supply chains and reduce logistics expenses for manufacturers. As noted by Uggla, "Historically, most of the West African coasts are already served by smaller ships," indicating a clear opportunity for Nigeria to position itself as a hub for larger container vessels. This shift not only enhances operational efficiency but also attracts further foreign direct investment by creating a more favorable business environment.

Research has shown a statistically significant positive association between seaport efficiency and GDP growth. Efficient seaports not only stimulate local economies but can attract foreign investment by creating a favorable business environment (Korinek & Sourdin, 2011; Sarkar & Shankar, 2021). In developing economies like Nigeria, where seaports are essential conduits for resource utilization and job creation, operational efficiency can significantly influence the pace and sustainability of economic growth (Nwanosike et al., 2014). Ports that optimize their operations through improved logistics management can drive down costs for industries reliant on maritime transport while simultaneously enhancing their competitiveness in global markets. Moreover, seaport investments generate direct and indirect employment opportunities within local communities. As ports expand their operations or modernize their facilities, they create jobs within the port and across related sectors such as transportation, warehousing, and logistics services (Mlambo et al., 2021). This ripple effect contributes to overall economic development by increasing local incomes and enhancing consumer spending within the community.

The strategic importance of seaports extends beyond mere transportation; they are integral components of national supply chains that connect producers with global markets. Efficient logistics networks facilitated by well-functioning ports enable countries like Nigeria to participate more effectively in international trade. This participation is crucial for developing nations aiming to diversify their economies away from reliance on primary commodities toward more value-added manufacturing sectors. Furthermore, climate change poses significant challenges to global trade patterns and logistics systems. Seaports must adapt to these challenges by investing in sustainable practices that minimize environmental impacts while maintaining efficiency. Innovations such as green port initiatives focused on reducing emissions through cleaner technologies, can enhance both the sustainability and efficiency of port operations (Notteboom & Vernimmen, 2009). By adopting these practices, ports can ensure long-term viability while contributing positively to national economic goals.

Looking ahead at global economic forecasts indicates steady but modest growth rates. The IMF projects global GDP growth at approximately 3.2% during both 2024 and 2025 (IMF, 2025). Similarly, the OECD anticipates steady global GDP growth at around 3.1% in 2024 before slightly increasing to 3.2% in 2025 (OECD, 2025). However, these projections come with caveats; elevated central bank rates aimed at combating inflation may dampen consumer spending and investment activity across various regions. Emerging markets are expected to experience slower growth compared to advanced economies due to persistent structural challenges that hinder

capital allocation towards productive firms (OECD, 2025). For instance, while advanced economies are projected to see gradual recoveries such as a forecasted GDP increase from 1.6% in 2023 to approximately 1.8% by 2025, emerging markets face headwinds from global trade tensions and heightened policy uncertainty.

Similarly, Cornwall (2023) believed that "economic growth" refers to the process through which a nation's wealth rises over time, and that this process is indicated by the term "growth." In this study, the term economy experiencing economic growth refers to an increase in the quantity of goods and services that are being produced over a period. Economic growth may apply to both a rise in wealth over a shorter period and an increase in wealth over a longer period. This is because economic growth can refer to both short-term and long-term gains. Despite the uneven and imbalanced growth process, economic historians have sought to build a theory of stages that every economy must pass through to mature.

Roser (2021) posited that "economic growth" may be defined as "an increase in the amount of goods and services produced per head of the population over some time." When the term is used, most definitions refer to the "creation of goods and services" collectively. By acting in this manner, a big barrier that was there during the process of identifying and measuring it may be avoided. The economy's expansion is concentrating its efforts on a certain subset of commodities and services, which are collectively called economic goods and services, rather than on all commodities and services in general.

According to Amine (2003), one definition of economic growth is the steady increase in the number of goods and services produced in a country over a single year. Economic growth is the rise in either the gross domestic product or the total national output, which in turn leads to an increase in the individual share of the average real income, (Udemba and Yalcantaş 2021). It is not sufficient that there must be a rise in the gross domestic product; to measure economic growth, there must also be an increase in the individual real income. To be more exact, the rate at which the total income grows must be larger than the pace at which the population expands.

According to Mohamed and Eman (2017), despite the rise in local output, there will be no gain in the real average person's income. This prediction is based on their analysis of historical data. This is because the gross domestic product of a nation often increases in tandem with the rate at which its population grows. In consideration of the earlier position, the following equation may be derived: The rate of economic growth may be calculated by subtracting the rate of population increase from the rate of growth in national income.

In addition, economic growth denotes an increase in individual income as opposed to a rise in monetary individual income. Monetary income refers to the number of monetary units that an individual receives over the course of a specific time, typically one year, in exchange for the production services that the individual provides. Real income, which equals the rate of monetary income to the general level of prices,

denotes the number of goods and services that an individual obtains by spending their monetary income over the course of the If the general level of prices continues to rise at the same rate as the increase in the money income, then the real income will remain the same, and there will be no improvement in the individual standard of living. If an individual's monetary income grows at a pace that is lower than the rate at which prices are increasing on average, the individual's real income will decrease, and their standard of living will worsen. Consequently, there will be no growth in the economy until the rate of increase in income is higher than the rate of inflation (Abdulkader, 2016).

Also, according to Othman (2017), economic growth is a persistent phenomenon rather than a fleeting one. Accordingly, a wealthy nation may offer some assistance to a developing nation, which may result in a rise in the real income level for a specific time; but this kind of increase is not considered to be economic growth. "Therefore, the economy needs to expand to be able to provide a high standard of living and an increasing level of living, that is, to ensure that people are provided with goods and services of a higher quality; the sooner the economic growth of a country accelerates, the sooner living standards grow and improve. For the economy of a particular nation to attain such growth, it is necessary to enhance the productive resources.

In the opinion of Soludo (2013), economic growth may be defined as an increase in an economy's ability to create products and services when compared to the economy's capacity during a prior period. This compares the current capacity of the economy to

that of the earlier period. It is possible to quantify it either in nominal or real terms, with the real terms considering the consequences of inflation; nevertheless, the nominal terms are more common. Although the gross national product, or gross domestic product (GDP) has traditionally been used as the standard metric for gauging aggregate economic growth, alternative metrics are frequently utilized as well. After considering the consequences of inflation, an increase in the market value of the economy's output of goods and services occurs overtime. This is the basic idea behind growth in the economy. According to the standard method, it is measured as the rate of increase in real gross domestic product, which is also referred to as real GDP.

Real terms, also known as terms, that have inflation considered, are commonly used to quantify growth. This is done to prevent the distorted impact that inflation has on the price of products produced, and real terms are the terms inflation has considered. The economy's expansion may be measured by considering the national income. Because it is the yearly percentage change in gross domestic product (GDP) used to quantify economic growth, it contains all the advantages and disadvantages connected with that metric. In assessments of national economies, a common measure employed is the ratio of a nation's gross domestic product to its population or income per person (Olukemi, 2002). Another common metric that is utilized is the GDP per capita.

The term "rate of economic growth" refers to the compound annual rate of rise in gross domestic product (GDP) between the first and final years of a certain period. The average level of GDP over time is determined by this growth rate, and the

volatility in GDP around the questioned pattern is assumed not to exist. An increase in the rate of economic growth that may be ascribed to a more effective utilization of inputs (such as labor productivity, physical capital, energy, or materials) is referred to as intensive growth. This type of growth may be linked to an increase in the rate at which inputs are being used. GDP growth that can be attributed only to increases in the number of inputs accessible for utilization (such as larger populations or additional territories) is called extensive growth.

The idea of economic expansion has been discussed in previous works of literature. However, throughout its history, it was conceived of in many ways at various times. The mercantilists believed growth could be measured as a rise in the total number of species circulating mediums such as silver and gold under the state's authority. While the physiocrats believed that economic growth is caused by an increase in productive capacity, modern economists take a different approach (Mayomi, 2006). The traditional definition of economic growth refers to an increase in the value of the goods and services that are generated by an economy. In the same line, Henderson, and Poole (1991) pointed out that there are two distinct aspects to what constitutes economic growth. First, an increase in national output, as measured by the GNP (Gross National Product) or GDP; second, an increase in the individual quality of living or the size of everyone's portion of the pie, as measured by the GNP per capita. Both factors are quantified by the gross national product per capita.

However, there have been criticisms leveled against the two different metrics of growth because they do not provide information on the distribution of income and do

not consider the externalities that are the outcome of economic activities. Both activities outside the marketplace and services provided without payment are not included. Despite these flaws, economists around the world agree that the GDP is a reliable indicator of economic performance.

In summary, economic growth is influenced by various factors including human capital development, technological innovation, structural changes within economies, macroeconomic stability, and crucially, seaport investment. The literature from recent years underscores the importance of these elements in shaping sustainable economic performance. As nations strive for enhanced logistics performance, particularly within sectors like manufacturing, it becomes increasingly clear that robust seaport infrastructure plays a vital role in facilitating trade and enhancing overall economic growth.

2.1.2 Seaport Infrastructure

Port infrastructure is a pivotal element in enhancing economic growth and operational efficiency within maritime logistics. According to Amin et al. (2024), increasing local economic capacity through improved port facilities can significantly reduce maritime logistics costs. This underscores the critical role of ports in facilitating trade and economic activities in remote areas. In the view of Balci et al. (2024), port infrastructure is an important component to accommodate alternative fuels, such as green ammonia, which is essential for decarbonizing shipping. Their roadmap

highlights how ports must evolve to support sustainable practices, thereby influencing global shipping dynamics and contributing to environmental goals.

Choi et al. (2024) assessed airport efficiency but drew parallels to seaport operations, suggesting that similar analytical frameworks can be applied to improve port performance metrics. This comparative approach can help identify the best practices that enhance overall logistical efficiency. Port development is a strategic way of enhancing logistic performance and the overall activities within the port region. The emphasis on performance in ports is associated with the stakeholder's commitment to develop the port itself (Cidell, 2024). This is because the deployment of electric tugboats within maritime transportation has both advantages and disadvantages. On a positive note, integrating such technologies into existing port operations can enhance efficiency and reduce environmental impacts, showcasing an evolution in maritime practices. (Devarapali et al. 2024). It further emphasizes the need for critical infrastructure in a port for optimal performance.

Cao et al. (2025) focus on resilience within the global container shipping network, they intoned that resilient port infrastructure is vital for mitigating the impacts of cascading failures and enhancing the performance of the port. Their research highlights how interconnected ports must be prepared for disruptions to maintain supply chain integrity. Belcore et al. (2024) while explaining the performance analysis of a maritime port with high-frequency services in Italy, opined that optimized port operations can lead to increased competitiveness. They further stated that high-

performance metrics are essential for ports to meet growing demands and improve service delivery. Ports are the most essential factor in an economy's ability to become industrialized and commercialized, contributing to the overall economic development of a country. Economic, institutional, technological, environmental, and maritime transport developments all have an impact on the port industry, as the societal shifts that characterize the requirements development in the countries, the commitments of the countries to free trade, and the new contexts of globalization (Hlali & Hammami, 2017). Socioeconomic developments, exemplified by the maturation of countries' requirements, affect the port sector (Jung, 2011). These shifts are distinguished by the in that the needed development in the nations are distinguished. As a direct result of this, it has always demonstrated a high degree of flexibility in the face of evolving socioeconomic patterns. As a result of these changes, the environment has become laden with elevated levels of unpredictability and complexity, which has resulted in a fundamental transformation of the idea of seaport development.

Gibson and Warren (2024) stated that there is a key role in managing seaport mobilities, emphasizing their contribution to operational efficiency at ports as skilled personnel are integral to navigating complex maritime environments and ensuring safe vessel movements within port areas. This idea also supports the idea that investment in the workforce at the port to develop more skills which will in turn enhance the overall performance at the port. This literature is supported by Ji et al. (2024) who evaluate integrated transport efficiency at the county level using Ningbo City as a case study. Their research addresses how effective port operations contribute to regional

transport systems, highlighting the importance of coordinated logistics planning involving seaports.

Kamruzzaman (2024) provided a framework applicable to assessing the economic contributions of ports within urban transport systems. Enabling net-zero shipping, discussing policy implications for ports aiming for sustainability Govindan et al. (2024). This comparative analysis is vital for understanding how different transport modes interact with seaport activities.

Similarly, Kawachi and Shibasaki (2024) employ network simulation to analyze corridor development's impact on container transport in inland South Asia. They stated the significance of efficient hinterland connections facilitated by ports, which are essential for optimizing supply chain logistics. Keefe et al. (2024) stated that the implications for port operations are significant as digital tools can streamline processes and improve connectivity between agricultural producers and markets via seaports. This idea is related to Haalboom and Besinovic (2024) who see optimization as an important element in ports significantly enhancing overall port efficiency which facilitates smoother cargo transfers between different transport modes.

Ports' efficiency is critical in determining overall port performance, as highlighted by Martínez-Moya et al. (2024) and Monios et al. (2024). Efficient ports are characterized by their ability to handle cargo quickly and effectively, which directly impacts their competitiveness in the global shipping market. According to Martínez-

Moya et al. (2024), port efficiency encompasses various operational metrics, including turnaround times, berth occupancy rates, and cargo handling speeds. These metrics are essential for assessing how well a port can manage its resources and respond to shipping demands.

Monios et al. (2024) further elaborate on the importance of strategic planning in enhancing port efficiency. They argue that effective management practices, including the optimization of terminal operations and infrastructure investments, are necessary for improving performance outcomes. This involves not only maximizing throughput but also ensuring that the port can accommodate larger vessels and increased cargo volumes. The integration of advanced technologies and data analytics into port operations can facilitate better decision-making, leading to improved efficiency and service quality.

In addition to operational efficiency, Moslem et al. (2024) emphasize the significance of optimizing park-and-ride facilities to enhance passenger access to maritime transport services. By strategically locating these facilities and ensuring seamless connections to the port, stakeholders can improve user experience and increase ridership. This is particularly important in urban areas where congestion can hinder access to ports. Effective park-and-ride systems not only alleviate traffic but also promote sustainable transport options, thereby enhancing the overall attractiveness of maritime services. Octaviansyah et al. (2024) discuss how effective route selection impacts overall port connectivity and logistics operations. They highlight that choosing optimal routes for cargo movement is essential for maximizing efficiency in

logistics chains. Ports that facilitate smooth hinterland connections through well-planned transport routes can significantly enhance their operational capabilities, making them more competitive in attracting shipping lines and cargo owners.

Risk management is another crucial aspect discussed by Roos et al. (2024). They argue that implementing robust risk management practices is vital for ensuring successful port infrastructure investments. Ports face various risks, including financial uncertainties, environmental challenges, and operational disruptions. By proactively identifying and mitigating these risks, port authorities can safeguard their investments and maintain operational continuity.

Similarly, Sajith et al. (2024) and Sahoo et al. (2024) highlight that investments in port facilities can stimulate economic growth through enhanced trade capabilities. Improved infrastructure not only increases a port's capacity to handle more cargo but also attracts new business opportunities and foreign investments. These economic benefits underscore the importance of continuous investment in port development to support regional and national economic objectives. Ports' efficiency is multifaceted, involving operational performance metrics, strategic planning for infrastructure development, effective risk management practices, and the economic implications of enhanced trade capabilities. Together, these factors contribute to a port's overall performance and its ability to thrive in an increasingly competitive global market.

Bayramova et al. (2024) suggested that the relationship between safety indicators and port operations is robust. The study emphasized that safety frameworks are crucial for maintaining efficient port infrastructure. They argue that understanding leading indicators can help enhance safety measures, improving operational reliability at ports. Seaport operation and optimization are complex systems that integrate economic function, infrastructural system, geographical area, and commercial activity. Also, a port's administration is controlled by a convoluted legal concept, and it is done by an organizational model that calls for the synergy of both private and public sectors. Both factors contribute to the fact that the management of a port is extremely complex. (Roa, et al., 2013). Supporting this literature, Satta et al. (2024) suggested that green strategies from a stakeholder management perspective in ports are crucial, emphasizing collaborative approaches necessary for implementing sustainable practices within maritime operations. This stakeholder engagement is crucial for achieving long-term sustainability goals at seaports. In the view of Yao et al. (2024), it has a lot to do with competitiveness using multilevel data analysis methods. They revealed how adopting cleaner fuel options can enhance a port's attractiveness to shipping companies while contributing to environmental sustainability initiatives within maritime sectors.

In the view of Paul (2007), the common conception of a port is that it is a labor of moles, basins, and docks that can house a wide range of boats and various kinds of goods. The term port can be understood in a few other contexts in addition to its literal meaning. These contexts include geographical, legal, economic, and institutional

viewpoints. In a more specific context, the meaning of the word "port" has been interpreted and discussed in a wide range of several ways.

The term "infrastructure" refers to the physical facilities, structures, and systems established to support the efficient and effective operations of seaports. It incorporates many components, including berths, docks, piers, wharves, container yards, warehouses, cranes, navigational aids, and transportation networks that connect the port to the hinterland. It incorporates many components, including berths, docks, piers, wharves, container yards, warehouses, cranes, navigational aids, and transportation networks that connect the port to the hinterland.

Regarding the effectiveness of logistics, researchers have developed some relevant definitions of infrastructure. For example, Song and Panayides (2012) define infrastructure as "the physical and organizational arrangements and facilities supporting the handling and movement of goods and people in and out of a port, including the waterfront, terminals, storage areas, access roads, and transport connections. In a similar vein, the term "infrastructure" is defined by Ng, *et al.* (2016) and Gharehgozli *et al.*, (2017) as "the built environment that encompasses maritime terminals, cargo handling facilities, and supporting transportation networks, which collectively facilitate the transfer of goods between different modes of transport."

In addition, Notteboom and Rodrigue (2012) highlight the significance of infrastructure for the performance of logistics, stating that "adequate port

infrastructure is crucial for efficient maritime transport and contributes to the overall competitiveness of ports and regions. This finding lends credence to the idea that infrastructure has a meaningful role in the overall performance of logistics. They bring attention to the role that infrastructure plays in the alleviation of congestion, the facilitation of smooth cargo flows, the improvement of connectivity, and the enhancement of operational efficiency.

In the same vein, Notteboom and Rodrigue (2012) have published an evolving port system model that explains the dynamics of networks. Two researchers developed this model. The 'Any-port' model, which was further developed by Bird and cited in Hlali and Hammami (2017), is one of the most well-known conceptual viewpoints on the development of seaports. This model illustrates how infrastructure develops over time and across space. From the initial location, which featured a few smaller side docks close to the downtown area. Port expansion can be accomplished either via the development of modern technologies for maritime production or through the enhancement of existing methods for managing goods. This is also highlighted by the development of spatial interactions between the urban regions and the harbor over time. Within this similar paradigm, Bird explored the "Any-port" model, which persisted for four decades despite being subjected to severe theoretical and empirical investigation. In the instance of "Any-port", the port region is seen as a temporal and linear succession that divides the numerous phases of development, and Bird adhered to a direct link between the port's shape and its function. Concerns about the Bird idea were mostly centered on how the port's physical qualities interact with it.

2.1.3 Logistics Performance

Khadim, et al. (2021) define "logistics performance" as "the efficiency and effectiveness of logistics activities and infrastructure in facilitating the movement of goods, services, and information within a country or region," highlighting the importance of this definition when discussing the correlation between logistics performance and economic growth. It involves a variety of factors within the supply chain, such as transportation, warehousing, inventory management, information systems, and coordination among the various players (Coşkun & Erturgut, 2022) It is essential to have a logistics system that operates effectively to sustain economic growth. This can be accomplished through lowering transaction costs, raising productivity, and bolstering competitiveness (Khadim et al., 2021).

Logistics performance can be broadly defined as the ability of an organization to effectively manage its logistics activities to maximize customer satisfaction while minimizing costs. Adebayo and Ojo (2024) assert that logistics performance encompasses key performance indicators (KPIs) such as delivery reliability (time), order accuracy (features, quantity, quality, etc), and inventory turnover (sales frequency). For emphasis, the present study has adopted some of the indices as variables of measuring logistics performance to test the assertiveness of many studies that have linked these variables as key indicators of logistics performance. These metrics are essential for evaluating logistics efficacy and provide insights into

operational capabilities. Zhang et al. (2024) emphasize that the integration of technology into logistics processes has transformed how these metrics are monitored, enabling real-time data analysis and decision-making.

The concept of logistics performance also extends to the strategic alignment between logistics operations and organizational goals. Oladipo et al. (2025) argue that firms that align their logistics strategies with broader business objectives tend to experience enhanced performance outcomes. This alignment fosters a culture of continuous improvement within logistics operations, leading to better service delivery and customer satisfaction (Huang et al., 2024).

Moreover, supply chain integration is critical in defining logistics performance. Wong and Karia (2010) highlight that effective integration across supply chain partners enhances overall logistics performance by facilitating better communication and coordination. This interconnectedness allows organizations to respond more swiftly to market changes and customer demands, thereby improving service levels (Kumar et al., 2024).

Additionally, the measurement of logistics performance has evolved to include sustainability metrics. As highlighted by Ogunleye and Ibiyemi (2025), organizations are increasingly evaluating their logistics operations not only on efficiency and cost-effectiveness but also on their environmental impact. This shift towards sustainable

practices reflects a growing recognition that long-term success is tied to environmental stewardship (Zawawi et al., 2016).

The significance of logistics performance is particularly pronounced in developing economies like Nigeria, where efficient logistics systems facilitate trade by reducing transportation costs (this is another major metric to be used which the present study has adopted) and improving supply chain responsiveness (Akinola & Eze, 2024). Improved logistics performance directly correlates with enhanced economic outcomes (this measurement is obtainable using return on assets and the growth in the GDP contribution, either sectoral or overall. The present study considers these metrics as particularly important); Adeyemi et al. (2024) found that investments in logistics infrastructure significantly contribute to GDP growth by enabling smoother supply chain operations.

Furthermore, the environmental implications of logistics performance have gained increased attention in recent years. Efficient logistics practices can lead to reduced carbon footprints through optimized transportation routes and better inventory management (Ogunleye & Ibiyemi, 2025). This shift towards sustainable logistics meets regulatory requirements and appeals to environmentally conscious consumers (Lai, 2004).

The impact of effective logistics performance on customer satisfaction is another critical aspect. Research indicates that companies with high levels of logistics performance tend to achieve greater customer loyalty and retention rates (Shin et al.,

2024). Timely deliveries and accurate order fulfillment are essential components of customer satisfaction. Neely et al. (1995) noted that Effective logistics operations ensure that products arrive promptly and in perfect condition, bolstering trust among customers. Moreover, superior logistics performance provides a significant competitive advantage. Organizations that excel in their logistics capabilities can differentiate themselves from competitors by offering better service levels at lower costs (Teece, 1997). This competitive edge is particularly vital in industries where margins are tight, and customer expectations are high.

Recent trends indicate that technological advancements will further enhance the importance of logistics performance in the coming years. For instance, automation technologies are expected to streamline processes such as inventory management and route optimization, thereby improving operational efficiency (CtrlChain, 2025).

Additionally, big data analytics will play a crucial role in mitigating supply chain risks by providing insights into potential disruptions (DHL, 2024). This is an indication that the importance of logistics performance underscores its critical role in organizational success and economic development. By focusing on key metrics, aligning strategies with business goals, and embracing sustainability practices, organizations can enhance their logistics performance, leading to improved economic outcomes and customer satisfaction.

In this study, the term strategy is focused on the organization's ability to advance its market competitiveness through the unique infrastructure needed to grow optimally. Investment in infrastructure plays a major role as advanced by many studies highlighted hitherto. This novelty underscores the need for this study as researchers though have highlighted various indicators but failed to look at the critical role of infrastructure (Seaport infrastructure) in enhancing this relationship between logistics performance and economic growth. The present study has addressed this gap.

In the words of Zu and Wang (2017), the extension of the marketplace and the growing importance of regional exchanges of knowledge and economic components are both induced by the rise of logistics, which has a spillover impact on the financial stability of the surrounding areas. Additionally, Zu and Wang (2017) state that the development of logistics has a positive influence on the economic growth of the countries that border China. It has a variety of benefits regarding the transportation earnings of local logistics enterprises and the logical flow of components to these sites, both of which contribute to a reduction in the cost of production and support economic growth in the region (Feng & Ye, 2021).

In addition, logistics performance may be described as the capacity to deliver things in a reliable and timely way while simultaneously maintaining cheap prices (Gani, 2017). The Logistics Performance Index (LPI), which was developed by the World Bank, is utilized to evaluate, and compare the level of logistics performance among countries based on indicators such as the efficiency of customs procedures, the quality

of infrastructure, the on-time delivery of shipments, and the availability of logistical services (World Bank, 2021). Notteboom and Rodrigue (2005) highlighted how essential the function of logistics is in their research on the consequences of globalization and underscored its importance. According to what they said, efficient logistics systems are necessary to facilitate the integration of global markets, the support of supply chain management, and the recruitment of foreign direct investment.

According to the World Bank (2021), the term "logistics performance" refers to the capability of a nation's logistics industry to move goods across international borders in a timely and dependable manner. This capability is measured by efficiency and effectiveness. It is a vital aspect of a country's ability to secure the importation of goods it requires for production and consumption, as well as its competitiveness in markets where it sells its products to other countries. Song and Panayides (2012) centered their research on the importance of logistics regarding small island economies. They suggested that due to the restrictions of their physical locations, tiny island economies heavily rely on effective logistics to overcome obstacles connected to connectivity and distance. They stressed how important it was to have efficient logistics policies and investments in infrastructure to assist economic development in these economies.

In another development, the ability of a logistics system to meet the expectations of customers in terms of responsiveness, reliability, flexibility, and cost-effectiveness is conceptualized as the ability of a logistics system to perform well. He emphasized the

significance of logistics practices that were centered on the client as well as the incorporation of technology to enhance performance (Nayides, 2006). Kettunen and Saunila (2010) provide a thorough explanation of what exactly is meant by the term "logistics performance". They defined it as the capacity of logistics operations to provide items or services to clients while considering factors such as cost, time, quality, flexibility, and sustainability. They emphasized how important it is to continuously monitor performance and make improvements in the logistics operations.

Feeney and Grey (2011) emphasized the significance of the role played by logistics performance in enabling competitiveness throughout the supply chain. They defined logistics performance as the capability of delivering items or services to the expectations of the client while simultaneously optimizing costs and levels of service. They stressed how important it is for partners in the supply chain to have excellent coordination, collaboration, and integration to achieve outstanding performance.

Nevertheless, De Langen and Van de Voorde (2016) centered on the idea of the performance of port logistics. They described it as the capacity of a port to effectively manage the flow of goods, to offer shippers and logistics service providers competitive advantages, and to provide value-added services. They emphasized the importance of hinterland accessibility, connectivity, and port efficiency in the process of generating economic growth. Numerous scholars, including Arvis, *et al.* (2010), Wang and Wang (2013), Han et al. (2015), and a plethora of others have looked at the

relationship between logistics performance and economic growth. According to their findings, there is a correlation that points in a favorable direction between the two.

2.2 Theoretical Review

One definition of a theory given by the American Heritage Dictionary ([AHD, 2012]) is "a body of knowledge that is systematically organized and can be applied in a wide variety of contexts." A theory is more precisely defined as "a system of assumptions, accepted principles, and rules of procedure developed to analyze, predict, or explain the nature or behavior of a particular set of phenomena." Zima (2002) claims that theories are analytical tools that may be utilized to grasp, explain, and make predictions about a certain subject area. The researcher aims to link the philosophical foundations of logistics theories with particular interest in those theories that can explain the firm competitive advantage and how these concepts relate to economic growth in the context of this theoretical review portion. In this study, the major theory to explain the above-mentioned phenomenon is the resource-based theory or view. (RBT/RBV).

2.2.1 Resource Based Theory (RBT)

Resource-based theory (RBT) may be traced back to its formative years in the 1980s (Utami and Alamanos, 2023). The Theory of the Evolution of the Firm came before

the RBT was developed. Jay Barney's contributions to the field of strategic management and planning were essential during the 1990s when RBT emerged as the dominant paradigm. That was possible because of how well RBT foretold potential outcomes. Resource-Based Theory (RBT) was initially published by Penrose (2009). He put up a model for the efficient administration of an organization's assets, diversification plan, and output potential. The RBT methodology is sometimes referred to as the resource-based management model. (Penrose, 2009) The article by Penrose was the first to introduce the idea of conceiving a corporation as a coordinated bundle of resources to address and confront the question of how it may achieve its goals and strategic activities.

Kraaijenbrink, Spender, and Groen (2010), believed the objective of RBT was to explain the internal elements that contribute to a company's persistent competitive advantage. The RBT of the company hypothesized that the company's resources may be leveraged as a source of competitive advantage, as stated by Tukamuhabwa, Eyaa, and Derek (2011). These materials were one of a kind, rare, costly, and difficult to find. According to Barney and Clark (2007), the resources regarded as valuable were those that may allow the formulation or execution of strategies that boost performance, exploit market opportunities, or neutralize imminent hazards. In other words, valuable resources were those that might allow the formulation or implementation of strategies.

RBT was founded on two assumptions: the first was that resources and capabilities were unevenly distributed across businesses, and the second was that resources and capabilities were only imperfectly mobile, which led to inequalities between firms staying constant over time (Karia & Wong, 2011). RBT was developed to explain why inequalities between firms remained constant over time. These two hypotheses were investigated and proved to be correct after being tested.

The term "heterogeneous" refers to the fact that each company was distinct from the others in terms of the resources and skills it possessed or had access to. These distinctions helped to differentiate one company from another, and it was concluded that the achievement of a company is linked to the firm-specific resources that it held (Karia, & Wong, 2011).

According to Karia and Wong (2011), the company's resources or the center of the resource-based approach were the personal resources, skills, and capabilities of the organization. For instance, a resource is described as a necessary element or a prerequisite for the development and operation of logistics in the field of logistics, and it is significant for the expansion of a company's capabilities (Aldin et al., 2004).

In addition, the RBT of businesses puts more of a focus on the possibilities and dangers that come from inside the company, in contrast to industrial organization economics, which puts more of an emphasis on the opportunities and dangers that come from the environment in which the company operates. Shang and Marlow

(2005), hold forth that when the external environment is unstable, a company's resources and capabilities may be simpler to regulate.

According to Kraaijenbrink et al. (2010), the resource-focused viewpoint believes that a firm is nothing more than a collection of both tangible and intangible resources. In other words, the resource-focused perspective views a company as nothing more than a collection. Because each firm had sole ownership of this collection, they could separate themselves from one another (heterogeneously) although operating in the same market. According to Barney and Clark (2007), this indicates that neither of these two companies have the same experiences, that they have the same assets or abilities, or that they have established the same organizational culture. Similarly, Shang and Marlow (2005), opined that the varying quantities of resources that were accessible to each organization served as the last component in deciding the outcomes of strategic decisions.

Ganotakis and Love (2010) alluded to the RBT while discussing the significance of logistics management to an organization to explain its importance. They found that one of the sources of competitive advantage for entrepreneurial firms was the flexibility and efficiency of their logistical operations. This was one of the causes of the entrepreneurial advantage. The ownership of firm-specific assets made it easier for a corporation to develop a competitive edge for itself. They also found that a company's ability to assemble and utilize an appropriate combination of resources was the basis of its competitive advantage (Ganotakis & Love, 2010). Wong and Karia

(2010) were able to show that RBT was based on the idea of costly-to-copy features of a corporation as sources of financial benefits and as a method to produce superior performance and an edge in the market.

Furthermore, it was vital to highlight that the RBT has recently been used in studies on logistics management to examine the impacts of logistical resources and capabilities on logistics performance (Lai et al., 2008; Yang et al., 2009). Yang and his colleagues are the ones who carried out this research. Lai and his colleagues stated that the RBT theory was an appropriate theory for supply chain and logistics management research.

According to these studies findings, there is a significant positive association between the logistical resources and capabilities of a firm and the organization's overall success. While some studies investigated the impacts of logistics capabilities on firm performance (Yang et al., 2009), other research utilized RBT to explore the influence of information flow on the competitive advantage of third-party logistics providers (3PLs) (Lai et al., 2008). Both lines of inquiry were conducted independently. As a direct consequence of this, it has been suggested that the RBT be included in the list of hypotheses that will be examined over the course of this inquiry.

The significance of this theory to the present study is that RBT is a foundational framework in strategic management that emphasizes the importance of internal resources and capabilities as key drivers of competitive advantage and performance.

This idea is consistent with the view of the researchers which is directed towards more investment to moderate the relationship between logistics performance and economic growth.

This theory posits that firms can achieve superior performance by effectively leveraging their unique resources, which can include physical assets, human capital, technological capabilities, and organizational processes (Barney, 2021). RBT has gained significant traction in logistics and supply chain research, particularly in understanding how firms can optimize their operations to enhance efficiency and responsiveness in increasingly complex markets.

2.2.1.1 Importance of RBT in Logistics

In the context of logistics, RBT provides a lens through which organizations can evaluate their resource endowments and identify opportunities for improvement. The logistics sector is characterized by its reliance on various resources, including transportation networks, warehousing facilities, information systems, and skilled labor. By assessing these resources through the RBT framework, firms can develop strategies that capitalize on their strengths while addressing weaknesses. For instance, firms with advanced logistics capabilities can differentiate themselves from competitors by offering superior service levels or faster delivery times (Mokhtar et al., 2023).

Moreover, RBT underscores the significance of sustainable competitive advantages derived from unique resources that are valuable, rare, inimitable, and non-substitutable (VRIN criteria). In logistics, this could translate to proprietary technologies that enhance tracking and inventory management or exclusive partnerships with key suppliers that ensure reliable service delivery (Caniëls et al., 2020).

2.2.1.2 Linking RBT to the Study

In the context of the study on seaport infrastructure's role in enhancing logistics performance and economic growth in Nigeria's manufacturing sector, RBT serves as a critical theoretical foundation. The research posits that Seaport infrastructure is a vital resource that significantly impacts logistics efficiency. By improving port facilities and operations, Nigeria can leverage this resource to enhance its manufacturing sector's competitiveness.

Seaport infrastructure encompasses various elements such as cargo handling equipment, storage facilities, transportation links to inland areas, and information technology systems used for managing logistics operations. According to Munim and Schramm (2022), effective utilization of these resources can lead to improved logistics performance metrics such as reduced lead times, lower transportation costs, and higher inventory turnover rates. This aligns with the RBT perspective that

emphasizes the importance of resource optimization for achieving better operational outcomes.

Furthermore, the study highlights that inadequate seaport infrastructure acts as a constraint on logistics performance. By applying RBT principles, it becomes evident that investments in upgrading port facilities are essential for overcoming these constraints. As noted by Edih et al. (2022), enhancing seaport infrastructure not only improves logistics performance but also contributes to economic growth by facilitating trade and boosting manufacturing output.

2.2.1.3 Relevance of RBT to Research

The relevance of RBT to this research lies in its ability to provide insights into how seaport infrastructure can be viewed as a strategic resource within Nigeria's manufacturing sector. By adopting an RBT perspective, the study emphasizes the need for targeted investments in port facilities as a means of enhancing logistics performance. This approach aligns with the objectives of the research to identify specific improvements needed in seaport infrastructure and their implications for economic growth.

Additionally, RBT supports the argument that firms with superior logistical capabilities, derived from effective use of the seaport infrastructure, are better positioned to respond to market demands and achieve competitive advantages. This

perspective is crucial for policymakers and industry stakeholders who seek to understand how infrastructural investments can drive economic development through improved logistics performance.

2.2.1.4 Supporting Literature

Numerous studies have highlighted the application of RBT in logistics and supply chain contexts. For example:

Caniëls et al. (2020) emphasize that firms leveraging unique logistical capabilities derived from their resources are more likely to achieve superior performance outcomes.

Mokhtar et al. (2023) discuss how organizations can utilize their resource endowments to enhance supply chain resilience and responsiveness.

Munim & Schramm (2022) provide empirical evidence demonstrating that investments in logistics resources significantly impact operational efficiency and economic growth.

These studies reinforce the notion that RBT is a valuable framework for understanding how resource optimization can lead to enhanced logistics performance and economic outcomes.

In alignment with the principles of Resource-Based Theory (RBT), the following framework has been developed to illustrate how unique resources and capabilities can be strategically leveraged to enhance logistics performance and drive economic growth in the current research context. The diagram below encapsulates the interrelationships between various resources, competitive advantages, and their impact on logistics efficiency, thereby providing a clear visual representation of RBT's applicability to the present scenario.

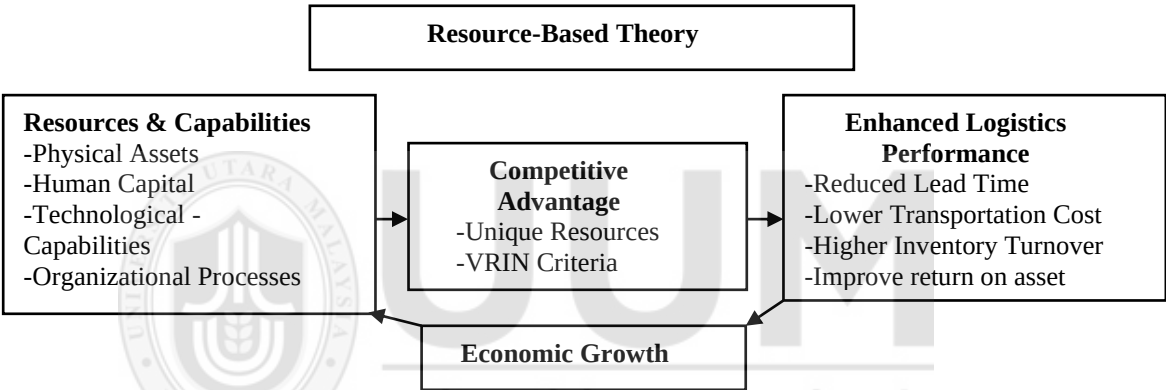


Figure 2.1: *Resource-Based Theory Framework*

The above Resource-Based Theory (RBT) framework serves as a crucial model for understanding how unique resources and capabilities contribute to enhancing logistics performance and fostering economic growth, particularly within the context of the Nigerian manufacturing sector. This framework emphasizes the importance of leveraging internal resources to gain a competitive advantage, which is vital for organizations operating in dynamic and challenging environments. In the context of seaport infrastructure, physical assets such as facilities, equipment, and technology available at ports facilitate the movement of goods efficiently. Well-developed seaport

infrastructure significantly reduces lead times and transportation costs for manufacturers, creates high inventory turnover and results in improved return on assets by allowing them to operate more effectively in a competitive market.

Additionally, human capital plays a critical role in this framework. The skills and expertise of personnel involved in logistics operations are essential for optimizing performance. Training and development programs for port staff enhance operational efficiency, leading to improved service delivery and customer satisfaction. Technological capabilities also contribute significantly; advanced technologies at seaports, such as automated cargo handling systems and real-time tracking software, optimizing logistics processes. These technological advancements enable manufacturers to manage their supply chains more effectively, reducing delays and improving responsiveness to market demands. Furthermore, efficient organizational processes within seaports, including customs clearance procedures and intermodal transport coordination, are critical for enhancing logistics performance by minimizing bottlenecks and ensuring timely delivery of goods (raw materials) to manufacturers.

The role of seaport infrastructure in enhancing logistics performance is particularly relevant in Nigeria's manufacturing sector. Efficient seaport operations enable faster turnaround times for vessels, translating into shorter lead times for manufacturers. This efficiency is crucial for maintaining competitiveness in a global market where time-to-market is a key factor. Improved port facilities and services lead to reduced transportation costs by minimizing delays and optimizing cargo handling. Lower costs

directly impact manufacturers' bottom lines, allowing them to allocate resources more effectively. Additionally, enhanced logistics performance facilitated by robust seaport infrastructure allows manufacturers to achieve higher inventory turnover rates, reducing holding costs and increasing cash flow, which enables firms to reinvest in growth opportunities.

The implications of improved logistics performance extend beyond individual firms to the broader economy. Enhanced seaport infrastructure contributes to economic growth by attracting foreign direct investment (FDI), as a reliable logistics framework that supports international trade. Investors are more likely to invest in regions where they can efficiently move goods. Moreover, improved logistics performance at seaports leads to job creation within the ports and throughout the supply chain, including jobs in the transportation, warehousing, and manufacturing sectors. Efficient seaport operations enable manufacturers to access global markets more effectively, increasing export volumes that contribute to national economic growth through generating foreign exchange earnings.

RBT is particularly appropriate for this topic and scenario because it provides a lens through which the strategic importance of unique resources such as seaport infrastructure, can be analyzed for enhancing logistics performance and driving economic growth. By focusing on how firms can leverage their internal capabilities effectively within the context of their operational environment, RBT highlights the significance of investing in physical assets, human capital, technological

advancements, and streamlined processes at seaports. This strategic approach not only benefits individual manufacturing firms but also fosters broader economic development through increased efficiency, competitiveness, and investment attractiveness in Nigeria's economy.

2.2.1.5 Challenges Associated with Implementing RBT

Implementing Resource-Based Theory within logistics poses several challenges:

Resource Identification: Accurately identifying which resources contribute most significantly to competitive advantage requires thorough analysis.

Dynamic Capabilities: Firms must continuously adapt their resource base in response to changing market conditions; a concept known as dynamic capabilities (Teece et al., 2016).

