

External Supply Chain Integration and Firm Competitiveness of Listed Oil and Gas Firms in Nigeria

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Abstract

This study investigates the relationship between external supply chain integration and firm competitiveness in the Nigerian oil and gas industry. The study considers both supplier integration and customer integration and their individual effects on profitability and sales growth. The empirical analysis is based on cross-sectional data collected primarily through a structured questionnaire from 84 purposely selected managers or representatives of 12 listed oil and gas companies in Nigeria. The Cronbach Alpha method is used to determine the reliability of the research instrument. Our empirical model incorporates technology as a control variable. The cross-sectional regression results show that both supplier and customer dimensions of supply chain integration have a positive relationship with firm profitability and sales growth. Hence, our conclusion is that external supply chain integration is a good strategy for improving marketing performance of listed oil and gas firms in Nigeria.

Key words: *External supply chain integration, profitability, sales growth*

Introduction

To compete successfully in today's hostile and dynamic business world, organizations must efficiently and effectively manage all players within their supply chain network. Supply chain management describes the extent to which all activities within and outside the organization are integrated towards achieving the organisational goals (Narasimhan & Viswanathan, 2010). According to Beheshti et al. (2014), effective supply chain network requires strong and robust partnership and bonding between the firm and the members of its supply chain. Also, supply chain management involves the integration of all business processes and activities from the end user or final consumer through the initial suppliers, which provides an overall synergistic value or long-term benefits to all stakeholders, and thereby enhances organizational competitiveness (Gunasekaran, A., & Ngai, 2004). Supply chain integration (SCI), which is facilitated by technology, leads to cost efficiency, high delivery speed, customer satisfaction, and increased overall performance (Frohlich & Westbrook, 2001; Zaid et al., 2021). According to () supply chain integration helps incorporate partners' resources, capabilities and perspectives into a firm's business model or value proposition, thereby allowing all stakeholders in the supply chain to excel in performance.

According to Fabbe-Coste and Jahre (2008), SCI has four layers: (1) integration of physical, information, and financial flows; (2) integration of processes and activities; (3) integration of systems and technologies; and (4) integration of actors (structures and organizations). Also, supply chain integration has both internal and external dimensions. Internal integration emphasizes the connections, interactions, and interdependencies among a firm's internal organs and functional areas such as purchasing, transportation, warehousing, inventory management, purchasing, demand planning, and production (Germain & Iyer, 2006). The absence of internal integration is costly to the organization as it typically leads to waste of resources, quality compromise, and inefficient pricing (Asnordin et al., 2021).

External integration focuses on the interactions between the firm and its external stakeholders in the supply chain (Flynn et al., 2010). External integration can be dimensionalized into supplier integration and customer integration. Supplier integration is the production alliance between a firm and its suppliers for the purpose of creating input supply efficiency (Zaid et al., 2021). Hence, it describes the extent of the collaboration or partnership a firm has with its suppliers to enhance its operational efficiency (Sinaga et al., 2019). On the other hand, customer integration

refers to the incorporation of customer resources into the internal and external processes of a company (Moeller, 2008). It focuses on improving the firm-customer relationship towards achieving higher customer experience and increased market share. Hence, customer integration enhances performance outcomes and firm competitiveness.

Although SCI is a well-developed concept in supply chain management, there is scanty literature that seeks to examine the extent of its impact on marketing performance. Besides much of the previous empirical studies are based on data obtained from manufacturing firms in the developed countries, thereby necessitating the need for more empirical studies on SCI-performance relationship from the perspective of the developing countries such as Nigeria.

This study contributes to the growing empirical literature by investigating the impact of external supply chain integration on firm competitiveness in the Nigerian oil and gas industry. Specifically, the study uses a cross-sectional multiple regression framework to examine the effects of supplier and customer dimensions of supply chain integration on firm profitability and sales growth, focusing on oil and gas firms that are listed on the Nigerian stock exchange. The study has four specific objectives as follows:

1. To determine the extent of the impact of supplier integration on firm profitability.
2. To determine the extent of the impact of customer integration on firm profitability.
3. To determine the extent of the impact of supplier integration on sales growth.
4. To determine the extent of the impact of customer integration on sales growth.

The remainder of the study is structured as follows: The next Section reviews the extant literature on the relationship between supply chain integration and competitiveness. This is followed by Section 3 which describes the methodology used for empirical analysis. Section 4 contains data analysis and discussion of findings, while the study is concluded in Section 5.

Literature Review

Yeung et al. (2009) investigates the determinants of internal and supplier integration using Chinese supply chain data. The empirical analysis is based on data collected through a structured questionnaire from 617 companies operating in different industries, while MONOVA technique is used to analyze the data. They find that both trust and coercive power are significant in explaining supplier integration, while only trust is significant in explaining internal integration. Also, it is reported that the interaction between trust and power is significant for both supplier and internal dimensions of supply chain integration.

