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SUPPLY CHAIN INTEGRATION AND PERFORMANCE OF SHIPPING COMPANIES IN RIVERS STATE

Aguocha, Chukwunonso. O.
University of Port Harcourt Business School.

Eke, Haniel.O (Ph.D)
Department of Marketing University of Port Harcourt
haniel.eke@uniport.edu.ng

Ogbuji, Chinedu. N.
Professor of Social and Services Marketing
University of Port Harcourt

ABSTRACT
This study empirically investigated the relationship between global supply chain integration and firm agility of shipping companies in Nigeria. Cross-sectional research design was adopted in accessing the study's subjects. The population of the study consists of 216 employees of shipping companies in Nigeria. A total of 5 hypotheses were proposed and statistically tested using Spearman's Rank Correlation Coefficient. Results indicated that the dimensions of supply chain integration such as supplier integration and customer integration were significantly related to the measures of performance; which include on-time delivery and cost efficiency. It was against this background that the study concluded that keeping closer collaboration, long-term partnership and coordination with key suppliers has been proven to enhance supply chain efficiency, on-time delivery and cost efficiency. The study therefore recommended that management of shipping companies who want to improve firm agility are encouraged to establish long-term partnership and coordination with key suppliers, as these strategies have been proven to enhance supply chain efficiency, on-time delivery and cost efficiency.

Keywords: Supply Chain Integration, Performance, Customer Integration.

Introduction

Global supply chain integration allow countries to benefit from a more efficient global division of labour, in which countries can use their different comparative advantages not only in different sectors, but also in different stages of production within sectors (Goeltz, 2018). Fragmented production makes it possible for firms, even smaller ones, in developing countries to enter foreign markets at low costs. They can specialize in a specific niche and gain access to larger markets for their output, benefiting from higher returns to scale. At the same time, companies from developing countries can also access cheaper and better inputs, such as productivity-enhancing technologies developed elsewhere and grow at a faster rate. The advent of global supply chain integration has often provided a stepping stone for firms in developing countries to integrate into the global economy. This is reflected for instance in the increasing share of

developing countries in exports, rising from 5% percent at the end of the 1980s to almost 35% in 2014 (Delbufalo, 2016). Their share in world trade also rose from 33% to 48% between 2000 and 2012. As a result, the global economy is today mainly structured around global supply chains that account for a rising share of international trade, global GDP and employment (Council of Supply Chain Management Professionals (CSCMP).

To enhance business agility and competitiveness among companies globally, it is necessary to implement strategies to partner with other companies that will affect competitive advantage (Huang et al., 2019). Several performance indicators of businesses at the global level need to improve, through supply chain integration and regulations, other globalization factors drive supply chain integration among firms (Goeltz, 2018). Meanwhile, Huo et al. (2018) found that multinational companies with strong internal integration in business processes build better competitive advantages that improve business agility. When the supply chain members are integrated, and there is a proper communication flow, the company can quickly adjust to any market changes, either in the long or short term (Seebacher and Winkler, 2015). The joint supply chain integration partnership with a win-win situation helps multinational organization find the best way to reduce production, inventory, or transaction costs and increase profitability (Deshpande, 2016). Therefore, global supply chain integration brings many benefits to multinational organization. The company's performance to integrate it is internal or external with its supply chain partners supports its ability to respond to market demands (Kumar et al., 2017).

The importance of business agility is growing in significance as a result of several factors, including shorter product life cycles, heightened demand for personalised products and services, less visibility of demand, and ongoing change. Therefore, it has been acknowledged by organisations that agility is of utmost importance for their survival and competitive advantage, particularly in the present day (Deshpande, 2016). Moreover, it has been shown that agility serves as a catalyst inside organisations, facilitating prompt and efficient responses that allow companies to gain a competitive edge. Furthermore, the level of adaptability exhibited by a company's supply chain has been recognised as a crucial determinant of its total competitive advantage. Research conducted by Delbufalo (2016) demonstrates that organisations operating within agile supply chains have enhanced capabilities in effectively adapting to unforeseen disruptions. This advantage stems from their improved ability to align the supply of goods and services with fluctuating consumer demand. The successful alignment of supply and demand necessitates the harmonization of the internal operations of a corporation with those of its suppliers and consumers (Chavez, Yu, Gimenez, Fynes, and Wiengarten, 2015).

Numerous scholarly investigations have been conducted to explore the notion of global supply chain integration in connection to various business outcomes. While previous studies have explored supply chain integration and business performance at country level (Chavez, et al., 2015; Delbufalo, 2017; Deshpande, 2016), limited research has been conducted at the global level. Therefore there exist a gap that this study was undertaken to bridge. It was on this premise that we investigated the relationship between firm agility of shipping companies in Rivers State.

