



## SUPPLY CHAIN INTEGRATION AND OPERATIONAL PERFORMANCE OF OIL SERVICE FIRMS, SOUTH-SOUTH, NIGERIA

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**ABSTRACT:** *This study examined the relationship between supply chain integration and operational performance of oil service firms in south-south, Nigeria. The specific objectives therefore were to: examine the relationship between internal integration and product quality; investigate the relationship between supplier integration and improvement in delivery time; and examine the relationship between customer integration and increase in market size. The study adopted a cross-sectional study with a population of 522 from six oil service firms. Taro Yamane formula was used to determine the sample size of 226. Data for this study were obtained from primary and secondary sources. Spearman's rank order correlation coefficient and partial correction technique with Z-test were used to analyze data. Based on the analysis of the findings, it was revealed that there was a strong and significant relationship between supply chain integration (internal integration, supplier integration, customer integration) and operational performance. Also, it was discovered that information technology significantly moderates the relationship between supply chain integration and operational performance. The study recommended that oil service firms should ensure that information sharing among supply chain partners is timely and complete; there should be a real-time integration and connection among all internal functions in oil service firms from raw internal functions in oil service firms from raw material management, through production to sales so as to deliver quality products to customers.*

**KEYWORDS:** Supply chain Integration, internal integration, supplier integration, customer integration, product quality, delivery time, market size, information technology, operational performance.



## INTRODUCTION

One of the most popular business strategies in recent times that organizations seeking competitive advantage adopt is the supply chain management. However, only recently has there been a call for a systematic approach to Supply Chain Integration (SCI), as increasingly global competition has caused organizations to rethink the need for cooperative, mutually beneficial supply chain partnerships and the joint improvement of inter-organizational processes to be a high priority (Flynn, Huo, and Zhao, 2010).

Integration is the quality or the state of collaboration required to achieve success through the collaborative effort of various units in order to satisfy market demand (Bagchi and Skjoett-Larsen, 2002). While supply chain has always been about companies working together to achieve a purpose. This relationship has always involved some degree of collaboration to solve bottlenecks in the supply chain network and overcome bumps in demand and supply. Therefore, SCI can be defined as the degree to which a manufacturer strategically collaborates with its supply chain partners to manage intra-and inter-organization processes. The goal is to achieve effective and efficient flows of products and services, information, money and decisions, to provide maximum value to the customer at low cost and high speed (Flynn, Huo and Zhao, 2010).

Wong and Boomtt (2011) argue that proper implementation of SCI in firms will meet individual customers' demand, reduce delivery time, decrease logistic and purchasing cost and increase work force efficiency. This happens since SCI enables different findings to work in tandem linking other cross-functionals of business. Because of these, firms now are moving towards integrating their supply chain. This integration serves to improve the firm's performance as globalization has led to an increase in demand for product variety as well as reduced product life cycles.

Today many oil firms in the downstream sector show a reluctant attitude as regards collaboration and information sharing due to a lack of strategic relationship and connection among internal functions from raw material management, through production to sales, the employees in the supply chain are not well informed with correct specific task to carry out, no application of monitoring system to check processes. These negatively affect the quality of products produced and delivered to customers. Besides, some suppliers have not considered strategic partnerships in their business relationships with manufacturers, to facilitate information sharing and knowledge of when the stock level is reduced and when to deliver raw materials. This has caused delays in the delivery of materials to manufacturers, affecting productivity and customers. Therefore, this study examines supply chain integration and operational performance in the downstream petroleum sector in south-south, Nigeria.



## LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

SCI is one of the most widely researched topics in the field of supply chain. Ebrahimi (2015) posited that SCI is the extent to which all activities within an organization, and the activities of its suppliers, customers, and other stakeholders in the industry are integrated in carrying out their functions directed at achieving organizational goals. According to Amue and Azuru (2014), SCI is concerned with the quality and cooperation among linked functional departments which prevent overlapping undertakings. Lee (2000) explains that SCI includes the collaboration among the upstream suppliers, midstream organization and downstream (distributors, retailers).