Flynn et al. (2010) employ the hierarchical regression to examine the impact of both internal and external (supplier and customer) dimensions of supply chain integration on firm performance, focusing on manufacturing companies in China. The empirical analysis is based on survey responses obtained from 617 companies through a structured questionnaire. They find that both internal and external supply chain integration are significant in explaining both the operational and business performance of a firm. However, it is also reported that the effects of internal and customer dimensions are stronger than the effect of the supplier dimension.

Beheshti et al. (2014) use a simple regression framework to analyze the extent to which supply chain integration is associated with financial performance of Swedish manufacturing firms. Based on survey data collected from 271 small and large companies, they find that supplier-firm-customer integration, firm-supplier integration, firm customer integration, and internal integration all have positive and significant effects on financial performance.

Munir et al. (2020) employ the covariance-based structural equation modeling to investigate the mediating role of supply chain risk management in the relationship between supply chain integration and operational performance. Their empirical analysis is based on survey data on 931 manufacturing companies across Europe Asia, North America and South America. Among their findings is that supply chain risk management partially mediates the effect of internal integration on operational performance but fully mediates the relationship between external integration (both supplier and customer dimensions) and operational performance.

In Indonesia, Zaid et al. (2021) examine the impact of supply chain integration on customer loyalty using the PLS-SEM framework. They examine internal, supplier and customer dimensions of supply chain integration using data collected from 308 top managers of Tuna Fillets SMEs through a structured questionnaire. They find, among other things, that all dimensions of supply chain integration has a positive and significant impact on customer loyalty and performance through operational performance and customer satisfaction.

Agyei-Owusu et al. (2022) examine the impact of dimensions of supply chain integration on firm performance using the partial least square structural equation modeling approach. The investigation is based on survey data obtained from 120 respondents from manufacturing and service firms in Ghana. Their findings provide empirical evidence that internal integration positively and significantly affects both customer integration and supplier integration. Also, their analysis shows that internal integration has positive and significant effect on firm performance, while customer integration exerts positive and significant effect on both operational performance and firm performance.

Methodology

Sample, Data and Measurement

This study focuses on the oil and gas industry in Nigeria. The sample includes 12 listed oil and gas companies in Nigeria: namely, Amino International, Capital Oil, Conoil, Eterna, Forte Oil, Total, Mobil, Oando, MRS, Rak Unity, Japaul Oil, and Seplat. The data are collected from a total of 84 managers and senior employees, with 7 respondents purposively selected from each of these companies. The instrument of data collection is a questionnaire instrument structured in Likert format with 5 ordered questions. The reliability of the data is determined based on the Cronbach Alpha method, while both face and content validity are based on opinions of industry experts and teaching professionals.

Supply Integration (SI): This variable is measured in terms of five statement items adopted from Yeung et al. (2009). The variables are production capacity, production techniques, production plan and schedules, demand forecast, and inventory level. The respondents are asked to indicate the extent to which their firms are sharing each of these variables with their suppliers. The options range from (1) very low extent to (5) very great extent.

Supply Integration (SI): This variable is measured in terms of five statement items adopted from different studies. The variables are value customer engagement, value co-creation, customer feedback, information sharing, and customer participation. The respondents are asked to indicate the extent to which each of these variables is present in their companies. The options range from (1) very low extent to (5) very great extent.

Profitability (PF): This variable is measured in terms of three statement items indicating measures that are commonly used in the literature. These measures are net profit, cost reduction, and return on assets. The respondents are asked to indicate the extent to which each of these performance measures has increased over the past three years. The options range from (1) very low extent to (5) very great extent.

Sales Growth (SG): This variable is measured in terms of three statement items indicating measures that are commonly used in the literature. These measures are customer base, sales revenue, market share. The respondents are asked to indicate the extent to which each of these variables has improved or grown over the past three years. The options range from (1) very low extent to (5) very great extent.

Technology (Tech): This variable is measured in terms of four statement items indicating measures that are commonly used in the literature. These measures are radio frequency system, Barcode system, computer-aided design system, and internet. The respondents are asked to indicate the extent to which each of these variables is used in their supply chain management. The options range from (1) very low extent to (5) very great extent.

Table 1 shows the descriptive analysis (mean and standard deviation) for dimensions of both SCI and firm competitiveness.