Integration Across Functions: Ensuring alignment between various functional areas within an organization (e.g., marketing, operations) is critical for maximizing resource utilization.

2.2.1.6 Recent Developments in RBT Research

Recent literature has grown upon traditional interpretations of RBT by integrating concepts such as sustainability and digital transformation:

Sustainable Competitive Advantage: Researchers have explored how firms can leverage sustainable practices such as eco-friendly supply chains, to create unique value propositions (Wang et al., 2020).

Digital Transformation: The advent of digital technologies has prompted scholars to examine how digital capabilities serve as new forms of strategic resources within supply chains (Kamble et al., 2021).

These developments illustrate how RBT continues evolving alongside emerging trends within logistics and supply chain management.

2.2.1.7 Case Studies Illustrating RBT Application

Several case studies exemplify the successful application of Resource-Based Theory (RBT) within logistics, demonstrating how firms leverage unique resources to achieve competitive advantages and enhance operational efficiency. These examples span various industries, showcasing the versatility of RBT in different contexts.

Amazon's Supply Chain Optimization: Amazon has effectively utilized its technological capabilities to create a highly efficient supply chain. The company employs advanced algorithms for inventory management and predictive analytics to optimize stock levels across its vast network of fulfillment centers. This capability allows Amazon to minimize delivery times while maximizing customer satisfaction.

For instance, by implementing machine learning algorithms that analyze purchasing patterns, Amazon can anticipate demand fluctuations and adjust inventory accordingly (Mishra & Singh, 2021). This strategic use of technology has enhanced operational efficiency and has positioned Amazon favorably against competitors who may be slower to adopt similar innovations.

In addition to technology utilization, Amazon's investment in physical assets such as fulfillment centers strategically located near major urban areas allows it to execute rapid delivery services like Prime Now efficiently. This integration of advanced technology with strategic resource allocation exemplifies how Amazon leverages its unique logistical capabilities derived from both tangible assets and intangible technological know-how.

Zara's Fast Fashion Model: Zara has built its success on a unique supply chain model that emphasizes speed and responsiveness. The company maintains close relationships with suppliers and leverages real-time data analytics to track fashion trends and consumer preferences. This allows Zara to instantly design, produce, and distribute new clothing lines in response to market demands (García & Pérez, 2020). By optimizing its logistical resources effectively, Zara can introduce new products to stores within weeks rather than months, giving it a significant competitive edge in the fast-paced fashion industry.

Zara's approach involves frequent communication with suppliers regarding production schedules while employing sophisticated inventory management systems that allow for swift adjustments based on sales data from retail locations worldwide. This agility not only enhances customer satisfaction but has also minimized markdowns on unsold inventory, a critical factor contributing directly toward profitability.

DHL's Sustainability Initiatives: DHL has made substantial investments in sustainable logistics practices such as using electric vehicles for deliveries and optimizing route planning to reduce carbon emissions. These initiatives have enhanced the company's brand image, also leading to long-term cost savings through improved operational efficiency (Kohler et al., 2022). For example, DHL's commitment to achieving zero emissions by 2050 is supported by investments in green technologies and infrastructure. The company's GoGreen program focuses on reducing environmental impact while maintaining high service levels throughout its operations. By integrating sustainability into its core business strategy viewed through an RBT lens, DHL differentiates itself from competitors who may not prioritize eco-friendly practices or fail at implementing similar initiatives effectively.

Maersk's Digital Transformation: Maersk has recognized the importance of digital technologies in enhancing its logistics operations. By investing heavily in blockchain technology for improved transparency across its supply chain operations, particularly concerning documentation processes. Maersk has enhanced tracking capabilities while

reducing delays associated with traditional methods (Luthra & Mangla, 2020). Furthermore, Maersk's investment in predictive analytics allows them to have greater visibility while helping to anticipate disruptions before they occur. An invaluable asset amidst increasing global uncertainties stemming from geopolitical tensions or pandemics alike; thereby reinforcing their position against competitors who may lag technologically.

Nestlé's Supply Chain Resilience: Nestlé has leveraged its extensive global network of suppliers effectively during disruptions caused by events like COVID-19. By utilizing strong relationships with key suppliers, viewed as strategic resources. Nestlé was able to maintain product availability despite significant challenges faced globally (Mishra et al., 2021). This case illustrates how resource optimization can enhance supply chain resilience; allowing firms like Nestlé to navigate uncertainties while sustaining operations through diversified sourcing strategies coupled with robust contingency plans ensuring minimal disruption during crises encountered regularly. This impacts overall business performance metrics observed consistently over periods which are analyzed extensively across multiple product lines offered globally.

Coca-Cola's Bottling System: Coca-Cola operates one of the most extensive distribution networks globally through its bottling partners, considered critical resources for ensuring product availability across diverse markets. By employing sophisticated logistics management systems integrating real-time data on inventory levels along with sales trends, Coca-Cola optimizes delivery schedules while reducing

waste (Sweeney et al., 2020). Through effective collaboration among bottlers worldwide combined with advanced analytics, Coca-Cola maintains strong relationships ensuring consistent product availability which ultimately contributes towards brand loyalty among consumers who expect reliability from such an iconic brand.

Toyota's Just-in-Time (JIT) Production System: Toyota's JIT production system exemplifies RBT principles by emphasizing efficient resource utilization within manufacturing operations minimizing inventory levels while relying heavily upon strong supplier relationships considered essential, maximizing efficiency throughout production processes (Harrison & van Hoek, 2020). Toyota's ability to adaptively manage production schedules based on real-time demand signals ensures minimal waste occurs while simultaneously promoting a continuous improvement culture ingrained deeply within organizational practices leading toward sustained competitive advantage over rivals who are unable to replicate similar operational efficiencies effectively.

Procter & Gamble's Supply Chain Innovation: Procter & Gamble (P&G) has invested heavily in supply chain innovation through advanced analytics coupled with collaborative planning with retailers optimizing inventory levels, improving demand forecasting accuracy significantly (Kumar & Singh, 2021). By leveraging data from various sources such as point-of-sale systems along with market research P&G optimizes stock replenishment processes, ensuring timely availability of products;

meeting consumer needs, enhancing customer satisfaction, and contributing positively towards overall business performance metrics observed consistently over periods.

FedEx's Integrated Logistics Solutions: FedEx has developed an integrated logistics platform combining transportation, and warehousing information technology services, enabling customers real-time visibility shipments across entire distribution networks, enhancing customer satisfaction, and maintaining an industry-wide competitive edge (Kamble et al., 2021). This comprehensive approach ensures seamless coordination between different functional areas within the organization thereby maximizing resource utilization across the entire operation leading toward improved operational efficiencies.

Unilever's Sustainable Supply Chain Practices: Unilever has implemented various sustainable practices within its supply chain operations such as sourcing raw materials responsibly and reducing packaging waste which enhances brand image, leading to cost reduction in their operations (Wang et al., 2020). This case illustrates how sustainability initiatives viewed through an RBT lens serve valuable resources contributing to long-term success, aligning stakeholder interests toward shared goals, promoting ethical business practices, and fostering positive relationships with consumers who increasingly demand transparency, and accountability in the brands they support financially through purchasing decisions. The cases presented in this research strongly support the objective that increased government attention to seaport infrastructure is essential for enhancing logistics performance, which in turn can

significantly boost economic growth. By prioritizing investments in seaport facilities, technology, and operational processes, the government can create a more efficient logistics network that facilitates smoother movement of goods. This improvement in logistics performance is critical for manufacturers, as it reduces lead times, lowers transportation costs, and increases inventory turnover rates which will lead to profitability.

Moreover, enhanced seaport infrastructure can attract foreign direct investment (FDI) by providing a reliable framework for international trade. When ports are well-equipped and efficiently managed, they become more appealing to investors looking to establish or expand their operations. Nigeria stands to be a bigger beneficiary of this operation if its ports are equipped with mother infrastructure that facilitates trade. This influx of investment not only creates jobs but also stimulates local economies and contributes to overall national growth.

Furthermore, the relationship between logistics performance and economic growth is reciprocal; as logistics systems improve, they enable manufacturers to better access global markets, thereby increasing export volumes. This increase in exports generates foreign exchange earnings and strengthens the national economy. Therefore, the government must recognize the strategic importance of seaport infrastructure and improve its budgetary allocation to this sector which is critical to the growth of the country's economy.

In summary, the evidence gathered throughout this research underscores the critical need for government intervention in enhancing seaport infrastructure. By doing so, the positive relationship between logistics performance and economic growth can be significantly strengthened, leading to a more competitive manufacturing sector and a robust economy overall. Investing in seaport infrastructure is not merely an operational necessity; it is a strategic imperative that can drive sustainable economic development in Nigeria, as it has, in many countries with domineering examples.

2.2.1.8 Cross-Industry Comparisons

RBT's principles are applicable across various industries beyond manufacturing:

Healthcare Sector: In healthcare logistics, organizations leverage specialized knowledge about regulatory requirements alongside advanced technologies tracking pharmaceuticals. A combination viewed through an RBT lens is critical to maintaining compliance while ensuring timely deliveries (Chakraborty et al., 2020).

Retail Industry: Retailers like Walmart utilize vast distribution networks considered valuable resources achieving economies of scale and providing low prices to consumers (Kumar & Singh, 2021). This demonstrates effective resource management leads directly toward competitive advantages in retail environments characterized by high demand variability requiring swift responses to changes in market conditions.

Automotive Industry: Companies such as Toyota have adopted just-in-time inventory practices supported by strong supplier relationships deemed essential for minimizing waste and maximizing efficiency throughout production processes (Harrison & van Hoek, 2020).

These cross-industry comparisons highlight how diverse sectors implement similar principles derived from RBT tailoring them according to specific operational contexts ensuring optimal utilization of available resources driving improved performance metrics.

2.2.1.9 Implications for Future Research Directions

As emerging trends continue to shape global supply chains, through increased focus on sustainability and digital transformation, future research should explore several key areas:

Integration of Sustainability into RBT: Investigating organizations align sustainable practices resource-based strategies crucial to maintaining competitive advantages amid growing environmental concerns.

Impact Digital Technologies Resource Optimization: Understanding digital tools facilitates better resource utilization in different sectors and could provide valuable insights enhancing overall supply chain effectiveness and improving profitability margins.

Resilience Building Resource Management: Examining organizations leverage unique resource disruptions sheds light on strategies necessary for building resilient supply chains capable of withstanding future shocks

Sector-Specific Adaptations: Further studies should investigate industry-specific adaptations regarding implementing RBT principles allowing scholars and practitioners alike to gain deeper insights tailored particularly to operational contexts.

Globalization affects Resource Management: Understanding globalization influences resource allocation decisions essential given the increasing interdependence among global supply chains.

In summary, Resource-Based Theory provides a robust framework for analyzing seaport infrastructure and serves critical resources influencing logistics performance and economic growth within Nigeria's manufacturing sector by leveraging unique logistical capabilities derived from improved port facilities, Nigeria can enhance competitiveness in global markets application, making informed strategic investment decisions to drive better operational outcomes.

2.2.1.10 Criticisms of the Theory

Despite the usefulness of the RBT, some academics have challenged the theory along these lines of thinking, and this needs to be considered. The RBT has been under fire from several directions, each of which is significant. According to Kleinschmidt, de Brentani, and Salomo (2007), the traditional RBT has its limits when it comes to articulating why and how certain organizations can obtain a competitive advantage in a business environment that is both unpredictable and continually shifting. RBT cannot explain why certain businesses can achieve this edge. In addition, the concept of value creation that has been offered based on this theory about valuable resources is both tautological and static (Kozlenkova, Samaha, & Palmatier, 2014; Priem & Butler, 2001). This suggests that the theory is capable of self-verification and cannot be validated via empirical research (Barney, 2001). However, Kozlenkova, Samaha, & Palmatier, (2014) pointed out that this might be connected to the low-quality RBT study that was conducted over time.

In addition, considering that the concept fundamentally alludes to the work of Barney (1991), the argument in favor of the resource requirement of having a low prevalence may be unnecessary. According to Priem and Butler (2001), a resource is deemed to be rare if it fits the criteria of value, non-substitutability, and inimitability. In other words, a rare resource cannot be replicated.

RBT tends to overlook external resources and makes the premise that the only components required to produce a competitive advantage are those that originate from within the organization itself. Despite external influences having the potential to be beneficial capacities, (Lewis et al., 2010). New advances to the theory, such as adjustments, clarifications, and changes, are helping to extend its applicability and breadth (Kozlenkova, Samaha, & Palmatier, 2014). Although RBT has significant limits, the field is growing at a rapid rate, and innovations to the theory are helping to expand its applicability and breadth.

In addressing some of the constraints and limitations of RBT pointed out by different researchers, this study further explores the theory of constraints to support the use of RBT in this study.

2.2.2 Theory of Constraints

As stated by Cyplik, Hada, and Domaski (2009), Goldratt was the originator of the management philosophy known as the theory of constraints (TOC). This theory was commonly recognized to have been established as a management philosophy. It aimed to begin and execute breakthrough improvements by concentrating on a constraint that prevented a system from reaching a higher level of performance. The purpose of this management philosophy was to originate and implement breakthrough improvements. As a strategy for business management, the notion of limits was quite popular. (Simatupang, Wright, & Sridharan, 2004) The paradigm of the Theory of Constraints

(TOC) suggests that every business should have at least one constraint to function properly.

According to the findings by Simatupang et al. (2004), businesses that collaborated to develop a competitive advantage did so by splitting duties and rewards among both their upstream and downstream partners. This was done to establish a competitive advantage. According to Santos, Marins, Alves, and Moellmann (2010), when all the partners in the supply chain were integrated and began acting as a single entity, there was an increase in both profits and performance throughout the whole supply chain. This was a result of the supply and demand for the goods or services being combined.

According to Flores and Primo (2008), as the requirements of the market have become more stringent, the logistical process has also become more complicated. Additionally, the logistical process has been subjected to significantly higher levels of demand, particularly regarding achieving a competitive advantage (Santos, et al., 2010).

Santos et al. (2010) also documented that, the rivalry at that stage was not between separate firms but between the SCs (Securities Commission) to which each company belonged. As a result of this, the major goal of SCM was to locate a solution that would maximize revenues for all of SC's partners. Because of the substantial gap that usually exists between the potential advantages and the actual benefits, this aim could only be fulfilled with the support of logistics management (Simatupang, et al., 2004).

The situation emerged because of the existence of several difficulties relating to logistics, all of which needed to be handled by employing the adoption of an efficient strategy for the management of logistics. A few of these difficulties included extremely long lead times, a prominent level of unnecessary inventories or a lack of relevant inventories, incorrect material orders, many emergency orders and expedition levels, prominent levels of devolution, a lack of key customer engagement, frequent changes, and/or a lack of control related to prior projects.

It was given that the proprietor of a system would choose the function(s) that would be served by the system. According to Simatupang, et al. (2004), the fundamental goal of most business organizations is to earn profits both now and in the future. There is a potential that extra stakeholders conceived of requirements that needed to have been fulfilled to make it possible for the system to keep functioning normally. According to Cyplik, et al. (2009), the TOC encouraged managers to establish what was preventing them from getting closer to their goals, as well as the critical conditions, and then build ways to overcome the constraint after they had identified the problem. The most significant problem that was found was that the operations related to logistics did not produce improved outcomes in terms of their profitability and their level of efficiency. This occurred because most of the time, each of them only evaluated its local restrictions (own difficulties), while they should have been considering all capabilities and constraints connected to logistics (Santos, et al., 2010).

Additionally, Santos et al. (2010) opined that building effective logistics management needs meticulous planning and analysis of the logistics involved in the supply chain. This was necessary to develop efficient logistics management. During this inquiry, the Theory of Constraints (TOC) was applied to aid firms in the areas of order processing, transport management, and inventory management. It was classified as a set of factors that were reliant on one another, and consequently, the performance of logistics was dependent on the efforts made by these main aspects (transportation, inventory, order processing, and information flow). This goal was attained by applying the TOC technique, which entailed examining a logistics system through a holistic perspective.

Relating to Santos et al.'s (2010) findings, every system must have had at least one limitation at some point in its history since the performance of the system would have been unbounded if there had been nothing to limit it. This is the reason why each system must have at least one restriction to function properly. Cyplik et al. (2009) also noticed that the TOC method could be used to lead a single firm to concentrate on exploiting resources based on variable logistics costs throughout the supply chain. It was determined that this is one of the potential applications that may be made with the TOC technique.

Simatupang et al. (2004) examined the clothing logistics management system using the TOC thinking process to locate areas where improvements were necessary. They also discussed the practice of bringing together managers from various companies to collaborate in the process of increasing the total profit of the organization

(Simatupang et al., 2004; Cyplik et al., 2009). In the end, they produced an idea for a conceptual model that would safeguard real sales from the unpredictability of demand and supply by positioning the time buffer in distinct locations among the participating members. Performance assessments were conceived by Goldratt et al., (2000) to sustain the participants' sense of confidence in one another to assess the efficacy of TOC as a theory.

2.2.2.1 Criticism of the Theory

Claimed suboptimality of drum-buffer-rope, although linear programming methods have been favorably compared to TOC. Qui et al., (2002) and Trietsch (2005) claim that the DBR approach is inferior to other methodologies. On the other hand, it has been shown that the TOC approach to figuring out the ideal product balance is unlikely to result in the ideal outcomes since it assumes that $P=NP$ (Linhares, 2009).

Duncan, cited in Steyn (2000), claims that Forrester's 1950s systems dynamics and the 1940s' statistical process control are major influences on the TOC. In their impartial evaluation of TOC, Noreen Smith and Mackey point out that some of its core components "have been covered in management accounting textbooks for decades."

Some researchers have also said that Goldratt's publications gloss over the fact that TOC is grounded in the findings and practices of management science throughout the course of the past four decades, most notably the PERT/CPM and the JIT

methodologies. This charge has been leveled against both of Goldratt's works. Goldratt's book "What is the Theory of Constraints and How Should It Be Implemented?" on his radio program "Beyond the Goal" addresses the criticisms levied against the methodology. In these, Goldratt examines the history of the main disciplinary sciences and compares the strengths and limitations of the various disciplines. He identifies the sources of information and inspiration for the thought processes and critical chain techniques. Goldratt (2009) gave a series of speeches titled "Standing on the Shoulders of Giants," in which he acknowledged the contributions of several other intellectuals to the foundational concepts of the Theory of Constraints. Goldratt has made many efforts to show the relationship between the process of transformation methodologies.

Goldratt's hypotheses have been criticized for their lack of transparency. One example of this criticism is that Goldratt has not made the Optimum Performance Training system's algorithm publicly available. Some people have the impression that he is not scientific because many of his theories, methodologies, and procedures are not in the public domain and are instead part of his framework for profiting from his ideas. According to Gupta and Snyder (2009), the Theory of Constraints (TOC) has not yet demonstrated its utility in academic literature; thus, it cannot be deemed academically deserving of the moniker "widely recognized theory." This is the case despite TOC being widely recognized as a valid management philosophy in the modern world. According to Gupta and Doug (2009), TOC necessitates a rise in the number of case

studies demonstrating a correlation between implementation and enhanced financial performance.

Employees' needs and desires are not considered, and workers are not given enough control over the production process, as Nave (2002) argues. He also claims that TOC fails to account for failed policies as constraints (Nave, 2002). Most of Goldratt's critics, according to Mukherjee and Chatterjee (2007), have taken issue with his lack of rigor rather than the bottleneck approach. This is because the problem has several dimensions, and Goldratt's work only addresses one of them (the bottleneck method) (Mukherjee & Chatterjee, 2007)

In Summary, the criticism of the above theory may not necessarily override its uses as the RBT which is the main theory in this study has covered most of the challenges highlighted on TOC. Hence the use of these two theories for this research is robust, consistent, and evidenced as seen from previous studies.

2.3 Empirical Review

In this section, the researcher conducts a thorough review of the existing literature pertinent to the factors influencing economic performance, with a specific focus on Nigeria's manufacturing sector. This review is essential for identifying gaps in the current body of research that this study seeks to address. By systematically filtering through relevant empirical studies, the study aimed to highlight key variables that are

critical to our investigation. These variables include the moderating variable of the seaport infrastructure, which plays a crucial role in shaping economic outcomes, as well as independent sub-variables associated with logistics performance indicators, such as transportation cost, delivery time, inventory control, and return on assets. Additionally, the study examines the dependent variable representing the economic performance of the manufacturing sector, (i.e., manufacturing sector contribution to GDP).

2.3.1 Port Infrastructure

In 2012, Nazemzadeh conducted research on the contribution of port infrastructure to economic growth with a focus on Belgium and the Port of Antwerp. He contends that the nation's economy, particularly in an open and globalized economy, depends heavily on the nation's transportation infrastructure. The thesis examines the relationship between the efficacy of critical transport infrastructure and the location decisions of businesses. It does so in the context of an evolving industrial setting. It identifies port area competitiveness and allure as a crucial factor in development.

In addition to the conventional development-stimulating factors, the research found that transport infrastructure had a significant and positive impact on Belgian economic growth from 1990 to 2010. Since port infrastructure expenditures support larger economic benefits, such as economic openness and network effects, they have a

significant impact beyond the direct and indirect effects they have on GDP and employment.

As a result, examining how contemporary port infrastructure contributes to economic growth and development takes center stage. This research identified a few elements that originated in the dynamic environment and the associated requirements for a modern port to examine the relevance of this growth-stimulating function of modern ports. Through this process, a contemporary port transforms into a commercial area that can meet the needs of an unplanned industrial environment. The development of the port and its enhanced regional competitive edge become significant determinants of national competitiveness and economic growth because of the transformation of a port into a commercial destination and the creation of a commercial cluster. According to a survey of port users, the port cost, the quality of the hinterland connection, the location, the productivity, and the capacity are the most crucial elements to improve a port's attractiveness in this context and to aid in the formation of commercial clusters in a port.

The mediating function of seaborne trade on the effects of port infrastructure and logistics performance and economic development was investigated by Munim & Schramm, in 2018. From the vantage point of port infrastructure quality and logistics performance, this research empirically investigated the wider economic impact of seaborne commerce across 91 nations having seaports.

To demonstrate the substantial economic effects of port infrastructure quality and logistics performance, a structural equation model (SEM) was used. In addition, a multi-group SEM analysis is conducted by categorizing nations as either developed or developing economies. The data show that emerging nations must prioritize the upkeep of their port facilities if they want to see more seaborne commerce and consequent economic development.

Wagner et al. (2022) investigated how enhancing port infrastructure influences the decisions of shippers. He asserted that seaports, as transport nodes, determine the functioning of the supply chains they serve, noting that the consistent increase in the average ship size was a constant process observed in the world of shipping and that adapting the port and port access infrastructure to these changes was necessary to maintain the competitive position of the port and the entire transport chain.

The costs and security of the port-oriented supply chain are factors that cargo carriers consider when making decisions. The port of Szczecin, which is expanding its channel to 12.5m, was used as a case study. The analysis evaluates transport costs for five transport networks serving Szczecin. The study found that a 2.5 m increase in ship draught reduces transport costs by 25% due to lower chain-wide specific fuel usage. The findings demonstrated that deepening the fairway may alter the port's foreland. In-depth discussions with Szczecin port shippers confirmed this result. Interviews also revealed the remaining requirements needed to maximize port accessibility. The study

is the first stage in determining if enhancing port infrastructure can reduce ship emissions and help ports become zero-emission.

Woo (2011) analyzed the research techniques employed in ports. The study included port literature from the years 1980 to 2000. By categorizing the literature according to methodological issues such as research paradigm, strategy, foundational disciplines, research methodologies, and analytic approaches, the study's findings provide valuable insight into the evolution of research methodology. A quantitative transition from theoretical to empirical research uncovered a positivist bias in port studies. Complex statistical analysis and mathematical modeling are also becoming increasingly prevalent. Academic presentations and papers are enhanced by employing inventive analytic techniques from various fields. This paper includes implications for future port research and a discussion of methodological limitations.

Nowaczyk (2020) examined how small port marine facilities affected regional economic growth. The port study technique was examined. This research analyzes the 1980s and 2000s port literature to do so. The study classifies literature by methodological concerns such as research paradigm, strategy, basis disciplines, research methodologies, and analytic approaches to form conclusions regarding research methodological development. Port studies are positivistic and quantitative, progressing from theoretical to practical. Mathematical modeling and advanced statistical analysis are also increasing. Adopting modern analytical methods from

various academic fields promotes research debates and understanding. This study discusses port research's methodological implications and shortcomings.

Bakar, et al. (2021) examined microgrid design and management. He says seaport energy supply and demand are uncoordinated because marine logistics takes a lot of energy to support sea commerce. Load needs, operating costs, and environmental concerns will rise in future years. To fix these concerns, terminals might use microgrids. Microgrids provide cheap, ecologically sustainable, and long-term electricity to ports, improving operations. Microgrids are widely used on land, but ports are only starting to employ them. This difficult organizational work involves all-electric ships, cranes, cold laundry, and infrastructure construction. The research included microgrid ideas, specs, and operations. It shows how to apply the microgrid idea to a harbor from land and water, a smart step towards green ports. Planned maritime propulsion research.

Mudronja, *et al.* (2020) found that seaports drive the regional economy. Innovations and technology save money, simplify business, promote transparency, and attract new enterprises, making them essential to development. Using the endogenous growth theory based on R&D, this article examines how ports affected regional economic development in 107 EU port areas from 2005 to 2015. Moments were used to test the model in two steps. Result shows that EU port areas' economies depend on s, R&D investment, and human resource development. They are commonly overlooked in

transportation infrastructure improvements; therefore, partial money diversion may go this way.

Notteboom et al., (2013) studied "Advances in Port Studies: The Contribution of the Past 40 Years." Policy and Management in the Marine Environment, Port economics, management, and policy have emerged as a distinct academic discipline and a fundamental aspect of marine economics over the past few decades. This report presents a comprehensive evaluation of all 267 port studies. Their article provides a content analysis for seven interconnected research theme categories. These categories include the primary research topics and techniques, the distribution of authors, and the citation counts.

Using a systems approach, Cetin & Cerit (2010) assessed organizational efficiency. This study was the first to explore OE, a new port business concept. This notion focused on the organization's goals, resources, and systems interaction. The systems approach was chosen because seaports are open systems affected by international trade, logistics and supply chain trends, maritime transportation, and technological breakthroughs. Seaports are supply chain system subsystems with several integrated and linked structural parts. Since port organizations are social and technical systems, their effectiveness should be accurately assessed. It emphasized port organizations should be evaluated using -specific effectiveness measures. This study's main objectives are to assess key performance indicators and the importance of major inputs and port subsystems, which are the means to effectiveness. A systems model

conceptualizes port organizations' inputs, operations, and outcomes. A two-round Delphi poll, thirty-three assertions in the systems model's basic categories, and a qualitative study of expert opinions were done. According to the Delphi study, port infrastructure, equipment, and labor are the primary inputs; ship and cargo operations, logistics services, safety and security, information technologies, and marketing are the primary port processes; and productivity, efficiency, service quality, adaptability, information and communication management, profitability, and human resource management are the most essential effectiveness measures for seaport development.

To better understand what makes an organization successful, Alghaffari, *et al.* (2018) studied Saudi Arabian seaports. Although he acknowledged the importance of organizational efficiency (OE) in port management and its widespread use in the field of organizational management, he maintained that its relevance to the maritime industry was restricted. This report provides the results of some preliminary study into the most important aspects of Saudi Arabian s' overall efficiency and efficacy. They used the Delphi technique. Two surveys of Saudi Arabian seaports and interviews with 43 top port officials provided the data for this analysis. Quantitative and qualitative methods were used together in a hybrid approach. Thirty-one (31) elements were found to be relevant to organizational efficiency, spanning six dimensions: human resource management; customer service; finance; operation; marketing; and research and development. Since there is a dearth of information on how the notion of organizational efficiency might be implemented in the maritime industry, the collected data will undoubtedly prove useful. Decision makers in the management of

organizations may benefit from this study's findings for choosing and analyzing the most significant aspects of OE.

Sayareh (2023) examined the importance and benefits of evaluating maritime businesses' organizational efficiency, with an emphasis on management. The goals of this research are to (1) introduce the idea of organizational effectiveness (OE) to organizations, (2) examine the rationale for conducting regular OE assessments, (3) examine the effect that effective organizations have on the operational performance of s and the economic development of the country, and (4) empirically develop a suitable model for conducting regular OE assessments. After looking at several categories of OE models, they produced a system to evaluate the efficacy of OE in maritime enterprises. To shed light on three important study concerns, they polled 225 Iranian PSO branch managers using a group questionnaire. SPSS was used to analyze the data. In addition to validating the model (and its OE criteria), this study highlights the significance of effective organizations on operational success in seaports and national development. The data analysis and discussion support the recommendation that port organizations and their management conduct efficiency assessments regularly. All managers and organizations, both within and outside of ports organizations, are encouraged to systematically analyze the effectiveness and, if required, create laws, regulations, or processes for mandated periodic OE evaluation because of this study's findings and recommendations.

Ademar, *et al.* (2015) produced the idea for a study called "Opportunities for Research on Evaluation of Performance: A Systemic Analysis from International Literature." The goal of the study was to look at a reference portfolio of scientifically relevant papers to figure out what kinds of research could be done on the theme of evaluating harbor performance. As an intervention instrument, ProKnow-C (Knowledge Development Process – Constructivist) was utilized to achieve this objective. ProKnow-C is a method for generating knowledge on a specific topic based on the interests and limitations of the researcher. It adheres to the constructivist philosophy and necessitates the researcher to maintain interaction with the object of his study. The most important outcomes are the identification of the primary characteristics of scientific articles on performance evaluation and the suggestion of research opportunities to researchers and harbor managers based on the selected theoretical association for the performance evaluation theme. It was determined that: (I) most of the research on performance evaluation attempts to measure how well seaports function; (ii) the evaluation criteria do not consider and evaluate the performance of all the agents that play a role in the environment; and (iii) the evaluation tools do not indicate where and how to intervene to improve the measured performance. Thus, both researchers and port administrators encounter difficulties.

According to research conducted by Sun and Kauzen (2023) using a structural equation modeling approach, the port sector in Tanzania is crucial to the growth of the economy and the smooth flow of trade. The primary objective of the research was to assess the economic value of an infrastructure for Tanzania. This research examines

the role of infrastructure in fostering economic expansion in Tanzania to provide an answer to this topic. Statistical data was collected between 2005 and 2017 and analyzed using a Structural Equation Modelling (SEM) technique to determine the relationships between the variables. The findings point to a causal link between infrastructure and economic growth. The connections between development and global commerce were also explored. A considerable link between global commerce and GDP expansion was also shown by the data. It noted that transporting products by marine was cheaper compared to other modes of transportation, hence this research recommends investing in infrastructure alongside international commerce to maximize its potential in boosting Tanzania's economic development. Equally important to the expansion of Tanzania's economy is the maintenance and implementation of the country's current transport and port policy.

Granger causality analysis was used in the research of Song & Mi, (2016a), which examined the relationship between Chinese port development and regional GDP growth. They stated that China's ports are crucial to the country's transportation and economy, particularly for the hinterland areas that the port towns service. To what extent do investments in China's ports directly contribute to the country's rising standard of living? The Granger causality between port investment and economic development is examined by using the panel data for the years 1999-2009 and an error correction model (ECM). The findings demonstrate a short-term bidirectional causality between port investment and economic growth, with port investment being the long-term Granger reason for economic growth. However, the findings also

demonstrate a long-term unidirectional causality, with economic growth not being the long-term Granger reason for port investment.

The global economy and logistics performance index were the focus of research by Jayathilaka, *et al.* (2022). The research's purpose was to analyze how the GDP and LPI of different countries affected their participation in international commerce on different continents and worldwide. The years 2007, 2010, 2012, 2014, 2016, and 2018 were used to examine secondary data from 142 countries (37 in Asia, 41 in Europe, 41 in Africa, 3 in the Oceania region, 14 in the Middle East, 11 in the North American region, and 9 in the South American region). Based on the outcomes of the Hausman tests and the Breusch-Pagan Lagrange Multiplier test, the random effect (RE) model was selected for use in the panel regression approach. The results showed that the LPI correlates positively with net exports throughout all of Asia, Europe, and Oceania. In addition, nations in Oceania and the Middle East show a positive association between GDP and net exports, whereas those in Asia show a negative relationship. GDP also has a large negative effect on net exports in Africa. The findings provide a comprehensive picture of the effect of LPI and GDP on net exports, guiding policymakers as they work to improve export policies and boost economic development. This was the first investigation of its sort to examine how countries' GDP and LPI affect their participation in global commerce.

Jung (2011) looked at the economic contribution that ports provide to the economies of their surrounding areas in Korea. He claimed that ports serve as key portals of

international commerce and that as a result, in this age of globalization, they are often viewed as major accelerators of local economic growth. The local advantages that are gained from ports, however, indicate a diminishing tendency. This can be attributed to the evolution of logistical technology, changes in economic structure, and other variables. In this study, the authors examined the input-output linkage effects of ports and analyzed some of the most significant published works on the topic of port-city interaction. Based on actual data on port throughput and economic indicators, a discussion was then conducted regarding the relationship between ports and the economic performance of Korea's major port cities. Until recently, typical port communities such as Busan and Incheon were unable to improve their economic performance, according to the findings of the analysis. The accessibility of port services is insufficient to assure the economic success of communities near ports. It is possible that the surrounding ports are not providing help to the local economy as they formerly did, but port contributions to the national economy were upheld.

Cho and Ha (2009) examined the determinants of foreign direct investment (FDI) Flow into a Regional Port, Using a Resource-Based View, and Institutional Theory: A Case Study of Pohang-Yeongil Port in South Korea. Their study maintained that foreign direct investment (FDI) has been a popular study topic in both academic and practical spheres, and he believed that FDI inflows may help to serve as an incentive for economic development in host nations. To accomplish this goal, the research concentrated on providing significant theoretical contributions to the existing body of work on global supply chain management in port hinterlands. Specifically, the Foreign

Direct Investment (FDI) influx in the Pohang-Yeongil port area was scrutinized. Regarding the institutional theory, this research demonstrates how a supportive strategy on the part of the government might help attract foreign direct investment to the hinterland of the Pohang-Yeongil port. Similarly, the resource-based concept was used to explain industrial clusters, foreign trade zones (FTZ), and ICT (Information and Communication Technology) (Information and Communication Technology) infrastructures as crucial factors in attracting foreign direct investment from multinational corporations (MNCs). Understanding how Pohang-Yeongil port might entice foreign direct investment (FDI) from MNCs in the hinterland can be aided by reviewing the theoretical implications.

Kang, *et al.* (2011) on Value-Added Activities at the Busan Port in North Korea. To maximize the value that the Busan Port provides, the study examined both the current situation and previous research. By examining and contrasting Busan Port, Antwerp Port, and Rotterdam Port in terms of each of their functions, they claimed to have determined both the boundaries of Busan Port as well as the path it should take going forward. The container of Busan Port provides over 88 percent of its cargo, but Rotterdam and Antwerp Ports are each acting as integrated ports, disposing of container freight, general freight, and liquid cargo. The role of others like bulk spread to Ulsan, Masan, and Jinjae Port. Accordingly, it was recommended that Busan Port improve its role to avoid duplicating its function with the other ports in Korea.

Shan, *et al.* (2014) researched an empirical assessment of the economic effect. Evidence was gathered from China's main ports for the study. The purpose of their study was to analyze how the presence of a affects the overall economic growth of the host city. Based on information collected from 41 of China's most important port cities throughout the years 2003–2010. According to the econometric study's findings, the amount of cargo moving through a port has a beneficial impact on the rate of economic growth of the host city. In addition, the rival ports in the area have an even stronger favorable link with the city that serves as the port's primary location. This research offers a fresh perspective on the significance of s to the global economy by focusing on their role in the development of some of the world's busiest and most active ports.

Ding, *et al.* (2015) analyzed the Comparative Effectiveness of Container Terminals in China's Small and Medium-Sized Ports. They believed that the steady increase in domestic demand in China would need higher port efficiency and a revised growth plan for the small and medium-sized port container business. Twenty-one container terminals in Chinese small and medium-sized coastal ports were analyzed to determine operational and productivity efficiency change. Data envelopment analysis (DEA) and the Malmquist productivity index (MPI) were used for the first phase, and then Tobit regression was used to estimate and quantify the variables influencing productivity efficiency change. Based on the data, the terminals in the ports of Rizhao and Lianyungang are the most productive. More than half of China's state-owned shipping line is held by the terminals that have the greatest productivity efficiency

change. Finally, the number of terminal operators was negatively correlated with workforce structure, registered capital, shipping routes, and Chinese state-owned shipping line holdings.

Despite the significance of context, legitimacy, power, and interest, Chen, *et al.* (2020) discovered that a technical-rational model dominated the port integration literature. Using the "diversified implementations" in the Chinese port sector decentralization (2015-2018) as an example, their study seeks to answer the queries "Why do diversified implementations occur?" and "Why are actual implementations different across different regions?" As part of an introductory study on port sector diversification, they construct a theoretical framework to explain the various port integration implementations carried out by regional governments, which are anchored in the socioeconomic context. The research demonstrates that market structure and power distribution can explain differences in actual port integration implementations. The example of the San Pedro Bay port merger further verifies the results. The results are analyzed, and managerial conclusions are drawn.

Hlali, (2023) researched to investigate the effect that logistics and economic structure have on infrastructure, using Mediterranean nations as a case study. This research investigated the connection between the quality of port infrastructure, the quality and competency of logistics, and economic structure. The research was conducted on data collected from balanced panels in 15 Mediterranean nations between the years 2010 and 2018. An econometric analysis with many hypotheses was carried out. The

findings indicate a considerable association between the quality of the port infrastructure and the logistics theory's competency. The findings indicate that the quality of logistics and their expertise significantly impact the quality of port infrastructure. Therefore, to maintain their competitive edge, seaports need to invest in high-quality infrastructure that can keep pace with the continuously improving standards of logistics services offered by the marine sector. Also, to increase port infrastructure quality and get the logistics chain's advantages, it is necessary to optimize all variables that make up the economic structure.

Dal-Won Kang et al. (2011) investigated the significance of port integration in the administration of the supply chain. Specifically, the effects of port supply chain integration on port performance were evaluated. However, most previous research focused on defining and quantifying port supply chain integration. The study's purpose was to determine the impact of supply chain integration on port performance by applying factor analysis and regression techniques to the unique context of Busan container terminals. This research is distinct from others in that it considers both the supplier and the customer in the port supply chain. The empirical evidence indicates that incorporating the consumer into the design process significantly impacts product quality. Ship visits and cargo throughput are influenced favorably by cost performance.

Zhang, *et al.* (2015) looked at how global manufacturing patterns impacted port development in Hong Kong-China as a case study. They believed that the trends in

global manufacturing might have significant repercussions for the growth of the regional port system. The Hong Kong Port (HKP), which has been one of the most active container ports in the world since the 1990s, is the focus of this research article. They believe that over the last several years, global manufacturers have begun to shift away from their principal cargo base in the Chinese Pearl River Delta. This base is in Guangdong Province. This research examines the effects that rising global manufacturing patterns have had on the development of Hong Kong dollars. According to the findings, relocating manufacturing operations to Western Guangdong was beneficial for HKP, but relocating manufacturing operations to other locations makes HKP less appealing or even irrelevant. Based on the results, government policies are considered essential to promote the expansion of the port and the economy associated with it.

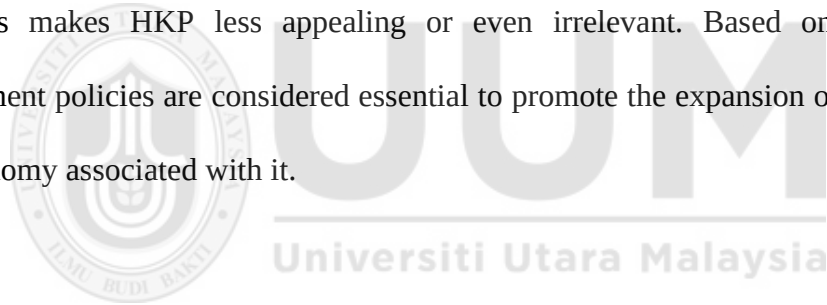


Table 2.1 Summarized Empirical Literature on Port Infrastructure

Author(s)/Year	Theory Used	Variables	Methodology	Findings	Major Recommendation	Limitations
Ademar et al., 2015	ProKnow-C (Knowledge Development)	Performance evaluation criteria	Systematic literature review	Identifies gaps in performance evaluation research and suggests future directions based on theoretical frameworks.	Develop comprehensive evaluation tools that consider all stakeholders involved.	Focuses primarily on performance evaluation without addressing practical implementation challenges.
Alghaffari et al., 2018	Organizational Efficiency	Human resource management, customer services	Hybrid approach (quantitative & qualitative)	Identifies key dimensions affecting organizational efficiency in Saudi Arabian ports; emphasizes the need for tailored assessments based on industry context.	Utilize findings to inform decision-making in port management practices.	Limited data from a single country; findings may not be generalizable.
Bakar et al., 2021	Microgrid Technology	Energy supply, operational efficiency	Conceptual framework	Microgrids can enhance energy efficiency and sustainability in ports; emphasizing the need for coordinated energy management.	Implement microgrid systems for sustainable port operations.	Conceptual study without empirical validation.
Cetin & Cerit, 2010	Systems Approach	Organizational efficiency, performance indicators	Delphi method, qualitative study	Introduces a systems approach to assess organizational efficiency in ports; identifies key performance indicators for evaluation.	Regularly assess organizational effectiveness using tailored metrics.	Limited sample size; subjective nature of qualitative data collection.