1.1 Aim and Objectives of the Study

The aim of this study was to investigate the relationship between supply chain integration and performance of shipping companies in Nigeria. However, the study's objectives are to:

i. investigate the relationship between supplier integration and on-time delivery of shipping companies in Rivers State;
ii. examine the relationship between supplier integration and cost efficiency of shipping companies in Rivers State;
iii. determine the relationship between customer integration and on-time delivery of shipping companies in Rivers State;
iv. ascertain the relationship between customer integration and cost efficiency of shipping companies in Rivers State;
v. evaluate the moderating effect of Information Technology (IT) capabilities on the relationship between supply chain integration and performance of shipping companies in Rivers State.

2. LITERATURE REVIEW

2.2 Theoretical Framework

2.2.5 Social Capital Theory (SCT)

The history of social capital traces a long way back to classical economists, such as Adam Smith and John Stuart Mill, and sociologists, such as Max Weber, who provided the cultural explanation to economic phenomena. The concept of social capital as a topical issue, however, came into the spotlight only in late 1980s and attracted growing research interest thereafter. The scientific study of social capital is relatively new, but the growth of literature on the topic is enormous.

The theory of social capital is particularly rooted on the notion of trusts, norms, and informal networks and it believes that 'social relations are valuable resources. Social capital is broadly defined to be a multidimensional phenomenon encompassing a stock of social norms, values, beliefs, trusts, obligations, relationships, networks, friends, memberships, civic engagement, information flows, and institutions that foster cooperation and collective actions for mutual benefits and contributes to economic and social development.

A significant contribution to social capital theory was made by Francis Fukuyama. He offered the more specific but significantly different definition of social capital. The author went on to define social capital in terms of trust as the ability of the people to work together for common purposes in groups and organizations (Fukuyama, 1995). Alternatively, he defines social capital simply as the existence of a certain set of informal values or norms shared among members of a group that permit cooperation among them (Fukuyama, 1995). He contends that interpersonal trust is fundamental for social relationships to emerge. Mutual trust improves the cooperation between individuals, reduces transaction costs, and increases business transactions.

2.2 Conceptual Framework

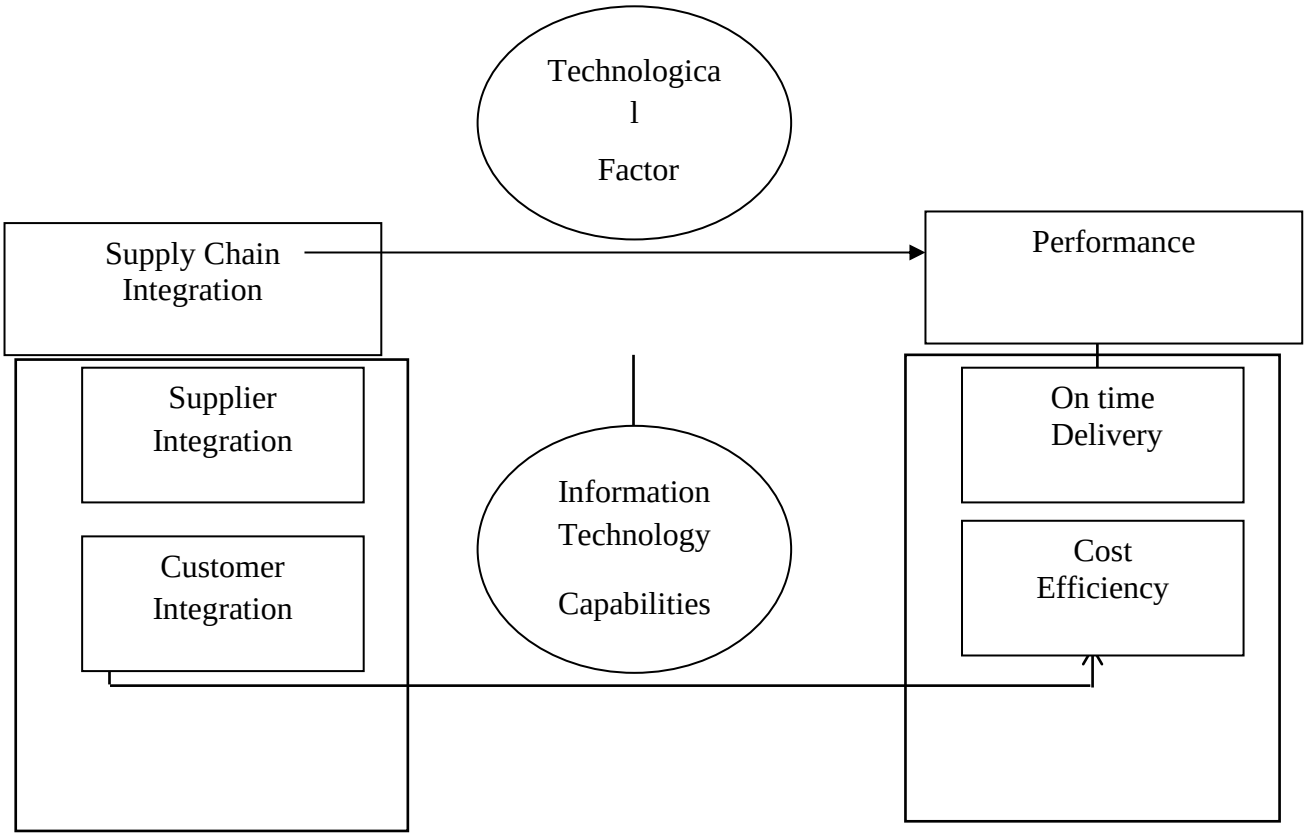

Fig 2.1: Conceptual Framework showing the relationship between Supply Chain Integration and Performance of Shipping Companies in Rivers State.
Source: Mesfin, 2022; Mitchell; 2005; Mohamed, Abdellatif and Fakher, 2012.