Frohlicks & Westbrook, (2001) define SCI as the degree to which a manufacturer strategically collaborates with its supply chain partners and collaboratively manages intra and inter-organization processes. The goal is to achieve effective and efficient flows of products and services, information, money and decisions to provide maximum value to the customer at low cost and high speed. This definition includes several important elements. First, we highlight the importance of strategic collaboration, which is an ongoing partnership to achieve mutually beneficial strategic goals. It engenders mutual trust, increases contract duration and encourages efficient conflict resolution and sharing of information, rewards and risks. While operational coordination can only lead to operational benefits, strategic coordination provides both operational and strategic benefits. This definition also emphasizes intra- and inter-organization processes, since SCI is comprehensive and encompasses a variety of activities, including many that are focused on materials transportation and administrative tasks. Finally, it emphasizes the customer-facing nature of supply chain integration, stating that its primary objective is to provide maximum value for the customer.

Wellenbrook (2013) and Mpuon et al. (2024c) also noted that the supply chain is about issues on how a firm or organization working together can attain a goal by way of solving bottlenecks and overcoming bumps in demand and supply. SCI is seen as a process through which all parties involved with the supply chain; suppliers, organizations and customers work independently and dependently in a harmonious way to achieve a united objectives such as providing maximum customer values, and lowering overall cost. Barnes and Liao (2012) view SCI as a combination of activities and processes through ownership structure (stakeholders) between upstream and downstream. They said SCI is a key to the success of companies and supply chains. Vander and Van-Dork (2008) opine that the main notion about SCI is that it is a suitable approach to enhance various measures of firm performance. It is also a set of practices that involves the sharing of resources and information across internal departments and external organizations.

### Internal integration

This focuses on activities within a manufacturer. It is the degree to which a manufacturer structures its own organizational strategies, practices and processes into collaborative, synchronized processes in order to fulfil its customer requirements and effectively interact with its suppliers (Mpuon et al., 2024a). Internal integration recognizes that the departments and functions within a manufacturer should function as part of an integrated process (Flynn, Huo, and Zhao, 2010). Internal integration breaks down functional barriers and engenders cooperation in order to meet the requirements of customers, rather than operating within the



functional silos associated with traditional departmentalization and specialization (Huang and Yen, 2014; Mpuon et al., 2024b).

Internal integration is the centre of gravity for both suppliers and customers and it's considered the linchpin that maintains the stability and continuity for all supply chain parties, so the organization couldn't make neither supplier nor customer integration without internal integration. Building the proper supply chain strategy depends heavily on the existence of clear and shared goals, which originally derived from the adoption of all departments of the organizational mission vision, and objectives. Zhao (2013) said the internal integration stresses organizational structure, procedures and practices, so it must be collaborative and synchronized to fulfil customer requirements. El-Tamini and Sharabati (2018) viewed internal integration as a process of maintaining cross-functional cooperation and collaboration within the organization that intends to achieve organizational strategic goals. Based on the above discussion, the following hypothesis is put forward:

Ho2: There is no significant relationship between supply chain internal integration and product quality in Nigeria's oil and gas industry

### **Supplier integration**

This involves core competencies related to coordination with critical suppliers (Flynn, Huo, & Zhao, 2010). Suppliers are considered the main source of inputs that are needed by the organizational operations, so they have an essential role in the continuation of manufacturing products and /or services in order to meet customer requirements. Today, giant manufacturing firms tend to build strong relationships and partnerships with their suppliers to manage the fluctuation in customer demands and reduce the cycle and delivery time. Moreover, suppliers now are more involved in designing the products and operations to facilitate the manufacturing process and being close to the customer (Flynn, 2010).