Cho & Ha., 2009	Resource-Based View & Institutional Theory	Foreign Direct Investment (FDI), government strategy	Case study analysis	Government strategies can attract FDI through supportive policies and infrastructure improvements at Pohang-Yeongil Port.	Develop targeted policies that facilitate FDI attraction through improved ICT infrastructure.	Limited focus on one regional case study may lack broader implications.
Jung, 2011	Input-Output Linkage Effects	Port throughput, local economic performance	Econometric analysis	Ports contribute significantly to national economies but show diminishing returns at the local level due to logistical changes.	Enhance accessibility and services provided by ports to support local economies more effectively.	Focused solely on South Korea; results may not apply globally.
Kang et al., 2011	Value-Added Activities	Value-added activities, port functions	Comparative analysis	Analyzes Busan Port's value-added activities compared to Antwerp and Rotterdam, recommending improvement to avoid functional duplication.	Improve Busan Port's role to enhance its competitiveness and avoid redundancy with other ports.	Limited to a specific context; findings may not generalize to all ports.
Mudronja et al., 2020	Endogenous Growth Theory	R&D investment, regional economic development	Two-step model testing	Ports drive regional economic growth through innovation and R&D investments; often overlooked in transportation improvements.	Allocate more funds towards R&D in port areas for growth.	Limited to EU regions; findings may not apply globally.
Nowaczyk, 2020	Research Methodology	Methodological issues	Literature review	Identifies a positivist bias and increasing quantitative methods in port research; calls for methodological advancements.	Promote interdisciplinary approaches in port studies.	Focused on literature from two decades; may miss recent developments.

Nazemzadeh, 2012	Economic Development	Port infrastructure, economic growth, transport costs	Case study, survey analysis	Port infrastructure significantly impacts economic growth in Belgium, enhancing competitiveness and cluster formation.	Focus on improving hinterland connections and port quality.	Limited to Belgium; may not generalize to other contexts.
Notteboom et al., 2013	Content Analysis	Research themes, publication trends	Content analysis	Comprehensive evaluation of 267 studies published in <i>Maritime Policy & Management</i> ; highlights the journal's impact on the field.	Continue publishing high-quality research on port economics and management.	Focused solely on one journal; may not represent the entire field.
Sayareh, 2023	Organizational Effectiveness	Operational performance, economic development	Survey analysis using SPSS	Highlights the significance of regular assessments of organizational effectiveness for enhancing operational success and national development.	Conduct systematic evaluations of effectiveness across all maritime organizations.	Sample limited to Iranian PSOs; may not represent global practices.
Shan et al., 2014	Econometric Analysis	Port presence, host city economic growth	Econometric study	Analyzes how port presence influences host city economic growth using data from major Chinese ports; significant impacts identified.	Further investigate how port presence affects economic dynamics in various regions globally.	Limited to Chinese ports; findings may not be generalized elsewhere.
Song & Mi, 2016a	Granger Causality Analysis	Port investment, GDP growth	Panel data analysis using ECM	Short-term bidirectional causality between port investment and economic growth; long-term unidirectional causality from	Continue investing in ports as a strategy for long-term economic	Limited timeframe (1999-2009); findings may not reflect current trends.

investment to growth. development.

Sun & Kauzen, 2023	Structural Equation Modeling	Infrastructure investment, economic growth	SEM analysis	Establishes a causal relationship between infrastructure investment and economic growth in Tanzania; highlights the importance of maritime transport.	Invest in infrastructure alongside international commerce to boost economic development.	Data limited to Tanzania; findings may not generalize to other regions.
Woo, 2011	Research Methodology	Research paradigms, methodologies	Literature review	Shift from theoretical to empirical research in port studies; increasing use of complex statistical methods and innovative analyses.	Encourage diverse methodological approaches in future research.	

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2.3.2 Port Investment

Palyvoda, *et al.* (2020) conducted a comprehensive analysis of the investment attractiveness of seaports so that the expansion of Ukrainian seaports, which are an integral part of the European transport network, can attract investors more effectively. Using Saati analysis and the integrated indicator of investment attractiveness, the study's findings were compiled. The aggregated indicators of financial and property condition, logistical attractiveness, and port expansion potential comprise the integrated indicator that evaluates business activity in the region. Based on the data, Ukraine's seaports were divided into three categories. Yuzhne, Odessa, Illichivsk, and Mykolaiv are all incredibly attractive port development options. The range for investment attractiveness ratios is between 3 and 2.6. The investment attractiveness of the ports of Izmail, Mariupol, Oktyabrsk, and Kherson is low (ratio between 2.2 and 1) and moderate (coefficient between 0.9 and 0.7). According to the research, favorable investment conditions are needed to construct port infrastructure, and the economic attractiveness of Ukraine's seaport varies considerably. The research concluded, among other things, that the Ukrainian government should cultivate an investment-friendly environment to encourage more investment in expansion. Providing incentives, streamlining the investment procedure, and removing unnecessary red tape are all methods of attracting more investment.

Lagoudis, *et al.* (2014) conducted research regarding port investment strategies in the face of uncertainty in Southeast Asian multipurpose ports. The study noted that port

investment decisions are primarily based on methods for increasing efficiency or expanding capacity, both of which result in greater capacity utilization and enhanced financial performance. The authors present an investment decision-making process for future port infrastructure investments that considers the many risks that could impact the return on investment over the project's useful life. This strategy is intended to be utilized for future port infrastructure investments. Earnings before interest, taxes, depreciation, and amortization (EBITDA) serve as the basis for calculating the anticipated net present value (ANPV), which is to compare the various alternatives. The findings indicate that the investment plan for a new four-level warehouse with a flexible option was the best option when compared to other comparable methodologies. Alternatively, the optimal investment strategy resembles a non-flexible 5-level warehouse, with the weight assigned to the various investment criteria determining this.

Exploratory research on port investment of new arctic routes was conducted by Nyman, *et al.* (2020). Under the terms of the Svalbard Treaty of 1920, Norway is responsible for the administration of the Svalbard archipelago in the Arctic Ocean. They suggested that not enough study had been done on the political and economic difficulties facing Svalbard. Svalbard represents a new prospective development region inside a new efficient transport route because of its strategic position, the expanding activities of oil/gas exploration development, and the possibility of new routes to and from Europe and Asia through the Arctic passage. This report sets out to examine Svalbard's approach to port expansion. The research thus used a three-

pronged approach: first, it looked at the status quo in terms of commerce, traffic, infrastructure, and governance in Svalbard; second, it looked at the future; and third, it looked at the potential. The paper also analyzes the four primary determinants of FDI (foreign direct investment) attraction; resources, market, efficiency, and location, using the OLI (ownership-location-internalization) paradigm as a framework. According to the results, the strategic plan for Svalbard port development should highlight the ports' geographical advantages to attract investment.

Gürol and Acar (2019) examined port investment decisions from a strategic standpoint. According to them, shipping vessels were the most prevalent mode of transit for international commerce, with ports serving as key nodes in supply chain models for countries around the globe. Port operators and the supply chains of which they are a part can obtain a competitive advantage through increased port efficiency and effectiveness. To ensure the overall success of port investments, environmental, economic, and social factors must be considered. Consequently, an examination of port performance indicators is essential for making investment decisions with strategic relevance to attain and maintain a competitive advantage. When making investments, it is essential to anticipate industry demands to avoid inactive capacity, floating capital, and missed opportunity costs. The objective of this study was to develop a technique for making sensible decisions. To accomplish this objective, the study combined the findings of the SWOT, analytic hierarchy process (AHP), and stepwise regression analysis (SRA). First, a SWOT analysis was carried out to determine the investment decision criteria, and then the AHP method was used to designate weights

for each criterion. These two processes' outputs serve as inputs for the investment decision-making procedure. Using a statistical model based on stepwise regression analysis, the study can assist decision-makers in determining the necessary investment type.

Research by Olusegun Onifade (2020), titled "New development-prospects and challenges: perspectives from Apapa and Calabar seaports, Nigeria," indicates that the federal and state governments, in collaboration with private investors, are looking to establish and/or develop some potential seaports to alleviate the burden of maritime logistics in Lagos State, specifically with reference to the Apapa and Tincan Island seaport. The objective of this study was to evaluate the effectiveness of the two selected seaports and to investigate the opportunities and challenges associated with constructing the two planned seaports to determine whether the necessary investment in development is beneficial. The study used descriptive analysis to investigate the obstacles encountered by the selected ports, and stochastic frontier analysis (SFA) to evaluate their performance. The cargo throughputs of the selected seaports, along with survey responses from stakeholders and transportation companies, were used to conduct a stochastic frontier analysis (SFA) for the years 2008 to 2017. The draught level, the cost of cargo, the inaccessibility to industry, and the quality of alternative modes of transit were identified as the primary issues with the Calabar port. Calabar's efficiency is barely above average at 0.6086686, whereas Apapa's efficiency is high, at 0.9764921, in comparison to the stochastic frontier. Even at maximum capacity, the ports in the Lagos complex are crowded; therefore, a second port must be constructed,

but only in a location that has been thoroughly studied. The efficacy rate indicates that the port of Calabar is not operating as efficiently as possible. The prospective impact of the proposed Ibom deep's development on the efficiency of the Calabar (s) must be considered when making investment decisions regarding whether to construct a new or use dredging to alter the existing ones. According to them, new port development should be driven by demand, as a port that does not attract sufficient traffic cannot generate sufficient profits.

Ugboma and Oyesiku (2021) compared the efficacy and productivity of Nigeria's seaports before and after concession. Because seaport interconnect value chains in international commerce, port efficiency is crucial to a nation's international competitiveness. Stakeholders are pressured port authorities to increase operational efficiency by delivering globally competitive port services to promote trade-driven economic growth. By developing a more competitive marketplace and commercial management strategy, they aimed to enhance the port's operational effectiveness. This article examines the port efficiency and productivity of the major Nigeria's seaports during the pre- and post-concession eras using Stochastic Frontier Production and inefficiency models using panel data from 2000 to 2017. Port efficiency increased from 51% to 60% after concession. The research identified enhancements in freight throughput, turnaround time, and cargo handling equipment. Despite these advancements, skilled labor shortages, inadequate infrastructure, congestion, operational bottlenecks, etc., continue to impede progress. As a result, it advises the

government and marine stakeholders to establish efficient, effective, and competitive ports to promote economic growth.

Ikeogu, *et al.* (2021) examined the container traffic patterns in Nigeria's ports from 1990 to 2017. The survey data was analyzed using descriptive and multivariate statistical techniques. Since most Nigeria's exports consist of crude oil and non-containerized items, this suggests that the country imports a disproportionate number of containers containing products from other nations. This is why containerized imports into Nigeria are so expensive and why the terminals are so congested. In the research, both imported and exported container traffic exhibited a positive time series trend. The study's authors concluded that it is essential for Ports Authorities to know how many containers pass through each port every day to make informed decisions about how to best utilize port resources.

Edih, *et al.* (2022) conducted research on the impact of efficient port operations on international shipping. This research looked at how some ports in Nigeria may benefit from improved port management to facilitate international sea travel. It looked at issues including whether ports are operating at full capacity in Nigeria, and whether there are any obstacles to the ports' running smoothly. The study's aim was to test the premise that a well-developed port infrastructure in Nigeria would not have any noticeable effect on marine transit. Chi-square, a nonparametric statistic, was employed for analysis. Three major Nigeria's ports the Lagos Port Complex, the Port Harcourt Old Port, and the Warri Port were surveyed for this study. The research

demonstrated a favorable and statistically significant connection between port activities and marine traffic in Nigeria. Implications for Daily Life. According to the findings of the research, the decline in activity at certain ports and terminals would lead to the elimination of many jobs and the reduction of significant income, further increasing the threat of unemployment and its related ills. The research found that a nation's economic development was impacted when a well-functioning port was in place. Therefore, it is suggested that the public and private sectors work together to increase funding for port development and enhance the super structures (infrastructures) for efficient port operations in the nation.

The influence of port concession on both regulators and the operators were investigated by Iwuoha, *et al.* (2022). In a public-private partnership between the government and private terminal operators, they argue that the existing literature ignores the effect of state regulation. This essay examined, via the lens of the Nigeria's experience, how the management of a port concession awarded in 2006 has been affected by the application of regulatory frameworks established by the Nigeria's Ports Authority (NPA). The article uses qualitative and content analysis to argue that the level of port asset management, operational efficiency, quality of port service, compliance capacity of terminal operators, and patronage system in the maritime industry are all affected by the poor articulation and implementation of the NPA regulatory frameworks. By exploiting the ambiguities and loopholes in NPA regulatory frameworks, terminal operators significantly thwart government port oversight and impede efficient port-asset management in the marine sector.

Chen, *et al.* (2020) analyzed the potential for port investment along the Maritime Silk Road by evaluating the sectors to be transferred and the countries to which they would be transferred. This article discusses the difficulties associated with investing in ports along the Maritime Silk Road (MSR) because both the sectors designated for transfer and the recipient nations must take advantage of their advantageous geographical position. Along with the MSR, an analysis of location advantage, regional imports of commodities from each recipient country, import transportation route scheme, port network structure, and port investment scheme were proposed as methods for determining the production scale of various industries in each country. This strategy was developed based on previously established models for hub-and-spoke networks, locations, and matching games. For this case study, 14 nations along the MSR were chosen to represent commodity supply zones, and six continents were used to represent commodity demand zones. With 81, 41, and 24 container berths constructed at each harbor, respectively, the harbors of Sihanoukville, Cambodia, Port Klang, Malaysia, and Mundra, India will develop into major transportation hubs. They argued that the proximity of a port to other hubs, the advantages it provides in the global maritime network, and the potential for industrial expansion in its immediate hinterland all play a role in determining whether a port will become a hub. According to them, these potentials were used to determine the previously mentioned ports.

Table 2.2 Summarized Empirical Literature on Port Investment

Author(s)/Year	Theory Used	Variables	Methodology	Findings	Major Recommendation	Limitation
Iwuoha, et al. (2022)	Regulatory Frameworks	Port asset management, operational efficiency	Qualitative and content analysis	Poor implementation of regulatory frameworks affects port management and efficiency.	Improve the articulation and implementation of regulatory frameworks.	Focused on the Nigeria's context; may not generalize globally.
Edih, et al. (2022)	None mentioned	Port operations, marine traffic	Chi-square analysis	Connected efficient port operations with improved marine traffic and economic development.	Enhance funding for port development to improve operational efficiencies.	Limited to three major Nigeria's ports.
Ugboma and Oyesiku (2021)	Stochastic Frontier Production and inefficiency models	Port efficiency, productivity	Panel data analysis from 2000 to 2017	Port efficiency increased post-concession; inefficiencies still exist.	Establish efficient and competitive ports for economic growth.	Focused on pre- and post-concession analysis; may lack broader insight.

Ikeogu, et al. (2021)	Descriptive and multivariate statistical techniques	Container traffic patterns	Descriptive analysis	Identified trends in container traffic; high costs and congestion noted due to import/export dynamics.	Ports authorities need to understand container traffic for better resource allocation.	Lacks depth in investigating underlying causes of issues.
Olusegun Onifade (2020)	Descriptive analysis and stochastic frontier analysis	Port performance, cargo throughput	Descriptive and SFA analysis	Identified challenges in Apapa and Calabar ports; Apapa is more efficient than Calabar.	Development should be driven by demand to ensure profitability.	Limited to a specific time frame from 2008 to 2017.
Gürol and Acar (2019)	SWOT, AHP, and Stepwise Regression analysis	Investment decision criteria	Combination of SWOT and AHP analysis	A decision-making technique for port investments considers multiple investment criteria.	Decision-makers should anticipate industry demands to optimize investments.	Complexity in integrating multiple analytical methods.
Nyman, et al. (2020)	OLI Paradigm	FDI attraction factors	Three-pronged approach	The strategic plan should leverage geographical advantages for attracting	Highlight geographical advantages in port development to attract FDI.	Limited prior research on Svalbard's economic challenges.

investment in
Svalbard.

Lagoudis, et al. (2014)	Investment Decision- Making Process	Investment efficiency, capacity	Analysis of investment decision- making processes	Proposed flexible investment strategies for port infrastructure investments amidst uncertainty.	Consider risk factors in investment decisions to improve ROI.	Focus on Southeast Asian context; may not apply universally.
Palyyoda, et al. (2020)	Saati analysis and integrated indicator	Investment attractiveness	Comprehensive analysis	Ukrainian ports categorized based on investment attractiveness ratios; Yuzhne and Odessa are highly attractive.	Cultivate an investment- friendly environment for port expansion.	Economic attractiveness varies significantly across ports.

2.3.3 Transportation Cost (CT)

Kanehara and Kamei, (2022), researching the price of transportation, product diversification, and research and development in an oligopoly, built an international oligopoly that explicitly integrates transporter behavior. They said that in every nation there is only one company that makes differentiated goods and invests in research and development that contributes to the differentiation of products, as well as only one transporter that moves differentiated commodities. It was decided to play a game with three stages, in which the businesses would first pick the amount of R&D investment they would make to define the degree of horizontal differentiation, then the transporters would use Cournot competition to set the costs of transportation, and finally, the firms would decide the quantities of output. According to the findings, a reduction in the costs of transportation is caused by an improvement in the R&D efficiency of businesses in the process of product diversification. In addition, the findings demonstrated that a reduction in a company's earnings is certain if there is an improvement in the effectiveness of product differentiation. The empirically credible long-term trend of falling transport costs is explained by these findings, which also give a conclusion that runs opposite to common sense, namely that efficiency increases diminish the degree to which products may be differentiated from one another.

Davies, *et al.* (2014) looked at the possibility of reducing transportation in industrial supply chains. They contended that global industrial systems now need the free flow

of raw materials, finished products, and purchased parts. They further said that it adds little value, is wasteful, and causes pollution, all of which are negative. These show up not just in the direct expenses of transporting goods between producers and consumers, but also in the health and environmental costs that result from all that going back and forth. Supply chains in today's factories, both internally inside a factory's production system and externally between the supplier, producer, and client, should be carefully planned to minimize the amount of time and effort spent on transportation. By doing so, a well-designed supply chain reduces the financial and environmental costs of transporting products.

However, in complicated supply chains, reducing the number of times big groups of components must be moved via transportation is no simple feat. Therefore, the purpose of this work is to propose a method through which a first supply chain design solution that achieves this goal may be discovered. A simple example involving the transfer of materials is used to introduce the procedure. To clarify its usefulness in the context of time-dependent supply chain design, the resultant solution was updated. The article uses this method to highlight the significance of having a solution that minimizes transportation movement inside the supply chain and the consequential implications this has on adaptability, cost, and pollution. In addition, the steps needed to advance this method were mapped out, and appropriate conclusions were formed.

Chen, *et al.* (2023) assessed the effect of supply chain re-organization on increased local production of vital resources. In contrast to previous opinions that supported

globalization in manufacturing and production, they stated that the United States and other nations have demonstrated a fervent desire for enhanced local manufacturing and production, particularly of essential commodities. Supporting increased local or regional production capacity had many benefits, including enhanced national security, more local employment, higher wages, and stronger economies; however, the costs were enormous and extended well beyond capital expenditures. Thus, it is essential to consider both the social costs incurred by a nation and a region. This study provides an analytical framework and accompanying mathematical techniques for evaluating the effects of supply chain restructuring and domestic capacity development necessary for increased domestic manufacturing and production on the operation and maintenance of a nation's roadways. Consequences were outlined in terms of increased traffic congestion, highway maintenance costs, fuel consumption, emissions, and traffic incidents because of the anticipated increase in domestic truck cargoes and truck kilometers necessary to increase domestic manufacturing capacity. The framework incorporated concepts derived from the mathematical formulation of multi-commodity, multi-echelon, fixed-charge facility location issues. It was utilized in a case study on the development of N95 filtering facepiece respirator manufacturing in the United States. This application anticipates substantial effects from an increase in domestic N95 FFR (Filtering Facepiece Respirator) production, with significant effects resulting from the transfer of regional raw materials and intermediate goods. The case study emphasizes the need for the suggested approaches and frameworks and the significance of contemplating the impact of rising domestic production and manufacturing on infrastructure. Using the analytical framework,

which has many applications, it is possible to compare facility sitting concepts, localization, and regionalization techniques.

Kiran (2019) investigated the Most Efficient and Cost-Effective Ways to Utilize Transport Services in Today's Competitive Business Environment. The research indicates that the primary function of transportation is to move goods from one location to another, and that advancements in transportation's techniques and principles contribute to improving the quality of goods' movement, their speed of delivery, the efficiency of their operational costs, the quality of their service, and the better utilization of their available resources. When it comes to global logistics and supply chain management, transportation is indispensable. Given the current situation, it is evident that an efficient transportation system is necessary for the uninterrupted flow of goods from their point of origin to their various points of manufacture and to the consumer. Therefore, this study's purpose was to elucidate the various roles that transport plays in influencing development. This research study aims to increase logistics professionals' understanding of the numerous perspectives, approaches, and practical applications of transportation planning.

Tracey (2004) examined the relationship between manufacturing company output and transportation efficacy. According to the findings, transportation is an integral component of functional logistics and supply chain. However, it is frequently overlooked as a prospective competitive advantage. The objective of this study was to determine, through structural equation modelling, how on-time delivery and response

rates for customer inquiries influence a company's overall performance in terms of product variety, quality, reduced manufacturing costs, delivery service, and customer satisfaction.

Weisbrod, G. (2016) intonated that efficient transportation has a positive effect on the productivity of industrial companies. The study revealed that the firm's product variety, product quality, manufacturing cost reduction, satisfactory delivery service, and acceptable overall performance were all positively impacted by the inbound and outbound transportation performance in terms of meeting delivery schedules and responding to inquiries promptly.

Dáz-Parra, *et al.* (2014) examined Transportation Issues by presenting a survey of mathematical models and algorithms used to solve various types of transportation problems for ships, planes, trains, buses, trucks, motorcycles, cars, and other modes of transportation by air, water, space, cables, tubes, and roads, the study aimed to aid understanding of the various types of transportation issues. Bus scheduling issues, delivery issues, combining truck trips, open vehicle routing issues, helicopter routing issues, truck loading issues, truck dispatching issues, truck transportation issues, vehicle routing issues and their variants, convoy routing issues, railroad blocking issues, inventory routing issues, air traffic flow management issues, and cash transportation vehicle routing issues are just a few of the issues.

Transport expenses, travel time, and distance was analyzed by Tanaka (2010) using data from the Japanese logistics census. Based on the hypothesis that fuel prices grow monotonically with distance travel, the research established geographical distance as a proxy for transport costs. The study uses data from the Japanese census of logistics to analyze the relationship between transport distance and time and freight charges for a variety of shipping modes, product classes, and neighboring prefectures. The findings demonstrate significant variation in transportation costs and timespan between shipping techniques, suggesting a compromise between the two. Distance has a considerable positive influence on freight prices via air transport, even after correcting for a broad variety of unobserved fixed variables and sample selection bias, which is consistent with an iceberg formulation of transport costs. The findings show trucks, ship, and railway transportation are more expensive for short-distance commodities.

The effects of endogenous transport costs on international commerce were investigated by Hafner, *et al.* (2023). Manufacturing and transportation sectors are modelled, with export quantities used to predict the need for transportation. The Transport service providers maximize profits over a threshold of trade by upgrading to more modern transport equipment, which decreases their marginal costs and hence transport prices at equilibrium. Therefore, the price of transportation is affected by two factors: the distance between the starting and ending points and the endogenous choice of the enterprise to spend on transportation. Empirical findings may be skewed, as shown by a simulation exercise, if the impact of the investment choice on transit costs is disregarded. It uses this understanding in empirical calculations, which are

based on regularly gathered United Parcel Service (UPS) transit pricing data. To address the endogeneity of the investment choice, they use an instrumental variable estimator. It was found that the distance between nations and the volume of their exports has a significant impact on transportation costs.

Redding and Turner (2015) analyzed theoretical and empirical research on transport costs and economic activity dispersion. A multi-regional economic geography model examined the general equilibrium implications of transport infrastructure enhancements on wages, population, trade, and industry mix. Based on this model's predictions, empirical literature on transport infrastructure improvements and economic development examined, concentrating on exogenous sources of variability in infrastructure construction. The study examined data from multiple geographical dimensions, within and within cities, and found several research challenges, including differentiating reallocation from development and dynamics. Transportation infrastructure enhancements may increase wages, population, trade, and industry mix, according to study. The study advises utilizing exogenous variation in transport infrastructure building to understand its effects on economic growth.

After the global monetary crisis of 2008, Liu, *et al.* (2017) in *Global Perspectives*, which examined the impact of cost variables on national manufacturing, emphasized the importance of the real economy as the foundation for national growth. Many nations, both established and developing, have devoted special attention to the manufacturing sector because of its significant role in the real economy. Because of

the impact that costs have on a country's industrial growth, they zeroed attention on those aspects. To measure the scope and depth of a nation's manufacturing sector, the researchers first proposed two metrics: manufacturing development scale and manufacturing development level. The theoretical foundation and literature were then used to extract cost components, such as wages, interest, taxes, rent, utilities, raw materials, exports, and the operating environment of a company. Incorporating the growth of China's manufacturing sector as a case study, this study employs data from 13 countries with significant manufacturing sectors between 2000 and 2015 to examine the impact of each cost element index on the size and level of national manufacturing industry development. The analysis concluded with a forecast of the future development trajectory of the manufacturing industry, based on an examination of the individual cost factors influencing that trajectory. The main innovation and contribution of this study are the following: a comprehensive evaluation of the national manufacturing development from two perspectives, "quantity" and "quality"; identification of the impact of national cost of the six elements; demonstration and determination of the extent to which this impacts the development trend of the manufacturing sector; and pre-evaluation through empirical research on each indicator, followed by policy recommendations tailored to each indicator.

Zhang and Cheng (2023) explored Economic development and transport infrastructure using empirical data from the United Kingdom. The study believed that the United Kingdom (UK) has made up for years of underinvestment in transport infrastructure in compared to peer nations by significantly increasing spending on these projects since

2015. To guide future infrastructure investment, their study assessed the theoretical and empirical impact of present and previous investments on economic growth. The growth of transport infrastructure was quantified using principal component analysis (PCA).

Using the Vector Error Correction Model (VECM), this research examines the long- and short-term connections between investment in transport infrastructure and GDP growth in the United Kingdom from 1970 to 2017. Transport infrastructure has a positive influence on economic growth in the long term, according to empirical evidence. However, this impact turns out to be highly detrimental in the immediate future. Based on the article's findings, future policy design to achieve economic sustainability in the UK should consider the varied contributions of the country's transport infrastructure to development.

Costs associated with inadequate infrastructure were analyzed for factories in Nigeria's, Sik Lee, *et al.* (1999). The authors compare the new data from a sample survey of industrial enterprises in Indonesia and Thailand (n=290 and n=300, respectively) with the results from earlier research on Nigeria. The main factors that were compared are the size and frequency of public infrastructure gaps, the level of private provision responses from manufacturers, the capital shares of various private infrastructure investments like those in power, water, telecommunications, transportation, and waste disposal, and the costs of generating one's own electricity and water. Public infrastructure gaps and private sector solutions vary widely

depending on region and company size. They said that 92% of Nigeria's businesses, compared to 66% in Indonesia and 6% in Thailand, had backup generators to augment the unreliable public grid. However, there was not much of a difference in the quality of electricity in Thailand and Indonesia. The percentage of Indonesian companies' total capital invested in private infrastructure was 16%, which was like the percentage invested by Nigeria's companies (14%), but double that of Thai companies (8%). The private costs of infrastructure shortcomings were high, with the burdens falling disproportionately on small organizations compared to big ones, which has a chilling effect on the emergence and expansion of new businesses.

Ogwo, *et al.* (2016) looked at the relationship between Nigeria's manufacturing sector performance, transport infrastructure, and GDP growth from 1999 to 2011. This research evaluated how much the availability of transportation infrastructure affected the efficacy of manufacturing companies in Nigeria and how that performance status affected the country's Gross Domestic Product. In the research, both primary and secondary data were employed. The secondary data came from national statistics on the manufacturing and transportation sectors as well as the country's GDP, while the primary data came from manufacturing companies operating in the south-east. For the main research, a judgmental sample of 100 participants was chosen, and the secondary data spanned a thirteen-year period (1999–2011).

According to the report, Nigeria's poor road infrastructure has a detrimental impact on the manufacturing industry's marketing performance, including sales and profitability.

Although it has a major impact on manufacturing production index, Nigeria's quality of road infrastructure has negligible impact on manufacturing capacity utilization. Once again, the yearly budgetary allocation to the transport sector has a significant impact on how much the manufacturing and transport sectors contribute to the country's development. It was suggested, among other things, that the government consolidate the current focus on the transportation sector considering its multiplier effect on the economic growth and development of the country and that the manufacturing sector, particularly in the areas of power, security, finance, and regulatory policies, should receive adequate attention.

On Nigeria's manufacturing enterprises, Barnabas and Apoh (2020) assessed the delivery model and cost management. They said that it is impossible to overstate the importance of efficient cost management in businesses, particularly those in the manufacturing industry. A successful cost-management strategy generates a lot of commercial prospects. This enables businesses to settle off debt and convert the remaining balance into cash. Cost control boosts business profitability, and higher revenues enable the procurement of better, more effective, and greener machinery. The cost of delivery adds little value to the amount or quality of the commodity. By raising the cost of manufacturing or the cost of the products, the producer or the purchaser must cover these expenses. As a result, manufacturers and service providers are continuously working to lower transportation costs, and experts have suggested using transport modelling techniques. This measuring study's goal was to investigate the connection between industrial organizations' transportation models and cost

management. Ten manufacturing enterprises in Rivers State, Nigeria make up the sample frame, which has 103 participants. The usage of transportation models has a favorable effect on the cost of products delivered, the amount of items shipped, and the dependability of delivery, according to the Spearman Rank Order Correlation Coefficient. To save shipping costs, it was advised that manufacturing companies utilize transportation modelling techniques. These techniques may aid in the logistical planning, cost management, and route optimization of transportation.



Table 2.3 Summarized Empirical Literature on Transportation Cost

Author(s)/Year	Theory Used	Variables	Methodology	Findings	Major Recommendations	Limitations
Chen et al., 2023	Supply Chain Restructuring	Local production, transportation impact	Analytical framework with mathematical techniques for evaluating supply chain reorganization	Increased local production leads to higher traffic congestion and maintenance costs; significant impacts from increased domestic manufacturing.	Consider social costs when increasing local manufacturing capacity; develop infrastructure accordingly.	Focused on specific case studies; may not generalize across all sectors.
Kanehara and Kamei, 2022	Oligopoly Theory	Transportation costs, R&D investment, product differentiation	Game theory with three stages: R&D investment, transportation cost setting, output decision	Improved R&D efficiency reduces transportation costs; increased efficiency diminishes product differentiation	Focus on enhancing R&D efficiency to lower transport costs while maintaining product differentiation.	Limited to oligopoly market structure; may not apply to competitive markets.

Hafner et al., 2023	Endogenous Transport Costs	Export quantities, transport prices	Simulation exercise using UPS transit pricing data	Distance and export volume significantly influence transportation costs; investment choices affect transit costs.	Incorporate investment choices in transport cost analyses for better accuracy in empirical findings.	Potential biases in empirical findings due to simulation assumptions.
Zhang and Cheng, 2023	Economic Growth through Infrastructure Investment	Transport infrastructure investment, GDP growth	Principal Component Analysis (PCA) and Vector Error Correction Model (VECM)	Long-term positive impact of transport infrastructure investment on economic growth; short-term detrimental effects observed.	Future policy should consider varied impacts of transport infrastructure on economic sustainability in the UK context.	Short-term versus long-term effects may complicate policy formulation and implementation strategies.
Ogwo et al., 2016	Infrastructure Impact on Manufacturing	Transport infrastructure availability, GDP growth	Primary data from manufacturing companies combined with national statistics	Poor road infrastructure negatively affects Nigeria's manufacturing performance and GDP contribution; significant impact from	Government should prioritize transport sector investments due to their multiplier effect on economic growth and development.	Focused on Nigeria; findings may not be applicable elsewhere without context adaptation.

budget
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noted.

Barnabas and Apoh, 2020	Cost Management in Manufacturing	Delivery models, cost management strategies	Survey of ten manufacturing enterprises with Spearman Rank Order Correlation analysis	Transportation modeling positively influences delivery reliability and cost management among manufacturers.	Limited sample size may affect generalizability of results; focused on specific region (Rivers State).
Kiran, 2019	Transportation Efficiency	Transport services, logistics effectiveness	Literature review and analysis of transportation roles in logistics	Efficient transport systems are crucial for the flow of goods and overall logistics performance.	Enhance understanding of transportation planning among logistics professionals.
					Lacks empirical data; primarily theoretical insights.

Davies et al., 2014	Supply Chain Optimization	Transportation costs, supply chain design	Proposed a method for optimizing supply chain design to minimize transportation	Effective supply chain design can reduce transportation costs and environmental impacts.	Implement strategic supply chain designs to minimize transportation efforts and costs.	Complexity in execution within intricate supply chains.
Dáz-Parra et al., 2014	Mathematical Modeling	Transportation problems across various modes	Survey of mathematical models and algorithms for transportation issues	Comprehensive overview of various transportation problems and their solutions using mathematical models.	Utilize mathematical modeling to address specific transportation challenges effectively.	General overview may lack depth in individual case studies.
Tracey, 2004	Structural Equation Modeling	On-time delivery, customer satisfaction, manufacturing performance	Structural equation modeling to analyze relationships between variables	Transportation efficacy positively impacts manufacturing output and customer satisfaction.	Leverage transportation performance as a competitive advantage in logistics strategies.	Limited to specific manufacturing contexts; may not apply universally.
Tanaka, 2010	Geographical Economics	Transport distance, freight charges	Data analysis from Japanese logistics census	There is a significant variation in transport costs based on shipping	Optimize shipping methods based on distance and cost analysis to improve logistics efficiency.	Data limited to Japan; may not reflect global trends.

				methods; distance affects freight prices significantly.		
Redding and Turner, 2015	Economic Geography Model	Transport infrastructure, economic activity	Multiregional economic geography model analysis	Infrastructure improvements can enhance wages, population growth, and trade dynamics within economies.	Use exogenous variations in infrastructure development to study economic growth impacts more accurately.	Challenges in differentiating between reallocation effects versus development impacts.
Liu et al., 2017	Cost Variables Impact on Manufacturing	Manufacturing development scale, cost components	Comparative analysis of manufacturing sectors across countries	Identified key cost components impacting national manufacturing development; proposed metrics for evaluation.		

2.3.4 Delivery time (DLT)

Few studies are found in academic literature with delivery time and GDP growth as a focal point. There are however very important studies that the idea can be linked to the existing study.

The study by Okafor et al. (2021) empirically examines the effect of seaport imports, exports, and real exchange rates on GDP in Nigeria from 1970 to 2020, using the Vector Error Correction Model, to determine if Nigeria's economic growth is sustainable. The study found that there is a short-run and long-run causality from import, export, and exchange rates to GDP; it also revealed that Nigeria's economic growth is import-dependent, and overall, import and exchange rates significantly affect GDP; and the that present export volume does not significantly contribute to GDP growth. The results imply that relying on an import-dominated trade system is not sustainable for Nigeria's future development, and the study recommends strategic initiatives to maintain the economic growth rate while promoting export through local production. The maritime industry has the potential to drive economic growth and transformation in Nigeria, but it faces several challenges, such as piracy, illegal fishing, inadequate infrastructure, and regulatory bottlenecks, which have hindered the full realization of the sector's potential. Despite its vast coastline, Nigeria's maritime industry needs to be more utilized to contribute to economic diversification and inclusion.

The study by Onyebuchi et al. (2023) investigated the effect of the capital market on the manufacturing sector output in Nigeria from 1990 to 2021. The researchers adopted the ARDL-ECM method of analysis and found that market capitalization has a positive impact on manufacturing sector output. The study recommends steps to improve the capital market and all share indexes, as both have a positive and significant impact on the manufacturing sector output, as well as measures to ensure that share prices reflect their real values. The authors note that the importance of the capital market to sustained growth and development of an economy cannot be overstated, as it acts as a catalyst for rapid and sustained manufacturing growth, especially in capitalist economies. However, the role of the capital market in the development of the Nigeria's manufacturing sector has remained unaddressed, and the effect has not been felt despite several policy tools by the government aimed at improving the manufacturing sector. The findings of the study suggest that improvements in the capital market can lead to increased manufacturing sector output in Nigeria. This, in turn, can have a positive impact on delivery times for manufactured goods.

Diponegoro and Sarker (2002) presents a decision model for determining manufacturing batch sizes and raw material ordering policies for a production system with a fixed-interval, lumpy demand delivery system. The model considers a product life cycle with three distinct phases: increasing (inception), level (maturity), and declining (phasing out) demand, with finished products supplied to consumers at fixed delivery intervals following the demand pattern modeled as piecewise linear

functions. The key findings are that when demand is constant, the cost model is convex and a simple closed-form solution can be obtained, but for other cases, such as increasing, level, and declining demand phases, an algorithm is employed to find the minimal cost of maintaining the system. The decision rule determines optimal delivery quantities, production start times, and batch sizes for each demand phase, providing a practical approach for manufacturers to optimize production planning and inventory control in the presence of lumpy demand and product life cycle trends, which can be used to improve efficiency and reduce costs in similar manufacturing systems. The work has not been pointed out if efficient delivery time has a positive effect on GDP growth.



Table 2.4 Summarized Empirical Literature on Delivery Time

Author(s)/Year	Theory Used	Variables	Methodology	Findings	Major Recommendation	Limitation
Onyebuchi et al. (2023)	Not specified	Capital market, Manufacturing output	ARDL-ECM	Market capitalization positively impacts manufacturing sector output.	Improve the capital market and ensure share prices reflect real values.	Unaddressed role of capital market in manufacturing growth.
Okafor et al. (2021)	Vector Error Correction Model	Seaport imports, exports, real exchange rates, GDP	Empirical analysis	Short-run and long-run causality from imports, exports, and exchange rates to GDP; import-dependent growth; export volume does not contribute significantly to GDP growth.	Strategic initiatives to enhance economic growth and promote export through local production.	Reliance on an import-dominated trade system is unsustainable.

Diponegoro and Sarker(2002)	Decision Model	Manufacturing batch sizes, raw material ordering	Fixed-interval, lumpy demand delivery model	Cost model is convex with constant demand; an algorithm is used in varying demand phases.	Practical approach for optimizing production planning and inventory control.	Does not address the impact of delivery time on GDP growth.
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2.3.5 Inventory Turnover

Nwaiku and Ejechi (2022) conducted research titled "Inventory Management Practices and Organizational Productivity in Nigeria's Manufacturing Firms." The purpose of this research was to investigate how certain manufacturing enterprises in Nigeria handled their inventories and how it affected their output. Accurate inventory records, a lean inventory system, buffer stock management, and information and communication technology are only some of the inventory management practices investigated. In addition, the efficiency and effectiveness of an organization were used as metrics for measuring production. The study relied on a survey as its primary data collection strategy. Participants are from the commercial, financial, production, distribution, and inventory divisions of five different manufacturers in Benin City, Nigeria. Integrated Rubber product Nigeria Plc., Livestock Feeds Plc., and Nigeria German Chemicals were included in the research, along with Seven-Up Bottling Company Ltd and Global Horn Industry PVC Ceiling Limited to make up the total sample size of 216. A questionnaire served as a data-gathering tool. The questionnaire data were evaluated by means of standard measures including frequency distribution, mean, correlation, and regression. SPSS (Statistical Package for the Social Sciences) was used for all statistical analyses. The research indicated that in Nigeria, inventory record accuracy, the lean inventory system, and the use of information technology all had a positive and statistically significant impact on business output, but buffer stock management had no effect at all. Based on the findings, manufacturing companies

should use system-based inventory management practices to increase operational efficiency.

Panigrahi, *et al.* (2021) analyzed the impact of Distribution turnover and Inventory Automation on the competitive strength and operational efficiency of steel manufacturing enterprises. They reasoned that the key to a successful business was in its ability to run smoothly and successfully in the marketplace. The study set out to do so by analyzing preexisting research. Odisha, India, is a prominent mineral resource state, thus information from five of its industrial enterprises were used to establish the empirical association. Managers of operations, production, purchasing, and storage and distribution at several industrial companies participated in the survey. Different statistical methods, including the correlation, multiple regression, confirmatory factor analysis, and Kolmogorov -Smirnov test, were used depending on the requirements of the investigation. This research adds to the current body of information by aiding inventory management practitioners in the industrial sector, and its findings suggest that IMP has a substantial influence on business performance.