2.2.1 Supply Chain Integration

Supply chain integration was developed in the 1980s, with the main idea of assisting firms to be more effective to integrate their business processes. For more than four decades now, it has received considerable attention from academics and practitioners. First and foremost, a supply chain is commonly referred to as a system of organizations, individuals, processes, information (or material), and resources that are required to move a product from suppliers to users (Frohlich & Westbrook, 2001). Supply chain integration has become one of the most significant features of supply chain management and its dimensions have been researched quite extensively (Das et al., 2006).

According to Rudberg & Olhager (2003) different types of supply chain integration have been discussed in the literature, which are classified as, vertical integration vs. horizontal integration. The authors stated that vertical integration is the degree to which an organization owns the network of processes. This type of integration involves the coordination between businesses located at different stages of the supply chain. Customer integration and supplier integration are major instances of vertical integration (Vallespir & Kleinhans, 2001). On the other side, horizontal integration is the coordination between businesses located at the same stage of the

supply chain. The aim of horizontal integration is to identify some organizational and managerial synergies enhancing inter-functional and interorganizational coordination.

2.2.1.1 Supplier Integration

Supplier integration is the existence of cooperation or partnership between companies and their suppliers. In this case, the activity is to make plans, develop inter-organizational strategies, and develop an integrated process for sharing information and experiences in running the organization (Flynn *et al.*, 2010). In the company's internal supply chain, there is also a production process where products are produced based on the production process starting from raw materials to finished goods, provided that the raw materials are of high quality so that the finished goods are also of high quality.

Supplier integration refers to the practices amongst companies and their suppliers, that enables the efficient transfer of knowledge and resources, required for generating mutual benefits (Childerhouse & Towill, 2011). According to Vereecke & Muylle (2006), supplier integration involves closer collaboration and coordination with key suppliers in order to achieve, mutual benefits such as a reduction of inventory, and supplier lead-time. The concept explains the long-term partnership with suppliers, which enhances the process of joint problem identification and real-time product solutions (Flynn et al., 2010). Supply chain researchers have expressed that supplier integration is the most common type of supply chain integration (Fawcett & Magnan, 2002). Therefore, as much as internal integration is vital to an organization success, in the post-industrial era organizations can no longer rely on themselves for continual development (globalized business processes). Childerhouse & Towill (2011) further argued that in uncertain and turbulent business environments, companies required higher level of accuracy on real-time information, in order to leverage supplier network (resources) and improve customer satisfaction.

2.2.1.2 Customer Integration

In many services, the integration of the customer is an inherent part of innovation and delivery processes. In recent years, customers have been increasingly involved in these activities, enabled by modern IT technologies and trends, such as the ubiquitous availability of the internet. The customer is consequently becoming an active partner in the creation of value (Huo, 2012).

Customer integration could be defined as the organizational practices of identifying, understanding, and utilizing customer requirements with the objective of producing customer-defined goods/products and increasing customer satisfaction (Boon-Itt & Wong, 2011; Childerhouse and Towill, 2011; Flynn et al., 2010; Huo, 2012). In other words, it is the mutual participation of customers with the local company, strategically distributing data, information and know-hows about their demands and performance levels such as quality, delivery time, and cost. (Childerhouse and Towill, 2011). Customer integration is therefore an important characteristic in better understanding the requirements of key customers, and the logical counterpart of supplier integration. It does so by enabling local company to penetrate deep into the customer firm, in order to understand the customer's product, culture, market, and organization, in order to efficiently react to customer needs (Boon-itt and Wong, 2011). Kim

(2006) has also conceptualized customer integration as a part of the external (vertical) connection of the firm.

2.2.2 Performance

Numerous scholars have engaged in scholarly discourse around the topic of performance, as evidenced by extant studies (Bergerona, Raymondb, & Rivardc, 2004; Aziz, 2022; Dhillon and Vachhrajani, 2012). Performance is a frequently employed dependent variable in contemporary management research literature, and its definition is often imprecise and lacking in specificity (Aziz, 2022). Nevertheless, it is crucial to make a clear distinction between individual performance and organisational performance. Performance refers to a collection of financial and non-financial indicators that provide insights into the level of accomplishment of outcomes (Bergerona, et al, 2004). However, organisational performance may be defined as the capacity of an organisation to achieve its desired outcomes via the optimal use of available resources in a manner that is both efficient and effective. Lambe (2014) defined organisational performance as the capacity of a company to attain set objectives, which encompass factors such as profitability, product quality, market share, financial outcomes, and sustainability, via the implementation of appropriate strategies and activities. According to Aziz (2022), organisational performance may be assessed by evaluating the productivity of an organization's staff, which is often quantified in terms of revenue, profit, growth, development, and expansion.

