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Original Research Article

Supply Chain Integration and Organisational Performance in the Upstream Oil and Gas Firms in Nigeria

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Abstract

This study is on supply chain integration and organisational performance in the upstream oil and gas sector in Nigeria, while the specific objectives are to examine the extent to which information sharing, knowledge sharing process, collaborative awareness, and technological capabilities integration influence on organisational performance of firms in the industry. It is a cross sectional field survey for the year 2017 with focus on oil and gas firms in the upstream sector operating in the six Niger Delta states (Akwa Ibom, Bayelsa, Cross River, Delta, Edo and Rivers). These include firms in the Joint venture companies with Nigerian National Petroleum Corporation (NNPC), production sharing companies, independent (Sole Risks) companies (national oil companies), and those in the marginal fields. A total of forty oil and gas companies were investigated with a total population of 1,683 and a sample size of 323 of management and senior staff of Supply Chain Units (Warehousing, Procurement, Inventory Management and Logistics), and Audit, Finance and Accounts Division that monitor or involved in the supply chain integration in the various organisations. Data generated were analysed using ordinary least square (OLS) regression. The study found that information sharing, knowledge sharing, process, collaborative awareness, and technological capabilities integration were statistically significant influence and positively related to organisational performance.

Key words: Supply chain integration, Upstream Oil and Gas, and Organisational Performance.

JEL Classification Codes: L250

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1.0 INTRODUCTION

Supply chain integration is very multifarious and complicated in the upstream oil and gas organisations because of several multi-tiered nodes and own structure like exploration and appraisal, fabrication, installation, drilling, production, processes and managing of logistics (Bernon, Upperton, Bastl, & Cullen 2013). These situations attract high levels of uncertainty and dynamic nature of the upstream oil and gas industry which result to challenges and difficult supply chain linkages among main partners such as suppliers, customers, and other stakeholders in the industry (Mitchell, 2012; Morton, 2003). This single reason makes upstream oil and gas firms to find it difficult to forcefully restructure their processes so as to preserve higher safety stock, and identify substitute source of supplies amidst several other activities within and outside the organisation (Ikram, 2004). Coia (1999) suggests that inadequate supply chain integration in oil and gas organisations can attract increase in cost of production, as well as prices of buying and selling oil which the final burden could shift to final consumers. Moreover, Ikram (2004) notes that collaboration and information sharing are closely linked among supply chain partners, but oil and gas firms always show lack of seriousness with view that they are cautious in implementing activities. The reluctant attitude as regards collaboration and information sharing in oil and gas especially upstream could negatively affect demand, increase costs, and unnecessarily delays could hinder opportunity to save capital and operational cost (Li, Ragu-Nathan & Ragu-Nathan, 2006).

However, some Nigerian studies (like Amue & Ozuru 2014; Ukpabi, Ikaba, Enyindah, & Idatoru, 2015; Somuyiwa, Mcilt & Adebayo, 2012) have been conducted on supply chain, but no established model of supply chain integration, the dearth of empirical studies in the area and their results were mixed and inconclusive. Also, the researcher is not aware of any empirical studies in Nigeria on supply chain integration antecedence as would enhance organisational performance in oil and gas firms in upstream sector in Nigeria. That is the gap that this study desires to fill. Hence, this study investigates supply chain integration on organisational performance in the upstream sector in Nigeria, while, it specifically examine the extent to which information sharing knowledge sharing, process integration, collaborative awareness and technological advancement integration influence organisational performance.

2.0 LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

Concept of Organizational Performance

The issue of performance has been the concern of management of organisations. Performance is the objective of any organisation because only through performance, are organizations able to grow and progress (Gavrea, Ilies & Stegorean, 2011). Performance can also be defined as the accomplishment of specified business objectives measured against known standards, completeness and cost (Davis & Cobb, 2010). Fauzi, Svensson, and Rahman (2010) opine that organisational performance is a function of market mechanism reflected in the way the firm interacts with the financial factor and customer product markets. Therefore, organisational performance measurement is not limited to financial

measures like Return on Assets (ROA), Return on Equity (ROE), Sales growth, and profitability growth, but non-financial which is the concern of this study, such as employee growth, customer satisfaction, Satisfaction with performance compared to competitors, efficient and effective sourcing, delivery of materials and overall satisfaction. Also, non-financial factors can be profitably applied to areas of major concern to the corporate organisation, and improves the quality of their performance.