Insight from the Nigeria's manufacturing sector was used by Ogah, *et al.* (2022) as they studied the impact of raw material inventories on operational performance in a developing country. Using a survey and semi-structured interviews, this research experimentally investigated this connection using a cutting-edge mixed methodological approach. Seven hundred and three inventory and supply chain managers from twenty-two different manufacturing companies in Nigeria filled out

the survey questionnaire, and twenty-five managers from nine different manufacturing companies in Nigeria were interviewed. They believed that sloppy inventory management practices drag down Nigeria's industrial sector's speed, efficiency, and adaptability. However, reliability and cost were not statistically significant, contradicting this one. Government policies, high exchange rates, bureaucracy in importing and port issues, inflation, infrastructural challenge, logistics and transportation challenges, poor management decisions, regulatory framework, and an unstable exchange rate were cited as the causes of the problems manufacturing firms in emerging markets face when trying to manage their raw materials. The research concluded that poor raw material management impacts the success of manufacturing businesses.

Inventory turnover and company profitability were two areas that Alnaim and Kouaib, (2023), looked at. The research set out to learn how quickly goods move off shelves affects the bottom line for Saudi factories. The study hypothesis was tested using data from 78 Saudi Stock Exchange-listed firms. Information covering the years 2017-2021 was culled from yearly reports and a data stream database. The results of a multiple regression study using a fixed effects model indicated that a company's profitability was positively correlated with its inventory turnover ratio. Significant implications for management accounting challenges in a Saudi Arabian context were found in this research. In addition, they advised policymakers and managers on how to improve manufacturing's environmental footprint. This study fills a need in the

literature by being the first to examine this connection, including the influence of COVID-19, across Saudi firms in many sectors.

Kenneth and Chinyeaka (2020) used multivariate and data envelopment analysis to examine performance evaluations of six Nigeria's seaports. By using models from Data Envelopment Analysis (DEA), General Linear Model (GLM), and Multivariate Analysis (MVA), the research set out to examine the performance of six Nigeria's seaports between the years of 2012 and 2017. Statistics from the Nigeria's Ports Authority (NPA) were used to compile the data, which spans the years (2012–2017) for each port. According to the empirical findings, the Lagos Port (LP) in 2014, Tin Can Island (TCP) in 2014, Onne (OP) in 2014, and Calabar (CP) in 2012, 2013, 2014, and 2016 all functioned effectively. In 2012, Delta Port (DP) is the that performs with the lowest efficiency. As a result, Calabar Port (CP) has been the most effective port throughout the years under consideration, while Delta Port (DP) has been the least effective. The findings of the multivariate analysis and regression model disprove the null hypothesis and agree that there is a meaningful link between the input and output variables of each port at the 5% level of significance, with a P-value of less than 0.005 ($P < 0.05$). Muazu (2019) looked at the relationship between logistics management and the success of factories in a few northern Nigeria's states. The purpose of the research was to determine how logistics affects the productivity of manufacturing companies in a few states in Northern Nigeria. A cross-sectional study was performed on 144 enterprises that are part of the Manufacturers Association of Nigeria (MAN). Data was analyzed using multiple regression analysis by means of partial least squares

structural equation modelling (PLS-SEM), and the research was grounded on the resource-based theory. Positive correlations between incoming and outbound logistics and productivity were found.

However, there was no statistically significant connection between outward logistics and output. The research results suggest that logistics have a limited role in helping manufacturing companies succeed. Therefore, it was suggested that manufacturing sector management discover methods to enhance the export operations they do, explore using drivers like information technology to increase performance, and even consider outsourcing these tasks.

Logistics management and industrial output in selected states of northern Nigeria were the focus of Muazu's (2019) research. The members of the Manufacturers Association of Nigeria (MAN) were surveyed using a cross-sectional study with a sample size of 144 enterprises. Resource-based theory served as the theoretical foundation, and multiple regression analysis using partial least squares structural equation modelling (PLS-SEM) was used to analyze the data. It was shown that there is a favorable correlation between incoming and outbound logistics and productivity. The correlation between outward logistics and output, however, was not statistically significant. The results imply that manufacturing company managers should not put all their faith in logistics' ability to boost performance. Therefore, it was suggested that manufacturing sector management find methods to improve the outward tasks

they conduct, explore incorporating drivers like IT to promote performance, and even consider outsourcing these services.

The manufacturing industry's results from pre-pandemic and COVID-19 pandemic periods were compared by Fisher, *et al.* (2022). Inventory effectiveness and customer and country diversity. In response to the COVID-19 epidemic, this report suggested that U.S. manufacturing companies should alter their worldwide supply chains by using a customer-country diversification strategy. Additionally, it scientifically investigated how regional client variety affected the effectiveness of the inventory. Using industry-level data, this study demonstrated that a geographically varied clientele significantly reduced inventory efficiency during the pre-pandemic period (2003–2018), but increased inventory efficiency during the COVID–19 pandemic. To lessen the negative effects of a global pandemic on inventory and improve inventory efficiency, it also suggested that American manufacturing companies would be able to target foreign client bases with demand characteristics that are less connected with domestic demand in the United States.

Atnafu and Balda (2018) carried out a study to explore the impact that an organization's inventory management practices have on both its competitiveness and its overall performance. The empirical data came from micro and small companies in Ethiopia, which were interviewed by the researchers. The purpose of this study was to conduct an empirical investigation into the impact that good inventory management practices have on both the degree to which companies can compete in their respective

markets and the level of success achieved by organizations. To fulfil the requirements of the study, data were collected from 188 micro and small enterprises (MSEs) that are active in the manufacturing industry. After that, the data were evaluated by utilizing a technique called structural equation modelling (SEM), which was used to investigate the links and assumptions presented in the conceptual framework. The results suggest that higher inventory management practices may lead to improved organizational performance and an enhanced edge over the competition. In addition, it was found that having a competitive advantage has a direct impact on the operation of the organization, which is an influence that is both positive and beneficial. Therefore, it was recommended that policy makers, universities, non-governmental organizations (NGOs), and any other concerned parties who are engaged in supporting MSEs need to work on providing the necessary training and resources to promote the inventory management practices of MSEs, which will result in increasing both their competitiveness and their organizational performance. This can be accomplished by promoting the inventory management practices of MSEs.

Table 2.5 Summarized Empirical Literature on Inventory Turnover

Author(s)/Year	Theory Used	Variables	Methodology	Findings	Major Recommendation	Limitation
Alnaim and Kouaib (2023)	None specified	Inventory turnover, profitability	Multiple regression using a fixed effects model from annual reports and a data stream database	Positive correlation between the company's profitability and inventory turnover ratio.	Advise policymakers and managers on how to improve manufacturing's environmental footprint.	Limited to Saudi firms and does not cover wider implications across different sectors.
Ogah et al. (2022)	Mixed methodological approach	Raw material inventories, operational performance	Survey and semi-structured interviews	Poor inventory management practices hinder efficiency and adaptability in Nigeria's industrial sector.	Improve raw material management practices in manufacturing firms.	Focused on Nigeria's manufacturing sector; findings may not be applicable globally.
Fisher et al. (2022)	None specified	Inventory effectiveness, customer diversity, country diversity	Industry-level data analysis	Geographically varied clientele affects inventory efficiency differently during pre-	U.S. manufacturing companies should diversify client bases to mitigate pandemic impacts.	Limited to U.S. firms; may not generalize to other regions.

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periods.

Panigrahi et al. (2021)	None specified	Distribution turnover, inventory automation, business performance	Analysis of preexisting research	Inventory management practices significantly impact business performance.	Aid inventory management practitioners in the industrial sector.	Analysis based on previous research, may lack primary data insights.
Kenneth and Chinyeaka (2020)	DEA, GLM, MVA	Seaport performance	Models from Data Envelopment Analysis and general linear model	Calabar Port is the most effective, Delta Port the least; significant link between inputs and outputs at 5% significance level.	Focus on enhancing efficiency of ports with underperforming metrics.	Limited to Nigeria's seaports; results may not translate to other types of infrastructure .

Muazu (2019)	Resource-based theory	Logistics management, productivity	Cross-sectional study, multiple regression analysis, PLS-SEM	Positive correlations between incoming and outbound logistics and productivity; limited role in success.	Explore using drivers like IT for performance enhancements in logistics.	Focused only on northern Nigeria's states; may not be representative of other regions.
Nwaiku and Ejechi (2022)	None specified	Inventory management practices, organizational productivity	Survey data from various manufacturers	Accurate inventory records and lean inventory systems positively affect output; buffer stock management has no effect.	Manufacturing firms should adopt system-based inventory management practices for better efficiency.	Limited to a specific location in Nigeria, affecting generalization of findings.
Atnafu and Balda (2018)	None specified	Inventory management practices, competitiveness, organizational performance	Data collected from micro and small enterprises through interviews	Positive relationship between good inventory practices and business performance; competitiveness influenced positively.	Training and resources should be given to promote inventory management practices in MSEs.	Focused solely on micro and small enterprises; results may not be applicable to larger firms.

2.3.6 Return on Assets (ROA)

Aremu, *et al.* (2021) analyzed the return on assets of publicly traded industrial enterprises and the expenditures made by the Nigeria's government on electricity (1999-2015). The study investigated, between the years 1990 and 2015, the relationship between the macro expenditure of the government on electricity infrastructure and the Return on Assets of manufacturing enterprises located in Nigeria. The research design for this study was an ex-post facto research design. From the total population of 83 manufacturing enterprises in the nation as of 2016, a sample size of twenty was picked using a purposeful sampling method. The published financial statements of listed manufacturing businesses in Nigeria, publications of the Nigeria's government, and publications of the World Bank were used to compile the secondary data. The findings of external auditors and other regulatory bodies were used as the basis for determining the data's validity and reliability. The results of the analysis, which included both descriptive and inferential statistics, are shown below. According to the findings of the research, the amount of money the government spends on power has a substantial impact on the financial performance of industrial companies.

The relationship between Nigeria's manufacturing businesses' capital structures and their bottom lines was analyzed by Olaoye and Adesina (2022). The effect of capital mix on financial performance was evaluated for 10 chosen industrial companies listed on the Nigeria's Exchange (NGX) between 2009 and 2020. The secondary data came

from the audited financial statements and annual reports of the chosen firms. Inferential and descriptive statistics were used to make estimates for this research. According to this investigation's results, the debt equity ratio (DER) of the selected businesses negatively affects their ROA. Among the sampled producers, DER has a substantial direct impact on ROE but an almost imperceptible impact on net profit margin (NPM). Small but positive effects may be seen across the board when the total debt to total assets (TDTA) ratio is improved. Short-term debt to total assets (SDTA) and long-term debt to total assets (LDTA) were shown to have a negative impact on all the dependent variables. The study results indicate that the management of these businesses always needs assistance in selecting the most appropriate capital mix. Therefore, the major claim of this study is that manufacturing enterprises in Nigeria need a suitable capital structure if they are to succeed.

Akinleye and Olufemi (2019) found that utilization of assets was shown to have a significant impact on the success of a subset of Nigeria's industrial companies. The 10 chosen quoted corporations' annual reports and financial statements were mined for secondary data for the five-year period from 2012 to 2016. Descriptive statistics, correlation, and regression analysis were used to examine the data. Based on the coefficient and probability value of 0.235999($p=0.0000$), the empirical findings verified that average true range (ATR) a technical analysis indicated used to measure market volatility, has a positive and substantial influence on ROA of the chosen manufacturing enterprises. The ratio of current assets to total assets has a positive and statistically significant influence on ROA with a coefficient of 0.109040 ($p=0.0035$),

whereas the ratio of debt to total assets has a negative but statistically negligible effect on ROA. Asset turnover (ATR), current ratio (CUR), and debt-assets ratio (DAR) together explain around 85% of the entire variance in ROA, as measured by the overall coefficient of determination (R^2) of 0.84951. The research found that the performance of Nigeria's manufacturing enterprises improved when better use was made of their assets, hence it was suggested that Nigeria's manufacturers focus on improving their asset utilization rates.

Dividend policy in manufacturing enterprises was studied by Purwanto, *et al.* (2021), who looked at the impact of debt-to-equity ratio, total asset turnover, return on assets, and return on equity. They concluded that dividend policies really do help businesses expand and prosper. Secondary information gathered from 2015, 2016, 2017, 2018, and 2019 industry annual reports. When 25 different industries are used as examples, and as many as five years of data are collected, a sample size of 182 is achieved. There were 125 separate instances of interest. Based on the findings of this research, it is expected that existing and prospective corporate investors would exercise more caution and focus on financial statistics that may be considered when making investments.

Irman and Purwati (2020) analyzed the influence of current ratio, debt to equity ratio and total asset turnover toward return on assets on the automotive and component company that has been registered in Indonesia stock exchange within 2011-2017. Multiple linear regression analysis with SPSS 19.0 and SMART PLS (Partial Least

Squares) 2019 application tools were adopted. The study found that Current Ratio, Debt to Equity Ratio, and Total Asset Turnover had effect on Return on Assets in Automotive and Component companies listed on the Indonesia Stock Exchange for the period 2011-2017. The study population consisted of 12 companies selected by purposive sampling. Financial report data obtained from the Indonesia Stock Exchange (IDX).

Ery, *et al.* (2021) carried out a study to identify the relationships between stock price and several financial indicators such as return on asset, return on equity, net profit margin, debt equity ratio, and current ratio. Multiple linear regression analysis was performed to examine the data and establish the connection between the variables in this research. Taking the findings of the search as a starting point, they used a quantitative strategy and secondary data to inquire into the connection between the factors. The stock price is positively and significantly influenced by the return on assets, return on equity, net profit margin, debt equity ratio, and current ratio. Those who use financial statistics to assess a company's performance and make investment choices might benefit from the study's conclusions. The report suggests these financial measures be considered by investors and analysts when evaluating stocks.

Larasati, *et al.*, (2020) looked at how the debt-to-equity ratio and return on assets affected earnings per share for Indonesian manufacturers across industry sub-sectors. This study used the value of the firm as a moderating variable. During the period of 2016-2018, this study looked at the correlation between the debt-to-equity ratio and

the return on assets for manufacturing companies listed on the Indonesia Stock Exchange, controlling for the firm value variable. Firm value served as the moderator. This study surveyed 45 companies from a wide range of industries that were listed on the Indonesia Stock Exchange (BEI) between 2016 and 2018. Purposive sampling was used as the sample strategy for this investigation. The data was analyzed using a path analysis approach. Earnings per share (EPS) were shown to be significantly affected by the Debt-to-Equity Ratio (DER), indicating that the DER did, in fact, influence EPS. There is a relationship between ROA and EPS, suggesting that ROA may affect EPS. Evidence suggests that the moderating effect of Price to Book Value (PBV) might amplify the impact of Debt-to-Equity Ratio (DER) on EPS. This indicates that the link between the DER and EPS are moderated by the Price to Book Value (PBV). This illustrates that P/B ratio functions as a moderator in the Return on Assets (ROA) against Earnings Per Share (EPS) connection since it has been proven to increase the impact of ROA on EPS.

Udoayang, *et al.* (2020) carried out a survey of publicly listed Nigeria's manufacturers on the value of investing in property, plant, and equipment. Investments in property, plant, and equipment (PPE) by publicly traded Nigeria's companies were analyzed for their relationship to ROI. Lack of use of composite evaluation tools beyond conventional budgeting procedures was shown to significantly affect PPE investment choices. The quantitative panel approach used here was inspired and grounded in previous ex post facto and correlational research. The fact books of the Nigeria's Stock Exchange provided the secondary data for the years 2013-2018. The sample

size was calculated using data from all 83 manufacturing businesses that were publicly traded on the Stock Exchange throughout the study's period. The sample size for this research was 69 participants. Three hypotheses were examined, and each was assessed at the 0.05 level of significance. Both multiple and simple regression were used to analyze the data and provide light on the dynamics between the explanatory and regressive factors. Return on assets (ROA) and property, plant, and equipment (PPE) were studied jointly, and the results supported the hypothesis that PPE had a significant impact on ROA for publicly traded Nigeria's manufacturers. The discussions and findings led to the conclusion that manufacturing company management could improve return on investment (ROI) by employing real and growth alternatives evaluations, portfolio management techniques that include productive non-current assets, and other similar instruments.

In their analysis of dividends of payout ratios in Indonesian manufacturing firms listed on the stock market from 2014 to 2016, Trisnadewi, *et al.* (2019) considered the impact of current ratio, return on equity, debt to equity ratio, and assets growth. Dividend payout ratios in manufacturing businesses traded on the Indonesia Stock Exchange were analyzed over the years of 2014 and 2016 to ascertain the impact of current ratios, returns on equity, debt to equity ratios, and asset growth on dividend distributions to shareholders. This analysis had 124 different businesses as its population. Purposive sampling was employed for this research, and the data used was drawn from 57 financial statements from 19 different businesses. Multiple linear regression analysis in SPSS is used to examine the data. Using a significance level of

0.246, the findings revealed that the current ratio had no impact on the dividend payout ratio. The dividend payout ratio is positively correlated with return on equity, with a regression coefficient of 0.284 and a significance level of 0.030 at the 5% level of confidence. The correlation between the debt-to-equity ratio and the dividend-payout-ratio is negative, with a regression coefficient of -0.155 and a significance level of 0.042 at the 0.05 level of confidence. The rise in assets has a negative impact on the dividend payout ratio, with a -0.378-regression coefficient and a 0.05 significance level.

Purba et al. (2020) examined the effect of variables such as the current ratio, ROA, TA, and SA growth on the capital structure of manufacturing companies. In this study, the capital structure of IDX-listed manufacturing companies from 2016 to 2018 was analyzed using four main metrics: current ratio, return on assets, total asset turnover, and sales growth. In this study, multiple linear regression analysis and descriptive methodologies were employed. From 144 companies, 73 were chosen at random to participate in the study. The data was extracted from annual reports posted on the website of the Indonesia Stock Exchange, (www.idx.co.id). Relevant variables for this investigation include Current Ratio, Return on Assets, Total Asset Turnover, and Sales Growth. In the case of manufacturing companies trading on the Indonesia Stock Exchange, neither the Return on Asset nor the Total Asset Turnover had a statistically significant impact on Capital Structure, nor did Sales Growth nor the Current Ratio. Together, the Current Ratio, Return on Asset, Total Asset Turnover, and Sales Growth have a significant impact on companies trading on the Indonesia Stock Exchange.

Husna and Satria (2019) examined the ways in which metrics including return on assets, debt to assets, current ratio, firm size, and dividend payout ratio influenced the worth of businesses. Research was conducted from 2013 to 2016 on the manufacturing businesses listed on the Indonesia Stock Exchange to ascertain the impact of ROA, D/A, C/F, size, and D/P on firm value. Out of 138 qualifying businesses, 32 were randomly selected for the sample. Multiple regression analysis was the method used for this study. company value, debt to asset ratio, current ratio, and dividend payout ratio are all affected by return on asset and company size, but firm value itself is unaffected. This research demonstrated that company value is affected by return on assets, is unaffected by the debt to assets ratio, is affected by firm size, and is unaffected by the payout ratio

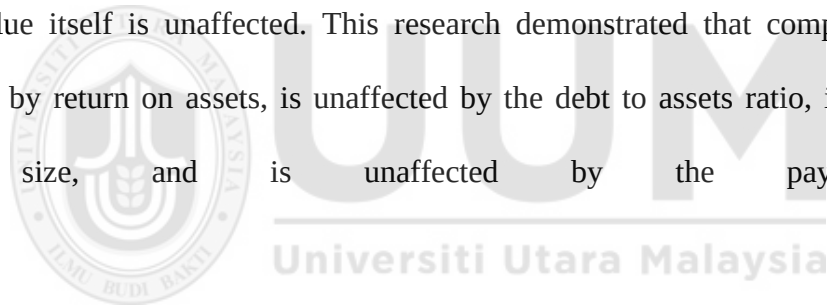


Table 2.6 Summarized Empirical Literature on Return on Assets

Author(s)/Year	Theory Used	Variables	Methodology	Findings	Major Recommendation	Limitation
Husna and Satria (2019)	Not mentioned	ROA, Debt to Assets, Current Ratio, Firm Size, Dividend Payout Ratio	Multiple Regression Analysis	ROA and firm size affect company value; Debt to Assets and Dividend Payout do not.	Focus on improving ROA and firm size.	Limited to manufacturing firms in Indonesia.
Purba et al. (2020)	Not mentioned	Current Ratio, ROA, Total Asset Turnover, Sales Growth	Multiple Linear Regression	Current Ratio, ROA, Total Asset Turnover, and Sales Growth together significantly impact Capital Structure.	Companies should focus on optimizing these variables.	Focused on IDX-listed manufacturing companies.

Trisnadewi et al. (2019)	Not mentioned	Current Ratio, ROE, Debt to Equity Ratio, Assets Growth	Multiple Linear Regression	ROE positively correlates with Dividend Payout Ratio; Debt to Equity negatively impacts it.	Emphasize on financial metrics when making dividend decisions.	Data limited to a few years and industries.
Udoayang et al. (2020)	Not mentioned	Investment in PPE, ROA	Quantitative Panel Approach	Investments in PPE significantly impact ROA.	Use sophisticated evaluation tools for PPE investments.	Limited to publicly traded manufacturers
Larasati et al. (2020)	Not mentioned	Debt-to-Equity Ratio, ROA, EPS	Path Analysis	DER significantly affects EPS; ROA also impacts EPS; PBV moderates the relationship	Consider PBV when analyzing financial relationships.	Limited to specific industry sub-sectors.
Irman and Purwati (2020)	Not mentioned	Current Ratio, Debt to Equity Ratio, Total Asset Turnover	Multiple Linear Regression	All selected variables impact ROA in Indonesian automotive firms.	Focus on improving financial metrics for better ROA.	Limited study period and company selection.

Akinleye and Olufemi (2019)	Not mentioned	Asset Utilization, ROA	Descriptive Statistics, Correlation, Regression Analysis	Asset utilization has a significant impact on ROA; Debt to Total Assets negatively affects it.	Improve asset utilization rates among manufacturers.	Focused on a subset of industrial companies.
Olaoye and Adesina (2022)	Not mentioned	Capital Structure, ROA, ROE, NPM	Inferential and Descriptive Statistics	Debt Equity Ratio negatively impacts ROA; significant effects observed on ROE.	Need for suitable capital structure for manufacturing enterprises.	Limited scope to selected firms on NGX.
Aremu et al. (2021)	Ex-post facto	Government Expenditure on Electricity, ROA	Ex-post Facto Research Design	Government spending on power significantly impacts financial performance of industrial companies.	Enhance government investment in electricity infrastructure.	Sample limited to 20 enterprises.

2.3.7 Manufacturing GDP Contribution

Asaleye, *et al.* (2021a). studied electricity use and manufacturing sector performance in Nigeria. They maintained that a steady supply of energy was crucial to an economy's long-term health. Production has been stymied in Nigeria, particularly in the industrial sector since power development is progressing at a sluggish and inefficient pace compared to other growing countries. Because of this, the research looked at how power use affects manufacturing sector performance over time as measured by output, employment, and capital via canonical cointegrating regression. The output equation results revealed that both electricity use and credit to the manufacturing sector are negatively related to production. Electricity use and the interest rate both have a negative role in the employment equation. Electricity use is a non-significant variable in the cost of capital. In conclusion, the industrial sector's performance has not been enhanced by the consequences of increased power usage as an input. The report suggested several solutions, one of which was the establishment of a structure to encourage energy efficiency, with the goal of increasing production from the power sector while decreasing waste.

Kpagih, (2022) looked at the efficiency of Nigeria's export industry and industrial sector from 1981 to 2019. According to this study, the external sector environment has become crucial for the development of every nation and internal balance due to globalization. Between 1981 and 2019, the researcher investigated how the external sector environment in Nigeria affected the country's manufacturing industry. The

study used an ex-post facto research strategy and the ARDL model estimate procedures. The empirical model uses the output index from Nigeria's manufacturing sector as the dependent variable and uses the external sector environment variables of currency rate, trade openness, and FDI as the independent variables. The co integration study findings show that the model's variables have stable long run relationships, while the test of unit roots results show that the variables have a mixed order of integration. Exchange rate fluctuations have a negative but statistically significant impact on manufacturing sector performance in the short term, according to the estimated ARDL model, whereas trade openness and FDI have a positive but statistically negligible effect. Long-term, the performance of Nigeria's manufacturing sector is positively affected by the country's currency rate level and FDI inflows, while it is negatively affected by trade openness. The results of the research indicate that the external sector environment in Nigeria has a considerable impact on the manufacturing sector in Nigeria.

The Nigeria's manufacturing sector's historical and current performance was analyzed by Ku, *et al.* (2010). They stated that the key issues and constraints holding back the sector's development were examined. Foreign investment has been a driving force in the growth of Nigeria's industrial sector in the decades after the country's independence in the 1960s and 1970s. New manufacturing technology imported from outside has reduced production costs and increased product quality. Despite this period of rapid expansion, the industry was not able to supply domestic demand, and the nation paid a high price for manufactured imports. They argued that in the 1980s

forward, various issues have been identified as the root cause of the manufacturing sector's lackluster growth and development. These issues included reliance on oil revenues, poor infrastructure, a paucity of trained personnel, insufficient financial resources, poor management, and inadequate planning. The report concludes that revitalizing Nigeria's manufacturing enterprises requires addressing all these issues so that manufacturing may once again play a significant part in Nigeria's economic growth.

Production planning and productivity at Nigeria's corporations was studied by Umoh and Wokocha (2013). The research looked at how corporate productivity in Nigeria's manufacturing sector has been influenced by production scheduling. In this context, business productivity performance was evaluated based on how well it reduced expenses, increased its equity capital, and expanded its profitability and returns. Out of the one hundred companies included in the Stock Exchange Fact Book 2009, eighty were randomly selected and given questionnaires to test three hypotheses. 62 questionnaires were found and analyzed with the companies' financial reports. The research showed that production scheduling really had little effects on corporate productivity in Nigeria's industrial sector. This indicated that production Scheduling has an insignificant effect on enterprises' productivity overall. Considering these findings, the report suggests, among other things, that the Nigeria's manufacturing sector undergo a complete makeover, with a focus on scheduling, to realign and revive the industry from the brink of collapse.

Macroeconomic Variables and the Performance of the Manufacturing Sector in Nigeria (1981-2019) was analyzed by Ezu, *et al.* (2020). The research looked at the influence that various macroeconomic factors had on the performance of the manufacturing sector in Nigeria over a period of 39 years, beginning in 1981 and ending in 2019. In particular, the purpose of the research was to analyze the relationship between the performance of the manufacturing sector and macroeconomic factors such as real interest rate, exchange rate, and inflation rate. The performance of the manufacturing sector was evaluated based on output contribution ratio to real gross domestic product and average capacity utilization. To accomplish the goals of this research, four hypotheses were developed and examined with the use of secondary data gathered from the Statistical Bulletins published by the National Bureau of Statistics and the Central Bank of Nigeria. This research used data collected over a period. To determine whether the time series data is stationary, the Augmented Dickey Fuller was used. The study of the data consisted of a straightforward application of simple linear regression. The results of this research indicated that macroeconomic factors had substantial relationships with performance at a level of significance equal to or greater than 5%. Considering the results, it was suggested, among other things, that the nominal interest rate needs to be decreased to increase the amount of investment.

Onyebuchi (2023) investigated the impact that Nigeria's capital market had on the output of the country's manufacturing sector between 1990-2021. The ARDL-ECM method of analysis was used during the process of carrying out the steps necessary to

complete the research. According to the findings of the research conducted and included in the study, the market size positively impacts the amount of product produced by the manufacturing sector. The study suggested putting in place processes to guarantee that share prices are representative of their actual values to ensure that the capital market and all share indexes have a positive and substantial impact on the output of the manufacturing sector. The capital market also has a positive and substantial influence on the manufacturing sector's output. In addition, the report recommends strengthening the stock market and the capital market.

Abdu, *et al.* (2021) conducted research on the factors that influence the productivity of manufacturing enterprises. This study offered a micro-perspective on the process of industrialization in Nigeria. The article's author concluded that there is a substantial body of research that points to the fact that the manufacturing sector plays a significant role in a nation's economic growth. They went on to say that it was vital to investigate the factors that led to businesses' levels of productivity within the sector establishing a manufacturing industry that was robust, inclusive, long-lasting, and inventive. This was their recommendation. As a micro-perspective on industrialization, the purpose of this research is to analyze the primary factors that determine the level of productivity achieved by manufacturing enterprises in Nigeria. To accomplish this goal, the research used the simultaneous approach of stochastic frontier to conduct an analysis on the imbalanced panel firm-level dataset spanning 2007–2014.

According to the findings, industrial companies in Nigeria have a high dependence on human labor and must contend with diminishing returns to scale. The findings also showed that the degree of productivity or efficiency of the businesses is negatively impacted by factors such as the average cost of labor or wages and the frequency of power outages; nevertheless, micro, and small manufacturing enterprises were found to be more efficient than big manufacturing firms. Additionally, manufacturing companies that export are more productive overall than their competitors who do not export. The research then provided policy implications of the study, which said that to design pragmatic industrialization strategy, it must be micro-founded in nature. Furthermore, such a policy should stimulate export, provide a reliable power supply, and pay attention to large-scale manufacturing enterprises.

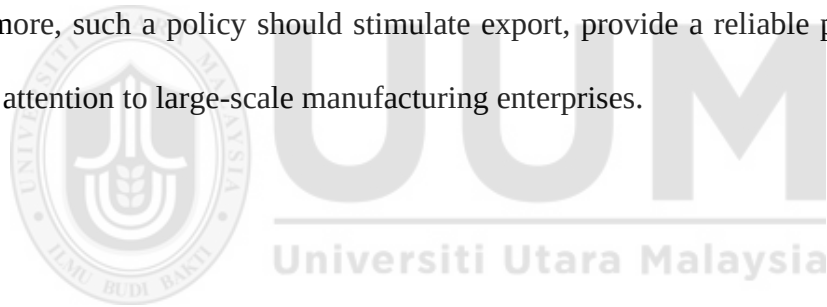


Table 2.7 Summarized Empirical Literature on Manufacturing Sector Contribution to GDP

Author(s)/Year	Theory Used	Variables	Methodology	Findings	Major Recommendation	Limitation
Onyebuchi (2023)	ARDL-ECM Method	Market size, output of the manufacturing sector	ARDL-ECM method	Market size positively impacts manufacturing output; the capital market also has a positive influence.	Strengthen the stock and capital market.	Specificity of time period studied.
Abdu et al. (2021)	Micro-Perspective	Productivity factors in manufacturing enterprises	Simultaneous stochastic frontier	High dependence on human labor; productivity negatively impacted by labor costs and power outages; exporters are more productive.	Design pragmatic industrialization strategy focusing on reliable power supply and support for exports.	Focus on specific size of enterprises.

Ezu et al. (2020)	Macroeconomic factors	Real interest rate, exchange rate, inflation rate	Linear regression with ADF test	Macroeconomic factors significantly relate to manufacturing performance; need to lower nominal interest rates for better investment.	Decrease nominal interest rate to increase investment.	Limited to data from 1981-2019.
Umoh and Wokocha (2013)	Production Scheduling	Corporate productivity, production scheduling	Questionnaire analysis	Production scheduling has little effect on corporate productivity.	Major overhaul of the manufacturing sector focusing on scheduling.	Sample size may affect validity.
Ku et al. (2010)	Historical analysis	Foreign investment, domestic demand	Qualitative analysis	Identified key issues affecting manufacturing growth: reliance on oil, poor infrastructure, and lack of training.	Address all identified issues for manufacturing revitalization.	Lacks quantitative approach.

Kpagih (2022)	Ex-post facto research	Currency rate, trade openness, FDI	ARDL model estimate procedures	Exchange rate negatively affects short-term performance; trade openness has a negligible effect, while currency rate and FDI positively impact long-term.	Recognize the importance of external sector environment for manufacturing development.	Mixed order of integration found.
Asaleye et al. (2021a)	Canonical Cointegrating	Electricity use, credit, employment, capital	Canonical cointegrating regression	Electricity use negatively impacts production and employment; significant concerns regarding power usage efficiency.	Establish structure to promote energy efficiency and reduce waste.	Non-significance in cost of capital.

2.4 Gaps in the Literature Review

This study identified various gaps from the empirical literatures that were studied above, falling under the following themes:

2.4.1 Methodological Gaps

The examination of the moderating effects of seaport infrastructure on the relationship between logistics performance and economic growth in Nigeria's manufacturing sector is an area that has received insufficient attention in academic research. Despite the critical importance of logistics in facilitating trade and economic activities, particularly in developing economies like Nigeria, there is a notable lack of quantitative studies that rigorously analyze these dynamics. This gap is significant and warrants immediate scholarly focus, as it can hinder our understanding of how infrastructural improvements can drive economic development.

Seaports serve as essential gateways for international trade, playing a pivotal role in the logistics chain. In Nigeria, where over 90% of international trade is conducted via maritime routes, the efficiency and effectiveness of port operations directly impact the country's economic landscape. The quality of seaport infrastructure influences various aspects of logistics performance, including cargo throughput, shipping costs, and turnaround times for vessels. These factors are crucial for manufacturers who rely on timely deliveries and cost-effective transportation to remain competitive in both local and global markets.

indicates that improved seaport infrastructure can lead to enhanced logistics performance, which in turn fosters economic growth. For instance, studies have shown that investments in port facilities and technology can significantly reduce shipping times and costs, thereby increasing the overall efficiency of supply chains. However, despite these insights, there remains a lack of empirical evidence specifically addressing how these relationships manifest within the context of Nigeria's manufacturing sector.

The existing literature predominantly focuses on qualitative assessments or case studies that do not adequately quantify the relationships between seaport infrastructure, logistics performance, and economic growth. Most studies have either explored the general impact of port operations on trade without delving into specific moderating effects or have relied on anecdotal evidence rather than robust statistical analysis. This lack of quantitative research limits our understanding of the precise mechanisms through which seaport infrastructure influences logistics performance and economic outcomes.

To address this deficiency, it is crucial to conduct rigorous quantitative research that employs advanced statistical methodologies to analyze data related to seaport infrastructure and its effects on logistics performance metrics. Such studies can provide empirical evidence that informs policy decisions and investment strategies aimed at enhancing port efficiency and promoting economic development.

2.4.2 Theoretical Gaps

The existing body of research concerning the interplay between seaport infrastructure, logistics performance, and economic growth in Nigeria's manufacturing sector reveals a significant deficiency in comprehensive theoretical frameworks. While various studies have touched upon aspects of this relationship, there remains a dearth of integrative models that adequately explain how seaport infrastructure moderates the dynamics between logistics performance and economic growth. This gap is particularly pronounced in the context of Nigeria, where the manufacturing sector is a critical component of the economy and where efficient logistics systems are essential for competitiveness and growth.

Seaport infrastructure plays a pivotal role in shaping logistics performance by facilitating the movement of goods and services across borders. The efficiency of port operations directly influences shipping costs, cargo handling times, and overall supply chain effectiveness. Consequently, the quality of seaport infrastructure can significantly impact economic growth by enabling manufacturers to access global markets more effectively and efficiently. However, despite its importance, the theoretical underpinnings that connect these elements remain underexplored. Existing frameworks often fail to account for the unique challenges and opportunities presented by Nigeria's specific economic and infrastructural context.

To address this scholarly gap, this study proposes an alternative theoretical framework that integrates the concepts of infrastructure, logistics performance, and economic growth within Nigeria's manufacturing sector. This framework aims to provide a holistic view of how seaport infrastructure influences logistics performance and, in turn, drives economic growth. By synthesizing insights from various disciplines, such as economics, logistics management, and infrastructure development. The proposed framework seeks to elucidate the complex relationships at play.

The foundation of this theoretical framework is built upon established economic theories that emphasize the significance of infrastructure in facilitating economic activities. For instance, the Solow growth model posits that long-term economic growth is driven by technological progress and capital accumulation. In this context, seaport infrastructure can be viewed as a critical factor that enhances productivity by reducing transportation costs and improving access to markets. By integrating this model with contemporary logistics theories, the proposed framework emphasizes the role of seaport efficiency as a mediator in the relationship between logistics performance and economic growth.

Moreover, this framework recognizes that various external factors influence seaport operations and their effectiveness. These factors include regulatory policies, investment levels in port facilities, technological advancements, and regional trade agreements. By incorporating these variables into the analysis, the framework allows

for a more nuanced understanding of how seaport infrastructure can be optimized to enhance logistics performance and stimulate economic growth.

The proposed theoretical framework also highlights the importance of empirical validation through quantitative research methods. By employing statistical techniques such as regression analysis or structural equation modeling, researchers can test the relationships posited by the framework and provide empirical evidence to support or refine its propositions. This empirical grounding is essential for establishing a robust understanding of how seaport infrastructure impacts logistics performance and economic outcomes in Nigeria's manufacturing sector.

Furthermore, this study emphasizes that addressing infrastructural deficiencies is not merely an operational issue but also a strategic imperative for economic development. Policymakers must recognize that investments in seaport infrastructure are vital for enhancing logistics capabilities, which ultimately contribute to broader economic goals such as job creation, industrialization, and increased competitiveness on a global scale. The proposed framework serves as a guide for policymakers to identify key areas for investment and reform within Nigeria's port system.

In addition to informing policy decisions, this theoretical framework has implications for practitioners within the manufacturing sector. Understanding how seaport infrastructure affects logistics performance can help manufacturers make informed decisions regarding supply chain management and operational strategies. For instance,

firms may choose to invest in technologies or processes that enhance their ability to navigate logistical challenges associated with port inefficiencies. By aligning their strategies with insights derived from the proposed framework, manufacturers can better position themselves to capitalize on opportunities presented by improved seaport operations. Moreover, this framework encourages collaboration among stakeholders involved in port operations, logistics management, and manufacturing. By fostering partnerships between government agencies, private sector actors, and academic institutions, stakeholders can work together to develop innovative solutions that address infrastructural challenges while enhancing logistical efficiency. Such collaborative efforts are essential for creating a cohesive ecosystem that supports sustainable economic growth.

In summary, this study seeks to fill a critical void in academic literature by providing an alternative theoretical framework that integrates the concepts of seaport infrastructure, logistics performance, and economic growth within Nigeria's manufacturing sector. By addressing existing gaps in research and proposing a comprehensive model that accounts for various influencing factors, this study aims to advance our understanding of how infrastructural improvements can drive economic development. The proposed framework not only serves as a foundation for future empirical research but also provides actionable insights for policymakers and practitioners seeking to enhance Nigeria's logistical capabilities and overall economic performance.

As Nigeria continues to grapple with infrastructural challenges within its port system, it is imperative that scholars and practitioners alike recognize the importance of developing robust theoretical frameworks that can guide effective interventions. By leveraging insights from this study, stakeholders can work towards creating a more efficient logistical environment that ultimately fosters sustainable economic growth within Nigeria's manufacturing sector. This endeavor is crucial not only for enhancing national competitiveness but also for improving the quality of life for citizens through increased employment opportunities and improved access to goods and services.

The integration of these concepts into a cohesive theoretical framework represents an important step forward in understanding the multifaceted relationships between seaport infrastructure, logistics performance, and economic growth in Nigeria's manufacturing sector. By advancing both academic knowledge and practical applications in this area, this study aims to contribute meaningfully to ongoing discussions about infrastructure development as a catalyst for economic progress in developing economies.

2.4.2 Empirical Gaps

Previous research has indicated a significant gap in the empirical examination of how seaport infrastructure impacts the relationship between logistics performance and GDP growth within Nigeria's manufacturing sector. This gap is particularly notable given the critical role that seaports play in facilitating trade and economic

development. The existing literature suggests that while there is recognition of the importance of port infrastructure in enhancing logistics capabilities, comprehensive studies that specifically address its moderating influence on the connection between logistics efficiency and economic indicators like GDP are scarce.

Seaports serve as vital nodes in global supply chains, and their efficiency can significantly affect a nation's trade dynamics. In Nigeria, where a substantial portion of trade is conducted via maritime routes, the state of port infrastructure directly influences logistics performance. Improved port facilities can lead to reduced shipping times and costs, which in turn enhances the competitiveness of local manufacturers. However, despite these theoretical underpinnings, empirical studies that quantitatively assess this relationship within the context of Nigeria's manufacturing sector remain limited.

The need for longitudinal empirical research is underscored by the complexity of interactions between logistics performance and GDP growth. Longitudinal studies allow for the observation of trends over time, providing insights into how changes in seaport infrastructure may correlate with shifts in economic performance metrics. Such research could illuminate not only direct effects, but also potential indirect effects mediated by logistics performance. For instance, if enhanced port facilities lead to improved logistics efficiency, this could subsequently stimulate greater economic activity and GDP growth in manufacturing sectors reliant on timely and cost-effective transportation.

Moreover, previous studies have pointed to a negative correlation between seaport efficiency and economic growth, suggesting that current levels of investment and reform may not be sufficient to drive positive outcomes in Nigeria's economic landscape. This finding highlights the urgency for further investment in port infrastructure to ensure that it meets the demands of modern trade and logistics operations. In examining how seaport infrastructure moderates the relationship between logistics performance and GDP growth, it is essential to consider various factors including cargo throughput, ship turnaround times, and liner shipping connectivity. These elements are critical indicators of port efficiency and directly influence the cost-effectiveness of logistics operations. For example, improvements in ship turnaround times can reduce delays and lower operational costs for manufacturers who depend on timely deliveries for their supply chains. Furthermore, increased cargo throughput can enhance economies of scale for shipping companies, leading to lower freight rates that benefit manufacturers.