2.2.3 Supply Chain Integration and Performance

Researchers generally view that global supply chain integration has a positive effect on business agility (Das et al., 2006; Flynn et al., 2010). However, some researchers have echoed concerns over the right level of supply chain integration required maximizing operational performance in both practice and research. For example, there were studies that did not find a direct or found a negative association (Koufteros et al., 2005) between supply chain agility and operational performance. Such differences in outcome could be mainly because it is difficult to define the scope of supply chain integration, and it may also be costly to implement in practice. It is therefore argued that the relationship supply chain integration and service delivery quality cannot be fully appreciated through direct association only. Instead, it is the complex interactions between these variables that lead to better understanding of their impact on the overall performance of the organizational (Swink et al., 2007).

Koufteros, et al., (2005) Argued that the firms with a broad span of integration have a greater focus on alignment with suppliers and customers, and have more of a supply chain focus than those with a narrow span. They also demonstrate higher levels of performance attributable to supply chain relationships. They highlight the importance to supply chain professionals of taking a broad view of the supply chain rather than focusing only on first tier suppliers and customers. They also suggest the importance of exploring opportunities to facilitate broader participation in supply chain integration efforts. In this regard, Flynn et al. (2010) mentioned that supply chain integration mechanisms may enhance interaction and collaboration in the firm supply chain, especially in the buyer-supplier interface. Internal integration between purchasing and manufacturing groups also played a significant role in supplier collaboration at the problem-

solving process. Customer integration seemed more important to address supply problems for Original Equipment Manufacturing (OEM) firms. Das et al. (2006) was of the view that supplier integration is touted as an imperative strategy to improve firm performance and enhance a firm's competitive advantage in the marketplace. He says that several supplier integration activities, including supplier involvement, design integration, supplier base reduction, supplier commitment, and information sharing practices are examined regarding their effect on time-based competition, measured as delivery speed, new product development time, delivery reliability, and manufacturing cycle time. The statistical findings indicate while supplier integration contributes to the performance of a firm's time-based competition.

Researchers generally view that supply chain agility has a positive effect on organizational performance (Das et al., 2006; Flynn et al., 2010; Liu et al., 2012). However, some researchers have echoed concerns over the right level of supply chain integration required maximizing operational performance in both practice and research. For example, there were studies that did not find a direct (Stank et al., 2001) or found a negative association (Koufteros et al., 2005) between supply chain agility and operational performance. Such differences in outcome could be mainly because it is difficult to define the scope of supply chain integration, and it may also be costly to implement in practice. It is therefore argued that the relationship supply chain integration and service delivery quality cannot be fully appreciated through direct association only. Instead, it is the complex interactions between these variables that lead to better understanding of their impact on the overall performance of the organizational (Swink et al., 2007).

2.2.3.1 Supplier Integration and Performance

A good number of studies have reported that higher supplier integration improves outcomes. Frohlich & Westbrook (2001) found that higher degrees of supplier integration was positively associated with operational performance. In another study, Frohlich & Westbrook (2002) reported that greater level of supply chain integration improved delivery time, transaction costs, and inventory turnover. Furthermore, Liu et al., (2012) argued that more effective external integration (information exchange) improved process and sourcing efficiency. The authors reported that the degree of shared data with supplier was a significant determinant of operational performance. Cousins & Menguc (2006) also suggested that higher degrees of supplier integration had a significant positive impact on supplier communication performance.

Koufteros et al. (2007) reported a significant and direct relationship between gray-box supplier integration and product innovation. In another empirical study Handheld et al. (2009) argued that more effective supplier integration improves sourcing enterprise performance. Wong et al. (2011b) also found a significant association between supplier integration and operational performance (delivery and flexibility). More recently studies have shown that higher supplier integration improves delivery performance (Droge et al., 2012). For example, Prajogo et al. (2012) found a positive relationship amongst strategic long-term supplier integration and delivery, flexibility and, cost performance. Furthermore, studies have also found that more effective supplier integration improves buyer performance (efficiency and flexibility) schedule

attainment and new product performance. In view of the above findings, we hypothesized as follows:

Ho$_1$: Supplier integration has no significant relationship with on-time delivery of shipping companies in Rivers State.

Ho$_2$: Supplier integration does not significantly relate with cost efficiency of shipping companies in Rivers State.

2.2.3.3 Customer Integration and Performance

Numerous studies have investigated the concept of customer integration, and how it relates with various business outcomes. A good number of them have defined the concept as the organizational practices of identifying, understanding, and utilizing customer requirements with the objective of producing customer-defined goods/products and increasing customer satisfaction (Boon-Itt & Wong, 2011; Childerhouse and Towill, 2011; Flynn et al., 2010; Huo, 2012). In other words, it is the mutual participation of customers with the local company, strategically distributing data, information and know-hows about their demands and performance levels such as quality, delivery time, and cost (Fabbe-Costes & Jahre, 2007).