Supply Chain Integration -

Supply chain integration is seen in different perspectives. Westbrook (2002) notes that supply chain is about issues on how firms or organisations working together can attain a goal by way of solving bottlenecks and overcome bumps in demand and supply. According to Amue and Azuru (2014), supply chain integration is concerned with the quality and co-operation among linked functional departments which prevent overlapping undertakings. Narasimhan, Swink and Viswanathan (2010) define supply chain integration as 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 organisational goals. Lee (2000) explains that supply chain integration includes the collaboration among the upstream suppliers, midstream organisation and downstream (distributors, retailers). Fabbe-Costes and Jahre (2008) view supply chain integration as a combination of activities and processes through ownership structure (stakeholders) between upstream and downstream. Van der Vaart and Van Donk, (2008) opine that the main notion about supply chain integration (SCI) is that it is a suitable approach to enhance various measures of firm performance. Based on the forgoing belief, integration can therefore be characterised by cooperation, collaboration, information sharing, trust, partnerships, shared technology, and a fundamental shift away from managing individual functional processes, to managing integrated chains of processes (Pagell, 2004). In effect, supply chain integration is associated with linking of activities (both internal and external) vital to the organisation in order to achieve goals and objectives.

Relationship between Supply Chain Integration and Organizational Performance

Below are specific supply chain integration attributes in relation to organizational performance.

Information Sharing and Organizational Performance

Information sharing among the functional areas of an organisation supply chain network requires cooperation and combined responsibility across tasks such as product design, procurement, production, sales, and distribution so as to achieve customer requirements at a reduced cost (Wong, Boonitt & Wong, 2011)..According to Lee, Kwon, and Severance (2007), information integration affords an easy access to operational data from the integrated database, linking information system to internal departments in the firm, access to inventory information throughout the supply chain, retrieving inventory status in real time, utilizing a computer based planning system between marketing and production. When every unit in the organisation is connected to online information all over the supply chain network, this would integrate value chain and entire value

systems through sharing timely information and as well as sustaining close communication within the supply chain network. This situation can result to quality customer service, pave way for exact required demand and prediction. It is expected that information sharing integration will influence organizational performance.

Knowledge Sharing Integration and Organizational Performance

In a bid to explain the concept of knowledge in relation to supply chain integration, Alavi (2000) opine that organisation's knowledge sharing can only be achieved through cooperation, communication, and relationship with stakeholders of the supply chain network. Okhuysen and Eisenhardt (2002) explain that knowledge sharing as it enhances organisational performance is completely made possible by individual employees in the firm. Therefore, knowledge sharing integration to a extent is vital in the supply chain network and enhancement of organisation performance.

Process Integration and Organizational Performance

Process integration entails all forms of concerted effort and cooperation work among participants of the firm, especially buyers and suppliers, joint product development, common systems and shared information. Dennis and Kampton (2010) note that successful operation of an integrated supply chain involves incessant processes flow so as to assist organisation to realise the paramount flow of goods and services. Lambert (2008) states that key supply chain in an organisation includes several fundamental process flows like customer service management process, physical procurement process, product development and commercialization process, manufacturing flow management process, physical distribution process, outsourcing/partnership process and performance measurement process which are not applicable to all industries or organisations. It is expected that process integration can influence organisational performance.

Collaborative Awareness and Organisational Performance

Collaborative awareness is one of the important components of supply chain integration Barnes and Liao (2012) define collaborative awareness by its association with the firm's level of awareness and effectiveness or efficiency supply network. The supply chain relationship consists of partners who are desirous of willingly assisting another without exception. Simatupang and Sridharan, (2002) state that collaborative awareness occurs when two or more independent companies work jointly to plan and execute supply chain operations with greater success than when acting in isolation. Manthou, Vlachopoulou and Folinis (2004), state that for effective and efficient partnership, there is need for participants to share gains and losses equitably, so that the outcome of the collaboration are quantifiably beneficial to all supply chain members with the view to align incentives which match investment in order for the collaboration to work. It is expected that collaborative awareness influences organizational performance.

Technological Capabilities and Organizational Performance

Information technology (IT) consists of a technology advance or resources shared and used by a firm. Ehigie and McAndrew (2005) state that one of the

important components identified to be necessary for inter-firm relationship performance and to remain competitive in the market is technological capability. Flynn, Huo and Zhao (2010) indicate that communicating with customers is greatly influenced by the firm's technological advancement, ability and available infrastructure.