El-Tamini and Sharabati (2018) defined supplier integration as the process of cooperation between suppliers and organizations that facilitate the sharing of information, knowledge, material and experience. Peterson, Hand-Field and Ragatz (2008) contend that in the current uncertain and complex business setting that company needs a greater level of accuracy on real-time information, in a bid to take advantage of supplier networks and boost its aptitude to enhance customer satisfaction. In an integrated supply chain, the development of a strong strategic partnership with suppliers will facilitate their understanding and anticipation of the manufacturer's needs in order to better meet its changing requirements. This mutual exchange of information about products, processes, schedules and capabilities helps manufacturers develop their production plans and produce goods on time, improving delivery performance. On the basis of the foregoing argument, we theorized as follows:

Ho2: There is no significant relationship between the supplier's integration and delivery time of the Nigeria's oil and gas industry

### **Customer Integration**

Customer integration involves core competencies derived from coordination with critical customers. Customers are considered the source of life for firms in whatever they provide either product or service and it's considered the fresh air that is needed by the organization to grow and be able to survive in the presence of the strong and tough competition. Customer needs and



requirements are always transformed, so what was considered essential in the past perhaps it become complementary in the near future. Managing the relationship with customers is considered a vital element in the supply chain. (Flynn, Huo & Zhao, 2010).

Sharabati (2018) defined customer integration as the process of building and maintaining a strong relationship and partnership with the customers. It includes sharing the knowledge, experiences, products, services, and suggestions with customers. A close relationship between the customer and the manufacturer offers opportunities for improving the accuracy of demand information, which reduces the manufacturer's product design and production planning time and inventory obsolescence, allowing it to be more responsive to customer needs. Because customer integration generates opportunities for leveraging the intelligence embedded in collaborative processes, it enables manufacturers to reduce costs, create greater value and detect demand changes more quickly. Considering the discussion above, we hypothesized as follows:

Ho3: There is no significant relationship between supply chain customer integration and market size

### **Operational performance**

The concept of operational performance in supply chain emerged from supply chain strategy which is derived from overall business strategy. A competitive strategy defined as "the set of customer needs that it seeks to satisfy through its products and services" (Chopra & Meindl, 2007). Each organization attempt to adopt different competitive strategy that fit to its strategy, then it seeks to afford the suitable capabilities and resources that help to achieve it. For example, one organization aims to provide high availability of a variety of products of reasonable quality of low price, while another organization aims to provide too many products, so it competitive strategy must be built around providing the customer convenience, availability, and so on. Any company intended to be successful must fit between supply chain strategy and its competitive strategy.

The efficiency of supply chain depends upon the delivery of goods and services to customers, reduction in cost and keeping the quality higher. A firm may face critical situation and failure due to un-awareness of success factors. The supply chain cost must be kept lower, quality as reliability must be higher to be certain, flexibility should be incorporated so as to address the market issues or changes. The standard of performance can be described as level of efficiency and effectiveness, whereas efficiency is used for describing internal standards of performance and effectiveness is associated with external standards to determine the performance (Jonsson, 2012). The effectiveness and efficiency of any operation can be accessed on the basis of product, fulfillment from workforce, fulfillment of customer needs, delivery time, profitability and efficient work.

### **Product quality**

Building the strategy based on quality of products, services, and processes requires matching the following: educate employees in the supply chain with specific tasks, applying monitoring system, motivating committed employee of quality standard and monitoring for complaints (El-Tamini & Sharabati, 2018). The degree through which the supply chain activities and processes seek to meet customer needs, requirements, and demands by following rules and standards of good manufacturing practice is termed quality (Mpuon and oyo – Ita, 2024d) .





From the customer perspective, the organization should provide reliable service such as order entry, document preparation, and warehouse picking accuracy. Fauzi and Rahman, (2010) and Mpuon & Oyo – Ita (2024) defined quality as “those features of products which meets customer needs and thereby provide customer satisfaction.