Table 1: Descriptive Statistics

Item/Measure	Description	\bar{x}	σ	Remark
Supplier Integration (SI): Cronbach Alpha = 0.759				
SI1	Sharing of production capacity	3.45	0.877	Moderate
SI2	Sharing of production techniques	3.51	0.851	Great Extent
SI3	Sharing of production plan and schedules	3.44	1.010	Moderate
SI4	Sharing of demand forecast	3.98	0.632	Great Extent
SI5	Sharing of inventory level	4.51	0.431	Very Great Extent
Customer Integration (CI): Alpha = 0.844				
CI1	Customer engagement	3.33	0.834	Moderate
CI2	Value co-creation	3.45	0.764	Moderate
CI3	Customer feedback	4.22	0.206	Great Extent
CI4	Information sharing	3.77	0.639	Great Extent
CI5	Customer participation	3.74	0.679	Great Extent
Profitability (PF): Alpha = 0.831				
PF1	Net Profit	4.30	0.972	Great Extent
PF2	Cost Reduction	4.18	1.057	Great Extent
PF3	Return on assets	4.31	1.088	Great Extent
SG (SG): Alpha = 0.722				
SG1	Customer base	4.30	0.972	Great Extent
SG2	Sales Revenue	4.18	1.057	Great Extent
SG3	Market share	4.31	1.088	Great Extent
Technology (Tech): Alpha = 0.765				
TECH1	Radio frequency system	3.75	0.762	Great Extent
TECH2	Barcode	4.01	0.521	Great Extent
TECH3	Computer-aided design	4.22	0.442	Great Extent
TECH4	Internet	4.51	0.171	Very Great Extent

Model Specification

To examine the impact of external supply chain integration on marketing performance, we specify the following cross-sectional regression models:

$$PF_i = \beta_0 + \beta_1 SI_i + \beta_2 CI_i + \beta_3 TECH_i + \epsilon_i \quad (1)$$

$$SG_i = \phi_0 + \phi_1 SI_i + \phi_2 CI_i + \phi_3 TECH_i + \epsilon_i \quad (2)$$

Where β_0 and ϕ_0 are the regression intercepts, β_1 and ϕ_1 capture the impact of supplier integration respectively on profitability and sales growth, β_2 and ϕ_2 capture the impact of customer integration respectively on profitability and sales growth, while ϵ_i and ϵ_i represent the regression residuals or error terms. Further, also consistent with the view by Frohlich and Westbrook (2001) that technology facilitates supply chain integration, our cross-sectional models

incorporate technology as a control variable which is captured by β_3 and ϕ_3 . Based on the well-established positive theoretical relationship between supply chain integration and performance measures, we expect, *a priori*, that β_1 , β_2 , β_3 , ϕ_1 , ϕ_2 and ϕ_3 all would be significantly different from zero, both statistically and in economic sense.

Empirical Analysis and Discussion

Table 2 reports the cross-sectional regression results for the specified relationships. The model estimation is done in EViews using the OLS technique. From the lower panel, the F-statistic (p-value = 0.0000) shows that the profitability and sales growth models are highly significant, while the \bar{R}^2 of 0.6598 and 0.7112 show that the proportion of the model variance explained by external chain integration and technology is higher for sales growth than for profitability. However, the Durbin-Watson statistic is very close to 2 for both models, showing that both models are valid and a true representation of reality.

Table 2: Regression Results; p-values in parenthesis

Variable	Profitability	Sales Growth
Intercept	0.4512** (0.0231)	0.7762*** (0.0011)
SI	0.2311*** (0.0451)	0.3917** (0.0001)
CI	0.3776** (0.0248)	0.5519*** (0.0049)
TECH	0.8771*** (0.0001)	0.9458*** (0.0000)
R^2	0.7021	0.7645
\bar{R}^2	0.6598	0.7112
F-statistic	97.665*** (0.0000)	133.23*** (0.0000)
Durbin Watson	1.9021	1.9353

***indicates 5% level significance

**indicates 10% level significance

Supplier Integration and Firm Competitiveness

The first objective of this study is to determine the extent to which supplier integration affects firm competitiveness. It is well established in theory that supplier integration is an effective way of improving marketing performance or competitiveness through cost reduction and production input efficiency (Zaid et al., 2021). Hence, there is a positive relationship between supplier integration and firm competitiveness. Consistent with this theoretical view, our results show that supplier integration has a positive and significant effect on both profitability and sales growth. As shown in the upper panel of Table 2, the coefficient on SI is estimated at 0.2311 with a p-value of 0.0451 in the profitability model, while its estimated value is 0.3917 with a p-value of 0.0001 in the sales growth model. This shows that supplier integration is an important explanatory factor for firm marketing performance. However, the sizes of these coefficients show that the effect of supplier integration is higher for sales growth than for profitability. This finding is consistent with Flynn et al. (2010), Beheshti et al. (2014), and Zaid et al. (2021). The results reported by these studies suggest that supplier integration leads to higher marketing performance. Hence, for listed oil and gas companies in Nigeria, improving the firm-supplier relationship through supplier integration is a good strategy for achieving higher competitiveness in terms of profitability and sale growth.