3.0 RESEARCH METHODS

Theoretical framework and Model Specification

This study is anchored on the Network Theory (NT). Network is connectivity of activities. According to Croom (2001), network theory can be used to provide a basis for the conceptual analysis of reciprocity in co-operative relationships. In this case, the firm's continuous interaction with other players becomes an important factor in the development of new resources (Haakansson & Ford, 2002). These relationships combine the resources of two organizations to achieve more advantages than through individual efforts. A network does not seek an optimal equilibrium, but is in a constant state of movement and change. Link between firms in a network develop through two separate, but closely linked process; types of interaction, exchange processes (information, goods and services, and social processes) and adaptation processes (personal, technical, legal, logistics, and administrative elements) (Johanson & Mattsson, 1987). Network theory is descriptive in nature and has primarily been applied in supply chain management to map activities, actors, and resources in a supply chain. The focus has been on developing long-term, trust based relationships between the supply chain members. Examples of issues include buyer-supplier relationships (Gadde & Haakansson, 2001), third party logistics (Halldorsson, 2002), and management roles in supply networks (Harland & Knight, 2001).

For the purpose of this study, our model is specified as:

$$OP = \beta_0 + \beta_1 ISI + \beta_2 KSI + \beta_3 PI + \beta_4 CAI + \beta_5 TCI + e$$

Where:

$$\beta_0 = \text{Constant}$$

β_1, \dots, β_5 = Coefficients of the independent variables; *OP*= Organisational Performance; *ISI* = information sharing integration; *KSI*= knowledge sharing integration; *PI*= process integration; *CAI*= collaborative awareness integration; *TCI*= Technological capabilities integration and *e*= error term.

Our Apriori expectation is stated as: $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 > 0$, $\beta_4 > 0$ and $\beta_5 > 0$.

Research Design

This study focused on oil and gas firms in the upstream sector operating in the six states of the South-South Geo-political zone which comprises of Akwa-Ibom, Bayelsa, Cross River, Delta, Edo and Rivers for the purpose of obtaining information about the firms supply chain integration. The choice of the zone was that most upstream activities were carried out there. It is a cross sectional field survey. A total of one thousand, six hundred and eighty-three (1683) management and senior staff of forty (40) upstream firms constitute the population. The population consists of staff of both multinationals and nationals

oil firms operating in the upstream sector. A total of three hundred and twenty-three (323) constituted the sample size and this was arrived at by using number estimation formular by Yamane (1967) as calculated below.

$$n = \frac{N}{1 + N(e)^2}$$

Where:

n = sample size;

N = population size (finite population);

e = desired level of significance, (in this case is 5%):-

$$n = \frac{1,683}{1+1683(0.05)^2}$$

$$n = 323$$

Table 1: Breakdown of Population and Sample Size

S/N	Upstream Firms Categories	Population Size of Management and Senior Staff	Sample Size of Management and Senior Staff
1	Joint Venture Companies (JVCs)	489	94
2	Production Sharing Companies (PSC)	456	87
3	Independent (Sole Risk) (NOC)	421	81
4	Marginal Fields (MF)	317	61
	Total	1,683	323

Researcher's, computation (2018)

Stratified purposive sampling technique was applied for the selection of staff for questionnaire administration. Copies of questionnaire were administered in proportion 19.2%. A total of 323 copies of questionnaire were administered while 300 copies were successfully retrieved while 23 copies were returned. Questionnaire successfully retrieved are analysed using Ordinary least square regression. Data generated was estimated with computer software (SPSS.21).

4.0 RESULTS AND DISCUSSION

Outcome of questionnaire successfully retrieved were analysed and least square regression method was used as indicated in the Table 2

Table 2: Ordinary Least Square (OLS) Regression Estimation

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	
	B	Std. Error	Beta			
(Constant)	-.325	.072		-4.517	.000	
1	ISI	.159	.027	.226	5.989	.000
	KSI	.210	.060	.160	3.534	.000
	PI	1.136	.071	.937	15.937	.000
	CAI	.116	.040	.093	2.923	.004
	TCI	.432	.044	.314	9.822	.000
R=0.768^a R Square=0.591 Adjusted R Square=0.588						
Std. Error of the Estimate=0.2892983						
F-Stat=205.972 Durbin-Watson=1.554						

Source: Authour's Compilations (2016) (SPSS.20)(see Appendix 4)

$$OP = -0.325 + 0.159ISI + 0.210KSI + 0.136PI + 0.116CAI + 0.432TCI$$

(-4.517) (5.989) (3.534) (15.937) (2.923)
 (9.822)

Table above showed the least square regression method results of the variables examined.