### **Delivery time**

Building a strategy on the basis of reducing the time between customer demands until meeting these demands entails work on the following: forecasting demand system, coordination of work processes, and change organizational layout, and managing the transportation. Studies have many type of time, for example, lead time, cycle time, delivery time etc. Cycle time is the time between one completion jobs or tasks to another, i.e from starting one process or task to start the same process or task again. Lead time is the time that is required from setting the order by customer to deliver the product or service (Company and supplier) including manufacture, transportation, processing, warehousing, and delivering the product or service to the final customer.

### **Market size**

Market size is the total number of potential clients or buyers in a particular market segment (Agarwal, 2018). It is the act of approximating how many people use a certain service or product, an estimation that evaluates the potential reach of your band (Jonsson, 2008). Market size describes the number of customer a business might attract over a specific period and the amount of money it can expect to generate from this hypothetical customer base (Morgan, 2012). Determining the number of potential buyers in a particular market segment is crucial before launching a product or service in the market.

This study is anchored on information processing theory. The justification for the using this theory as the anchored theory is discuss in the next section.

### **Information processing theory**

Information Processing Theory propounded by George A. Miller and Richard Shiffrin in the 1960s. He explains how the human mind processes, stores and retrieves information. The theory states that an organization’s main task is to cope with information and that information has a positive impact on performance. Therefore, organizations that can transmit more and act on available information in a timely manner have greater advantage over their competitors who may be slow to act. Although, there is a level beyond which more information does not lead to better performance. IPT identifies three concepts that affect performance. These are: the information processing needs of the organization, its information processing capabilities and the fit between the two.

The environment is constantly changing and is complex in nature, leading to uncertainty while the organization needs quality information despite these changes in order to make sound decisions, hence a balance has to be found between the two. This balance is found by trying to reduce the uncertainty the organization is exposed to, by implementing mechanisms and information processing capabilities that enhance information flow with the organization and with its supply chain partners. For example, by redesigning business process and promoting the use of integrated information systems, flow of information is improved and uncertainty is reduced as the organization carries out its operations.



## RESEARCH METHODS

In this study, the survey design was adopted. Specifically, the cross sectional survey was used since it relies on a sample of element from the population of interests which are measured at a simple point in time. Data for this study were obtained from both primary and secondary sources. The accessible population comprises 522, top and middle level management from six major oil petroleum downstream companies in south –south states, Nigeria. The sample size for the study was derived by using Taro Yamane's formula. Data obtained from the questionnaire were analyzed using Spearman's rank order correlation coefficient ( $r_s$ ) and the z-test using the Statistical Package for Social Sciences (SPSS) version 25 was used in analyzing data collected.

## RESULTS

### Research Question One

What is the relationship between internal integration and product quality?

**Table 1: Spearman Rank Correlation of internal integration and product quality**

Variables	N	$r_s$	Decision
Internal integration (X)	196	.773	Very Strong Relationship
Product quality (Y)			

**Source:** *Field Data (2024)*

Results presented in table 1 above shows the value of relationship between internal integration and product quality of oil firms in south-south, Nigeria. The  $r_s$  value of .773 shows that there is very strong relationship between internal integration and product quality of oil firms in south-south, Nigeria. This implies that internal integration has a very strong relationship with product quality of oil firms in south-south, Nigeria.

### Research Question Two

What is the relationship between supplier integration and delivery time?

**Table 2: Spearman Rank Correlation of supplier integration and delivery time**

Variables	N	$r_s$	Decision
Supplier integration (X)	196	.679	Strong Relationship
Delivery time (Y)			

**Source:** *Field Data (2024)*

Results presented in table 2 above shows the value of relationship between supplier integration and delivery time of oil firms in south-south, Nigeria. The  $r_s$  value of .679 shows that there is strong relationship between supplier integration and delivery time of oil firms in south-south, Nigeria. This implies that supplier integration has a strong relationship with delivery time of oil firms in south-south, Nigeria.



### Research Question Three

What is the relationship between customer integration and market size?