Customer Integration and Competitiveness

The second objective of this study is to determine the extent to which customer integration affects competitiveness. Theoretically, customer integration improves the firm-customer relationship, leading to product/service innovation, improved product quality, higher delivery performance and customer satisfaction. Hence, there is a positive relationship between customer integration and firm competitiveness. Consistent with this theoretical view, our results show that customer integration has a positive and significant effect on both profitability and sales growth. As shown in the upper panel of Table 2, the coefficient on CI is estimated at 0.3776 with a p-value of 0.0248 in the profitability model, while its estimated value is 0.5519 with a p-value of 0.0049 in the sales growth model. This shows that customer integration is an important explanatory factor for firm competitiveness. Again, the sizes of these coefficients show that the effect of customer integration is higher in both magnitude and significance for sales growth than for profitability. This finding is consistent with Flynn et al. (2010), Beheshti et al. (2014), and Zaid et al. (2021). The results reported by these studies suggest that customer integration leads to higher marketing performance. Hence, for listed oil and gas companies in Nigeria, improving firm-customer relationship through customer integration is a good strategy for achieving higher competitiveness in terms of profitability and sales growth.

Summary and Conclusion

This study considers the empirical linkage between external supply chain integration and competitiveness of listed oil and gas firms in Nigeria. External supply chain integration is examined in terms of firm-supplier integration and firm-customer integration, while competitiveness is measured in terms of profitability and sales growth. The empirical model incorporates technology as a control variable.

There is evidence that both firm-supplier integration and firm-customer have positive and significant effects on both profitability and sales growth. Both supply chain integration dimensions blended with technology account for approximately 66% and 71% of the total variation in profitability and sales growth respectively. Hence, we conclude that external supply chain integration is a good strategy for improving competitiveness of firms that are listed on the oil and gas index of the Nigerian stock exchange.

References

- Agyei-Owusu, B., Asamoah, D., Nuerter, D., & Acquah, I. N. (2022). Examining the relationship between dimensions of supply chain integration, operational performance and firm performance: evidence from Ghana. *Management Research Review*, 45(12), 1644-1669.
- Asnordin, N. A., Sundram, V. P. K., & Noranee, S. (2021). The influence of supply chain integration towards supply chain performance in manufacturing firms. *International Journal of Academic Research in Accounting Finance and Management Sciences*, 11(1), 350-362.
- Beheshti, H. M., Oghazi, P., Mostaghel, R., & Hultman, M. (2014). Supply chain integration and firm performance: an empirical study of Swedish manufacturing firms. *Competitiveness Review*, 24(1), 20-31.
- Fabbe-Costes, N., & Jahre, M. (2008). Supply chain integration and performance: a review of the evidence. *The International Journal of Logistics Management*, 19(2), 130-154.
- Flynn, B. B., Huo, B., & Zhao, X. (2010). The impact of supply chain integration on performance: A contingency and configuration approach. *Journal of operations management*, 28(1), 58-71.
- Frohlich, M. T., & Westbrook, R. (2001). Arcs of integration: an international study of supply chain strategies. *Journal of operations management*, 19(2), 185-200.
- Germain, R., & Iyer, K. N. (2006). The interaction of internal and downstream integration and its association with performance. *Journal of business logistics*, 27(2), 29-52.
- Gunasekaran, A., & Ngai, E. W. (2004). Information systems in supply chain integration and management. *European journal of operational research*, 159(2), 269-295.

- Moeller, S. (2008). Customer integration—a key to an implementation perspective of service provision. *Journal of service research*, 11(2), 197-210.
- Munir, M., Jajja, M. S. S., Chatha, K. A., & Farooq, S. (2020). Supply chain risk management and operational performance: The enabling role of supply chain integration. *International Journal of Production Economics*, 227, 107667.
- Narasimhan, R., Swink, M., & Viswanathan, S. (2010). On decisions for integration implementation: An examination of complementarities between product-Process technology integration and supply chain integration. *Decision sciences*, 41(2), 355-372.
- Yeung, J. H. Y., Selen, W., Zhang, M., & Huo, B. (2009). The effects of trust and coercive power on supplier integration. *International journal of production Economics*, 120(1), 66-78.
- Zaid, S., Palilati, A., Madjid, R., & Abadi, S. (2021). The effect of supply chain integration on customer loyalty: The mediating roles of operational performance and customer satisfaction. *Uncertain Supply Chain Management*, 9(4), 867-876.