A closer investigation of the current empirical studies on customer integration and operational performance indicates mixed outcomes. In particular, authors have retained that customer integration has a complex nature, and more studies are needed to examine its impact on operational performance. Some authors have reported that integrating closely with customers improves product innovation and performance (productivity and marketplace) (Droge et al., 2004; Frohlich and Westbrook, 2001; Koufteros et al., 2005). Furthermore, authors have argued that customer integration enables companies to better understand customer requirements, decrease uncertainties and achieve higher performance abilities (quality, delivery, flexibility, and cost). Schoenherr & Swink, Droge et al. (2004) reported that customer integration directly increases time-to- market, time-to-product, and responsiveness. Koufteros et al. (2005) also argued that higher levels of customer integration, improves quality and innovation performance. Also, Zhao et al. (2013) suggested that customer integration positively impacts schedule attainment, competitive performance, and customer satisfaction. Similarly, Droge et al. (2004) found customer integration positively affected new product performance. In view of the above postulations, the study states the following hypotheses:

Ho$_3$: There is no significant relationship between customer integration and on-time of shipping companies in Rivers State.

Ho$_4$: There is no significant relationship between customer integration and cost efficiency of shipping companies in Nigeria.

2.2.3.4 Effect of Information Technology (IT) Capability on Supply Chain Integration and Performance

The discussion on IT is pertinent to have a clear understanding of the nature of the concept. In this line of thought, existing literature on IT revealed that defining the concept is not easy (Reddy & Zhoa, 1990); therefore, IT capability has been defined from different perspectives. According to Kumar et. al (1999) technology consists of two primary components; physical and

information components. While the former comprises of items such as products, tooling, equipments, blueprints, techniques, and processes; the latter involves technical know-how in management, marketing, production, quality control, reliability, skilled labor in various organizational functional areas.

IT capability could improve supply chain performance by providing timely, accurate and reliable information. Despite integrated IT implementation becoming widespread among organizations, the direct positive effect on financial performance remains elusive. More recently, resource-based view represents a potential framework that enhances and improves the conceptual analysis of integrated information technology's effects on a firm's performance, which connects and relates organization performance to resources and skills (Barney, 1991). In general, it is argued that organizations can achieve many benefits through integrative IT processes. Integrated IT offers an appropriate tool that has significant effects on improving the level of prices, reducing the cost of production processes, increasing the speed of achievement, and quality improvement, which leads to increasing the competitiveness of organizations and achieving its goals in survival, development, and expansion in its work performance. However, mixed results have been reached by many empirical studies that have investigated the relationship between integrated IT and performance of a firm. For example, some scholars found a positive and significant relationship between integrated IT and a firm's performance; more specifically, integrated IT enhanced processes and improved efficiency in different firm activities ((Reddy & Zhoa, 1990; Kumar, et al., 1999). However, a few empirical studies showed ambiguous and equivocal results for the impact of information technology on performance (Hitt & Brynjolfsson, 1996). It was against the above, we state the hypothesis below:

Ho_5: Information Technology (IT) capabilities does not moderating the relationship between supply chain integration and performance of shipping companies in Rivers State.

2.3 Empirical Review

Habibullah (2019) investigated the interconnectedness of supply chain integration, learning, agility, and organisational success. Data was gathered from a sample of 257 publicly held enterprises in Pakistan, and a structural equation model was employed to examine the proposed framework. The study revealed that the integration of supply chains has a notable influence on both external and internal learning. Furthermore, it was determined that the integration of supply chains had a negligible effect on both the performance of firms and the agility of supply chains. The study concluded that internal learning had a negligible effect on supply chain agility, but a noteworthy direct effect on company performance. On the other hand, external learning had an inconsequential influence on firm performance, both directly and indirectly.

Hasan, Murat, and Mustafa (2018) aimed to investigate the impact of supply chain agility on the performance of firms. In the contemporary global landscape characterised by fast change, development, and complexity, corporations find themselves engaged in perpetual rivalry with one another. In the current highly competitive business landscape, organisations must strategically allocate their resources in a precise and efficient manner in order to ensure their survival. Companies may achieve a competitive edge by effectively and efficiently addressing the diverse and changing demands of customers across various marketplaces, while also

ensuring timely responsiveness. This can also be achieved by focusing on enhancing the agility element within the supply chain. When faced with ambiguity, it is imperative for organisations to possess an agile supply chain in order to get a competitive edge. This study aims to investigate the impact of agility and technological uncertainty on the performance of companies in supply chain management. The research findings indicate that technological uncertainty exerts an influence on supply chain agility, which in turn positively impacts firm performance.

Mesfin (2022) investigated the relationship between supply chain agility and operational performance, with a specific focus on the telecommunications industry in Ethiopia. By analysing the example of Ethiotelecom, the aim is to gain insights into how supply chain agility influences the operational performance of a telecommunications company. The findings of this research contribute to the existing body of knowledge on supply chain management and provide practical implications for organisations operating in similar contexts. Introduction: Supply chain agility has the division responsible for managing the supply chain. Supply Chain Agility (SCA) is a crucial determinant of success for firms functioning in global markets. It enables them to effectively address competitive issues and leverage these skills to get a competitive edge over their counterparts.