**Table 3 Spearman Rank Correlation of customer integration and market size**

Variables	N	$r_s$	Decision
Customer integration (X)			
	196	.816	Very Strong Relationship
Market size (Y)			

**Source:** Field Data (2024)

Results presented in table 3 above shows the value of relationship between customer integration and market size of oil firms in south-south, Nigeria. The  $r_s$  value of .816 shows that there is very strong relationship between customer integration and market size of oil firms in south-south, Nigeria. This implies that customer integration has a very strong relationship with market size of oil firms in south-south, Nigeria.

### Test of Hypotheses

**H<sub>01</sub>:** There is no significant relationship between internal integration and product quality.

**Table 5: internal integration and product quality**

#### Correlations

		Internal_Integration	Product_Quality
Spearman's rho	Correlation Coefficient	1.000	.773**
	Sig. (2-tailed)	.	.000
	N	196	196
	Correlation Coefficient	.773**	1.000
	Sig. (2-tailed)	.000	.
	N	196	196

\*\*. Correlation is significant at the 0.05 level (2-tailed).

Source: Researcher field survey, 2024

From the result in table 4, the correlation coefficient ( $r=.773$ ) between internal integration and the product quality is strong and positive.



**Table 6: Z-test of significance of the relationship between internal integration and product quality of oil firms in south-south.**

Variables	N	$r_s$	Df	z-cal.	z-cri.	Decision
Internal integration(X)	196	.773	195	11.60	1.96	Sig.
Product quality(Y)						

**Source:** Field Data (2024),  $Z = r_s\sqrt{N-1}$

Results presented in Table 5 shows that the calculated z-value of (11.60) is greater than the critical value of 1.96 at 0.05 level of significance. This is interpreted to be statistically significant. Therefore, the null hypothesis which states that there is no significant relationship between internal integration and product quality is rejected. This implies that there is a significant relationship between internal integration and product quality of oil firms in south-south, Nigeria.

**H<sub>02</sub>:** There is no significant relationship between supplier integration and delivery time.

**Table 7: Supply integration and delivery time****Correlations**

		Supplier_Integrati on	Delivery time
Spearman's rho	Correlation	1.000	.679**
	Supplier_Integrati on		
	Coefficient		
	Sig. (2-tailed)	.000	.000
	N	196	196
	Correlation	.679**	1.000
Delivery time	Coefficient		
	Sig. (2-tailed)	.000	.000
	N	196	196

\*\*. Correlation is significant at the 0.05 level (2-tailed).

**Source:** Researcher field survey, 2024

From the result in table 6, the correlation coefficient ( $r=.679$ ) between supplier integration and delivery time is strong and positive

**Table 8: Z-test of significance of the relationship between supplier integration and delivery time of oil firms in south-south.**

Variables	N	$r_s$	Df	z-cal.	z-cri.	Decision
Supplier integration(X)	196	.679	195	10.19	1.96	Sig.
Delivery time(Y)						

**Source:** Field Data (2024),  $Z = r_s\sqrt{N-1}$



Results presented in Table 7 shows that the calculated z-value of (10.19) is greater than the critical value of 1.96 at 0.05 level of significance. This is interpreted to be statistically significant. Therefore, the null hypothesis which states that there is no significant relationship between supplier integration and delivery time is rejected. This implies that there is a significant relationship between supplier integration and delivery time of oil firms in south-south, Nigeria.

**H<sub>03</sub>:** There is no significant relationship between customer integration and market size.

**Table 9: Customer integration and market size**

**Correlations**

			Customer Integration	Market size
Spearman's rho	Customer_Integration	Correlation Coefficient	1.000	.813**
		Sig. (2-tailed)	.	.000
		N	196	196
	Market Size	Correlation Coefficient	.813**	1.000
		Sig. (2-tailed)	.000	.
		N	196	196

\*\* . Correlation is significant at the 0.05 level (2-tailed)

Source: Researcher field survey, 2024.

From the result of table 8, the correlation coefficient ( $r=.813$ ) between customer integration and increase in market size is strong and positive.