From Table 1, it is deduced that correlation coefficient was 0.768 which implied that supply chain variables examined are highly correlated to organisational performance. The adjusted coefficient of determination ($R^2=0.588$) indicates that about 59% of the organisational performance is accounted for by the explanatory variables in term of information sharing integration, knowledge sharing, process sharing, collaboration awareness and technological capability integration. The overall test (F-statistic) (goodness-of-fit measure) which indicated value of 205.972 units and at significant level of 1%, compared with standard error of regression with minimal value of 0.2892. Outcomes of respective individual variable t and f-statistics as indicated in the table were statistically significant.

First, was observed that information sharing integration (ISI) was statistically significant, suggesting that it is a strong component of supply chain in relation to organisational performance. This finding is consistent with the report of Wong *et al.*, (2011) who showed that information sharing among the functional areas of an organisation supply chain network in terms of product design, procurement, production, sales and distribution can enhance performance.

Second, it was deduced that knowledge sharing integration (KSI) has significant positive influence on organisational performance. The finding is consistent with

the views of Okhuysen and Eisenhardt (2002) who observes that knowledge sharing integration is fundamental in the supply chain network so as to influence organizational performance.

Thirdly, the study revealed that process integration (PI) was statistically significant, implying that it is a strong component of supply chain in relation to organisational performance. The finding supported the views of Adrain (2011) who showed that process integration includes the process of outsourcing and partnering in terms of procurement of materials and components, sourcing for services, logistic warehousing, materials handling, inventory control so as to enhance organisational performance.

Fourthly, it was also revealed that collaborative awareness integration is statistically significant indicating that it is a strong component of supply chain and has positive influence organisational performance. This is consistent with views and findings of Simatupang and Sridharan, (2002) who stated that collaborative awareness integration in supply chain operation has greater success to firm performance than when acting in isolation.

Lastly, technological capabilities integration was found to be statistically significant, implying that technological capability is a strong component of supply chain on organisational performance. The finding buttressed Ehigie and McAndrew (2005) who noted that one of the key components found to be essential for inter-firm relationship performance and to remain competitive in the market is technological capability.

5.0 CONCLUSION AND RECOMMENDATIONS

The thrust of this paper is on supply chain integration and organisational performance of upstream oil and gas sector in Nigeria. Supply chain integration is a multifaceted management issue which requires unique capabilities among process and operational functions of an organisation. Supply chain integration brings together suppliers, buyers and other related parties towards achieving performance. Organisation can achieve better performance by developing certain supply chain integration competencies. Ability in managing these integrative relationships in areas of information sharing, logistics, technology, processes, collaboration better than the firm's competitors, can assist in achieving goals and objectives and better competitive advantage. Supply chain integration in terms of knowledge sharing, process, technological capabilities and level of collaboration are significant for firms in the upstream oil and gas to enhance their performance. Hence, this study recommended as follows

- (1) That oil and gas companies in the upstream sector should continuously share information for key decision making, logistics, ordering and planning, materials, sources of supply, suppliers, customers and utilisation and intra-organisational integration for efficient and effective operations and service delivery.
- (2) That oil and gas companies in the upstream sector should have adequate knowledge of the industry especially visibility of demand, supply and inventory among supply chain members to enhance organisational performance.

- (3) That oil and gas companies in the upstream sector should integrate their process to reposition the supply chain members so as to facilitate cooperation, increase coordination, reduced uncertainty, faster materials flow, high order fulfilment, shorter circle time, reduced inventory costs, customer satisfaction and enhance organisational performance.
- (4) That collaborative awareness will support inter and intra-organisational relationships. Hence, oil and gas firms should employ synergy and collaboration among supply chain partners and this could enhance all aspects of the business.
- (5) That acquisition of the latest technology for their operations will enhance organisational performance. In this light, the supply chain integration of the firms must be highly ICT compliance to stay competitive and enhance operations efficiency

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