Yuen and Thai (2017) assessed the effect of the internal and external (customer and supplier) integration on firm agility. The study adopted a quantitative research approach. Questionnaires were the main instrument for the data collection from 138 products and 174 service companies in Singapore. The findings of the study revealed that internal integration and external integration have a significant positive relationship on firm agility in product and service supply chains. Also, the relationship between internal integration and firm agility was found to be partially mediated by product supply chains, whereas a fully-mediated relationship was observed in service supply chains.

3. METHODOLOGY

The research design adopted for this study is cross-sectional survey. The study population comprised of top and middle-level management staff of shipping companies in Rivers State. According to the Nigerian Shippers Council, Rivers State branch, there is fifty four (54) Shipping companies operating in Rivers State. It is pertinent to mention that due to their wealth of knowledge and experiences, designated staff such as store keepers, inventory managers, purchasing/procurement managers, and logistics managers were considered for this study. These four respondents (store keepers, inventory/dock managers, purchasing/procurement managers, and logistics managers) were chosen from each of the fifty four (54) shipping companies in Rivers State; thus, making a total population of two hundred and sixteen (216) staff and the entire population was studied.

3.1 Validity and Reliability of the Instrument

Validity of the Instrument

The credibility of a research study is contingent upon the validity and reliability of the measures employed to assess the intended constructs. Validity pertains to the degree to which a measurement accurately captures the intended construct it claims to assess. This study primarily

focused on assessing the face and content validity of the data collecting instrument. Regarding face validity, the instrument has statement items that effectively elucidate the factors in each instance and are also readily comprehensible and legible to responders. Furthermore, the concept of content validity pertains to the notion that each statement item included in the instrument is derived from scholarly sources, particularly academic authorities that have utilised identical variables in their own investigations.

Factor Analysis

This sub-part presents factor loading values of all studied instruments and loadings were above the value of 0.60. The standardized factor loadings ranged from 0.70 to 0.99 as they appeared in tables below. Additionally, composite reliability (CR) and average variance extracted (AVE) were calculated. All these values were above the threshold value of 0.70. The AVE values were above 0.50, which was acceptable (Hair et. al, 2010). It is also expected that CR is higher than AVE.

Table 3.1: Discriminant Validity

Construct	SI	CI	IT
SI	**0.95**	0.353	0.381
CI	0.353	**0.94**	0.268
IT	0.381	0.268	**0.96**

Source: Computed from Pilot Study CFA results

From Table 3.1, it can be seen that the average variance extracted is above the 0.5 threshold in all cases, being 0.95 for supplier integration, 0.95 for customer integration, 0.94 for customer integration, and 0.95 for IT capabilities. These coefficients are well above the 0.7 convergent reliability threshold; hence, all the scales satisfy the convergent reliability conditions and are consistent for further analysis.

Reliability of the Instrument

Reliability refers to an agreement of two or more efforts to measure the same thing with the same method and the ability to measure consistency. Cronbach Alpha test was used to determine the reliability of the instruments. Extant literature suggests that an alpha of 0.7 (70%) or above is considered to be reliable. The outcome of this analysis was presented in chapter four of this study.

3.2 Reliability Outputs

Construct	Statement Items	Cronbach Alpha	Remark
Supplier Integration	5	0.763	Reliable
Customer Integration	5	0.885	Reliable
On-Time Delivery	5	0.815	Reliable
Cost Efficiency	5	0.819	Reliable
IT Capabilities	5	0.800	Reliable

Source: Cronbach Alpha Output SPSS (2025)

3.5 Data Analysis Techniques

There are three levels of analyses in this study; the primary, secondary and tertiary analyses. The primary analysis, which is descriptive in nature, were displayed in the form of tables, chats and percentages. The secondary analysis, which is inferential in nature, involved test of proposed research hypotheses, using the Spearman's Rank Correlation coefficient, trusting on the Statistical Package for Social Sciences (SPSS) version 26.0. The tertiary analyses will be discussion of findings, conclusions and recommendations.

4. RESULTS AND DISCUSSION

4.1 Data Analyses and Results

4.1.1

Test of Hypotheses

As earlier stated, this study adopted Regression Analysis in order to determine the relationship between supply chain integration and performance of shipping companies in Rivers State. The finding of Model Summary, ANOVA and Regression Coefficients is indicated in subsequent sections. The coefficients of correlation R and coefficients of determination R^2 is indicated in the Table below.

Hypotheses One and Three

Ho_1: Supplier integration has no significant relationship with on-time delivery of shipping companies in Rivers State.

Ho_3: Customer integration does not significantly relate with on-time delivery of shipping companies in Rivers State.

Model One

The coefficients of correlation R and coefficients of determination R^2 is indicated in the Table below as follows.