**Table 10: Z-test of significance of the relationship between customer integration and market size of oil firms in south-south.**

Variables	N	$r_s$	df	z-cal.	z-cri.	Decision
Customer integration(X)	196	.813	195	12.20	1.96	Sig.
Market size(Y)						

**Source:** Field Data (2024),  $Z = r_s \sqrt{N - 1}$

Results presented in Table 9 shows that the calculated z-value of (12.20) is greater than the critical value of 1.96 at 0.05 level of significance. This is interpreted to be statistically significant. Therefore, the null hypothesis which states that there is no significant relationship between customer integration and market size is rejected. This implies that there is a significant relationship between customer integration and market size of oil firms in south-south, Nigeria.



## **DISCUSSION OF FINDINGS**

### **The relationship between internal integration and product quality**

The study tested the relationship between internal integration and product quality using spearman rank and z-test statistical technique. The results revealed that there is strong and significant relationship between internal integration and product quality, hence the alternate hypothesis was accepted. This implies that firms breakdown functional barriers and maintain cooperation and collaboration within the firm to meet the requirement of customers, use a cross functional team in new product development motivate committed employee, and monitor for complaints use transportation means that maintain the product quality thereby producing quality products for customer. This finding is in line with that of El-Tamini and Sharabati (2018) who maintained that internal integration helps in maintaining cross functional cooperation and collaboration within the organization that intends to achieve organizational strategic goals.

### **The relationship between supplier integration and delivery time**

The study tested the relationship between supplier integration and delivery time using spearman rank and z-test statistical technique. The results revealed that there is a significant relationship between supplier integration and delivery time, hence the alternate hypothesis was accepted. This implies that firms communicate with its major suppliers and upgrade information about product, and schedules on when to deliver goods, bears the differences in transportation cost of improve the delivery time of suppliers, establish a quick ordering system with major suppliers, develop supplier enhancement program to have a flexible business network improving delivery performance. The finding is in line with El-Tammin and Sharabati (2018), they said supplier integration is a process of cooperation between supplier and organizations that facilitate sharing of information, knowledge, material and experience.

### **The relationship between customer integration and market size**

The study tested the relationship between customer integration and market size using spearman rank and z-test statistical technique. The results revealed that there is a strong and significant relationship between customer integration and market size, hence the alternate hypothesis was accepted. This implies that firms detect demand changes quickly, listen to customers' complaints and feedback on quality and delivery, build trust with their customers, responsive to customers' needs thereby increasing market size. In live with the finding, Flynn (2010), says customer integration generate opportunities for leveraging the intelligence embedded in collaborative processes, enables manufactures to reduce costs, create greater value and detect demand changes more quickly. Supporting the finding, Zhang (2013), said customer integration helps manufacturer better understand customer requirements and better forecast customer demand, thus allowing the manufacturer to provide better quality products at lower cost and more flexibly.



## CONCLUSION AND RECOMMENDATIONS

The focus of this study was to examine SCI and operational performance of oil service firms, in south-south, Nigeria. SCI has become an essential tool where firms, use to obtain competitive advantage relative to more independent firms, firms with highly integrated SC have the potential to lower the net costs of conducting business and the total delivered costs to customer. Also, through integrated SC, partners in the value chain are well informed about changes in the market. Having the right technology and strategies that connect suppliers with manufacturers, it will eventually help manufacturer provide better customers service, help suppliers better understand and anticipate the demands of firm, and better meet it shifting needs. Creating SC cooperation can help firms to pool resources and capacities increase inter-and-intra-firm knowledge sharing and develop efficient governance structure. The study recommended thus:

1. There should be a real-time integration and connection among all internal functions in oil service firms from raw material management, through production to sales so as to deliver quality products to customers.
2. There should be a high degree of strategic partnership with suppliers in the value chain response to obtain rapid response in the ordering process and deliver good on time.
3. Oil service firms in the supply chain should build a strong customer relationship, responsive to customers' need and frequently in close contact with them. Building customer loyalty is an excellent strategy for acquiring a large market size.

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