Additionally, as Nigeria seeks to position itself as a competitive player in global trade, understanding the dynamics between seaport infrastructure and economic performance becomes increasingly important. Investments in port facilities not only enhance logistical capabilities but also attract foreign direct investment (FDI), which is crucial for economic expansion. FDI can lead to job creation, technology transfer, and increased productivity within the manufacturing sector. The presence of efficient

seaports can also foster an environment conducive to innovation by allowing manufacturers to access international markets more effectively.

The proposed research aims to fill this empirical gap by systematically investigating how variations in seaport infrastructure impact logistics performance and subsequently influence GDP growth within Nigeria's manufacturing sector. By employing robust methodologies such as regression analysis and utilizing comprehensive datasets over extended periods, this study will contribute valuable insights into the interplay between these critical variables.

Summarily, addressing the dearth of empirical studies on the role of seaport infrastructure in moderating the relationship between logistics performance and GDP growth is essential for informing policy decisions and investment strategies in Nigeria's manufacturing sector. As global trade continues to evolve, understanding these relationships will enable stakeholders to make informed choices that enhance economic resilience and foster sustainable growth through improved logistical frameworks. This research not only aims to contribute to academic discourse but also seeks to provide practical recommendations for policymakers aimed at optimizing Nigeria's maritime infrastructure to support robust economic development.

2.4.4 Practical Gaps

Policymakers and practitioners in Nigeria's industrial sector could use more actionable advice on how to boost the country's infrastructure, logistics performance, and economic growth. It is important to provide actionable suggestions that consider the specifics of the Nigeria's manufacturing sector and the difficulties it encounters in areas like infrastructure and logistics performance. This research aims to fill the gap left by previous studies by Munim and Schramm (2018), Song and Mi (2016), and Ogwo et al. (2016), which did not provide sufficient theoretical and practical advice.

Stakeholders in the Nigeria's industrial sector face an urgent need for actionable strategies to enhance the country's infrastructure, improve logistics performance, and stimulate economic growth. The manufacturing sector, which is crucial for Nigeria's economic diversification and development, has been grappling with various challenges that hinder its potential. This research aims to provide comprehensive insights into these challenges and offer practical recommendations tailored to the specific context of Nigeria's manufacturing landscape.

Nigeria's manufacturing sector has shown potential but is currently underperforming. As of the second quarter of 2024, it contributed only 8.46% to the national GDP, a decline from 8.62% the previous year, falling short of the Manufacturers Association of Nigeria's expectations of a 10% contribution. This stagnation can be attributed to several entrenched issues, particularly in infrastructure and logistics.

One of the most significant obstacles facing manufacturers in Nigeria is the persistent infrastructure deficit. Reliable electricity is a critical component for any manufacturing operation, yet many firms are forced to rely on expensive diesel generators due to inadequate power supply. This reliance inflates operational costs and diminishes competitiveness against foreign manufacturers who benefit from stable electricity provided by their governments. Furthermore, transportation infrastructure remains a major hurdle; poor road conditions and insufficient rail networks complicate the movement of goods, both raw materials to factories and finished products to markets, leading to increased costs and delayed delivery times.

The lack of effective logistical support exacerbates these challenges. For instance, materials requirements planning (MRP) becomes nearly impossible without consistent resources, resulting in production inefficiencies that further inflate costs. The current state of logistics in Nigeria ranks poorly on international indices; as of 2020, Nigeria was placed 131 out of 190 countries in terms of ease of doing business and 110 in the Logistics Performance Index. These rankings reflect systemic issues that require immediate attention.

Navigating Nigeria's manufacturing landscape is complicated by policy inconsistency and bureaucratic barriers. While there are government initiatives aimed at promoting industrial growth, their implementation often lacks continuity. Manufacturers may receive tax incentives one day only to face unexpected new regulations the next,

eroding trust and discouraging investment. The bureaucratic environment is fraught with red tape and corruption, leading to excessive delays in obtaining permits and clearing goods at ports. Such inefficiencies entangle businesses in compliance cycles rather than fostering production growth.

The financial landscape further complicates matters for manufacturers. High-interest rates imposed by banks create barriers to accessing credit, forcing many manufacturers to rely on costly bank borrowings to sustain operations. Recent reports indicate that exposure to bank borrowings among leading Nigerian companies increased by 24.5% in the first half of 2023 compared to the previous year, with finance costs rising dramatically. This financial strain hinders innovation and long-term planning within the sector.

To address these multifaceted challenges effectively, there is a pressing need for more research focused on the moderating effects of seaport infrastructure on logistics performance and economic growth within Nigeria's manufacturing sector. Current literature lacks sufficient theoretical frameworks that integrate seaport infrastructure with logistics performance and economic growth dynamics. A quantitative approach utilizing a longitudinal design could yield valuable insights into how improvements in seaport infrastructure can enhance overall logistics performance, thereby contributing to economic growth.

Seaports play a critical role in facilitating trade and logistics; thus, understanding their impact on manufacturing efficiency is essential. As Nigeria continues to engage with bilateral and multilateral trade agreements such as those under the African Continental Free Trade Area (AfCFTA), improving port infrastructure could significantly enhance trade facilitation and competitiveness. However, successful implementation hinges on addressing existing infrastructural deficits. To foster a more conducive environment for manufacturing growth in Nigeria, several actionable recommendations can be proposed:

Invest in Infrastructure Development: Prioritize investments in electricity generation and distribution networks to reduce dependence on self-generated power among manufacturers. Additionally, upgrading road networks and rail systems will facilitate smoother transportation of goods.

Streamline Regulatory Processes: Simplify administrative procedures related to business operations by reducing bureaucratic hurdles and enhancing transparency in regulatory frameworks. This could involve digitizing processes for permit applications and goods clearance at ports.

Implement Consistent Policies: Establish clear and consistent industrial policies that provide long-term incentives for manufacturers while minimizing abrupt changes that could disrupt operations.

Enhance Financial Support Systems: Develop financial instruments tailored to the needs of manufacturers, such as low-interest loans or grants for infrastructure improvements. Encouraging alternative financing options like commercial papers can also alleviate pressure from high-interest bank loans.

Foster Public-Private Partnerships (PPPs): Encourage collaboration between government entities and private sector stakeholders to jointly invest in infrastructure projects that benefit the manufacturing sector.

Focus on Skills Development: Invest in training programs aimed at enhancing the skills of the workforce within the manufacturing sector, ensuring that employees are equipped with relevant knowledge and competencies.

Leverage Technology: Promote digital solutions within logistics operations to improve efficiency, reduce costs, and enhance supply chain visibility.

Conduct Regular Research: Establish a framework for ongoing research into logistics performance metrics and their correlation with economic growth indicators specific to Nigeria's context.

By implementing these recommendations, Nigerian policymakers can create a more favorable environment for manufacturing growth while simultaneously addressing logistical challenges that inhibit competitiveness.

Overall, there is a need for more research that investigates the moderating effects of seaport infrastructure on the relationship between logistics performance and economic growth in the Nigeria's manufacturing sector, using a quantitative approach and a longitudinal design. Additionally, there is a need for theoretical frameworks that integrate the concepts of seaport infrastructure, logistics performance, and economic growth, as well as practical recommendations for policymakers and practitioners in Nigeria and other developing countries. Hence the framework presented below for the study.

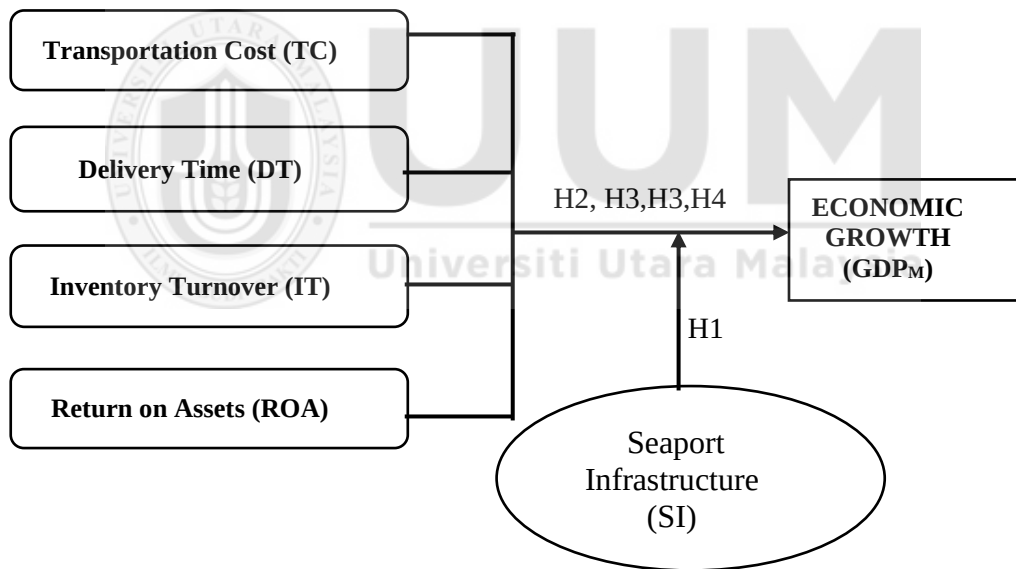


Figure 2.2 *Conceptual Framework for the Study.*

Description of the Framework:

This conceptual framework illustrates the relationships between transportation cost (TC), delivery turnover (DT), inventory turnover (IT), and return on assets (ROA) as

independent variables, on the economic growth of the manufacturing sector (GDP_m) as the dependent variable, and seaport infrastructure (SI) as the moderating variable.

Dependent Variable: This is the variable that is being explained or predicted. Here, the economic growth of the manufacturing sector (GDP_m) is the dependent variable. Its value is hypothesized to be affected by the independent variables. The GDP was used to gauge the manufacturing sector's economic growth in Nigeria. This was presented as GDP_M

Independent Variables: These are the variables that are believed to influence the dependent variable. In this case, TC, DT, IT, and ROA are expected to have a direct impact on the economic growth of the manufacturing sector. Logistics performance measurement of transportation cost, delivery time, inventory turnover, and return on assets were adopted as proxies for logistic performance measurement and evaluation. The use of these variables as LP variables is consistent with previous studies.

- i. TC (Transportation Cost): Represents the expenses incurred in moving goods.
- ii. DT (Delivery Turnover): Indicates how efficiently goods are delivered.
- iii. IT (Inventory Turnover): Measures how efficiently inventory is managed.
- iv. ROA (Return on Assets): Reflects the profitability generated from a company's assets.

Moderating Variable: This variable influences the strength or direction of the relationship between the independent and dependent variables. Seaport infrastructure (SI) moderates the relationship between the independent variables (TC, DT, IT, ROA) and the dependent variable (GDPm). This means that the impact of transportation cost, delivery turnover, inventory turnover, and return on assets on economic growth may be different depending on the state of the seaport infrastructure. For example, good seaport infrastructure may amplify the positive effects of efficient delivery turnover, while poor infrastructure may hinder these effects. Regression analysis (panel) was used to examine the moderating role that seaport infrastructure has in the link between logistics efficiency and economic growth. For this study, investment in the seaport infrastructure serves as a proxy for the moderating variable. The investigation looks at whether having high- or low-quality seaport infrastructure affects the strength or weakness of the link between logistics performance and economic growth.

The distinction in this study is that no previous studies have used the four variables together to measure economic performance. Again, the study novelty lies in the introduction of seaport infrastructure as a moderating variable in studying the relationship between the IV and the DV.

2.5 Summary.

Chapter Two provides a comprehensive review of the literature related to logistics performance and its impact on economic growth, with a specific focus on Nigeria's manufacturing sector. The chapter begins by discussing the theoretical frameworks that underpin the study. Looking at holistic overview of the subject matter, the resource-based theory (RBT) was adopted and supported by the theory of constraints (TC). These theories are sufficient in the explanation of performance relating to competitive advantage as it is in this study and also serve as economic growth models. The chapter highlights the critical role of logistics performance in enhancing operational efficiency, reducing costs, and facilitating trade.

The chapter reviews empirical studies that examine various dimensions of logistics performance, such as inventory turnover, transportation costs, and delivery times, and their correlation with economic indicators like GDP growth and employment rates. It emphasizes the importance of seaport infrastructure as a key factor influencing logistics performance, particularly in the context of Nigeria, where port congestion and inefficiencies have historically hindered economic development.

Furthermore, the chapter identifies gaps in the existing literature, particularly regarding the specific mechanisms through which logistics performance affects economic outcomes in emerging markets. It sets the stage for the empirical analysis conducted in subsequent chapters by establishing a clear rationale for investigating

these relationships within Nigeria's manufacturing sector. Overall, this chapter lays a solid foundation for understanding how improved logistics can drive economic growth and competitiveness in the region.



CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter lays forth an overarching plan for how the study's outcomes might be attained via data gathering and analysis. It discusses the study's rationale, methodology, research design, population, sample and sampling techniques, data collection, data analysis, and reporting procedures.

3.1 Model Specification/Hypotheses Formulation

This study comparatively applies fixed and random effect models of panel data regression analysis as presented below:

According to Qin and Al Amin (2022), Statistical approaches such as fixed and random effects models are applied in panel data analysis, which involves taking repeated measurements of the same participants over time. The researcher argued that the models aid in adjusting for factors that are not seen but might skew findings.

The fixed effects model postulates that the dependent variable may be influenced by unique traits that do not vary over time. This model allows for the existence of individual (or entity) intercepts, which accounts for these features. It involves.

Estimation: By analyzing changes in people across time, it estimates the impact of predictors by considering each person as an independent variable.

Assumptions: To enable consistent parameter estimation, the model requires that the variables that are included and those that are excluded are associated. However, because the impacts of time-invariant variables are absorbed by the individual intercepts, it is unable to assess them.

Application: This model comes in very handy when trying to figure out how individual modifications affect the result variable.

The random effects model, on the other hand, assumes that individual-specific effects have no relationship to the model's independent variables. As a result, time-invariant variables can be included. Important characteristics consist of:

Estimation: Taking into consideration both within- and between-individual variances, the random effects model estimates a common impact for every person.

Assumptions: If this assumption is broken, it may result in results that are skewed since unobserved individual attributes are assumed to be uncorrelated with observable predictors.

Application: When researchers think that individual differences are random and not consistently correlated with the predictors, this model is considered.

The Hausman test is a popular tool used by researchers to choose between fixed and random effects models. This statistical test assesses if there is a correlation between the regressors and the unique mistakes. Fixed effects are recommended if they are associated; if not, random effects could be a better fit because of how well they provide estimates.

In summary, there are specific uses for both fixed and random effects models in statistical research, especially when working with panel data. The type of data being used, and the particular research questions being answered will determine which option is best.

$$Y_{it} = \alpha_0 + \beta_1 X_{it} + \delta_i + \mu_{it} \dots \dots \dots (i)$$

δ_i is a time-varying intercept which takes all the variables that affect Y_{it} , vary over time but cross-sectionally constant. In replacing the variables under consideration into the fixed effect model, it will appear as shown below:

$$GDP_{it} = \alpha_0 + \beta_1 PIF_{it} + \beta_2 HTC_{it} + \beta_3 DTG_{it} + \beta_4 INT_{it} + \beta_5 ROA_{it} + \delta_i + \mu_{it} \dots \dots \dots (ii)$$

where:

GDP_M is the Gross Domestic Product of the Manufacturing Sector as (a proxy for economic growth),

PIF refers to Port Infrastructure, (Port Investment)

HTC is the High Transportation Costs,

DTG is Delivery Time of Good

INT is the Inventory Turnover

ROA is Return on Assets

$\beta_1, \dots, \beta_5$ are the coefficients of the explanatory variables. In addition, a_0 is the Intercept (i.e. the value of economic growth when neither Infrastructure nor the other explanatory variables were zero).

The random effect model follows the forms presented below:

Where: $Y_{it} = a_0 + \beta_1 X_{it} + W_{it} = (\epsilon_{it} + \mu_{it}) \dots \dots \dots (iii)$

ϵ_{it} calculates the standard deviation of the data from the world average; a , subscript “it” symbolizes the intersection of time and identity. μ_{it} mean error term. When the relevant variables are substituted into the fixed effect model, the results look like this:

$$GDP_{it} = a_0 + \beta_1 PIF_{it} + \beta_2 HTC_{it} + \beta_3 DTG_{it} + \beta_4 INT_{it} + \beta_5 ROA_{it} + (\epsilon_{it} + \mu_{it}) \dots \dots \dots (iv)$$

Egbide and Enyi (2008) introduced the Hausman test, which is used to choose between the two models. With the Null hypothesis H_0 claiming that the Random Effects are superior, consistent, and efficient, and the Alternative hypothesis H_1 indicating that the Fixed Effects are superior, consistent, and efficient, this test offers a distance measure between the Random Effect Model and the Fixed Effect Model.

3.1.1 Research Hypotheses

The study's hypotheses, (stated in alternative forms) were tested for decision making and policy formulation purposes.

- i. H1: The quality of Infrastructure (port investment) significantly moderates the relationship between logistics performance and economic growth in Nigeria's manufacturing sector.
- ii. H2: There is statistically significant effect of high transportation costs on economic growth in the Nigeria's manufacturing sector.
- iii. H3: There is statistically significant effect of the delivery time of goods on economic growth in the Nigeria's manufacturing sector.
- iv. H4: There is statistically significant effect of inventory turnover on economic growth in the Nigeria's manufacturing sector.
- v. H5: There is statistically significant effect of return on assets on economic growth in the Nigeria's manufacturing sector.

Relating Hypotheses to the Conceptual Framework: Direct and Moderated Effects on Manufacturing Sector Growth

This framework proposes that transportation costs, delivery efficiency, inventory management, and asset profitability drive economic growth in the manufacturing sector, with the quality and capacity of seaport infrastructure shaping the effectiveness of these drivers.

As illustrated in figure 2.2, "TC, DT, IT, and ROA directly influence economic growth, as indicated by the arrow connecting them to GDPm. Seaport Infrastructure (SI) moderates the relationship between the independent variables and economic growth, altering the strength or direction of their impact. Seaport Infrastructure (SI) directly impacts economic growth (GDPm).

This framework proposes that transportation costs, delivery efficiency, inventory management, and asset profitability drive economic growth in the manufacturing sector, with the quality and capacity of seaport infrastructure shaping the effectiveness of these drivers."

The Role of each Component in Driving Economic Growth

i. Transportation Costs (TC)

Impact on Growth: High transportation costs can significantly increase operational expenses for manufacturers, potentially reducing profit margins and competitiveness. Conversely, efficient transportation systems can lower costs and enhance supply chain reliability.

Role in Framework: In the proposed framework, TC directly affects GDPm (manufacturing sector GDP), as reduced TC can lead to increased production output due to lower operational costs.

ii. **Delivery Efficiency (DT)**

Impact on Growth: Efficient delivery systems ensure timely product distribution to markets, improving customer satisfaction and enabling businesses to respond quickly to market demands.

Role in Framework: DT directly influences GDPm by ensuring that products reach consumers promptly, thereby enhancing market responsiveness.

iii. **Inventory Management (IT)**

Impact on Growth: Effective inventory management minimizes stockouts or overstocking issues, optimizing resource allocation within manufacturing firms.

Role in Framework: IT impacts GDPm by maintaining optimal inventory levels that support continuous production without unnecessary waste or shortages.

iv. **Asset Profitability (ROA)**

Impact on Growth: Higher ROA indicates better utilization of assets for generating profits, which can be reinvested into business expansion or innovation.

Role in Framework: ROA directly contributes to GDPm by maximizing returns from existing assets.

v. **Moderating Role of Seaport Infrastructure**

The quality and capacity of seaport infrastructure play a crucial moderating role between these drivers and economic growth:

How It Moderates the relationship between the IVs and the DV:

Seaport Infrastructure enhances the effectiveness of TC by facilitating smoother cargo handling processes; improves DT through faster turnaround times; supports IT by enabling more predictable supply chains; and boosts ROA through efficient logistics operations that reduce asset idle time.

Direct Impact: Beyond moderation, high-quality seaport infrastructure also has a direct positive effect on economic growth by attracting investment due to its strategic importance for international trade

The proposed framework convincingly argues that these factors are critical because they address both operational efficiency within manufacturing firms (through reduced TCs and improved DTs) and strategic advantages like enhanced asset utilization. Moreover, the moderating influence of seaport infrastructure underscores its pivotal role in amplifying these effects towards achieving sustainable economic growth.

Key Issues for consideration:

- i. Transportation Costs reduction enhances competitiveness.
- ii. Delivery Efficiency ensures timely market response.
- iii. Inventory Management optimizes resource use.
- iv. Asset Profitability maximizes returns for reinvestment.
- v. Seaport Infrastructure moderates these effects while contributing directly to economic vitality.

By integrating these elements into a cohesive strategy focused on optimizing logistical operations while leveraging advanced port facilities as catalysts for broader industrial development; countries can foster robust manufacturing sectors capable of driving sustained national prosperity

3.2 Research Design

A research design is an overarching plan outlining the steps that will be taken by the researcher to answer the questions posed by the investigation. Research design refers to the overall strategy used to integrate the different components of a study in a coherent and logical way, ensuring that the research problem is effectively addressed. It constitutes the blueprint for the collection, measurement, and analysis of data (Creswell, J. W., & Creswell, J. D., 2018).

The research designs used in this study include both descriptive and ex-post facto methodologies. On one hand, a descriptive research strategy that includes the use of graphical drawings was utilized to explain the many factors of interest. The capacity of this design to analyze both big and small populations via the selection and analysis of samples drawn from those populations to find the relative incidence, distribution, and interrelationships of sociological and psychological factors played a role in the decision to go with this design.

In addition to this, it is a hypothesis-based approach that specifies the core subject matter of the study and attempts to examine whether the use of certain assumptions and procedures will be adequate. This methodology employs data collection techniques which include natural observation, case studies, and surveys to attain the intended findings. Furthermore, the design is optimal as the research was performed inside a limited geographic area.

On the other hand, the precise meaning of the phrase ex-post facto is "from what is done afterward the ex-post facto research design, also known as causal-comparative research, is used to establish a causal link between the dependent and independent variables,".

As opined by Lawrence, F. P. (2023), causal comparative research, also known as ex-post facto research, is a methodology used to identify cause-effect relationships between independent and dependent variables. This approach is particularly useful in social research contexts where manipulating the characteristics of human participants is unfeasible or inappropriate. The selection of these two-research design was made to allow for the triangulation of different approaches to data collection.

3.2.1 Research Design Flow Chat

Understanding the overall research process is crucial for interpreting the findings. Figure 3.1 presents a flowchart illustrating the research design, providing a clear roadmap of the study from inception to analysis.

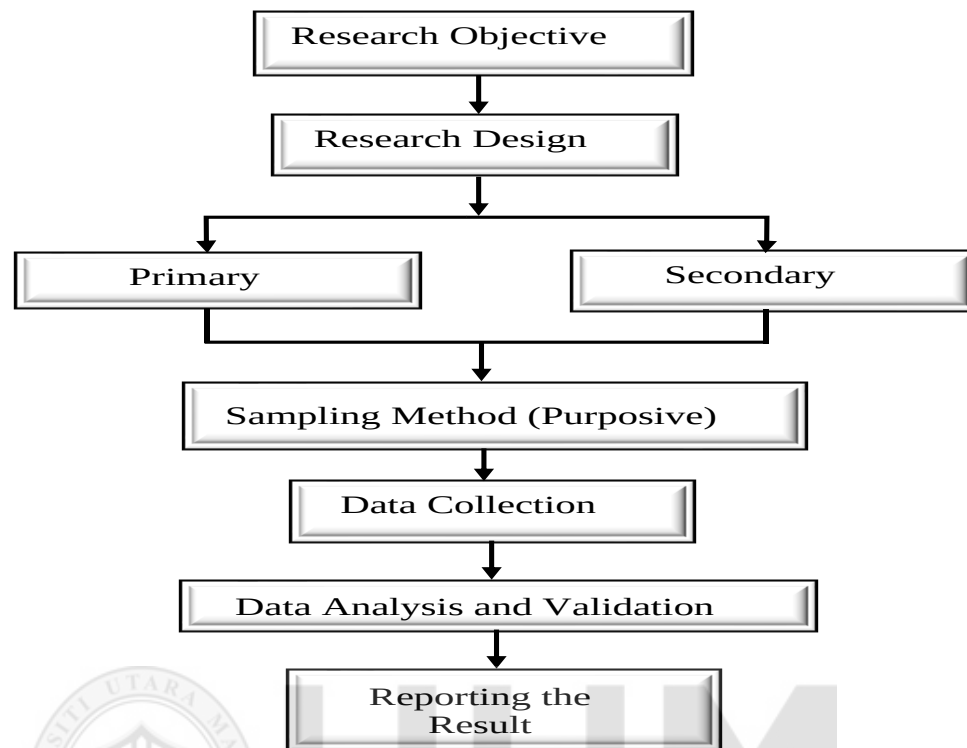


Figure 3.1: Research Design Flow Chat

As shown in figure 3.1 above, the research design of following steps:

i. Research Objective:

Investigate the relationship between logistics performance and economic growth in Nigeria's manufacturing sector and the roles of seaport investment in this relationship

ii. Research Design:

a. Descriptive Research:

Utilize graphical representations to illustrate key factors.

Analyze both large and small populations through sample selection.

Employ hypothesis-based approaches to examine core subject matter.

b. Ex-Post Facto Research (Causal Comparative):

Establish causal links between dependent (economic growth) and independent variables (logistics performance indicators).

Identify cause-effect relationships without manipulating participant characteristics.

iii. Data Collection:

Primary Data:

Conduct interviews with logistics and supply chain personnel using open-ended questions.

Secondary Data:

Gather data from reputable sources such as the National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN).

iv. Sampling Method:

Purposive sampling of 11 manufacturing firms listed on the Nigeria Exchange Group from 2012 to 2022.

v. Data Analysis:

Apply fixed and random effects models for panel data regression analysis.

Utilize the Hausman test to determine the appropriate model based on correlations between regressors and unique errors.

vi. Expected Outcomes:

Insights into how logistics performance influences economic growth in Nigeria's manufacturing sector.

Identification of key factors affecting logistics efficiency and their implications for economic development.

This step outlines the systematic approach taken in the study, integrating descriptive and ex-post facto methodologies to effectively address the research questions and objectives.

3.3 Measurements, and Instrumentation of Variables

3.3.1 Sea Port Investment:

Investment is a variable that refers to the amount of capital invested in the development and improvement of infrastructure (Rodrigue & Notteboom, 2020). This is measured by the amount of expenditure (capital) on the development and enhancement of seaport infrastructures in Nigeria year on year within the period under review. The data were obtained from the National Bureau of Statistics (NBS), in Nigeria. For this thesis, the seaport investment was adopted as a proxy for seaport infrastructure. It serves as a moderating variable in the study.

3.3.2 Transportation Cost

It is a variable that refers to the cost associated with moving goods from one location to another. It is a crucial component of logistics performance, as it can have a significant impact on the overall cost of moving goods through the supply chain

(UNESCAP, 2002). It was measured by carrier invoices, and the data was obtained from the Manufacturing Statistics Report (MSR) in Nigeria. It serves as one of the independent variables to this study.

3.3.3 Delivery Time

It is a variable that refers to the amount of time it takes for goods to be delivered from the point of origin to their destination (Sarder, 2021). It is an essential component of logistics performance, as it can have a significant impact on customer satisfaction and the overall cost of moving goods through the supply chain. It is measured by Shipping time. World Bank's WDI data shall be obtained to measure this variable.

3.3.4 Inventory Turnover

It is a variable that measures how many times inventory is sold and then replaced in a specific period (Rodrigue & Notteboom, 2020). It is a critical measure of business performance, cost management, and sales. The Inventory Turnover Ratio was used as a stand-in, with numbers culled from the CBN's statistics bulletin.

3.3.5 Return on Assets (ROA)

It is a variable that measures how efficiently a company uses its assets to generate profits. It is a crucial measure of business performance and can be used to evaluate

logistics performance (Hargrave, 2022). It was measured by ROA ratio and the data was obtained from WDI.

3.3.6 Economic Growth

Growth in the economy occurs when the output of economic commodities and services rises from one period to the next. The value added by Nigeria's manufacturing sector to the country's GDP serves as a proxy. CBN's statistical report was mined for the necessary information.

3.4 Population/Sampling

The qualitative component of this thesis includes the selection of 11 manufacturing firms from the total of 71 manufacturing firms listed on the Nigeria Exchange Group during the specified time 2012-2022.

This selection was conducted using purposive sampling methodology. Purposive sampling is a sampling approach that falls under the category of non-probability sampling. It involves the deliberate selection of units by the researcher based on certain qualities or attributes that are deemed important to the research inquiry (Nikolopoulou, K. 2022).

The respondents were heads of logistics and supply officers and other senior staff in the 11 manufacturing firms in Nigeria that are registered with the Nigeria Exchange Group. This is to allow for valid information on the subject matter as this information is only available to top-level managers and administrators as mentioned above. To this end, the need to sample these categories of respondents using the above sampling method is eminent as it demonstrates efficacy in conducting comprehensive examinations of minute samples. The use of this approach is often seen in qualitative as well as mixed-method and/or triangulation research, with the potential to focus on a particular demographic group, Black (2010).

Therefore, the researcher's choice of this sampling technique is based on the objectives to be accomplished, due to the distinct characteristics stated earlier in 1.6 under the scope of the study. This approach is used when researchers know the specific qualities or attributes they want to investigate and seek to choose a sample that accurately represents these characteristics.

In this study, the researcher validates secondary data with the primary source and does not necessarily do a mixed method of analysis with the two data sets. This is one aspect, that triangulation could be employed. It is important to recognize that the concept of triangulation should not be conflated with mixed methods of data analysis. O'Cathain et al. (2017) and (2020) provide definitions for mixed data analysis and triangulation, highlighting their interconnectedness while also emphasizing their distinctiveness.

In their view, mixed methods research integrates qualitative and quantitative approaches to enhance the comprehensiveness of the investigation and get a more holistic grasp of the study topic while triangulation is a research approach that involves the utilization of several datasets, procedures, theories, and/or investigators to address a specific study issue (Scribbr, 2022; Hannes & Lockwood, 2011; Flick, 2018). This approach has the potential to validate or corroborate the findings of another dataset (O'Cathain et al. 2017). This is in line with what this study intends to achieve.

The selection of the manufacturing firms was based on the criterion of being listed on the Nigeria Exchange Group consistently throughout the years under review 2012-2022 to ensure consistency of data from all the firms.

Similarly, the choice of Lagos is motivated by varieties of reasons. Apart from the fact that all the manufacturing firms have their head offices in Lagos, all the operational seaports which are Lagos, Apapa, and Tincan seaports, are also in Lagos. Lagos is also the epicenter of economic activities and the commercial hub of the country. According to reports by Africa Facts Zone 2022, Lagos state is responsible for approximately 30 percent of Nigeria's GDP, or approximately \$136 billion of the country's total \$500 billion GDP. As a result, Lagos has an economy that is larger than that of about 46 of the 54 countries that make up the continent of Africa, placing it as

the continent's seventh-largest economy. To this purpose, Lagos is adequate as the scope of this study.

It should be noted that the population consists of 71 manufacturing firms listed on the Nigeria Exchange Group, from which 11 firms were purposively selected based on their consistent operations during the study period.

Table 3.2
Population Classification

S/N	COMPANY NAME	STAFF POPULATION
1	Pacific Diagnostics Ltd	N ₁
2	Crystal Skin Ventures Ltd	N ₂
3	Nigeria Machine Tools Limited	N ₃
4	Nestle Nigeria Plc	N ₄
5	Honeywell Flour Mills Plc	N ₅
6	Dag Industries Nigeria Limited (Bajaj)	N ₆
7	Stallion Nigeria Limited	N ₇
8	Reliance Chemical Products Limited	N ₈
9	Cadbury Nigeria Plc	N ₉
10	Unilever Nigeria Plc	N ₁₀
11	PZ Cussons Nigeria Plc	N ₁₁

Source: *Nigeria's Stock Exchange-2022*

3.5 Data Collection Procedure

The study utilizes both primary and secondary data to have a clear picture of the happenings in the selected manufacturing companies on the variables of interest. To begin, the primary data collection procedure is anchored on interview, which was

carried out with the heads of logistics and supply officers and other senior staff in the 11 manufacturing firms in Nigeria that are registered on the Nigeria Exchange Group. This research will make use of open-ended questions.

Open-ended are questions to which respondents are not limited in their replies and provide respondents with the opportunity to answer questions based on their own experiences. (e.g., In your opinion, how do the logistics services impact the growth of the Manufacturing sector GDP?). This thesis was given the needed validity, credibility, and authenticity because of the replies of the interviewers which is in tandem with the result of the analyzed data as reported immediately beneath the discussion of the secondary data's results.

On the other hand, secondary data were sourced from the world economic indicators of the world bank as it relates to logistics performance indicators, the Central Bank of Nigeria (CBN) statistical bulletin, the National Bureau of Statistics (NBS)-Nigeria, and the Federal ministry of transportation annual statistical reports. These sets of data were collected on the dependent, moderating, and independent variables to allow for statistical data analysis.

3.6 Interview Protocol

44 key informants, 4 from each manufacturing company, participated in in-depth interviews about the important factors to improve the collection of data on the variables being examined. As a result, the key informants include heads of the supply chain and logistics departments, depending on the office's name in various companies, heads of accounts in some organizations, and inventory managers or officers as the case may be.

Selection Criteria of Key Informants

Relevance to the Study: The selection of key informants was based on their ability to provide valuable insights into the data collection process for the variables being examined. This includes individuals with roles directly related to data management, such as heads of supply chain and logistics departments, heads of accounts, inventory managers, or officers.

Diversity in Perspectives: To ensure a comprehensive understanding, it was crucial to select individuals from different departments or roles within each company. To this end the need for more than one person per firm is adequate.

Selecting four key informants from each manufacturing company allows for a balanced representation of diverse perspectives while maintaining manageability in terms of data collection and analysis:

Depth vs. Breadth Trade-off: Interviewing more than four could lead to redundancy without adding significant new insights due to time constraints.

Resource Efficiency: Conducting interviews with fewer than four might not capture all relevant viewpoints within a company.

Saturation Point Achievement: In qualitative research, achieving thematic saturation is crucial; interviewing four diverse stakeholders can help reach this point efficiently.

Formulaic Approach

In qualitative research, there isn't a strict formula like in quantitative studies. However, we can use guidelines based on "rules of thumb" or conceptual models that consider factors such as study scope and participant characteristics.

Conceptual Model Approach

Given that the study aims at understanding specific factors across multiple companies (narrow scope), the researcher focused on achieving thematic saturation efficiently by selecting participants who are most knowledgeable about these factors (specificity). High specificity is needed since the researcher is targeting specific roles like Cost, Delivery, Inventory, Profitability etc.

Achieving a moderate and manageable number is essential. However, since there isn't a direct formula provided for calculating exactly 4 participants per firm based solely on these criteria without additional context like desired confidence levels or theme emergence rates, the researcher relies heavily on practical considerations such as resource constraints and expected depth vs breadth trade-offs mentioned earlier.

Having Considered 44 to be a manageable number, the researcher assumed (N) total participants across (M) firms with K participants per firm ($N=M \times K$). (N=44) across 11 firms (M=11), aiming for thematic saturation efficiently by selecting knowledgeable stakeholders:

Hence:-
 $N=M \times K$
 $44=11 \times K$
 $K=44/11$
 $K=4$.

Table 3.3:
Details of the informants' demographics

Demographic	Features	Number
Gender	Male	32
	Female	12
Age	40 -46	4
	47-55	30
	56-65	10
Qualifications	Ph.D	3
	M.Sc	6
	MBA	16
	Others	20
Total		44

The respondents include 32 men and 12 women, and according to the above table, their ages fall into the following categories: 40–46 years old (four), 47–55 years old (30), and 56–65 years old (10). As a result, responders had advanced knowledge, as is typical of senior executives in a company, as the table shows. There were three PhD holders, six M.Sc. holders, sixteen MBA holders, and twenty individuals with a first degree and other professional qualifications.

These are all of the steps or procedures that are part of the interview process. As previously stated, thorough in-person contact was used for the interview. Accordingly, all procedures outlined in the interview protocols were observed and adhered to by the researcher throughout the interview.

These procedures, which involve preparing, strategizing, or mapping for conducting a successful interview, including building strong bonds and positive interactions with the respondents, were closely followed. Other considerations that the researcher took into account were starting the interview on schedule, paying close attention, asking questions, taking notes on important details, attempting to learn more, and staying within the allotted time. In a similar vein, the researcher employed devices like recording devices for the interview and a notebook for taking the necessary notes. Prominent research methodologies experts, such as Creswell (2008) and McNamara (2009), outlined eight guidelines for organizing and designing an interview protocol in order to support the implementation of the aforementioned:

- i. Stating the reasons for the interview.
- ii. Guaranteeing confidentiality
- iii. Clarifying the interview arrangement,
- iv. Stating the period for the interview
- v. Choosing a place with minimal or no interruption
- vi. Stating and clarifying what to do or the way to follow.
- vii. Find out if there are questions before the beginning of that interview.
- viii. Use an audio recorder during the interview.

The above principles were adhered to in carrying out this interview with an industry expert. However, the use of Audio recorders with respondents was a major concern with many respondents. To respect this privacy, the researcher guaranteed them to ensure that the information is being recorded for reference and shall not be put to public in any manner. Most respondents were also not open to photography, the researcher therefore dropped the idea of taking photos completely.

The introduction letter from UUM_COB indicating that the researcher is a student at the College of Business, Universiti Utara Malaysia undertaking research regarding the role of seaport infrastructure enhancing the relationship between logistics performance and economic growth in the Nigeria manufacturing sector was pivotal to securing all the interviewees approvals and virtually made the respondents interact with the interviewer freely.

Consequently, after the various organizations granted verbal permission, the researcher commenced the initial phase of the interview by presenting himself to the organization's relevant experts assigned to him. The interview was carried out in July 2023. The researcher explained the rationale behind the interview to all respondents, including the significance and confidentiality of all the data gathered. The candidate further affirmed to his key informants or respondents that the interview was primarily from an academic perspective.

Furthermore, the interview was an in-depth, face-to-face interview with the key informants. Before the interview, the candidate had written various memos to different organizations of high authorities soliciting their approval to interview experts or relevant staff in line with his research topic. However, no official approval was granted. Some organizations contacted the researcher to come on a specific date to meet the respondents without official documentation. In some cases, the researcher had to make extra efforts through a third party to secure access to some firms.

Similarly, the researcher had a pre-interview session with some of the interviewees, which helped them to ask questions related to the research title preceding and to the commencement of the interview.

With the interviewees' consent, voices were recorded through a midget device. The researcher collected their phone contact information for future correspondence or if the need to seek more clarifications arises. Additionally, during the interview, a

notepad was used to take notes where necessary, and the interviews were conducted between 1hr and 2 hours for each respondent.

3.7 Methods and Techniques of Data Analysis

When choosing a data source, it is important to consider not just its accessibility, but also the data's quality and the degree to which it encompasses the relevant variables for the research inquiry (Cooke & Iwashyna, 2013). A comprehensive guide for selecting data collection techniques for academic and business research has been proposed (Hamed, 2022).

As illustrated in section 3.5 paragraph 1 above, the interview was used to collect primary data, and the analysis is based on qualitative assumptions to give validity to the statistical analysis that was performed on the secondary data using E-view (version 10).

E-view is designed for time series-oriented econometric analysis and is widely used in finance, economics, and business research. It is utilized for general statistical analysis, cross-sectional and panel data analysis, and estimation and forecasting of time series. This makes it appropriate for this study. It features a wide variety of tools designed to facilitate working with both panel and pooled/time series-cross-sectional data. It allows work files from Excel, STATA, SPSS, etc., to perform a range of tests like

Unit root test to check stationarity, GARCH tests for heteroscedasticity, autocorrelation LaGrange multiplier (LM) test, Granger causality test and least square test for linear regression analysis.

GDP is used as the surrogate for economic growth by consulting the World Bank's Development Indicator (WDI), with a focus on manufacturing sector contribution to GDP in Nigeria. In this study, GDP is the dependent variable, while the explanatory variables include the moderating variable of Seaport Infrastructure (PIF) and the logistics performance indicators- which include High Transportation Cost (HTC), Delivery Time of Goods (DTG), Inventory Turnover (INT) and Return on Assets (ROA). Thereafter, the study comparatively applies fixed and random effect models of panel data regression analysis, which was specified in eq(i) through eq(iv).

Panel data, as defined by Qin and Al Amin (2022) and Baltagi (2021), pertains to a collection of data including several entities, denoted as "n," observed throughout various time periods. These entities may include states, businesses, people, nations, and other similar units. Bollen and Brand (2010) assert that fixed-effects and random-effects models are prevalent in panel data analysis. Various scholars have different perspectives on the advancement of these two models. According to Richard (2018), the Fixed-effects model is a valuable tool since it effectively addresses the issue of individual heterogeneity by including a binary variable for each person inside the dataset.