Table 4.1: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
On-Time Delivery	.787[a]	.619	.606	1.31974

a. Predictors: (Constant) Supplier Integration and Customer Integration

From the findings, coefficient of correlation R is 0.787 an indication of strong correlation between variables, coefficient of determination R^2 is 0.619, showing that 61.9% change in on-time delivery is explained by the independent variables; supplier integration and customer integration. Based on the above result there was a very strong correlation between supplier integration & customer integration, and on-time delivery. This therefore means that 38.1% explains factors that affect performance of shipping companies in Rivers State that were not carried in the current study.

Table 4.2: Analysis of Variance

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	330.712	4	82.678	47.461	.000[b]
Residual	203.779	117	1.742		
Total	**534.492**	**121**			

a. Dependent Variable: On-Time Delivery

b. Predictors: (constant), Supplier Integration and Customer Integration.

From the findings, F Calculated was 47.470 and F Critical (4, 117) was 2.449, therefore, F Calculated>F Critical thus indicating that the overall regression model was significant in determining the relationship between supply chain integration and on-time delivery of shipping companies in Rivers State. The p value was p=0.000<0.05, an indication that at least one of the dependent variable significantly influences on-time delivery of shipping companies in Rivers State; indicating that that supplier integration and customer integration had a significant relationship on-time delivery of shipping companies in Rivers State.

Test of Hypotheses Two and Four

Ho_2: There is no significant relationship between supplier integration and cost efficiency of shipping companies in Rivers State.

Ho_4: There is no significant relationship between customer integration and cost efficiency of shipping companies in Nigeria.

Model Two

Table 4.4: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
Cost Efficiency	.869[a]	.755	.712	1.21867

b. Predictors: (Constant) Supplier Integration and Customer Integration.

From the findings, coefficient of correlation R is 0.787 an indication of strong correlation between variables, coefficient of determination R^2 is 0.755, showing that 75.5% change in cost efficiency is explained by the independent variables; supplier integration and customer integration. Based on the above result there was a very strong correlation between supplier integration & customer integration and cost efficiency. 24.1% explains factors that affect cost efficiency of shipping companies in Rivers State that were not carried in the current study.

Analysis of Variance:

An ANOVA was conducted at 5% significant level. A comparison between F calculated and F Critical are shown below

Table 4.5: Analysis of Variance.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	345.729	4	85.894	49.562	.000[b]
Residual	226.879	118.85	1.952		
Total	**572.608**	**114.85**			

c. Dependent Variable: Cost Efficiency

d. Predictors: (constant), Supplier Integration and Customer Integration.

From the findings, F Calculated was 47.470 and F Critical (4, 117) was 2.449, therefore, F Calculated>F Critical thus indicating that the overall regression model was significant in determining the impact of supply chain integration and performance shipping companies. The p value was p=0.000<0.05, an indication that at least one of the dependent variable significantly influences cost efficiency; indicating that that supplier integration and customer integration had significant relationship with cost efficiency of shipping companies in Rivers State.

4.1.3 Multivariate Analysis

Test of Hypothesis Five

Ho_5: IT caperbility does not statistically moderate the relationship between supply chain integration and performance of shipping companies in Rivers State.

Table 4.6: Comparative Regression Analysis showing the Influence of Supply Chain Integration and Performance (Without the Moderating Effect of IT Capability)

Dependent Variable: P
Method: Least Squares
Date: 04/29/25 Time: 07:54
Sample: 202
Included observations: 202

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P	103.3326	0.920159	112.2986	0.0000
SCI	1.010970	0.035250	28.67987	0.0000

R-squared	0.956953	Mean dependent var	83.74269
Adjusted R-squared	0.955790	S.D. dependent var	18.31211
F-statistic	822.5352	Durbin-Watson stat	0.972894
Prob(F-statistic)	0.000000		

Where: P = Performance
SCI = Supply Chain Integration

Table 4.7: Comparative Regression Analysis showing the Influence of Supply Chain Integration and Performance (With Moderating Effect of IT Capability)

Dependent Variable: P
Method: Least Squares
Date: 07/25/24 Time: 07:56
Sample: 202
Included observations: 202

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P	103.3326	0.258838	399.2176	0.0000
SCI	1.010970	0.009916	101.9559	0.0000
ITC	1.000000	0.048135	20.77493	0.0000

R-squared	0.996686	Mean dependent var	83.74269
Adjusted R-squared	0.996502	S.D. dependent var	18.31211
F-statistic	5413.305	Durbin-Watson stat	0.740550
Probability (F-statistic)	0.000000		

Where: P = Performance

SCI = Supply Chain Integration
ITC = Information Technology Capability
Source: Field Survey Data, 2025, Eview 13 Output

To test this hypothesis, a comparative regression analysis was performed using two models. The first model, without the moderating effect of IT capability, demonstrated a strong relationship between supply chain integration (SCI) and performance (P). The coefficient for supply chain integration was 1.010970 with a standard error of 0.035250, yielding a highly significant t-statistic of 28.67987 ($p < 0.0001$). The R-squared value was 0.956953, indicating that approximately 95.70% of the variance in performance could be explained by supply chain integration alone. The F-statistic of 822.5352 ($p < 0.0001$) further confirmed the model's overall significance.