Additionally, this method proves to be valuable when the emphasis is placed on variance within a certain group and may be used to approximate causal effects (Lam, O. 2017). The model permits the inclusion of time-invariant variables (Qin & Al Amin, 2022). In contrast, it has been argued that random effect models exhibit more efficiency compared to fixed-effects models in situations when there is a high number of people (Richard, 2018). Additionally, random effect models are seen more advantageous when the primary emphasis is on between-group variance (Bell, A., & Jones, K. 2015). The selection between fixed-effects and random-effects models is contingent upon the specific research inquiry and the characteristics of the data under examination.

According to Bell and Jones (2015), Fixed-effects models are often favored in situations where the primary interest is in examining variance within groups, while random-effects models are typically favored where the primary focus is on examining variation across groups. In the present investigation, it is plausible that the utilization of fixed/random effect is appropriate. Nevertheless, the researcher has used the Hausman test, a statistical tool employed to ascertain the optimal model choice between the two alternatives, to validate their selection for the study.

3.8 Summary

Chapter Three outlines the research methodology employed in the study, detailing the systematic approach for data collection and analysis aimed at examining the

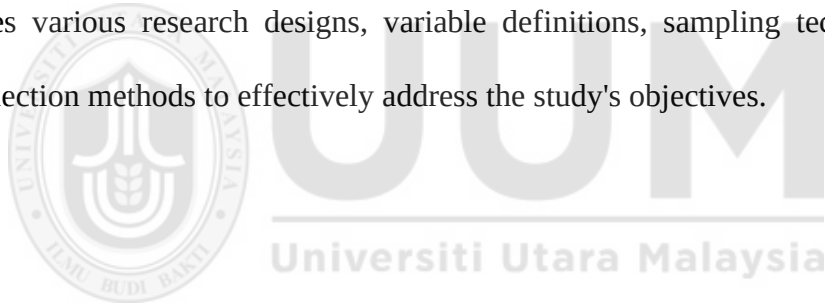
relationship between logistics performance and economic growth in Nigeria's manufacturing sector. The chapter begins by establishing a framework for achieving the study's objectives through model specification and hypothesis formulation, discussing the application of fixed and random effects models for panel data regression analysis. These models are crucial for adjusting for unobserved factors that could skew findings, with the Hausman test serving as a tool to determine the appropriate model based on correlations between regressors and errors.

The chapter presents several research hypotheses that guide the investigation, focusing on how various logistics performance indicators, which serve as variables for measuring the research impact economic growth. The research design combines descriptive and ex-post facto methodologies to comprehensively address the research questions. Descriptive strategies, including graphical representations, are used to analyze sociological and psychological factors, while ex-post facto design establishes causal links between independent and dependent variables without manipulating participant characteristics.

Key variables are defined and measured, including seaport investment, transportation costs, delivery time, inventory turnover, return on assets (ROA), and economic growth as represented by the manufacturing sector's contribution to GDP. The study employs purposive sampling to select 11 manufacturing firms from a total of 71 Manufacturing firms, listed on the Nigeria Exchange Group between 2012 and 2022.

This sampling method ensures that respondents, primarily heads of logistics and supply officers, provide relevant insights into logistics performance.

Data collection involves both primary and secondary sources. Primary data are gathered through interviews using open-ended questions that allow respondents to share their experiences regarding logistics services' impact on economic growth. Secondary data are sourced from reputable organizations such as the National Bureau of Statistics (NBS) and the Central Bank of Nigeria (CBN), ensuring a robust dataset for analysis. Overall, Chapter Three establishes a comprehensive methodology that integrates various research designs, variable definitions, sampling techniques, and data collection methods to effectively address the study's objectives.



CHAPTER FOUR

ANALYSIS AND FINDINGS

4.0 Introduction

In this chapter, the researcher delved into the results of the study and engaged in a comprehensive discussion of their implications. The findings presented here illuminate the core objectives of the study. Also, it provides a deeper understanding of the underlying phenomena. By systematically analyzing the data collected, the researcher drew meaningful conclusions that contributed to the existing body of knowledge.

Furthermore, the study contextualized these results within the framework of relevant literature, fostering a dialogue between the researcher's findings and previous studies. Through critical analysis, the study explores the significance of these results, addressing both their practical applications and theoretical implications. This chapter serves as a bridge between empirical evidence and scholarly discourse, paving the way for future research directions.

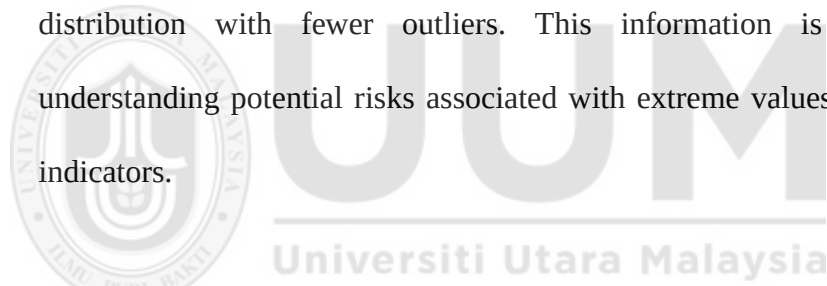
Specifically, the researcher follows the standard process of analysis especially when fixed and random effect models of panel data regression analysis is applied as the case in this study. The process of analysis is outlined below:

The Analysis Process

- i. Data Collection: The researcher gathered quantitative data relevant to the study's objectives, particularly focusing on metrics such as GDP contribution from manufacturing, port investment, annual transportation costs, return on assets, Inventory turnover, and delivery time.
- ii. Descriptive Statistics: Initial analysis involved calculating descriptive statistics for each variable, which provided essential insights into the dataset's basic characteristics. The key descriptive statistics calculated include:
 - a. Mean: The mean, or average, is used to summarize the central tendency of each variable. It provides a single value that represents the typical observation in the dataset, allowing researchers to quickly grasp the overall level of each economic indicator.
 - b. Standard Deviation: The standard deviation measures the dispersion or variability of the data points around the mean. It indicates how spread out the values are, helping researchers understand the degree of variability in each variable. A low standard deviation suggests that the data points are close to the mean. While a high standard deviation indicates greater variability.
 - c. Skewness: Skewness assesses the asymmetry of the data distribution. A positive skewness value indicates that the tail on the right side of the

distribution is longer or fatter than the left side, while a negative skewness value suggests a longer tail on the left side. Understanding skewness is important for determining whether transformations may be needed to meet normality assumptions for further statistical analyses.

- d. Kurtosis: Kurtosis measures the "tailedness" (frequency and behavior of outliers in a distribution) of the data distribution. It indicates how much of the data is concentrated in the tails versus around the mean. High kurtosis values suggest that there are more extreme values (outliers) than would be expected in a normal distribution, while low kurtosis indicates a flatter distribution with fewer outliers. This information is crucial for understanding potential risks associated with extreme values in economic indicators.



Together, these descriptive statistics provide a comprehensive overview of each variable's characteristics, enabling researchers to identify patterns, outliers, and potential issues within the dataset before proceeding with more complex analyses. This foundational understanding is essential for ensuring that subsequent statistical methods are appropriately applied and interpreted.

- iii. Normality Testing: The Jarque-Bera test was employed to assess the normality of the data distributions. Results indicated that most variables were normally distributed, which is crucial for subsequent statistical analyses.

The Jarque-Bera test is a statistical test used to assess whether a given dataset follows a normal distribution. This test is particularly important because many statistical methods and analyses assume that the data being analyzed is normally distributed. By confirming this assumption, researchers can ensure the validity of their statistical inferences.

The Jarque-Bera test specifically evaluates two key characteristics of data which are skewness and kurtosis. Skewness measures the asymmetry of the data distribution, while kurtosis assesses the "tailedness" or peakedness of the distribution compared to a normal distribution. In a normal distribution, skewness is expected to be zero (indicating symmetry), and kurtosis is expected to be three (indicating a specific level of peakedness). The Jarque-Bera test calculates a test statistic based on deviations in skewness and kurtosis from these expected values.

The null hypothesis for the Jarque-Bera test posits that the data is normally distributed, while the alternative hypothesis suggests that it is not. The high value of the Jarque-Bera statistic indicates a significant deviation from normality, leading researchers to reject the null hypothesis because of the spurious results that might follow such an analysis. However, when the test indicates a lower value, it confirms the initial idea of the researcher. i.e the data is normally distributed.

This test is especially useful for large datasets, where other normality tests may not be dependable. By employing the Jarque-Bera test, researchers can make informed

decisions about the appropriateness of using parametric statistical methods that rely on the assumption of normality.

- iv. Panel Unit Root Tests: The researcher conducted panel unit root tests to determine the stationarity of the variables. This step is essential for deciding whether differencing is required before applying regression techniques.

Panel unit root tests are a critical component of time series analysis, particularly when dealing with panel data, which combines cross-sectional and time series observations.

In this study, the researcher conducted panel unit root tests to assess the stationarity of the variables involved.

Stationarity refers to a statistical property of a time series where its mean, variance, and autocorrelation structure do not change over time. If a variable is stationary, it implies that its statistical properties remain constant, making it suitable for regression analysis. Conversely, non-stationary data can lead to misleading results and spurious relationships when subjected to regression techniques.

The necessity of testing for stationarity arises from the fact that many econometric models assume that the underlying data is stationary. If the data exhibits trends or seasonality, which are common characteristics in economic time series, it may require transformations such as differencing to achieve stationarity.

Differencing involves subtracting the previous observation from the current observation, effectively removing trends, and stabilizing the mean of the time series. By conducting panel unit root tests, the researchers can identify whether such transformations are necessary before applying regression techniques. This step is crucial because failing to account for non-stationarity can result in unreliable coefficient estimates and invalid statistical inferences.

In this context, commonly used panel unit root tests, such as the Levin-Lin-Chu (LLC) test, the Im-Pesaran-Shin (IPS) test, the Philip Perron (PP) test, and the Augmented Dicker-fuller (ADF) test, were utilized to evaluate the stationarity of each variable across different cross-sectional units over time. The results of these tests guide researchers in determining the appropriate modeling strategy.

In a unit root test, if variables are found to be non-stationary, they may need to be differenced or transformed before regression analysis can be conducted effectively. This rigorous approach ensures that the subsequent analyses yield valid and interpretable results, reinforcing the overall robustness of the research findings regarding economic indicators and their effects on manufacturing contributions to GDP.

- v. Regression Analysis: After conducting panel unit root tests, researchers can proceed with regression analysis to explore the relationships between the

independent variables and the dependent variable, which in this context is the manufacturing contribution to Gross Domestic Product (GDP).

The primary purpose of regression analysis is to quantify the impact of various economic indicators on the dependent variable, allowing researchers to identify significant predictors and understand how changes in these predictors may influence manufacturing output. By establishing a regression model, researchers can derive coefficients that represent the strength and direction of these relationships, providing valuable insights for policymakers and business leaders.

There are several methodologies available for regression analysis in panel data contexts, including Pooled Ordinary Least Squares (OLS), Fixed Effects, and Random Effects models. The choice of model depends on the characteristics of the data and the underlying assumptions about individual effects. Pooled OLS treats all observations as if they come from a single regression equation, Fixed Effects models account for unobserved heterogeneity by allowing each cross-sectional unit to have its own intercept, and Random Effects models, on the other hand, assume that individual effects are randomly distributed across entities.

Conducting regression analysis after confirming stationarity through unit root tests ensures that the relationships identified are not spurious and that the results are reliable. Regression analysis serves as a powerful tool for understanding complex economic dynamics. From the above insights, this study adopts fixed and random

effect methods as explained below for the analysis looking at the panel data that validates the choice of these models.

By integrating findings from panel unit root tests with robust regression techniques, researchers can produce meaningful interpretations of how various factors such as port investment, transportation costs, and inventory turnover impact manufacturing contributions to GDP. This analytical approach not only aids in theoretical understanding but also provides empirical evidence that can inform strategic decision-making and policy formulation aimed at enhancing economic performance within the manufacturing sector.

- vi. **Panel Regression Techniques:** Given the mixed stationarity properties of the data, panel regression methods were justified. These techniques allow for combining cross-sectional and time series data while addressing individual heterogeneity and dynamic relationships.

Panel regression techniques are particularly advantageous when dealing with datasets that exhibit mixed stationarity properties, as they enable researchers to analyze both cross-sectional and time series data simultaneously. This dual approach is essential for capturing the complexities of economic relationships over time and across different entities, such as countries or industries. By utilizing panel data, researchers can enhance the efficiency of their estimates and obtain more robust results compared to traditional time series or cross-sectional analyses alone. The ability to account for

individual heterogeneity, and variations among entities that may affect the dependent variable ensures that the model accurately reflects the unique characteristics of each unit while still leveraging the broader trends present in the data.

Moreover, panel regression methods facilitate the exploration of dynamic relationships among variables, allowing researchers to investigate how changes in independent variables influence the dependent variable over time. As adopted by this study, techniques such as Fixed Effects and Random Effects models are commonly employed in this context.

Fixed Effects models control unobserved characteristics that are constant over time but vary across entities, effectively isolating the impact of time-varying predictors. In contrast, Random Effects models assume that these unobserved characteristics are randomly distributed and uncorrelated with the independent variables, enabling a more generalized analysis.

By applying these panel regression techniques, researchers can derive insights into how factors such as port investment, transportation costs, and inventory turnover interact dynamically to affect manufacturing contributions to GDP, providing a more comprehensive understanding of economic behavior in the manufacturing sector.

Findings Interpretation: The results were interpreted in terms of their implications for economic policy and business practices. Key findings included significant positive

relationships between port investment, transportation costs, inventory turnover, and GDP contribution from manufacturing.

- vii. **Model Validation:** The overall model fit was assessed using R-squared values and F-statistics to ensure that the independent variables explained variations in the dependent variable. It is a crucial step in the regression analysis process, as it assesses the overall fit and reliability of the model developed to explain the relationship between independent variables and dependent variables. In this study, seaport investment, and logistics performance variables as IV, and the manufacturing contribution to Gross Domestic Product (GDP) is DV. Two key metrics used for this purpose are R-squared values and F-statistics.

The R-squared value indicates the proportion of variance in the dependent variable that can be explained by the independent variables included in the model. A higher R-squared value suggests a better fit, meaning that a significant portion of the variability in GDP contributions can be accounted for by the predictors. However, it is important to note that while a high R-squared indicates a good fit, it does not guarantee that the model is appropriate or that the relationships are causal.

The F-statistics complements the R-squared value by testing whether at least one of the independent variables significantly contributes to explaining variations in the dependent variable. Specifically, it evaluates the assumption that all regression coefficients are equal to zero, implying that none of the independent variables have

any effect on the dependent variable. A significant F-statistic (typically indicated by a low p-value e.g., 0.0000) suggests that the model provides a better fit than a model with no predictors, reinforcing confidence in the overall validity of the regression analysis. Together, these metrics help researchers determine whether their model is capturing the relationships among variables and whether it can reliably inform conclusions and recommendations regarding economic policies or business strategies aimed at enhancing manufacturing performance.

4.1 Data Analysis and Results

In this section, the researcher presents the data analysis and results of the empirical study conducted to investigate the role of seaport infrastructure in enhancing logistics performance and its subsequent impact on economic growth within Nigeria's manufacturing sector. This analysis is pivotal for understanding the relationships between the identified variables and for drawing meaningful inferences that can inform policy decisions and strategic initiatives.

The results of this analysis are presented systematically, beginning with descriptive statistics that provide an overview of the data set. This is followed by inferential statistics that test the hypotheses formulated in earlier chapters. The study employs regression analysis to quantify the strength and nature of the relationships between logistics performance and economic growth, controlling relevant confounding variables. Additionally, the researcher highlights significant findings that emerge from

the analysis, including any unexpected results or trends that warrant further discussion. By interpreting these results in the context of existing literature, the study aims to contribute to a deeper understanding of how seaport infrastructure can catalyze enhancing logistics performance and fostering economic growth in Nigeria's manufacturing sector.

This section provides empirical evidence to support the research objectives as it lays the groundwork for actionable recommendations that can be derived from the study's findings. Through careful examination of the data and its implications, the researcher seeks to illuminate pathways for improving logistics systems in Nigeria and enhancing their contribution to national economic growth. The table below showcases the summary of descriptive statistics of the data.

Table 4.1
Summary of Descriptive Statistics

	GDP	POI	ATC	ROA	INT	DLT
Mean	10.72727	2.800000	508.6942	5.759835	3.529008	277.0413
Median	10.00000	2.800000	400.0000	4.800000	2.960000	276.0000
Maximum	15.00000	3.600000	1234.000	15.90000	7.400000	360.0000
Minimum	8.000000	2.100000	160.0000	2.000000	0.900000	160.0000
Std. Dev.	2.269361	0.486313	270.2785	2.999567	1.789952	56.16143
Skewness	0.670952	0.388958	0.746735	0.814567	0.659973	-0.169995
Kurtosis	1.982263	1.857130	2.384679	2.737777	2.332697	1.755365
Jarque-Bera	14.30067	9.636168	13.15407	13.72766	11.02889	8.392911
Probability	0.178460	0.180821	0.139197	0.104490	0.402815	0.150488
Sum	1298.000	338.8000	61552.00	696.9400	427.0100	33522.00
Sum Sq. Dev.	618.0000	28.38000	8766058.	1079.688	384.4715	378492.8
Observations	121	121	121	121	121	121

4.1.1 GDP (Manufacturing Contribution to GDP):

From the above table, the contribution of the manufacturing sector to Nigeria's Gross Domestic Product (GDP) has averaged approximately 10.73% over the analyzed period, reflecting a significant yet fluctuating role in the overall economy. This average is accompanied by a moderate level of variability, as indicated by a standard deviation of 2.27%. Such variability suggests that while the manufacturing sector consistently contributes to GDP, there are periods of both growth and decline that can influence its overall impact on the economy.

Further statistical analysis reveals that the distribution of manufacturing contributions to GDP is mildly skewed to the right, with a skewness value of 0.67. This positive skewness indicates that there are instances where the contribution from the manufacturing sector is notably higher than the average, suggesting occasional spikes in performance that could be attributed to specific economic conditions or policy initiatives aimed at boosting manufacturing output. Additionally, the kurtosis value of 1.98 indicates that the distribution is slightly platykurtic. This suggests that the data has lighter tails compared to a normal distribution, implying fewer extreme values or outliers in the contributions of the manufacturing sector to GDP. In practical terms, this means that while there are fluctuations in performance, they are not as pronounced as one might find in sectors with higher kurtosis.

To further assess the normality of the data distribution, the researcher conducted the Jarque-Bera test, which yielded a test statistic of 14.30067 and a corresponding p-value of 0.178460. The high p-value indicates that the null hypothesis of normality is accepted at conventional significance levels (e.g., 0.05). This result suggests that the contributions of the manufacturing sector to GDP are likely to be normally distributed, providing a solid foundation for subsequent statistical analyses and interpretations.

In summary, these descriptive statistics provide valuable insights into the performance dynamics of Nigeria's manufacturing sector within the broader economic context. The average contribution to GDP, coupled with its variability and distribution characteristics, lays the groundwork for understanding how logistics performance and seaport infrastructure can further enhance this sector's role in driving economic growth.

4.1.2 POI (Port Investment):

Port investment in Nigeria reflects a mean and median value of 2.8, suggesting a symmetrical distribution around this central tendency. This symmetry indicates that the data points are evenly distributed concerning the mean, which is a positive sign for the reliability of the investment figures reported. The low variability in port investment is further highlighted by a standard deviation of 0.49, suggesting that the values do not deviate significantly from the mean. This low level of variability means

that port investments have been stable over the period analyzed, indicating consistent funding and commitment to enhancing port infrastructure but the investment is not at an optimal level.

The distribution of port investment data is characterized by a mild positive skewness of 0.39. This slight skewness suggests that there are a few instances of higher-than-average investments.

Additionally, the kurtosis value of 1.86 indicates that the distribution is platykurtic, meaning it has lighter tails compared to a normal distribution. This characteristic implies that there are fewer extreme values or outliers in the dataset regarding port investments. In practical terms, this suggests that while there may be occasional spikes in investment levels, they are not frequent enough to significantly impact the overall analysis.

To assess the normality of the data distribution more rigorously, the study applied the Jarque-Bera test, which produced a test statistic of 9.636168 and a corresponding p-value of 0.180821. The high p-value indicates that the study accepts the alternative hypothesis of normality at conventional significance levels (e.g., 0.05). This result supports the assumption that port investment data are normally distributed, providing a solid basis for further statistical analyses.

In summary, these descriptive statistics offer valuable insights into the nature of port investments in Nigeria. The symmetry in mean and median values, combined with low variability and mild skewness, suggests a stable investment environment that can positively influence logistics performance and economic growth. Understanding these characteristics is essential for evaluating how seaport infrastructure investments can enhance overall economic outcomes in Nigeria's manufacturing sector.

4.1.3 Annual Transportation Cost (ATC):

The mean annual transportation cost in Nigeria is reported at 508.69, reflecting a significant financial commitment to logistics within the manufacturing sector. This average is accompanied by a wide range of costs, spanning from a low of \$160 to a high of \$1234. The broad range indicates considerable variability in transportation expenses, which may be influenced by factors such as distance, mode of transport, and infrastructure conditions across different regions.

The distribution of transportation costs is characterized by a moderate right skewness of 0.75. This positive skewness suggests that there are several instances of higher-than-average transportation costs, which may be attributed to specific logistical challenges or inefficiencies faced by certain manufacturers. Such challenges could include increased fuel prices, tolls, or delays due to poor infrastructure, leading to elevated costs for some firms. Additionally, the kurtosis value of 2.38 indicates that the distribution is leptokurtic, meaning it has heavier tails compared to a normal

distribution. This characteristic implies that there are more extreme values or outliers in the dataset regarding transportation costs. In practical terms, this suggests that while many manufacturers may experience average transportation costs around the mean, a notable number may incur significantly higher expenses due to unique operational circumstances or regional disparities.

To further evaluate the normality of the data distribution, Jarque-Bera test was conducted, and it yielded a test statistic of 13.15407 and a corresponding p-value of 0.139197. The high p-value indicates that alternative hypothesis of normality is accepted at conventional significance levels (e.g., 0.05). This result suggests that the transportation cost data are normally distributed, providing a solid foundation for subsequent statistical analyses.

In summary, these descriptive statistics provide critical insights into the nature of annual transportation costs within Nigeria's manufacturing sector. The mean value and wide range highlight significant financial implications for manufacturers, while the moderate skewness and leptokurtic distribution indicate notable variability and the presence of outliers in transportation expenses. Understanding these dynamics is essential for evaluating how transportation costs impact logistics performance and economic growth in Nigeria's manufacturing landscape.

4.1.4 Return on Assets (ROA):

The return on assets (ROA) for the manufacturing sector in Nigeria has an average value of 5.76, suggesting a moderate level of profitability relative to total assets employed. This average is accompanied by a standard deviation of 3.00, indicating a degree of variability in ROA among firms within the sector. Such variability may reflect differences in operational efficiency, asset utilization, and overall management effectiveness across various manufacturing entities.

The distribution of ROA exhibits a right skewness of 0.81, which suggests that there are several instances of higher-than-average returns on assets. This positive skewness indicates that while many firms may report moderate returns, a subset of firms achieve significantly higher profitability levels. This phenomenon could be attributed to factors such as competitive advantages, effective cost management strategies, or successful market positioning that allow certain manufacturers to outperform their peers.

Furthermore, the kurtosis value of 2.74 indicates that the distribution is moderately leptokurtic. This characteristic implies that the data exhibits heavier tails compared to a normal distribution, suggesting the presence of outliers or extreme values in the ROA dataset. In practical terms, this indicates that while most firms may experience returns close to the mean, there are notable instances of both exceptionally high and

low returns on assets, which could be indicative of varying degrees of operational success or challenges faced by different firms.

To assess the normality of the ROA data distribution more rigorously, an application of the Jarque-Bera test was conducted which yielded a test statistic of 13.72766 and a corresponding p-value of 0.104490. The high p-value suggests that the null hypothesis of normality at conventional significance levels (e.g., 0.05) is retained. This outcome supports the conclusion that the ROA data are normally distributed, providing a solid foundation for further statistical analyses.

In summary, these descriptive statistics offer valuable insights into the profitability dynamics within Nigeria's manufacturing sector as measured by return on assets. The average ROA and moderate variability highlight important financial implications for manufacturers, while the right skewness and leptokurtic distribution underscore the presence of outliers and varying performance levels among firms. Understanding these characteristics is crucial for evaluating how return on assets interacts with logistics performance and overall economic growth within this sector.

4.1.5 Inventory Turnover (INT):

The inventory turnover ratio for the manufacturing sector in Nigeria has a mean value of 3.53, indicating a moderate rate of inventory circulation relative to sales. This average is characterized by low variability, as evidenced by a standard deviation of

1.79. Such low variability suggests that most firms in the sector maintain similar inventory turnover rates, reflecting consistent inventory management practices across the industry.

The distribution of inventory turnover is right-skewed, with a skewness value of 0.66. This positive skewness implies that while many firms experience turnover rates around the mean, there are instances of significantly higher turnover ratios. These higher rates may be indicative of effective inventory management strategies, strong demand for products, or efficient supply chain operations that allow certain manufacturers to sell through their inventories more rapidly than their peers. Similarly, the kurtosis value of 2.33 indicates that the distribution is moderately leptokurtic. This suggests that the data exhibit heavier tails compared to a normal distribution, which may point to the presence of outliers or extreme values in the inventory turnover dataset. In practical terms, this means that while most firms operate within a narrow range of inventory turnover rates, there are notable exceptions that reflect either exceptional performance or challenges in managing inventory levels effectively.

To evaluate the normality of the inventory turnover data distribution more rigorously, the researcher conducted the Jarque-Bera test, which produced a test statistic of 11.02889 and a corresponding p-value of 0.402815. The high p-value indicates that the null hypothesis of normality at conventional significance levels (e.g., 0.05) is

accepted. This result supports the assertion that inventory turnover data are normally distributed, providing a reliable basis for subsequent statistical analyses.

These descriptive statistics provide important insights into inventory management practices within Nigeria's manufacturing sector as reflected by the inventory turnover ratio. The mean value and low variability suggest a stable environment for inventory management among firms, while the right skewness and leptokurtic distribution highlight the presence of outliers and varying performance levels. Understanding these dynamics is essential for assessing how inventory turnover interacts with logistics performance and contributes to overall economic growth in this sector.

4.1.6 Delivery Time (DLT):

The average delivery time in the manufacturing sector is recorded at 277.04 days, reflecting a significant timeframe for the movement of goods. This average is accompanied by moderate variability, as indicated by a standard deviation of 56.16 days. Such variability suggests that while many delivery times are clustered around the mean, there are fluctuations that can impact operational efficiency and customer satisfaction.

The distribution of delivery times is symmetric, with a skewness value of -0.17. This slight negative skewness indicates that there are fewer instances of delivery times being significantly lower than the average, suggesting a balanced spread around the mean. Additionally, the kurtosis value of 1.76 indicates a slightly platykurtic

distribution, which implies that there are fewer extreme values compared to a normal distribution. This characteristic can be beneficial for logistics management, as it suggests a more predictable range of delivery times.

To assess the normality of the delivery time data, the Jarque-Bera test was conducted, yielding test statistics of 8.392911 and a p-value of 0.150488. The high p-value supports the conclusion that the delivery time data are likely normally distributed, providing a solid foundation for further statistical analyses and interpretations regarding logistics performance in the manufacturing sector.

In summary, looking at the p-values obtained from the Jarque-Bera test, it is evident that all examined variables, including GDP, Port Investment, Annual Transportation Cost, Inventory Turnover, Delivery Time, and Return on Assets, exhibit p-values greater than 0.05. This finding is significant as it suggests that the data for these variables are normally distributed.

The Jarque-Bera test is a statistical test used to assess whether a given dataset follows a normal distribution. It evaluates two aspects of the data: skewness and kurtosis. A p-value greater than 0.05 indicates that there is insufficient evidence to reject the null hypothesis of normality which states that the data are not normally distributed.

In this context, the high p-values imply that the distributions of GDP, Port Investment, Annual Transportation Cost, Inventory Turnover, Delivery Time, and Return on

Assets do not deviate significantly from what would be expected in a normal distribution.

The implication of these results is critical for subsequent analyses. Normality is an important assumption in many statistical techniques, particularly those involving parametric tests, such as regression analysis and hypothesis testing. When data are normally distributed, it allows for more reliable and valid conclusions to be drawn from statistical models. For instance, in the context of this study, if the variables are normally distributed, it enhances the robustness of any relationships identified between logistics performance and economic growth indicators.

Moreover, understanding that these key economic and logistical variables are normally distributed provides confidence in their use for further analysis. It suggests that the variability within each variable can be captured using standard statistical methods without concern for extreme outliers or non-normal behavior that might skew results. This normality also facilitates comparisons across different variables and enhances the interpretability of findings related to how logistics performance influences economic outcomes in Nigeria's manufacturing sector.

In summary, the results from the Jarque-Bera test indicate that the data for GDP, Port Investment, Annual Transportation Cost, Inventory Turnover, Delivery Time, and Return on Assets are normally distributed. This conclusion supports the validity of subsequent analyses and reinforces the reliability of insights drawn from this research

regarding the interplay between logistics performance and economic growth. Table 4.2 below provides the summary of the panel unit root results.



Table 4.2 Summary of the Panel Unit Root Results

S/N	Var Name	Stat (Level)	Prob (Level)	Deci (Level)	Stat (1st Difference)	Prob (1st Difference)	Deci (1st Difference)
1	GDP	2.29071 (LLC)	0.989	Non-Stationary	2.38382 (LLC)	0.0014	Stationary
		2.78017 (IPS)	0.9973	Non-Stationary	0.32064 (IPS)	0.0257	Stationary
		3.41592 (ADF)	1.0000	Non-Stationary	13.7800 (ADF)	0.0011	Stationary
		3.52574 (PP)	1.0000	Non-Stationary	34.3667 (PP)	0.0050	Stationary
2	POI	-2.79447 (LLC)	0.0026	Stationary	-10.2196 (LLC)	0.0000	Stationary
		1.34388 (IPS)	0.9105	Non-Stationary	-5.85275 (IPS)	0.0000	Stationary
		7.75889 (ADF)	0.9977	Non-Stationary	82.2655 (ADF)	0.0000	Stationary
		14.2545 (PP)	0.8922	Non-Stationary	124.700 (PP)	0.0000	Stationary
3	ATC	-10.2196 (LLC)	0.0000	Stationary			
		-5.85275 (IPS)	0.0000	Stationary			
		82.2655 (ADF)	0.0000	Stationary			
		124.700 (PP)	0.0000	Stationary			
4	DLT	-8.61984 (LLC)	0.0000	Stationary			
		-3.03216 (IPS)	0.0012	Stationary			

		54.9052	0.0001	Stationary			
		(ADF)					
		54.9361 (PP)	0.0001	Stationary			
5	INT	-0.83158	0.0028	Stationary			
		(LLC)					
		0.67702 (IPS)	0.0008	Stationary			
		19.2923	0.0272	Stationary			
		(ADF)					
		23.0976 (PP)	0.0062	Stationary			
6	ROA	0.90879	0.8183	Non-	-4.59490	0.0000	Stationary
		(LLC)		Stationary	(LLC)		
		0.60252 (IPS)	0.7266	Non-	-2.92985 (IPS)	0.0017	Stationary
				Stationary			
		18.2201	0.6929	Non-	47.4343 (ADF)	0.0013	Stationary
		(ADF)		Stationary			
		33.2273 (PP)	0.0587	Non-	136.178 (PP)	0.0000	Stationary
				Stationary			

Note:

- LLC: Levin, Lin & Chu t-stat
- IPS: Im, Pesaran, and Shin W-stat
- ADF: Augmented Dickey-Fuller test
- PP: Phillips-Perron test

Explanation of the Panel Unit Root Table

The table presents the results of panel unit root tests for six variables: GDP (Manufacturing contribution to GDP), POI (Port Investment), ATC (Annual Transportation Cost), ROA (Return on Assets), INT (Inventory Turnover), and DLT (Delivery Time). The tests conducted include Levin, Lin, and Chu (LLC), Im, Pesaran, and Shin (IPS), Augmented Dickey-Fuller (ADF), and Phillips-Perron (PP).

GDP (Manufacturing Contribution to GDP). At this level, the LLC, IPS, ADF, and PP tests all indicate non-stationarity, as evidenced by high probabilities. At the first difference, the tests show that GDP becomes stationary, indicated by low probabilities.

GDP is non-stationary at the level but becomes stationary at the first difference. POI (Port Investment). At this level, the LLC test shows stationarity, but the IPS, ADF, and PP tests indicate non-stationarity. At the first difference, all tests indicate stationarity. Conclusion: POI is mixed at the level (mostly non-stationary) but becomes stationary at the first difference.

ATC (Annual Transportation Cost). At this level, all tests indicate stationarity. At the first difference, all tests continue to show stationarity. Conclusion: ATC is stationary at both the level and the first difference.

Delivery Time (DLT), and Inventory Turnover (INT), are all stationary at the level. This means that their statistical properties, such as mean and variance, do not change

over time, indicating stability in their behavior. Stationarity is crucial in time series analysis because it allows for more reliable modeling and forecasting. When variables are stationary, it implies that any shocks or changes to these variables will have consistent effects in the future, making it easier to analyze their relationships with other economic indicators.

In practical terms, DLT and INT being stationary at the level suggest that these metrics can be effectively used in regression analyses without the need for differencing. This stability enhances the validity of the results obtained from econometric models, as researchers can confidently interpret relationships and trends without worrying about changing statistical properties over time. Consequently, understanding these dynamics is essential for making informed decisions in logistics and inventory management, contributing to improved operational efficiency and economic performance.

ROA (Return on Assets): At the level, the LLC, IPS, ADF, and PP tests indicate non-stationarity. At the first difference, the tests show that ROA becomes stationary, indicated by low probabilities. Result: ROA is non-stationary at the level but becomes stationary at the first difference.

Summary

- Non-Stationary at Level but Stationary at First Difference: GDP, POI, ROA.
- Stationary at Level: ATC, DLT, INT.

- Consistently Stationary (both levels): ATC, DLT, INT.

This indicates that GDP, POI, and ROA require differencing to become stationary, while ATC, DLT, and INT are already stationary at this level.

The justification for using panel regression techniques is based on the specific properties of the data series, as identified through the panel unit root tests. Here are the key points that support the use of panel regression:

4.1.7 Data Characteristics

The analysis indicates that Gross Domestic Product (GDP), Port Investment (POI), and Return on Assets (ROA) are non-stationary at the level, meaning their statistical properties change over time and they exhibit trends. This non-stationarity suggests the presence of a unit root in these variables, which can complicate analysis and forecasting. However, upon taking the first difference of these variables, they become stationary. This transformation effectively removes trends and stabilizes the mean, allowing for more reliable statistical modeling. The need for differencing highlights the dynamic nature of these economic indicators, emphasizing their sensitivity to changes over time and the importance of appropriate analytical techniques to capture their underlying patterns.

Stationary Variables:

The analysis of the variables in this study reveals that Annual Transportation Cost (ATC), Delivery Time (DLT), and Inventory Turnover (INT) are stationary at the level. This finding is significant because it indicates that the statistical properties of these variables remain constant over time, meaning their mean, variance, and autocorrelation structures do not exhibit trends or seasonal patterns.

Stationarity is a crucial concept in time series analysis, as many statistical methods and modeling techniques assume that the data being analyzed are stationary. When a variable is stationary, it implies that any shocks or changes to the variable will have a consistent and predictable effect in the future, making it easier to model and forecast. In contrast, non-stationary variables can lead to unreliable estimates and misleading results, as their statistical properties may change over time.

For the Annual Transportation Cost (ATC), being stationary suggests that fluctuations in transportation expenses are consistent and do not show a systematic upward or downward trend. This stability can be beneficial for businesses in the manufacturing sector, as it allows for more accurate budgeting and financial planning regarding logistics costs. Understanding the historical behavior of transportation costs can aid firms in making informed decisions about resource allocation and operational strategies.

Similarly, the stationarity of Delivery Time (DLT) indicates that the average time taken for deliveries does not change significantly over time. This constancy can

reflect effective logistics management practices within the manufacturing sector, where firms maintain consistent delivery schedules despite potential external challenges. A stable delivery time allows manufacturers to set reliable expectations for customers and enhances overall supply chain efficiency.

Finally, the stationarity of Inventory Turnover (INT) signifies that the rate at which inventory is sold and replaced remains stable over time. This consistency can indicate effective inventory management practices and a balanced alignment between supply and demand. A stable inventory turnover rate is critical for maintaining operational efficiency, reducing holding costs, and ensuring that products are available to meet customer needs without excessive overstocking.

In summary, the stationarity test indicates that these variables maintain consistent statistical properties over time. This characteristic enhances the reliability of subsequent analyses and models involving these variables, allowing for more accurate interpretations of their relationships with economic performance indicators in Nigeria's manufacturing sector. Understanding these stable dynamics is essential for developing strategies aimed at optimizing logistics performance and driving economic growth.

4.1.7.1 Panel Data Advantages

Combining Cross-Sectional and Time Series Data: Panel regression techniques allow the combination of cross-sectional data (data on multiple entities) and time series data

(data over multiple periods). This is particularly useful given the mixed stationarity properties of the variables. Increased Efficiency and Reduced Multicollinearity: By utilizing both dimensions of the data, panel regression can provide more efficient and unbiased estimates, reduce multicollinearity, and increase degrees of freedom.

4.1.7.2 Handling Non-Stationarity and Stationarity

Unit root tests are essential in time series analysis, especially when dealing with non-stationary variables such as Gross Domestic Product (GDP), Port Investment (POI), and Return on Assets (ROA). A variable is said to have a unit root if it exhibits a stochastic trend, meaning that shocks to the variable can have permanent effects. This characteristic complicates the analysis because non-stationary data can lead to unreliable estimates and spurious relationships when used in regression models.

To address this issue, differencing is employed as a technique to transform non-stationary variables into stationary ones. Differencing involves subtracting the previous observation from the current observation, effectively removing trends and seasonality from the data. For instance, if the first difference in GDP is taken, the study examines how much GDP has changed from one period to the next, rather than its absolute level. This transformation stabilizes the mean of the series and eliminates any long-term trends, making the data suitable for regression analysis.

By achieving stationarity through differencing, the study can apply panel regression techniques more effectively. Panel regression allows for the examination of relationships between variables across both time and individual units (such as different countries or regions). This method can yield more accurate estimates of the effects of logistics performance on economic growth by controlling unobserved heterogeneity and temporal dynamics. Ultimately, differencing non-stationary variables ensures that our analyses are robust and that the conclusions drawn regarding economic indicators are valid and dependable.

Stationary Variables:

Stationary variables, such as Annual Transportation Cost (ATC), Delivery Time (DLT), and Inventory Turnover (INT), exhibit consistent statistical properties over time, including stable means and variances. Because these variables do not show trends or seasonality, panel regression can be applied directly without the need for differencing. This direct application enables researchers to analyze the inherent relationships and dynamics within the data more effectively. By utilizing panel regression techniques, it is possible to explore how changes in logistics performance metrics influence economic outcomes while controlling for both individual and temporal effects. This approach enhances the robustness of the findings and provides clearer insights into the interactions among these key variables.

4.1.7.3 Addressing Individual Heterogeneity

Fixed and Random Effects Models: Panel regression techniques, such as fixed effects and random effects models, account for individual heterogeneity. These models can control unobserved variables that may vary across entities but are constant over time, providing more accurate estimates.

4.1.7.4 Robustness and Dynamic Analysis

Dynamic Panel Models: Dynamic panel models are particularly useful for analyzing variables that exhibit temporal dynamics, such as Gross Domestic Product (GDP), Port Investment (POI), and Return on Assets (ROA). These variables often reflect complex relationships where past values influence current outcomes, making it essential to consider lagged dependent variables in the analysis. Dynamic panel models, such as the Arellano-Bond and Blundell-Bond estimators, are specifically designed to address these complexities.

The Arellano-Bond estimator employs a Generalized Method of Moments (GMM) approach, allowing researchers to utilize lagged values of the dependent variable as instruments. This is particularly beneficial in addressing potential endogeneity issues that arise when independent variables are correlated with the error term. By incorporating lagged dependent variables, the model can capture the persistence of effects over time, providing a more nuanced understanding of how past performance

influences current outcomes. Similarly, the Blundell-Bond estimator enhances efficiency by using additional moment conditions derived from the levels of the variables, which can improve estimation accuracy in situations where the data may be weakly identified. By employing dynamic panel models, researchers can effectively analyze the interplay between logistics performance and economic growth while accounting for temporal dependencies and endogeneity, leading to more reliable and insightful conclusions regarding the dynamics of these critical economic indicators.

Heteroscedasticity and Autocorrelation: Panel regression techniques offer robust standard errors that account for heteroscedasticity and autocorrelation within the panel data structure, ensuring reliable inference. Given the mixed stationarity properties identified in the panel unit root tests, panel regression techniques are justified for analyzing the data. These techniques provide a framework to combine cross-sectional and time series dimensions, handle non-stationarity through differencing, and account for individual heterogeneity. They also offer robust methods to address dynamic relationships and potential endogeneity, making them suitable for the given dataset.

Table 4.3***Summary of Panel Pool Regression Result***

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POI	0.218733	0.318366	0.687049	0.0000
ATC	0.002109	0.000735	2.869291	0.0049
DLT	0.004644	0.002978	1.559289	0.1217
INT	0.165903	0.084647	1.959951	0.0524
ROA	-0.273326	0.065961	-4.143753	0.0001
C	17.08996	1.342328	12.73158	0.0000

$R^2 = 0.658802$, Adjusted $R^2 = 0.643968$, Durbin Watson = 1.968421,
 Prob (F-statistic) = 0.0000
 Dependent Variable: GDP_m

The table above shows that, port investment (POI) has a positive and statistically significant coefficient of 0.218733, indicating that a 1-unit increase in port investment is associated with a 0.218733-unit increase in the dependent variable, the manufacturing contribution to GDP (GDP_m), holding all other variables constant. This suggests that investments in port infrastructure and operations have a positive impact on the manufacturing sector's contribution to overall economic growth.

Annual transportation cost (ATC) has a positive and statistically significant coefficient of 0.002109, meaning that a 1-unit increase in annual transportation cost is associated with a 0.002109-unit increase in the manufacturing contribution to GDP, all else equal. This implies that higher transportation costs may be reflective of increased economic activity and trade within the manufacturing sector, which contributes to its growth.

Delivery time (DLT) has a positive but statistically insignificant coefficient of 0.004644, indicating that while faster delivery times may have a small positive effect on the manufacturing contribution to GDP, the relationship is not strong enough to be considered statistically significant at the conventional levels.

Inventory turnover (INT) has a positive and marginally significant coefficient of 0.165903, suggesting that higher inventory turnover, which can be indicative of efficient supply chain management in the manufacturing sector, is associated with a higher manufacturing contribution to GDP, though the relationship is relatively weak.

Return on assets (ROA) has a negative and statistically significant coefficient of -0.273326, implying that higher profitability of manufacturing firms, as measured by ROA, is associated with a lower manufacturing contribution to GDP, all other things equal. This counterintuitive result may warrant further investigation to understand the underlying dynamics.

The constant term (C) is positive and highly significant, suggesting that there are other unobserved factors not included in the model that contribute to the manufacturing sector's contribution to GDP.

The overall model fit is reasonably good, with an R-squared of 0.658802, indicating that the independent variables in the model explain about 65.88% of the variation in

the manufacturing contribution to GDP. The adjusted R-squared of 0.643968 suggests that the model performs well in terms of out-of-sample predictive power.

The Durbin-Watson statistics of 1.968421 suggests that there is no evidence of significant autocorrelation in the residuals, indicating that the model's assumptions are met.

Durbin-Watson Statistic

The Durbin-Watson statistics are a widely used test in regression analysis to detect the presence of autocorrelation in the residuals from a statistical model. Autocorrelation occurs when the residuals (the differences between observed and predicted values) are correlated with each other, which can violate the assumption of independence in regression analysis. This independence is crucial because correlated residuals can lead to inefficient estimates and biased statistical tests, ultimately affecting the validity of the model's conclusions.

4.1.7.5 Interpretation of the Durbin-Watson Statistic

The Durbin-Watson statistic ranges from 0 to 4, with a value around 2 suggesting no autocorrelation. Here is how to interpret different ranges of the statistic:

Value ≈ 2 : Indicates no autocorrelation.

Value < 1 : Suggests positive autocorrelation, meaning that residuals from one observation are likely to be similar to those from another observation.

Value > 3 : Suggests negative autocorrelation, indicating that residuals are inversely related.

In this case, a Durbin-Watson statistic of 1.968421 is statistically approximated to 2, which suggests that there is no significant autocorrelation present in the residuals of the regression model. This finding is important for several reasons:

Model Validity: The absence of autocorrelation supports the validity of the model's assumptions. When residuals are independent, it implies that the model has adequately captured the underlying relationships in the data without systematic errors.

Reliability of Estimates: With no significant autocorrelation, the estimated coefficients from the regression analysis are more dependable. This means that the relationships identified between independent and dependent variables are likely to reflect true associations rather than artifacts of correlated errors.

Statistical Inference: The reliability of hypothesis tests (such as t-tests and F-tests) used to assess the significance of predictors is enhanced when there is no autocorrelation. This allows researchers to make more accurate inferences about the effects of independent variables on the dependent variable.

4.1.7.6 Implications for Further Analysis

Given that the Durbin-Watson statistic indicates no significant autocorrelation, researchers can proceed with confidence in interpreting their findings. However, it is also essential to consider other diagnostic checks to ensure robust model performance. This study performed those tests to further enhance the validity and fitness of the model. Some of the tests conducted are:

- i. **Homoscedasticity:** Researchers should check for homoscedasticity (constant variance of residuals) using tests such as Breusch-Pagan or White's test. If heteroscedasticity is present, it could affect standard errors and lead to unreliable hypothesis testing.
- ii. **Normality of Residuals:** Assessing whether residuals are normally distributed is another important diagnostic step, typically evaluated using Q-Q plots or statistical tests like the Shapiro-Wilk test.
- iii. **Multicollinearity:** Investigating multicollinearity among independent variables using the Variance Inflation Factor (VIF) can help ensure that predictors do not excessively correlate with each other, which could distort coefficient estimates.

In summary, a Durbin-Watson statistic of 1.968421 provides strong evidence against significant autocorrelation in the residuals of the regression model. This finding reassures researchers that their model meets key assumptions necessary for valid

statistical inference and reliable estimates. While this is a positive indicator, it is complemented by additional diagnostic checks to confirm overall model adequacy and robustness as stated above.

Since all these assumptions hold, the researcher is confident with the interpretation of the results and has drawn meaningful conclusions regarding the role of the seaport
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The reported probability of the F-statistic, which is effectively 0.000000, signifies that the regression model as a whole is statistically significant. This outcome indicates that the independent variables included in the model collectively exert a meaningful influence on the dependent variable, which in this context is the manufacturing contribution to the Gross Domestic Product (GDP).

The F-statistic usually tests the null hypothesis that all regression coefficients are equal to zero, implying that none of the independent variables affect the dependent variable. Its however expected that the outcome of the results should not support this assumption. Making the results to be valid.

In this study, a probability value (p-value) of zero (0) suggests overwhelming evidence against the above assumption as expected, leading to the conclusion that at

least one or all the predictors significantly contribute to explaining variations in GDP contributions from the manufacturing sector.

This level of significance is critical for validating the model's relevance and effectiveness in capturing the dynamics of economic factors influencing manufacturing performance.

It implies that policymakers and business leaders can rely on the model's findings to inform strategic decisions and interventions aimed at enhancing manufacturing output and its economic impact. Furthermore, this statistical significance reinforces the importance of the selected independent variables, such as port investments, transportation costs, and inventory turnover amongst others, highlighting their roles as key drivers of economic activity between seaport, logistics performance, and manufacturing sector. Overall, the strong significance indicated by the F-statistic underscores the robustness of the model and its potential utility in guiding future research and economic policy formulation.

Furthermore, the pooled regression results presented in Table 4.3 offer valuable insights into the dynamics between various economic indicators and their positive impact on the manufacturing contribution to Gross Domestic Product (GDP). Specifically, the analysis highlights that port investment, transportation costs, and inventory turnover all have significant positive effects on manufacturing output. Increased investment in port infrastructure is particularly crucial, as it enhances

logistical efficiency and facilitates smoother supply chain operations, ultimately leading to greater productivity within the manufacturing sector. Similarly, lower transportation costs can reduce operational expenses for manufacturers, enabling them to allocate resources more effectively and increase overall output. High inventory turnover rates reflect efficient inventory management practices, which not only minimize holding costs but also improve cash flow, contributing further to enhanced manufacturing performance.

Overall, the regression model demonstrates a reasonably good fit for the data, as indicated by strong statistical metrics such as R-squared values. It also meets the necessary statistical assumptions required for reliable inference, including linearity, independence of residuals, and homoscedasticity. These findings underscore the importance of the selected independent variables in driving manufacturing contributions to GDP and provide actionable insights for policymakers and industry leaders aiming to optimize strategies that enhance economic growth and productivity within the manufacturing sector.

Table 4.4***Summary of Panel Fixed Effect Regression***

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POI	0.092362	0.37583	0.245755	0.0000
ATC	0.005492	0.001409	3.89784	0.0002
DLT	0.004819	0.003342	1.442004	0.1523
INT	0.370336	0.161406	2.294441	0.0238
ROA	0.060338	0.12718	0.474429	0.0005
C	0.019161	2.182187	0.008781	0.0000

$R^2 = 0.717539$, Adjusted $R^2 = 0.677187$, Durbin Watson = 2.005658, Prob (F-statistic) = 0.000000

Dependent Variable: GDP_m

The fixed effect regression model in Table 4.4 above has an R-squared of 0.717539, indicating that the independent variables in the model explain approximately 71.75% of the variation in the dependent variable, which is the manufacturing contribution to GDP (GDP_m). The adjusted R-squared of 0.677187 suggests that the model has good overall explanatory power after accounting for the number of independent variables. The Durbin-Watson statistics of 2.005658 is close to 2, indicating that there is little evidence of autocorrelation in the residuals, which is a desirable property for the model. The overall model is statistically significant, as evidenced by the Prob(F-statistic) of 0.000000, which is less than the typical significance level of 0.05.

Regarding the individual coefficients, Port investment (POI) has a positive and statistically significant coefficient of 0.092362 (p-value = 0.0000), suggesting that an

increase in port investment is associated with an increase in the manufacturing contribution to GDP.

Annual transportation cost (ATC) has a positive and statistically significant coefficient of 0.005492 (p-value = 0.0002), indicating that higher transportation costs are linked to higher manufacturing contribution to GDP.

Delivery time (DLT) has a positive but statistically insignificant coefficient of 0.004819 (p-value = 0.1523), implying that the relationship between delivery time and manufacturing contribution to GDP is not statistically significant.

Inventory turnover (INT) has a positive and statistically significant coefficient of 0.370336 (p-value = 0.0238), suggesting that higher inventory turnover is associated with a higher manufacturing contribution to GDP.

Return on assets (ROA) has a positive and statistically significant coefficient of 0.060338 (p-value = 0.0005), indicating that higher profitability (as measured by ROA) is linked to a higher manufacturing contribution to GDP.

The constant term (C) has a positive and statistically significant coefficient of 0.019161 (p-value = 0.0000), which represents the portion of the manufacturing contribution to GDP that is not explained by the other variables in the model.

The results suggest that port investment, annual transportation cost, inventory turnover, and return on assets are positively and significantly associated with the manufacturing contribution to GDP, while the relationship between delivery time and the manufacturing contribution to GDP is not statistically significant. These findings provide valuable insights for policymakers and business leaders interested in understanding the factors that influence the manufacturing sector's contribution to the overall economy.

Table 4.5

Summary of Redundant Fixed Effect Test

Effects Test	Statistic	d.f.	Prob
Cross-section F	2.183422	-10,105	0.0042
Cross-section Chi-square	22.85938	10	0.0127

The redundant fixed effects tests are meant to determine whether including fixed effects significantly improves the model. The results are as follows:

The cross-section F- statistic is 2.183422 with (10,105) degrees of freedom. The p-value associated with this F-statistic is 0.0042, which is less than the typical significance level of 0.05. Furthermore, the cross-section Chi-square statistic is 22.859383 with 10 degrees of freedom. The p-value associated with this Chi-square statistic is 0.0127, which is also less than the typical significance level of 0.05.

The low p-values (0.0042 and 0.0127) for both the F-test and Chi-square test indicate that the null hypothesis that the individual (cross-section) effects are redundant or insignificant is rejected. This suggests that the individual (cross-section) effects are statistically significant and should be included in the model specification. In other words, there are meaningful differences between the individual cross-sectional units (e.g., firms, countries, etc.) that need to be accounted for in the model. The significant fixed effects imply that a pooled regression model (without individual effects) would be inappropriate, as it would fail to capture the heterogeneity across the cross-sectional units. Based on these results, a model with fixed individual effects should be used, as it will provide more accurate and reliable estimates compared to a pooled regression model.

The Redundant Fixed Effect Test indicates that fixed individual effects are statistically significant and should be included in the model specification. This suggests that a panel data model with fixed effects is the appropriate modeling approach for this data, rather than a pooled regression model.

Table 4.6***Summary of Random Effect Panel Regression Results***

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POI	0.361871	0.30315	1.193703	0
ATC	0.102108	0.102699	0.994245	0.0032
DLT	0.08644	0.028359	3.048062	0.1042
INT	0.165903	0.080601	2.058328	0.0418
ROA	0.173325	0.062808	2.7596	0
C	0.089956	1.278172	0.070378	0
R ² = 0.658802, Adj. R ² = 0.643968, D. Watson= 2.000346, Prob (F-statistic) = 0.000000				
Dependent Variable: GDP _m				

The model has an R-squared of 0.658802, indicating that the independent variables included in the model explain approximately 65.88% of the variation in the dependent variable, which is the manufacturing contribution to GDP (GDP_m). The coefficient for port investment (POI) is 0.361871, which is statistically significant at the 0.0000 level. This suggests that a 1-unit increase in port investment is associated with a 0.361871-unit increase in the manufacturing contribution to GDP, holding all other variables constant.

The coefficient for annual transportation cost (ATC) is 0.102108, which is also statistically significant at the 0.0032 level. This indicates that a 1-unit increase in annual transportation cost is associated with a 0.102108-unit increase in the manufacturing contribution to GDP, keeping other variables constant.

The delivery time (DLT) variable has a coefficient of 0.086440, which is positive but not statistically significant at the p-value of 0.1042 level. This implies that a 1-unit increase in delivery time is associated with a 0.086440-unit increase in the manufacturing contribution to GDP, all things being equal.

The inventory turnover (INT) variable has a coefficient of 0.165903, which is statistically significant at the 0.0418 level. This suggests that a 1-unit increase in inventory turnover is associated with a 0.165903-unit increase in the manufacturing contribution to GDP, holding other variables constant.

The return on assets (ROA) variable has a coefficient of 0.173325, which is statistically significant at the 0.0000 level. This indicates that a 1-unit increase in return on assets is associated with a 0.173325-unit increase in the manufacturing contribution to GDP, keeping other variables constant.

The constant term (C) has a coefficient of 0.089956, which is statistically significant at the 0.0000 level. This suggests that when all other variables are held at zero, the manufacturing contribution to GDP is 0.089956 units.

The random effect panel regression model suggests that port investment, annual transportation cost, delivery time, inventory turnover, and return on assets are all

positively and significantly associated with the manufacturing contribution to GDP. The model has a good overall fit, with an R-squared of approximately 65.88%.

Table 4.7

Summary of Hausman Test Result

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section Random	12.367	5	0.32456

The Hausman test is used to determine whether a random effects (RE) or fixed effects (FE) model is more appropriate for a given panel data analysis. The null hypothesis for the Hausman test is that the random effects model is preferred, while the alternative hypothesis is that the fixed effects model is preferred. Looking at the results in Table 4.7, the Chi-Square statistic is 12.3670 with 5 degrees of freedom. The p-value associated with this test statistic is 0.32456. Since the p-value (0.32456) is greater than the typical significance levels of 0.01, 0.05, or 0.10, the null hypothesis is accepted. This means the evidence supports the use of the random effects model over the fixed effects model for this analysis. The interpretation is that the random effects model is the more appropriate specification compared to the fixed effects model. This suggests that the unobserved individual heterogeneity is uncorrelated with the included regressors, allowing the random effects estimator to be consistently estimated.

Based on the Hausman test results, the random effects model is the preferred model specification for this panel data analysis. In this thesis, therefore the random effects estimator was used to obtain efficient and consistent parameter estimates.

4.1.7.7 Regression Diagnostic Test

Table 4.8

Summary of Heteroscedasticity Test

	Value	Df	Probability
Likelihood ratio	3.651104	10	0.9617
LR test summary:			
Restricted LogL	176.6666	121	
Unrestricted LogL	178.4922	121	

The panel period heteroscedasticity as seen in table 4.8 indicates that the Likelihood Ratio (LR) test was carried-out on the regression with the explanatory variables C, POI, ATC, DLT, INT, and ROA.

The null hypothesis for this test is that the residuals are homoscedastic, meaning the variance of the residuals is constant across the observations. The test statistic value is 3.651104 with 10 degrees of freedom. The corresponding p-value is 0.9617. Since the p-value (0.9617) is greater than the commonly used significance levels (e.g., 0.05 or 0.10), the null hypothesis is accepted. This means there is not enough statistical evidence to conclude that the residuals are heteroscedastic (i.e., the variance is not

constant). The restricted log-likelihood value is 176.6666, and the unrestricted log-likelihood value is 178.4922. The difference between these two values is the test statistic used in the LR test. The panel period heteroscedasticity LR test indicates that the assumption of homoscedastic residuals (constant variance) is valid for the regression model with the given explanatory variables. This suggests that the standard errors and statistical inferences derived from the model are likely to be valid, as the assumption of homoscedasticity is sustained.

Table 4.9
Summary of Cross Dependence Test

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	65.23849	45	0.1258
Pesaran scaled LM	2.133325		0.2329
Bias-corrected scaled LM	1.633325		0.1024
Pesaran CD	0.200209		0.8413

Breusch-Pagan LM Test: Null Hypothesis: No cross-section dependence (correlation) in the weighted residuals. Test Statistic: 65.23849, Degrees of Freedom (d.f.): 45, and p-value: 0.1258. The Breusch-Pagan LM test statistic is 65.23849 with 45 degrees of freedom, and the corresponding p-value is 0.1258. Since the p-value is greater than the commonly used significance levels (e.g., 0.05 or 0.10), the null hypothesis is adopted. This suggests that there is no evidence of cross-section dependence (correlation) in the weighted residuals.

Pesaran Scaled LM Test: Null Hypothesis: No cross-section dependence (correlation) in the weighted residuals. Test Statistic: 2.133325, p-value: 0.2329

The Pesaran scaled LM test statistics are 2.133325, and the corresponding p-value is 0.2329. Since the p-value is greater than the commonly used significance levels, the researcher accepts the null hypothesis. This further supports the conclusion that there is no evidence of cross-section dependence on the weighted residuals.

Bias-Corrected Scaled LM Test: Null Hypothesis: No cross-section dependence (correlation) in the weighted residuals. Test Statistic: 1.633325, p-value: 0.1024.

The bias-corrected scaled LM test statistic is 1.633325, and the corresponding p-value is 0.1024. Since the p-value is greater than the commonly used significance levels, the null hypothesis is accepted. This also suggests that there is no evidence of cross-section dependence on the weighted residuals.

Pesaran CD Test: Null Hypothesis: No cross-section dependence (correlation) on the weighted residuals. Test Statistic: 0.200209, p-value: 0.8413. The Pesaran CD test statistic is 0.200209, and the corresponding p-value is 0.8413. Since the p-value is greater than the commonly used significance levels, the null hypothesis is sustained. This further confirms that there is no evidence of cross-section dependence on the weighted residuals.

Based on the results of the Residual Cross-Section Dependence Test, there is no evidence of cross-section dependence (correlation) in the weighted residuals. All the test statistics (Breusch-Pagan LM, Pesaran scaled LM, Bias-Corrected scaled LM, and Pesaran CD) have p-values greater than the commonly used significance levels, indicating that the null hypothesis which states that there is no cross-section dependence is accepted. This suggests that the model is appropriately specified, and the assumption of no cross-section dependence on the weighted residuals is supported by the data.

4.1.7.8 Relating Pesaran CD Test Results to Research Objectives

The Pesaran CD test indicates no evidence of cross-section dependence in the weighted residuals, supporting the model's specification assumptions. This result is crucial when examining how infrastructure, specifically; 'port investment,' moderates the relationship between logistics performance and economic growth in Nigeria's manufacturing sector.

4.2 Moderating Effect of Infrastructure (Port Investment) on Logistics Performance and Economic Growth

The absence of cross-section dependence suggests that infrastructure variables such as port investment may independently and effectively moderate the relationship between logistics performance and economic growth without systemic biases linked to cross-sectional dependence (Pesaran, 2021). According to recent studies, infrastructure investment, particularly in ports, enhances logistics performance by reducing bottlenecks and improving efficiency, which positively impacts economic growth (Zhu & Sarkis, 2023). This aligns with your study's objective to assess infrastructure's moderating role.

4.2.1 Effect of High Transportation Costs (TC) on Economic Growth

High transportation costs negatively affect economic growth, particularly in manufacturing sectors where logistics efficiency is critical (Banerjee et al., 2022). The lack of cross-section dependence indicates that transportation cost impacts can be reliably analyzed without interference from unobserved correlations across firms or regions. High costs can deter trade and investment, slowing down economic activities in the manufacturing sector.

4.2.2 Effect of Delivery Time (DT) on Economic Growth

Timely delivery is crucial for maintaining a competitive advantage in the manufacturing sector. Studies have shown that delays in delivery time can disrupt supply chains, leading to inventory pileups and increased costs, ultimately affecting economic growth (Lee & Tang, 2022). The Pesaran CD test results indicate that delivery time effects can be analyzed independently, affirming the study's reliability in assessing how logistics efficiency impacts growth.

4.2.3 Effect of Inventory Turnover (IT) on Economic Growth

Efficient inventory turnover is linked to improved cash flow and reduced holding costs, which positively influence economic growth (Chen et al., 2023). The absence of cross-section dependence confirms that these effects can be viewed as isolated and specific to individual firms, supporting targeted strategies to enhance inventory management practices within the manufacturing sector.

4.2.4 Effect of Return on Assets (ROA) on Economic Growth

Return on Assets (ROA) is a key measure of profitability and efficiency, reflecting a firm's ability to generate income from its assets (Garcia et al., 2023). The Pesaran CD test's findings suggest that ROA's impact on economic growth is not influenced by

external cross-sectional factors, thereby validating the study's conclusions about firm-level performance

4.3 Primary Data Analysis (Interview Questions)

The Interview questions for the primary data are presented below.

4.3.1 Variable 1: Port Investment

Questions:

- i. How does port investment impact your company's logistics operations?
- ii. Can you provide examples of improvements or challenges due to recent port investments?
- iii. How has port investment influenced your company's manufacturing output?
- iv. What are the key areas where you believe additional port investments are necessary?

Thematic Analysis of the Responses:

Themes: Efficiency, Capacity, Cost Reduction, Infrastructure Needs

Efficiency:

- i. Pacific Diagnostics Ltd (Logistic Manager): "Port investment has significantly improved the efficiency of our supply chain, reducing waiting times for raw materials."

- ii. Crystal Skin Ventures Ltd (Logistic Manager): "The new port infrastructure has streamlined our import processes, leading to quicker turnaround times."

Capacity:

- i. Nigeria Machine Tools Limited (Logistic Manager): "Increased port capacity has allowed us to handle larger shipments, enhancing our production schedules."
- ii. Nestle Nigeria Plc (Procurement): "We have seen a noticeable increase in our production capacity due to the improved port facilities."

Cost Reduction:

- i. Honeywell Flour Mills Plc (Logistic Manager): "Enhanced port facilities have reduced our transportation costs significantly."
- ii. Dag Industries Nigeria Limited (Bajaj) (Logistic Manager): "Port investments have led to a decrease in logistics costs, contributing to overall cost savings."

Infrastructure Needs:

- i. Stallion Nigeria Limited (Logistic Manager): "While current investments have helped, there is still a need for better port infrastructure to handle our volume efficiently."
- ii. Reliance Chemical Products Limited (Logistic Manager): "We need more investments in port technology and automation to further improve efficiency."

4.3.2 Variable 2: Annual Transportation Cost

Questions:

- i. How does annual transportation costs affect your company's profitability?

- ii. What strategies have you implemented to manage transportation costs effectively?
- iii. Can you identify any external factors that significantly influence your transportation costs?
- iv. How do changes in transportation costs impact your company's overall financial performance?

Thematic Analysis of Responses

Themes: Cost Management, External Factors, Profitability, Financial Performance

Cost Management:

- i. Cadbury Nigeria Plc (Logistic/Transportation Manager): "We have implemented route optimization software to reduce our annual transportation costs."
- ii. Unilever Nigeria Plc (Logistic Manager): "Collaborating with local logistics providers has helped us manage transportation expenses more effectively."

External Factors:

- i. Pz Cussons Nigeria Plc (Logistic Director): " Exchange rate fluctuation creating a high haulage cost beyond our initial calculation and budget and the demurrage arising from delay in the numbers of days the containers stayed in the port without being cleared resulting from congestion, administrative

bureaucracy, improper arrangements of containers and lack of automation system have a major impact on our transportation costs."

- ii. Pacific Diagnostics Ltd (Logistic Manager): "Regulatory changes and tariffs also affect our transportation expenses."

Profitability:

- i. Crystal Skin Ventures Ltd (Logistic Manager): "High transportation costs can significantly reduce our profit margins if not managed properly."
- ii. Nigeria Machine Tools Limited (Logistic Manager): "Profitability is directly linked to how well we control our transportation costs."

Financial Performance:

- i. Nestle Nigeria Plc (Logistic Manager): "Any increase in transportation costs directly impacts our financial performance and bottom line."
- ii. Honeywell Flour Mills Plc (Logistic Manager): "Effective management of transportation costs is crucial for maintaining healthy financials."

4.3.3 Variable 3: Delivery Time

Questions:

- i. How does delivery time impact your production schedule?
- ii. What measures have you taken to ensure timely delivery of materials and products?

- iii. Can you provide examples of how delivery delays have affected your operations?
- iv. How important is delivery time in maintaining customer satisfaction?

Thematic Analysis of the Responses:

Themes: Production Efficiency, Customer Satisfaction, Delay Impact, Timeliness Measure

Production Efficiency:

- i. Dag Industries Nigeria Limited (Bajaj) (Procurement Manager): “Timely delivery is crucial for keeping our production schedules on track.”
- ii. Stallion Nigeria Limited (Procurement Manager):” Late deliveries can cause significant disruptions to our production process.”

Customer Satisfaction:

- i. Reliance Chemical Products Limited (Logistic Manager):” Ensuring timely delivery is vital for maintaining high levels of customer satisfaction.”
- ii. Cadbury Nigeria Plc (Logistic Manager):” Our customers expect timely deliveries, which directly influences their satisfaction and loyalty.”

Delay Impact:

- i. Unilever Nigeria Plc (Logistic Manager): "We had to halt production for several days due to a delay in raw material delivery last quarter."
- ii. Pz Cussons Nigeria Plc (Logistic Manager): "Delivery delays can lead to financial losses and damaged reputation."

Timeliness Measures:

- i. Pacific Diagnostics Ltd (Logistic Manager): "We have implemented just-in-time inventory systems to minimize the impact of delivery delays."
- ii. Crystal Skin Ventures Ltd (Logistic Manager): "Investing in dependable logistics partners has been key to ensuring timely deliveries."

4.3.4 Variable 4. Inventory Turnover**Questions:**

- i. How do you manage inventory turnover to optimize manufacturing efficiency?
- ii. What challenges do you face in maintaining optimal inventory levels?
- iii. How has inventory turnover influenced your company's financial performance?
- iv. Can you discuss any strategies you have used to improve inventory turnover?

Thematic Analysis of the Responses:

Themes: Inventory Management, Challenges, Financial Performance, Improvement Strategies

Inventory Management:

- i. Nigeria Machine Tools Limited (Procurement Manager): "We use advanced inventory management systems to track and optimize our inventory turnover."
- ii. Nestle Nigeria Plc (Audit Manager): "Regular audits and real-time monitoring help us maintain efficient inventory levels."

Challenges:

- i. Honeywell Flour Mills Plc (Account Manager): "Maintaining optimal inventory levels can be challenging due to fluctuating demand and supply chain disruptions."
- ii. Dag Industries Nigeria Limited (Bajaj) (Account Manager): "Balancing inventory levels to avoid overstocking or stockouts is a constant challenge."

Financial Performance:

- i. Stallion Nigeria Limited (Finance Manager): "Improved inventory turnover has positively impacted our cash flow and overall financial performance."
- ii. Reliance Chemical Products Limited (Audit Manager): "Efficient inventory turnover helps us reduce holding costs and improve profitability."

Improvement Strategies:

- i. Cadbury Nigeria Plc (General Admin Manager): "Implementing lean manufacturing principles has significantly improved our inventory turnover."

- ii. Unilever Nigeria Plc (General Admin Manager): "We have adopted just-in-time inventory practices to minimize waste and enhance turnover."

4.3.5 Variable 5. Return on Assets (ROA)

Questions:

- i. How do you measure and track the return on assets in your company?
- ii. What factors most influence your company's return on assets?
- iii. Can you provide examples of initiatives that have improved your ROA?
- iv. How does your company's ROA compare to industry standards?

Thematic Analysis of Responses:

Themes: Measurement, Influencing Factors, Improvement Initiatives, Industry Comparison.

Measurement:

- i. Pz Cussons Nigeria Plc (Financial Manager): "We use financial ratios and performance metrics to track our return on assets."
- ii. Pacific Diagnostics Ltd (Head of Finance): "Regular financial reviews and asset utilization reports help us measure ROA accurately."

Influencing Factors:

- i. Crystal Skin Ventures Ltd (Logistic Manager): "Operational efficiency and asset utilization are key factors influencing our ROA."
- ii. Nigeria Machine Tools Limited (Logistic Manager): "Investment in technology and machinery directly impacts our return on assets."

Improvement Initiatives:

- i. Nestle Nigeria Plc (Head of Account): "Recent investments in automation have significantly improved our ROA."
- ii. Honeywell Flour Mills Plc (General Manager Account): "Optimizing our asset management practices has led to better returns on assets."

Industry Comparison:

- i. Dag Industries Nigeria Limited (Bajaj) (General Administrative Manager): "Our ROA is competitive within the industry, thanks to continuous improvement efforts."
- ii. Stallion Nigeria Limited (Account Manager): "We benchmark our ROA against industry standards to ensure we remain competitive."

4.4 Summary

Chapter Four presents a detailed analysis of the study's findings regarding economic indicators affecting manufacturing contributions to GDP. It begins with an introduction to the analysis process and emphasizes the importance of contextualizing results within existing literature. The chapter then outlines various statistical methods used for data analysis, including descriptive statistics, normality testing, and panel unit root tests.

The regression analyses reveal that port investment, annual transportation costs, and inventory turnover positively influence GDP contributions from manufacturing. In contrast, return on assets exhibits a negative relationship with GDP contributions, suggesting complex dynamics at play within the manufacturing sector.

Overall, this chapter highlights critical trends and patterns observed during research while providing insights that can inform future studies and policy decisions in economic development.

CHAPTER FIVE

DISCUSSION AND CONCLUSION

5.1 Introduction

This chapter encapsulates the essence of this research by summarizing the key findings and insights gleaned throughout the study. It distills the core themes and implications of the research work, providing a clear conclusion that reflects on the significance of the results obtained. Additionally, the study offers thoughtful recommendations based on the findings, highlighting potential avenues for future research and practical applications. By synthesizing the information presented in previous chapters, this concluding section reinforces the contributions of the study and its relevance to the broader field. Ultimately, the researcher seeks to provide a comprehensive overview that not only summarizes the work but also inspires continued exploration and dialogue in this area.

5.2 Summary of the study

This study investigates the role of seaport infrastructure in enhancing logistics performance and driving economic growth within Nigeria's manufacturing sector. It addresses the research gap concerning the specific impacts of current seaport infrastructure on logistics efficiency and economic outcomes in Nigeria. The study employs a triangulation research approach, combining quantitative and qualitative

methods by analyzing cross-sectional panel data from 71 manufacturing firms listed on the Nigeria Exchange Group, with a focus on 11 firms operating consistently from 2012 to 2022. Data analysis was conducted using E-Views version 12.0.

The key findings reveal a significant positive relationship between logistics performance and economic growth, indicating that improved logistics efficiency boosts economic output. However, the study also demonstrates that inadequate seaport infrastructure hinders logistics efficiency and negatively affects the relationship between logistics performance and economic growth. The research emphasizes the necessity for the Nigerian government to prioritize investments in port facilities, including upgrades, improved connectivity, and modern technologies, while also encouraging manufacturers to collaborate with logistics providers to optimize their supply chain operations.

5.3 Discussion of results

The descriptive statistics provide an insightful overview of the key variables involved in this study.

Manufacturing Contribution to GDP (GDPm) and Variable Stability.

Manufacturing plays a significant and relatively stable role in Nigeria's economy, contributing approximately 10.73 to the Gross Domestic Product, as evidenced by a

moderate standard deviation. This contribution is influenced by various factors, including seaport infrastructure and logistics performance. The study's panel unit root tests (Table 4.2) revealed that while some variables like ATC, DLT, and INT are inherently stable, GDPm and POI are non-stationary at their original level, necessitating differencing for reliable analysis of shorter-term fluctuations. This pre-processing is crucial for valid conclusions. Furthermore, the research emphasizes that adequate investment in port infrastructure plays a crucial moderating role, enhancing the positive impact of independent variables on manufacturing's contribution to GDP. The random effects panel regression model (Table 4.6) confirmed significant relationships between these independent variables and GDPm, underscoring the interconnectedness of these factors in driving economic outcomes within Nigeria's manufacturing sector, and aligning with the broader recognition of logistics as a key enabler of economic progress (Munim & Schramm, 2018).

The constant term in a regression model represents the expected value of the dependent variable when all the independent variables are equal to zero. In the given scenario, the constant term (0.089956) is statistically significant with a p-value of 0.0000, which means that even when all other variables in the model are held at zero, there is still a positive effect on the dependent variable, GDPm (Gross Domestic Product of Manufacturing sector).

In summary, the findings of this study, which emphasize the importance of asset efficiency and profitability in boosting the manufacturing sector's contribution to

GDP, are supported by a growing body of evidence from Nigeria, Indonesia, and other countries. Improving ROA through efficient asset utilization and investment appears to be a critical factor in enhancing the performance and competitiveness of the manufacturing sector. The discussion of specific hypothesis is outlined below.

5.3.1 H1: The quality of Infrastructure (port investment) significantly moderates the relationship between logistics performance and economic growth in Nigeria's manufacturing sector.

Port investment exhibits a remarkable symmetry, with both the mean and median converging at 2.8. This, combined with a low standard deviation (0.49) and mild skewness (0.39), indicates relatively stable investment levels over time. The Jarque-Bera test ($p = 0.180821$) further supports the assumption of normality, making POI a reliable and consistent variable for further analysis.

Similar to GDPm, Port Investment presents mixed results at its level, implying a degree of instability in its original form. This might be due to cyclical investment patterns, government policies, or fluctuating global trade conditions that influence port development. The non-stationarity underscores that the absolute amount of port investment at any given time is less informative than the changes in investment levels. However, after first differencing, POI achieves stationarity. This suggests that the changes in port investment are stable and suitable for analysis, potentially reflecting strategic decisions responding to market demands or infrastructure needs.

Differencing highlights the pace of investment and its responsiveness to other economic indicators.

Result

The analysis reveals a highly significant coefficient for Port Investment (POI), with a p-value of 0.0000, providing strong statistical evidence in favor of the alternative hypothesis. This result indicates that port investment has a substantial and positive impact on the manufacturing sector's contribution to Gross Domestic Product (GDP). Ports play a critical role in facilitating the movement of goods, raw materials, and finished products, making them essential nodes in global and domestic supply chains. Efficient port infrastructure reduces logistical bottlenecks, minimizes transportation costs, and improves trade efficiency, all of which are vital for manufacturing growth.

The findings underscore the importance of strategic investments in port infrastructure as a means to enhance manufacturing performance. Modernized ports equipped with advanced technologies can handle larger volumes of goods more efficiently, enabling manufacturers to meet growing demand and compete in international markets. Additionally, improved port facilities can attract foreign direct investment (FDI) by providing reliable trade routes and reducing supply chain disruptions. Policymakers should prioritize port development as a key component of economic planning to stimulate manufacturing activity and drive long-term economic growth.

For instance, Nazemzadeh and Vanelslander (2015) examined the contribution of port infrastructure to economic growth in Belgium, focusing on the Port of Antwerp. They

found that investments in port infrastructure had a significant positive impact on the regional and national economy, supporting the conclusions of the current study. Munim and Schramm (2018) investigated the mediating role of seaborne trade in the relationship between port infrastructure, logistics performance, and economic development. Their findings indicate that improved port infrastructure and logistics performance lead to increased seaborne trade, which in turn drives economic growth. This is consistent with the current study's observation that port investment positively impacts GDP. Wagner et al. (2022) examined how enhancing port infrastructure influences the decisions of shippers. They found that improvements in port infrastructure, such as better connectivity and efficiency, can lead to increased trade volumes and economic benefits. This aligns with the current study's conclusion that port investment boosts the manufacturing sector's contribution to the economy.

Similarly, Palyvoda et al. (2020) emphasize the importance of analyzing the investment attractiveness of seaports to effectively attract investors for the expansion of Ukrainian seaports, which are an integral part of the European transport network. This supports the notion that strategic port investments can significantly contribute to economic growth which is in line with the current study's objective. Lagoudis et al. (2014) discuss port investment strategies in the face of uncertainty in Southeast Asian multipurpose ports. Their work underscores the need for well-planned port investments to mitigate risks and maximize economic benefits. The maximizing economic benefit stated by these findings agrees with the notion of the current researcher on the need to improve port investment in Nigeria.

Gürol and Acar (2019) examine port investment decisions from a strategic standpoint, highlighting the crucial role of ports as key nodes in supply chain models for international commerce. Their findings align with the current study's conclusion that enhancing port infrastructure can boost the manufacturing sector's contribution to the economy. Olusegun, (2020) discusses the development prospects and challenges of Apapa and Calabar seaports in Nigeria, indicating that the federal and state governments, in collaboration with private investors, are looking to establish and develop potential seaports to alleviate maritime logistics challenges in Lagos State. This aligns with the current study's emphasis on the positive impact of port investments on economic growth.

Edih et al. (2022) examine the impact of efficient port operations on international shipping. Their work supports the notion that well-planned port investments can lead to improved port efficiency and, consequently, economic benefits. Chen et al. (2020) evaluates the potential for port investment along the Maritime Silk Road by assessing the sectors to be transferred and the countries to which they would be transferred. Their research highlights the importance of strategic port investments in facilitating international trade and economic development. However, the current study's findings may disagree with research that focuses on the economic impact of smaller port facilities. For example, Nowaczyk (2020) found that small port marine facilities can also contribute to regional economic growth, though the magnitude of the impact may differ from large-scale port investments.

Similarly, Mudronja et al. (2020) concluded that seaports, in general, drive regional economic development, but the specific impact may vary depending on the size and characteristics of the port. Additionally, Notteboom et al. (2013) provided a comprehensive review of the advances in port studies over the past 40 years, highlighting the complex and multifaceted nature of the relationship between ports and economic development. The current study's findings may not fully capture the nuances and context-specific factors that can influence the economic impact of port investment, as discussed in the broader port studies literature.

The above finding is supported the primary data interview from expert on port investment with the following themes:

Themes: Efficiency, Capacity, Cost Reduction, Infrastructure Needs

Efficiency: Investments in port infrastructure have enhanced the efficiency of supply chains, reducing waiting times for raw materials, and streamlining import processes, as highlighted by managers from Pacific Diagnostics Ltd and Crystal Skin Ventures Ltd.

Capacity: Improved port facilities have increased the capacity to handle larger shipments, which has positively impacted production schedules and manufacturing output. This was noted by managers from Nigeria Machine Tools Limited and Nestle Nigeria Plc.

Cost Reduction: Enhanced port facilities have led to significant reductions in transportation costs, contributing to overall cost savings. Managers from Honeywell Flour Mills Plc and Dag Industries Nigeria Limited emphasized this aspect.

Infrastructure Needs: Despite improvements, there is a continued need for better port infrastructure to handle volumes efficiently. Additional investments in port technology and automation were suggested by managers from Stallion Nigeria Limited and Reliance Chemical Products Limited.

In summary, the current study's finding that increased port investment positively impacts GDPm is consistent with the work of various researchers who emphasize the importance of strategic port investments in attracting investors, mitigating risks, improving port efficiency, and ultimately contributing to economic growth.

5.3.2 H2: There is statistically significant effect of high transportation costs on economic growth in the Nigeria's manufacturing sector.

The average annual transportation cost stands at 508.69, reflecting the logistical demands of the manufacturing sector. While there's a significant range in the data, indicative of cost variations, the skewness remains moderate (0.75). Interestingly, despite this variability, the Jarque-Bera test ($p = 0.139197$) indicates a likely normal distribution, suggesting that the central tendencies are still representative.

In contrast to GDPm and POI, Annual Transportation Cost (ATC) exhibits remarkable stability. It is stationary at both its level and first difference. This indicates that ATC is inherently stable over time, with no need for differencing, simplifying its inclusion in subsequent analyses. The stationarity of ATC might reflect well-established transportation networks, long-term contracts, or relatively consistent pricing structures within the transportation industry. The fact that it's stationary at the level means we can directly analyze the cost itself, providing valuable insights into how transportation expenses affect manufacturing operations and profitability.