In contrast, the second model incorporated the moderating effect of IT capability. This extended model revealed that both supply chain integration and IT capability significantly influenced performance. The coefficient for supply chain integration remained consistent at 1.010970, but with a reduced standard error of 0.009916, leading to an even more significant t-statistic of 101.9559 ($p < 0.0001$). IT capability itself had a coefficient of 1.000000 and a standard error of 0.048135, resulting in a highly significant t-statistic of 20.77493 ($p < 0.0001$). The inclusion of IT capability markedly improved the model's explanatory power, as reflected by an R-squared value of 0.996686, indicating that approximately 99.67% of the variance in performance could be accounted for when considering both supply chain integration and IT capability. The F-statistic soared to 5413.305 ($p < 0.0001$), underscoring the model's enhanced significance with the moderating variable.

Comparing the two models, the substantial increase in the R-squared value from 0.956953 to 0.996686 and the significant coefficients of IT capability in the second model provide strong evidence that IT capability does indeed moderate the relationship between supply chain integration and performance in of shipping companies in Rivers State. The null hypothesis (Ho5) is therefore rejected, affirming that IT capability significantly enhances the predictive power of supply chain integration and performance of shipping companies. This finding underscores the importance of IT capability as a key factor in optimizing the benefits of supply chain integration for the performance of shipping companies in Rivers State.

4.2 Discussion of Findings

Result (**R^2 0.619 =70%**) from hypothesis one and three revealed that there is a positive and strong correlation between supplier integration, customer integration and on-time delivery of shipping companies in Rivers State. This result however corroborates with the findings of Kim, 2009 (2009) reported that supplier integration positively impacts operational performance, which in-turn plays a significant role service delivery performance. Although in some research a direct association was not found amongst internal integration and operational performance (Koufteros et al., 2005; Gimenez and Ventura, 2005), Other researchers managed to find direct positive associations including, enhancing customer satisfaction, productivity, financial performance and development time (Allred et al., 2011; Chen et al., 2007).

Similarly, result (**R^2: 0.755 = 76%**) from hypothesis two and four showed a positive and strong correlation between supplier integration, customer integration and cost effectiveness of shipping companies in Rivers State. These finding relates with that of Koufteros et al. (2007) where the author reported that there is a significant and direct relationship between supplier and customer integration and cost leadership. In another empirical study Handheld et al. (2009) argued that more effective supplier integration improves sourcing enterprise performance. Wong et al. (2011b) also found a significant association between supplier integration and operational performance (delivery and flexibility). More recently studies have shown that higher supplier integration improves delivery performance (Droge et al., 2012). For example, Prajogo et al. (2012) found a positive relationship amongst strategic long-term supplier integration and delivery, flexibility and, cost performance. Furthermore, studies have also found that more effective supplier integration improves buyer performance (efficiency and flexibility) schedule attainment (Zhao et al., 2013) and new product performance (He et al., 2014).

Lastly, finding from the test of hypothesis five revealed that the inclusion of IT capability markedly improved the model's explanatory power, as reflected by an R-squared value of 0.996686, indicating that approximately 99.67% of the variance in performance could be accounted for when considering both supply chain integration and IT capability. The F-statistic soared to 5413.305 ($p < 0.0001$), underscoring the model's enhanced significance with the moderating variable. This showed a strong evidence that IT capability does indeed moderate the relationship between supply chain integration and performance in of shipping companies in Rivers State. This result is in line with extant studies. For instance, firms who have IT human resources capability with technical, business, and interpersonal skills will likely lead to successful sustainable competitive advantages (Wang, Liang, Zhong, Xue, & Xiao, 2012). As a technological tool, IT human resources capabilities is advocated as an opportunity for human resource professionals to become strategic partners with top management (Al-Shawabkeh, 2014). IT knowledge management capabilities are the tangible and intangible organizational assets or resources, which enhance the generation, sharing, usage, protection of knowledge continuously, which enable enterprises to better manage processes for capturing and applying knowledge and expertise to attain operational efficiency (Corso, Martinib, Pellegrinib, Massac, & Testac, 2006).

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusions

Based on the findings of this research, the following conclusions were arrived at:

(i) Keeping closer collaboration, long-term partnership and coordination with key suppliers has been proven to enhance supply chain efficiency, on-time delivery and cost efficiency.

(ii) Mutual participation of customers with an organization such as distributing data, information and know-hows about their demands and performance levels are necessary conditions to enhancing firm performance.

(iii) Customer integration is therefore an important characteristic in better understanding the requirements of key customers, in order to penetrate deep into the market and efficiently react to customer needs wants.

5.2 Recommendations

In view of the results and conclusion of this research, the following recommendations were advanced:

(i) Management of shipping companies who want to improve firm agility are encouraged to establish long-term partnership and coordination with key suppliers, as these strategies have been proven to enhance supply chain efficiency, on-time delivery and cost efficiency.

(ii) Lastly, shipping companies should build a mutually beneficial network of value co-creation and participation between them and customers (including other stakeholders) in areas of distributing data and/or information and know-hows about their demand requirement, in order for management improve performance.

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