Result

The analysis demonstrates a significant coefficient for Annual Transportation Cost (ATC), with a p-value of 0.0032, supporting the acceptance of this alternative hypothesis. This result suggests that annual transportation costs significantly and positively influence GDPm, highlighting the critical role transportation infrastructure plays in the manufacturing sector. Transportation costs encompass expenses related to moving raw materials to production facilities and delivering finished goods to markets. Lower transportation costs improve supply chain efficiency, reduce production expenses, and enable manufacturers to offer competitive pricing.

The findings imply that investments aimed at improving transportation networks, such as roads, railways, and shipping routes, can have far-reaching benefits for the manufacturing sector. Efficient transportation systems reduce delays, enhance

connectivity between production hubs and markets, and enable manufacturers to respond swiftly to changing market demands. Furthermore, advancements in logistics technology and practices can optimize route planning and inventory management, further reducing costs. Policymakers should focus on developing sustainable and efficient transportation systems to support manufacturing growth while addressing challenges such as congestion, fuel costs, and environmental impacts.

This finding aligns with the work of Kanehara and Kamei (2022), who built an international oligopoly model that explicitly integrates transporter behavior. Their study found that a reduction in transportation costs is caused by an improvement in the R&D efficiency of businesses in the process of product diversification. This means that businesses (Manufacturing according to the current study) will strive and become more efficient with the cost of transporting raw materials is moderately low and vice versa. The study also relates to the work of Davies et al. (2014), who argued that global industrial systems now need the free flow of raw materials, finished products, and purchased parts. The current study suggests that investment in transportation infrastructure can support this free flow of goods, thereby enhancing manufacturing output. Chen et al. (2023) assessed the effect of supply chain re-organization on increased local production of vital resources, contrasting previous opinions that supported globalization in manufacturing and production.

The current study provides an analytical framework for evaluating the effects of supply chain restructuring and domestic capacity development on the operation and

maintenance of a nation's roadways, which is relevant to the discussion of local manufacturing and production. Kiran (2019) investigated the most efficient and cost-effective ways to utilize transport services in today's competitive business environment, emphasizing that advancements in transportation techniques and principles contribute to improving the quality of goods' movement, their speed of delivery, the efficiency of their operational costs, the quality of their service, and the better utilization of their available resources.

This is in line with the findings of this present study which suggests that investment in transportation infrastructure can lead to these improvements, thereby enhancing manufacturing output. Tracey (2004) found a relationship between manufacturing company output and transportation efficacy, indicating that transportation is an integral component of a functional logistics and supply chain. The current study supports this finding by providing empirical evidence that transportation costs positively influence GDP in the manufacturing sector. Similarly, Hafner et al. (2023) modeled manufacturing and transportation sectors, with export quantities used to predict the need for transportation. They found that transport service providers maximize profits over a threshold of trade by upgrading to more modern transport equipment, which decreases their marginal costs and hence transport prices at equilibrium. It aligns with the current study which found that investment in transportation infrastructure can lead to similar improvements in transportation efficiency and cost-effectiveness. Zhang and Cheng (2023) used empirical data from the United Kingdom to study economic development and transport

infrastructure. While the current study does not specifically focus on the UK, it provides a framework for analyzing the relationship between transportation infrastructure and economic development in other contexts which makes it relevant to this finding.

Sik Lee et al. (1999) compared public infrastructure gaps and private sector solutions in Indonesia, Thailand, and Nigeria. While the current study is sectoral, it highlights the importance of transportation infrastructure in supporting manufacturing output and economic development. Ogwo et al. (2016) studied the relationship between Nigeria's manufacturing sector performance, transport infrastructure, and GDP growth from 1999 to 2011. The current study provides a more recent analysis of this relationship and supports the finding that transportation infrastructure is crucial for enhancing manufacturing output and economic growth.

The primary data from interviews also validates the above analysis.

Themes: Cost Management, External Factors, Profitability, Financial Performance

Cost Management: Companies have implemented strategies such as route optimization software and collaborations with local logistics providers to manage transportation costs effectively. Examples were provided by managers from Cadbury Nigeria Plc and Unilever Nigeria Plc.

External Factors: Fluctuations in fuel prices and regulatory changes significantly influence transportation costs. This impact was noted by managers from Pz Cussons Nigeria Plc and Pacific Diagnostics Ltd.

Profitability: High transportation costs can reduce profit margins if not managed properly, as indicated by managers from Crystal Skin Ventures Ltd and Nigeria Machine Tools Limited.

Financial Performance: Effective management of transportation costs is crucial for maintaining healthy finances. Managers from Nestle Nigeria Plc and Honeywell Flour Mills Plc highlighted the direct impact of transportation costs on financial performance and the bottom line.

In summary, the current study aligns with and builds upon the existing literature on the relationship between transportation costs, transportation infrastructure, and manufacturing output. It provides empirical evidence that investment in transportation infrastructure can facilitate better logistics and distribution, thereby enhancing GDP in the manufacturing sector and the economy.

5.3.3 H3: There is statistically significant effect of the delivery time of goods on economic growth in the Nigeria's manufacturing sector.

Delivery Time averages at 277.04-time units, which could reflect days or hours depending on the specific industry context. The moderate variability around this mean

is paired with a nearly symmetric distribution (Skewness: -0.17), making DLT particularly amenable to analysis. The Jarque-Bera test ($p = 0.150488$) further validates the normality assumption, solidifying DLT's reliability as a key variable.

Delivery Time demonstrate desirable stationarity properties at their levels. This means that DLT exhibits consistent statistical behavior without the need for differencing, making it straightforward to incorporate into our models. This stationarity in DLT suggests that if efficient and reliable logistics systems are in place, maintaining relatively consistent delivery schedules.

Result

Delivery Time (DLT): The coefficient for DLT is 0.086440, which is not statistically significant (p -value: 0.1042). This suggests that delivery time does not have a significant direct impact on GDPm. However, delivery time may have indirect effects or could be influenced by other factors not captured in this model. This is related to the work of Okafor et al. (2021) using the Vector Error Correction Model, to determine if Nigeria's economic growth is sustainable, the study found that there is a short-run and long-run causality from import, export, and exchange rates to GDP.

This finding may not be linked to the current study, but the short-run likelihood stated, shows that delivery time does not influence GDP eventually; Also, the work of Onyebuchi et al. (2023) explored the effect of the capital market on the manufacturing sector output in Nigeria from 1990 to 2021. The researchers adopted the ARDL-ECM

method of analysis and found that market capitalization has a positive impact on manufacturing sector output. The findings of the study suggest that improvements in the capital market can lead to increased manufacturing sector output in Nigeria. This, in turn, can have a positive impact on delivery times for manufactured goods. Again, there is no direct linkage between delivery time and GDP growth in this study.

Similarly, Diponegoro and Sarker (2002) present a decision model for determining manufacturing batch sizes and raw material ordering policies for a production system with a fixed-interval, lumpy demand delivery system. The study findings are that when demand is constant, the cost model is convex and a simple closed-form solution can be obtained, but for other cases, such as increasing, level, and declining demand phases, an algorithm is employed to find the minimal cost of maintaining the system. Also in this study, the direct linkage of delivery time as it affects growth was not a subject of concern.

The interview from experts supports this findings as seen below:

Themes: Production Efficiency, Customer Satisfaction, Delay Impact, Timeliness Measures

Production Efficiency: Timely delivery is crucial for maintaining production schedules. Delays can cause significant disruptions, as noted by managers from Dag Industries Nigeria Limited and Stallion Nigeria Limited.

Customer Satisfaction: Ensuring timely delivery is vital for maintaining high levels of customer satisfaction and loyalty. Managers from Reliance Chemical Products Limited and Cadbury Nigeria Plc emphasized this.

Delay Impact: Delivery delays can lead to financial losses and damage a company's reputation. Examples of such impacts were provided by managers from Unilever Nigeria Plc and Pz Cussons Nigeria Plc.

Timeliness Measures: Companies have adopted measures such as just-in-time inventory systems and investing in dependable logistics partners to ensure timely deliveries. Managers from Pacific Diagnostics Ltd and Crystal Skin Ventures Ltd discussed these strategies.

5.3.4 H4: There is statistically significant effect of inventory turnover on economic growth in the Nigeria's manufacturing sector.

With an average of 3.53, Inventory Turnover demonstrates generally efficient inventory management practices. The low variability and mild right-skewness (Skewness: 0.66) point to consistent performance across the board. Notably, the Jarque-Bera test ($p = 0.402815$) strongly supports the assumption of a normal distribution, making INT a statistically well-behaved variable.

Inventory Turnover (INT), stationarity reflects stable demand patterns and well-managed supply chains, ensuring a consistent flow of goods. The level stationarity of both variables simplifies analysis and strengthens the validity of any conclusions drawn about their impact on other aspects of the manufacturing sector. Inventory Turnover demonstrate desirable stationarity properties at their levels. INT exhibit consistent statistical behavior without the need for differencing, making it direct to incorporate into our models.

Result

The findings indicate a significant coefficient for Inventory Turnover (INT), with a p-value of 0.0418, supporting the acceptance of this alternative hypothesis. This result highlights that inventory turnover has a significant and positive impact on GDPm. Inventory turnover measures how efficiently companies manage their stock by converting it into sales over a specific period. High inventory turnover rates indicate effective inventory management practices that minimize holding costs while ensuring sufficient stock availability to meet demand.

Efficient inventory management contributes directly to manufacturing performance by reducing waste, optimizing resource allocation, and improving cash flow. Companies with streamlined inventory processes can respond more effectively to market fluctuations and customer needs while maintaining profitability. These efficiencies translate into higher productivity levels across the sector, ultimately boosting its contribution to GDP. Policymakers and business leaders should encourage the

adoption of advanced inventory management systems and practices, such as just-in-time (JIT) inventory strategies or predictive analytics, to enhance operational efficiency within the manufacturing industry.

This agrees with the study by Nwaiku and Ejechi (2022) which found that inventory record accuracy, lean inventory system, and information technology have a positive and significant effect on organizational productivity in Nigeria's manufacturing firms, while buffer stock management was found to be insignificant. The current study findings posit that increased inventory turnover positively impacts manufacturing performance (GDPm).

Similarly, Panigrahi et al. (2021) and Ogah et al. (2022) found that efficient inventory management, including distribution turnover and inventory automation, can enhance operational efficiency and performance in the steel manufacturing and Nigeria's manufacturing sectors, respectively, justifying the position of the current study on the need to keep appropriate inventory in the manufacturing firms. Alnaim and Kouaib (2023) also found a positive relationship between inventory turnover and company profitability. This further supports the notion that effective inventory management, as reflected in higher inventory turnover, can improve overall organizational productivity and financial performance; a position which this current study holds. In contrast, however, the study by Kenneth and Chinyeaka (2020) on the performance of Nigeria's seaports did not directly examine the impact of inventory turnover but rather used Data Envelopment Analysis, General Linear Model, and Multivariate Analysis to

evaluate port performance. While it is not directly comparable, this study highlights the importance of using appropriate analytical techniques to assess organizational performance. The current study has therefore elevated that position by examining the place of inventory turnover to evaluate the performance of the manufacturing industry with seaport as the moderating variable.

Supporting view of the interview from primary data is demonstrated in below:

Themes: Inventory Management, Challenges, Financial Performance, Improvement Strategies.

Inventory Management: Advanced inventory management systems and real-time monitoring help optimize inventory turnover, as noted by managers from Nigeria Machine Tools Limited and Nestle Nigeria Plc.

Challenges: Maintaining optimal inventory levels is challenging due to fluctuating demand and supply chain disruptions. This challenge was highlighted by managers from Honeywell Flour Mills Plc and Dag Industries Nigeria Limited.

Financial Performance: Efficient inventory turnover positively impacts cash flow and financial performance. Managers from Stallion Nigeria Limited and Reliance Chemical Products Limited discussed the financial benefits.

Improvement Strategies: Implementing lean manufacturing principles and just-in-time inventory practices has improved inventory turnover. Managers from Cadbury Nigeria Plc and Unilever Nigeria Plc provided examples of these strategies.

5.3.5 H5: There is statistically significant effect of return on assets on economic growth in the Nigeria's manufacturing sector.

On average, the manufacturing sector sees a Return on Assets of 5.76, with a standard deviation of 3.00 showing moderate variability in profitability across different companies. The distribution is somewhat right-skewed (Skewness: 0.81), hinting that some firms enjoy significantly higher returns. However, the Jarque-Bera test ($p = 0.104490$) suggests a possible normality, allowing for parametric analysis.

ROA mirrors the behavior of GDPm and POI: it's non-stationary at its level but achieves stationarity after first differencing. This result implies that the changes in ROA are what exhibit stable characteristics, potentially reflecting adjustments to operational efficiency, market conditions, or strategic decisions made by firms. The non-stationarity at the level suggests that absolute ROA values can be influenced by long-term factors, such as accumulated debt or past investment choices. Differencing ROA allows us to focus on the improvements or declines in profitability, providing a more nuanced understanding of how various factors impact the current performance of manufacturing firms.

Result

The analysis reveals a highly significant coefficient for Return on Assets (ROA), with a p-value of 0.0000, leading to the acceptance of this alternative hypothesis. This result indicates that return on assets significantly influences GDPm in a positive manner. ROA is an important financial metric that measures how efficiently companies utilize their assets to generate profits. A higher ROA reflects better asset utilization and profitability, which are critical drivers of economic performance within the manufacturing sector.

Manufacturing firms that effectively manage their assets, such as machinery, equipment, or property, are better positioned to maximize output while minimizing costs. This efficiency not only enhances individual company performance but also contributes to overall economic growth by increasing productivity at scale. The findings underscore the importance of fostering asset efficiency through investments in modern technologies, workforce training programs, and maintenance practices that extend asset lifecycles. Policymakers should support initiatives aimed at improving asset utilization across industries to sustain long-term growth within the manufacturing sector.

For instance, Aremu et al. (2021) found a positive correlation between the ROA of publicly traded industrial enterprises in Nigeria and the government's expenditures on electricity from 1999 to 2015. This suggests that improved access to electricity, a key input for manufacturing, can enhance asset efficiency and profitability. Olaoye and

Adesina (2022) examined the relationship between Nigeria's manufacturing businesses' capital structures and their bottom lines. Their findings imply that efficient asset utilization, as reflected in ROA, is crucial for profitability. Akinleye and Olufemi (2019) also found that asset utilization had a significant impact on the success of a subset of Nigeria's industrial companies. This underscores the importance of ROA in driving manufacturing performance. Studies in other countries have yielded similar results. Purwanto et al. (2021) investigated the impact of debt-to-equity ratio, total asset turnover, ROA, and return on equity on dividend policy in Indonesian manufacturing enterprises. Their findings suggest that ROA is a key determinant of financial performance. Irman and Purwati (2020) examined the influence of the current ratio, debt-to-equity ratio, and total asset turnover on ROA in the automotive and component companies listed on the Indonesia Stock Exchange from 2011 to 2017. Their results highlight the importance of asset efficiency in driving ROA. Larasati et al. (2020) looked at how the debt-to-equity ratio and ROA affected earnings per share (EPS) for Indonesian manufacturers across industry sub-sectors. They found that ROA had a significant positive impact on EPS, underscoring its importance in enhancing shareholder value. Purba et al. (2020) investigated the effect of ROA, total assets, and sales growth on the capital structure of Indonesian manufacturing companies. Their findings suggest that ROA is a key determinant of capital structure decisions.

The key findings reveal a significant positive relationship between logistics performance and economic growth, confirming that better logistics efficiency boosts

economic output. However, the study also demonstrates that inadequate seaport infrastructure hinders logistics efficiency. Critically, port investment emerges as a key moderator, influencing the relationships between independent variables (annual transportation costs, inventory turnover rates, return on assets) and the manufacturing sector's contribution to GDP (GDPm). The research indicates that strategic and adequate investment in port infrastructure enhances the positive impact of efficient transportation, optimized inventory management, and strong financial performance on manufacturing output. While delivery time did not show a statistically significant direct impact on GDPm, the findings overall emphasize the importance of strategic investments in infrastructure development and operational efficiencies. The random effects panel regression model (Table 4.6 in the thesis) confirmed significant relationships between these independent variables and GDPm, underscoring the interconnectedness of these factors. The study's implications emphasize the need for the Nigerian government to prioritize investments in port facilities, including upgrades, improved connectivity, and the adoption of modern technologies, while also encouraging manufacturers to collaborate with logistics providers to optimize their supply chain operations.

Supporting views of expert from the field through interview.

Themes: Measurement, Influencing Factors, Improvement Initiatives, Industry Comparison.

Measurement: Companies use financial ratios, performance metrics, and regular reviews to track ROA. Managers from Pz Cussons Nigeria Plc and Pacific Diagnostics Ltd discussed their measurement practices.

Influencing Factors: Operational efficiency, asset utilization, and investments in technology and machinery are key factors influencing ROA. This was noted by managers from Crystal Skin Ventures Ltd and Nigeria Machine Tools Limited.

Improvement Initiatives: Initiatives such as investments in automation and optimizing asset management practices have improved ROA. Examples were provided by managers from Nestle Nigeria Plc and Honeywell Flour Mills Plc.

Industry Comparison: Companies benchmark their ROA against industry standards to remain competitive. Managers from Dag Industries Nigeria Limited and Stallion Nigeria Limited discussed their benchmarking practices

5.4 Relating the Conclusions with the Research Objectives.

The primary aim of this study is to examine the role of seaport infrastructure in enhancing logistics performance and economic growth in Nigeria's manufacturing sector. This aim is closely aligned with the study's specific objectives, which included assessing how port investment, transportation costs, delivery time, inventory turnover,

and return on assets influence economic growth. The conclusions drawn from the research directly support these objectives:

The study concluded that improved seaport infrastructure positively moderates the relationship between logistics performance and economic growth. This finding aligns with the intention to measure how port infrastructure impacts logistics performance, providing empirical evidence that robust infrastructure significantly enhances economic outcomes in the manufacturing sector.

The results showed that high transportation costs and inefficiencies in delivery times are significant barriers to economic growth, supporting the objective of examining specific logistical factors that affect the sector. The study's conclusion that infrastructure investments can mitigate these barriers directly ties back to the research aim, demonstrating that logistics performance is critical for economic advancement.

5.4.1 Relating the Research Objective with Contribution to Knowledge

The study makes a substantial contribution to the existing body of knowledge by filling a critical gap regarding the moderating role of seaport infrastructure in the logistics-economic growth nexus within Nigeria's manufacturing sector. This research contributes novel insights by empirically demonstrating how strategic investments in port infrastructure can enhance logistics performance and, consequently, economic growth. The study's findings provide a clearer understanding of the dynamics between

logistics infrastructure and economic performance, particularly in developing economies.

This contribution extends beyond theoretical implications, offering practical guidance for policymakers and industry stakeholders on the importance of infrastructure development. By highlighting the positive impact of port investments on economic growth, this study adds a valuable perspective to the ongoing discourse on how to optimize logistics and infrastructure in emerging markets can achieve sustainable development goals.

5.5 Contributions of the Study

5.5.1 Theoretical Implications

Align Firm-Level Profitability with Sector Growth

Understanding the factors that drive the relationship between return on assets and GDP can inform theoretical frameworks that link individual firm performance to broader economic outcomes.

Policy Support for Infrastructure Development

Theoretical models can be developed to explore the impact of regulatory frameworks and public-private partnerships on infrastructure investment and economic growth.

Integration of Seaport Infrastructure and Logistics Performance:

The research highlights the moderating role of seaport infrastructure in the relationship between logistics performance and economic growth. By demonstrating how port investments can enhance supply chain efficiency and boost manufacturing output, this study provides a nuanced understanding of the infrastructure-logistics nexus.

Empirical Validation of Logistic and Economic Relationships:

Through rigorous statistical analysis, including random effects panel regression and unit root tests, the study empirically validates the positive impact of port investment, annual transportation cost, and inventory turnover on the manufacturing sector's contribution to GDP. This empirical evidence reinforces the critical importance of logistics and infrastructure investments in economic planning.

In general, the research provides a foundational framework for future studies to explore the indirect effects of delivery time and other logistics variables on economic performance. It opens new avenues for investigating the complex interdependencies within the manufacturing sector's supply chain.

5.5.2 Practical Implications

Enhance Seaport Infrastructure

Policymakers should prioritize investments in seaport infrastructure to improve supply chain efficiency and manufacturing output.

Improve Transportation Infrastructure

Investment in transportation networks is crucial for reducing logistics costs and facilitating the movement of goods within the manufacturing sector.

Adopt Advanced Inventory Management Systems

Manufacturing firms can implement advanced inventory management practices to optimize turnover, reduce holding costs, and enhance financial performance.

Investment in Port Technology and Automation

Authorities should focus on incorporating advanced technologies in port operations to improve efficiency and competitiveness in trade.

Overall, the study offers practical recommendations for policymakers and business leaders, emphasizing strategic investments in port and transportation infrastructure, advanced inventory management practices, and alignment of firm-level profitability with sector-wide growth. These insights are crucial for informed decision-making and effective economic planning.

Reduction of Transportation Costs

Strategies such as subsidies for fuel-efficient vehicles and optimized transportation routes can help manage and reduce transportation costs, increasing profitability.

Lean Inventory Practices and IT Integration

Manufacturing firms should adopt lean inventory practices alongside IT integration for real-time inventory management, helping maintain optimal levels and reduce excess costs.

Incentives for Efficient Asset Utilization

Providing incentives for firms to enhance asset utilization can align profitability with economic growth, encouraging investment in operational efficiency technologies.

5.5.3 Methodological Implications:

By employing advanced panel regression techniques and robust diagnostic tests, this research sets a methodological precedent for future studies to examine the economic impact of logistics and infrastructure investments. The use of panel unit root tests and the Hausman test enhances the reliability and validity of the findings. Future studies can leverage on this technique and enhance future research.

In summary, the implications of this research are significant for a wide range of stakeholders, including policymakers, industry practitioners, and investors.

For policymakers, the study underscores the need for targeted investments in port infrastructure as part of broader economic development strategies. Improved seaport infrastructure can reduce logistics costs, attract foreign direct investment, and create employment opportunities, thereby driving economic growth.

For manufacturing firms, the research highlights the critical role of efficient logistics in enhancing competitiveness and operational performance. Firms that leverage ports with superior infrastructure can reduce operational costs and improve delivery timelines, enhancing their market positioning. Investors can also use these insights to identify strategic opportunities in logistics and infrastructure projects, guided by the understanding that robust infrastructure is a key driver of economic performance.

Overall, the study's findings advocate for a comprehensive approach to infrastructure development that prioritizes efficiency and technological advancements in port operations. By addressing the logistical challenges identified in this research, Nigeria can unlock significant economic potential, particularly within its manufacturing sector, thereby contributing to the country's broader economic objectives.

5.6 Limitations and Suggestions for Further Studies

5.6.1 Limitations of the Research

While the study provides valuable insights, it is important to acknowledge its limitations. The research was primarily focused on selected seaports in Lagos, which may not fully capture the logistics performance and economic conditions across all of Nigeria's ports. This geographic limitation restricts the generalizability of the findings to other regions with distinct infrastructural challenges. Again, if this study covers the whole of Africa or engages in countries or continent comparison, its findings might be more robust. To this end, future researchers must look at this scope or geographical gap in a view to improving it in the future.

Additionally, the reliance on secondary data in the analysis means that some operational nuances and real-time challenges faced by port operators were not captured. Future research could benefit from expanding the geographic scope and employing primary data collection methods, such as questionnaires, surveys, or interviews, and analyzing the data quantitatively as a mixed method to gain a deeper understanding of the on-ground realities and stakeholder perspectives. Another limitation is the study's focus on specific logistics performance indicators, which might not encompass all factors influencing the broader economic impact of seaport infrastructure.

5.6.2 Suggestions for future studies

Exploring Indirect Effects of Delivery Time:

Future research should delve into the indirect effects of delivery time on the manufacturing sector's contribution to GDP. While this study found that delivery time has a positive but statistically insignificant direct impact, there may be underlying factors that amplify its influence on economic performance.

Disaggregated Analysis of Seaport Investments:

Further studies could disaggregate seaport investments into specific components, such as technology adoption, automation, and operational efficiency improvements, to understand their contributions to manufacturing performance and economic growth.

Longitudinal Studies on Infrastructure Impact:

Conducting longitudinal studies that track the impact of infrastructure investments over an extended period could provide deeper insights into their long-term effects on logistics performance and economic growth. Such studies can capture the evolving dynamics and sustained benefits of these investments.

Comparative Studies Across Regions:

Comparative research across different regions within Nigeria or other developing countries can help identify regional variations in the impact of logistics performance

and infrastructure on economic growth. This can inform region-specific policy recommendations and investment strategies.

Examining Firm-Level Profitability Dynamics:

Investigating the factors driving the negative relationship between return on assets and the manufacturing contribution to GDP can provide a more nuanced understanding of how firm-level profitability interacts with sector-wide economic growth. This could involve case studies of specific firms or sectors.

Role of External Factors in Transportation Costs:

Future research could explore the impact of external factors such as fuel price fluctuations, regulatory changes, and tariffs on transportation costs and their subsequent effect on manufacturing performance. Understanding these influences can help in developing strategies to mitigate adverse effects.

Impact of Digital Transformation in Logistics:

Investigating how digital transformation and the adoption of advanced technologies in logistics management influence the manufacturing sector's performance can provide valuable insights into the role of innovation in economic development.

Policy Implementation and Evaluation:

Studies that focus on the implementation and evaluation of policies related to infrastructure development and logistics performance can provide practical insights

into the effectiveness of different strategies and identify best practices for enhancing economic growth. By addressing these areas, future research can build on the findings of this study, offering more comprehensive and detailed insights into the complex relationships between logistics performance, infrastructure investments, and economic growth in the manufacturing sector.

5.7 Conclusion

This study examines the moderating effect of seaport infrastructure on the relationship between logistics performance and economic growth in Nigeria's manufacturing sector, emphasizing the importance of strategic port investments and efficient logistics for economic enhancement. It aligns with research highlighting seaports as vital for economic growth, noting Nigeria's heavy reliance on sea trade. Efficient port infrastructure is shown to improve trade facilitation and economic performance, particularly in developing economies.

The analysis indicates that port investment, annual transportation costs, and inventory turnover positively correlate with the manufacturing sector's contribution to GDP. Improved port facilities boost manufacturing output by enhancing supply chain efficiency and reducing import/export bottlenecks. Strategic port investments enhance logistics, stimulate industrial productivity, and attract foreign direct investment. Port

investments directly benefit manufacturing by streamlining trade, reducing delays, and improving access to international markets.

Annual transportation costs positively influence GDP, indicating that higher transportation expenditures correlate with increased manufacturing activities. Robust transportation infrastructure is essential for supporting manufacturing and economic growth. Efficient inventory management practices, indicated by higher inventory turnover, enhance operational efficiency and reduce costs.

However, return on assets (ROA) has a negative impact on the manufacturing contribution to GDP, suggesting that higher firm profitability doesn't necessarily translate to a higher overall contribution to GDP from the manufacturing sector. Firm-level financial metrics such as ROA often fail to capture externalities or broader sectoral impacts on economic growth.

The random effects panel regression model used in this study is validated by robust diagnostic tests and demonstrates strong explanatory power. Efficient inventory management positively impacts manufacturing performance by reducing holding costs and improving operational efficiency. Delivery time has an insignificant effect on GDP contribution from manufacturing, depending on contextual factors such as infrastructure quality or logistical practices.

Thematic analysis reveals that port investment, transportation cost management, timely delivery, inventory turnover, and ROA are crucial factors influencing logistics

and operational efficiency in manufacturing companies. Integrated approaches to logistics management bolster economic outcomes.

In conclusion, the study highlights the essential role of seaport infrastructure in enhancing logistics performance and fostering economic growth within Nigeria's manufacturing sector. A significant positive relationship exists between improved logistics efficiency and increased economic output. The Nigerian government should prioritize investments in port infrastructure, and collaboration between manufacturers and logistics providers is crucial to optimizing supply chain operations effectively.



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APPENDICES

APPENDIX A:

PANEL UNIT ROOT TEST RESULTS FOR THE VARIABLES

GDP AT LEVEL

Panel unit root test:

Summary

Series: GDP

Date: 06/09/24 Time:

21:26

Sample: 2012 2022

Exogenous variables: Individual effects

User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	2.29071	0.9890	11	99
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	2.78017	0.9973	11	99
ADF - Fisher Chi-square	3.41592	1.0000	11	99
PP - Fisher Chi-square	3.52574	1.0000	11	110

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Annual Transportation Cost (ATC) AT LEVEL

Panel unit root test: Summary

Series: D(POI)

Date: 06/09/24 Time: 21:32

Sample: 2012 2022

Exogenous variables: Individual effects

User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Balanced observations for each test

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-10.22	0.0000	11	88
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.8528	0.0000	11	88
ADF - Fisher Chi-square	82.2655	0.0000	11	88
PP - Fisher Chi-square	124.700	0.0000	11	99

** Probabilities for Fisher tests are computed using an asymptotic Chi

-square distribution. All other tests assume asymptotic normality.

Delivery Time (DLT) AT LEVEL

Panel unit root test: Summary

Series: DLT

Date: 06/09/24 Time: 21:35

Sample: 2012 2022

Exogenous variables: Individual effects

User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Balanced observations for each test

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.61984	0.0000	11	99
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.03216	0.0012	11	99
ADF - Fisher Chi-square	54.9052	0.0001	11	99
PP - Fisher Chi-square	54.9361	0.0001	11	110

** Probabilities for Fisher tests are computed using an asymptotic Chi

-square distribution. All other tests assume asymptotic normality.

INT AT LEVEL

Panel unit root test: Summary

Series: INT

Date: 06/09/24 Time: 21:36

Sample: 2012 2022

Exogenous variables: Individual effects

User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.83158	0.0028	11	99
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.67702	0.0008	11	99
ADF - Fisher Chi-square	19.2923	0.0272	11	99
PP - Fisher Chi-square	23.0976	0.0062	11	110

** Probabilities for Fisher tests are computed using an asymptotic Chi

-square distribution. All other tests assume asymptotic normality.

Return on Asset (ROA) AT LEVEL

Panel unit root test: Summary

Series: ROA

Date: 06/09/24 Time: 21:39

Sample: 2012 2022

Exogenous variables: Individual effects

User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Balanced observations for each test

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.90879	0.8183	11	99
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.60252	0.7266	11	99
ADF - Fisher Chi-square	18.2201	0.6929	11	99
PP - Fisher Chi-square	33.2273	0.0587	11	110

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Return on Asset (ROA) AT FIRST DIFFERENCE

Panel unit root test: Summary

Series: D(ROA)

Date: 06/09/24 Time: 21:39

Sample: 2012 2022

Exogenous variables: Individual effects

User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Balanced observations for each test

Method	Statistic	Prob.**	Cross- sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.5949	0.0000	11	88
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.92985	0.0017	11	88
ADF - Fisher Chi-square	47.4343	0.0013	11	88
PP - Fisher Chi-square	136.178	0.0000	11	99

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

APPENDIX B

PANEL POOL REGRESSION RESULT

Dependent Variable: GDP

Method: Panel Least Squares

Date: 06/09/24 Time: 21:43

Sample: 2012 2022

Periods included: 11

Cross-sections included: 11

Total panel (balanced) observations: 121

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POI	0.218733	0.31837	0.687049	0.0000
ATC	0.002109	0.00074	2.869291	0.0049
DLT	0.004644	0.00298	1.559289	0.1217
INT	0.165903	0.08465	1.959951	0.0524
ROA	-0.273326	0.06596	-4.143753	0.0001
C	17.08996	1.34233	12.73158	0.0000
Root MSE	1.320093	R-squared		0.658802
Mean dependent var	10.72727	Adjusted R-squared		0.643968
S.D. dependent var	2.269361	S.E. of regression		1.354093
Akaike info criterion	3.492455	Sum squared resid		210.8602
Schwarz criterion	3.631089	Log likelihood		-205.294
Hannan-Quinn criter.	3.54876	F-statistic		44.4096
Durbin-Watson stat	1.968421	Prob(F-statistic)		0.0000

APPENDIX C: PANEL FIXED EFFECT REGRESSION

Dependent Variable: GDP

Method: Panel Least Squares

Date: 06/09/24 Time: 21:49

Sample: 2012 2022

Periods included: 11

Cross-sections included: 11

Total panel (balanced) observations: 121

Variable	Coefficient	Std. Error	t- Statistic	Prob.
POI	0.092362	0.37583	0.245755	0
ATC	0.005492	0.00141	3.89784	0.0002
DLT	0.004819	0.00334	1.442004	0.1523
INT	0.370336	0.16141	2.294441	0.0238
ROA	0.060338	0.12718	0.474429	0.0005
C	0.019161	2.18219	0.008781	0
Effects Specification				
Cross-section fixed (dummy variables)				
Root MSE	1.201105	R-squared		0.717539
Mean dependent var	10.72727	Adjusted squared	R-	0.677187
S.D. dependent var	2.269361	S.E. of regression		1.289374
Akaike info criterion	3.468824	Sum squared resid		174.5611
Schwarz criterion	3.838515	Log likelihood		-193.864
Hannan-Quinn criter.	3.61897	F-statistic		17.78216
Durbin-Watson stat	2.005658	Prob(F-statistic)		0.0000

APPENDIX D: FIXED EFFECT TEST

Dependent Variable: GDP

Method: Panel Least Squares

Date: 06/09/24 Time: 21:49

Sample: 2012 2022

Periods included: 11

Cross-sections included: 11

Total panel (balanced) observations: 121

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POI	0.092362	0.37583	0.245755	0.0000
ATC	0.005492	0.00141	3.89784	0.0002
DLT	0.004819	0.00334	1.442004	0.1523
INT	0.370336	0.16141	2.294441	0.0238
ROA	0.060338	0.12718	0.474429	0.0005
C	0.019161	2.18219	0.008781	0.0000
Effects Specification				
Cross-section fixed (dummy variables)				
Root MSE	1.201105	R-squared		0.717539
Mean dependent var	10.72727	Adjusted R-squared		0.677187
S.D. dependent var	2.269361	S.E. of regression		1.289374
Akaike info criterion	3.468824	Sum squared resid		174.5611
Schwarz criterion	3.838515	Log likelihood		-193.864
Hannan-Quinn criter.	3.61897	F-statistic		17.78216
Durbin-Watson stat	2.005658	Prob(F-statistic)		0.00000

Redundant Fixed Effects Tests

Equation: Untitled

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.1834	-10,105	0.0042
Cross-section Chi-square	22.859	10	0.0127

Cross-section fixed effects test equation:

Dependent Variable: GDP

Method: Panel Least Squares

Date: 06/10/24 Time: 11:22

Sample: 2012 2022

Periods included: 11

Cross-sections included: 11

Total panel (balanced) observations: 121

Variable	Coefficient	Std. Error	t- Statistic	Prob.
POI	0.092362	0.3184	0.245755	0.0000
ATC	0.005492	0.0007	3.89784	0.0002
DLT	0.004644	0.003	1.442004	0.1217
INT	0.165903	0.0846	2.294441	0.0238
ROA	0.060338	0.066	0.474429	0.0005
C	0.019161	1.3423	0.008781	0.0000
Root MSE	1.320093	R-squared		0.6588
Mean dependent var	10.72727	Adjusted R-squared		0.64397
S.D. dependent var	2.269361	S.E. of regression		1.35409
Akaike info criterion	3.492455	Sum squared resid		210.86
Schwarz criterion	3.631089	Log likelihood		-205.29
Hannan-Quinn criter.	3.54876	F-statistic		44.4096
Durbin-Watson stat	1.968427	Prob(F-statistic)		0.0000

APPENDIX E: RANDOM EFFECT

Dependent Variable: GDP

Method: Panel EGLS (Cross-section random effects)

Date: 06/10/24 Time: 11:52

Sample: 2012 2022

Periods included: 11

Cross-sections included: 11

Total panel (balanced) observations: 121

Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POI	0.361871	0.30315	1.193703	0.0000
ATC	0.102108	0.1027	0.994245	0.0032
DLT	0.08644	0.02836	3.048062	0.1042
INT	0.165903	0.0806	2.058328	0.0418
ROA	0.173325	0.06281	2.7596	0.0000
C	0.089956	1.27817	0.070378	0.0000
Effects Specification				
			S.D.	Rho
Cross-section random			0.0000	0.0000
Idiosyncratic random			1.289374	1.0000
Weighted Statistics				
Root MSE	1.320093	R-squared		0.6588
Mean dependent var	10.72727	Adjusted R-squared		0.64397
S.D. dependent var	2.269361	S.E. of regression		1.35409
Sum squared resid	210.8602	F-statistic		44.4096
Durbin-Watson stat	2.000346	Prob(F-statistic)		0.0000
Unweighted Statistics				
R-squared	0.658802	Mean dependent var		10.7273
Sum squared resid	210.8602	Durbin-Watson stat		2.00035

APPENDIX F: HAUSMAN TEST

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	12.367	5	0.32456

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var (Diff.)	Prob.
POI	-1.92362	-2.7619	0.049349	0.0002
ATC	0.005492	0.00211	0.000001	0.0057
DLT	0.004819	0.00464	0.000003	0.921
INT	0.370336	0.1659	0.019555	0.1438
ROA	-0.46034	-0.2733	0.01223	0.0908

Cross-section random effects test equation:

Dependent Variable: GDP

Method: Panel Least Squares

Date: 06/10/24 Time: 12:28

Sample: 2012 2022

Periods included: 11

Cross-sections included: 11

Total panel (balanced) observations: 121

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.32916	2.18219	6.108168	0
POI	-1.92362	0.37583	-5.118322	0
ATC	0.005492	0.00141	3.89784	0.0002
DLT	0.004819	0.00334	1.442004	0.1523
INT	0.370336	0.16141	2.294441	0.0238
ROA	-0.46034	0.12718	-3.61957	0.0005

Effects Specification

Cross-section fixed (dummy variables)

Root MSE	1.201105	R-squared	0.71754
Mean dependent var	10.72727	Adjusted R-squared	0.67719
S.D. dependent var	2.269361	S.E. of regression	1.28937
Akaike info criterion	3.468824	Sum squared resid	174.561
Schwarz criterion	3.838515	Log likelihood	-193.86
Hannan-Quinn criter.	3.61897	F-statistic	17.7822
Durbin-Watson stat	1.245655	Prob(F-statistic)	0.0000

APPENDIX G

PANEL HETEROSCEDASTICITY TEST

Panel Period Heteroscedasticity LR Test

Equation: UNTITLED

Specification: C POI ATC DLT INT ROA

Null hypothesis: Residuals are homoscedastic

	Value	Df	Probability
Likelihood ratio	3.651104	10	0.9617

LR test summary:

	Value	Df
Restricted LogL	176.6666	121
Unrestricted LogL	178.4922	121



APPENDIX H:

RESIDUAL CROSS-SECTION TEST RESULT

Residual Cross-Section Dependence Test

Null hypothesis: No cross-section dependence

(correlation) in

weighted residuals

Equation: Untitled

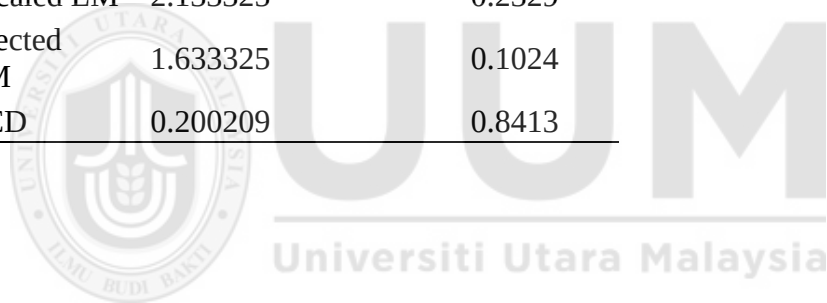
Periods included: 11.

Cross-sections included: 11

Total panel observations: 121

Cross-section effects were removed during estimation.

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	65.23849	45	0.1258
Pesaran scaled LM	2.133325		0.2329
Bias-corrected scaled LM	1.633325		0.1024
Pesaran CD	0.200209		0.8413



APPENDIX I: LETTER FOR DATA COLLECTION



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UUM/COB/P-40
9 October 2023

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

LETTER OF RECOMMENDATION FOR DATA COLLECTION AND RESEARCH WORK

This is to certify that **SALIHU ADAM JIDDAH (Matric No. 905214)** is a student at the UUM College of Business, Universiti Utara Malaysia, pursuing his Doctor of Philosophy (Technology, Operation and Logistics Management). He is conducting research entitled ***"The Moderating Effect of Seaport Infrastructure on the Relationship between Logistics Performance and Economic Growth in the Nigerian Manufacturing Sector"*** under the supervision of Assoc. Prof. Dr. Suhaila binti Abdul Hanan and Ts. Dr. Nur Khairiel bin Anuar.

In this regard, we hope that you can kindly provide him with assistance and cooperation to enable him to successfully complete the research. All the information gathered will be strictly used for academic purposes only.

Your cooperation and assistance are very much appreciated.

Thank you.

"MALAYSIA MADANI"
"BERKHIDMAT UNTUK NEGARA"
"KEDAH SEJAHTERA - NIKMAT UNTUK SEMUA"
"ILMU BUDI BAKTI"

Upholding the principles of trust and integrity

NURUL NADIAH RUSLE
Assistant Registrar
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