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Supply Chain Integration in Organizations: An Empirical Investigation of the Nigeria Oil and Gas Industry

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Abstract

This paper develops and tests a conceptual model of supply chain integration and operational performance where integration of its supply chain network helps to keep closer look at the current performance to ensure flexibility in business operations. Empirical results based on the three dimensions of supply chain integration and a moderator. Information technology capability demonstrates that the availability of well integrated phenomena will enhance operations' performance. This facilitating effort does not occur in the absence of a moderating variable. The results reveal how supply chain integration can be used to enhance operational performance. Implications are discussed for the organization of better supply chain network and effect across a highly dynamic global marketplace and for understanding prior research findings on supply chain integration.

Keywords: integration, supply chain, process integration, operational performance, information sharing, knowledge, IT-capability

1. Introduction

Oil was discovered in commercial quantity in Oloibiri, Bayelsa state by Shell Corporation in 1956. The industry has grown to become a major player in the international oil and gas market in the World. Nigeria is the largest oil producer in Africa and the 11th largest in the world market (Adegoke & Bitrus, 2006). Currently, Nigeria is the 5th largest exporter of crude to the United States of America with oil revenue making up over 90% of Nigeria's foreign earnings (Festus and Gowon, 2004). The industry is divided into three sectors: the upstream sector consist of exploration and production activities which involves seismic, geophysical and geological studies that serves as input resources for production operations while the production involves drilling, production, facility Engineered and reservoir (Christopher, 2007). The downstream sector consists of processing, transportation, marketing and distribution of petroleum products (Hackward and Shore, 2004 and Roebar, 1994), in area like exploration-production-refining-market-customer. These supply chain activities need to be integrated in order to reduce cost of operations in the industry. Therefore through supply chain integration, the total supply chain network in the industry will work more efficiently through sharing valuable information, resources, knowledge and expertise with each other (Tamzidul, 2012). Oil and gas in Nigeria, considering current market situation, requires a high degree of integration within the supply chain network of the industry, and the long term sustainability of the oil market will depend on how different sectors can work in an integrated manner.

The broader concept supply chain integration is well established in the supply chain management literature (Jamespeter, 2005; McDonald, 2006; Chopra et al., 2007). Generally, it is as the integration on information, knowledge, processes and through which different functions within and outside of the sector can work together to enhance the level of efficiency as well as reduce the cost of operation to increase organizational effectiveness. The purpose of this study is to investigate the influence of supply chain integration on operational performance in oil and gas context. Thus, the objective of this study is threefold, first, the study examine the impact of supply chain integration on operational performance. Second, the study assess the impact of information integration, knowledge integration and process integration on operational performance in oil and gas sector. Third, the study determines the moderating effect of Information capability on supply chain integration and operational performance. this study discusses the implications of our findings for World best practices in the oil and gas industry.

2. Conceptual Foundation

Supply chain integration is an offshoot of supply chain management. Scholars has viewed supply chain management as all the activities involved from upstream suppliers to downstream distributors and retailers to fulfill customer request (Chopra et al., 2007). Supply chain has always been about companies working together to achieve a purpose (Westbrook, 2002), these relationships have always involves some degree of collaboration to solve bottlenecks in the supply chain network and overcome bumps in demand and supply. This study can define supply chain integration as the quality of state of collaboration existing among linked functional departments which present overlapping activities (Lawrence & Lorsch, 1986). The definition limited the supply chain integration within the company, that is considering only the midstream activities of supply chain integration. But lee (2000) gave more embracing definition of supply chain integration, there are some that stand out as shown below. According to Maigaet et al (2010), supply chain integration as the level or intensity of information sharing and collaboration among internal functions and between value chain partners including customers and suppliers. This definition collaborate with the definition of lee (2000), meaning that the comprehensive definition of supply chain integration includes the upstream suppliers, midstream (company) and downstream (distributor, retailers). The purpose of supply chain integration is to create the best customer value at the lowest operating cost, hence supply chain integration emphasizes effective information sharing and physical item flow to meet customer demands starting from raw materials supply sources to the delivery of the products to the customers (Li et al., 2009), (Zhang et al., 2006; Sezen, 2008; Wong et al., 2011) argued that proper implementation of supply chain integration in the organizations will meet individual customers' demand, reduced delivery time, decrease logistics and purchasing cost, reduced the level of inventories increase work force efficiency and market share by sharing the supply and demand information. Supply chain integration is divided into three level of integration: high, medium and low integration (Bagchi & Larsen, 2004). The low level of integration has to do with partial integration in the supply chain where as high integration involve the present of direct links among the people at different decision making levels across the interlinked organization in the supply chain network. Many scholars has investigated different degree of integration, for example the work of Frowich and Westbrook (2001), found that the degree of integration varies from company to company depending on their business nature and expectations. Some companies involve there stakeholders within the supply chain network on a very supplier and customers. A high degree of integration means a high degree of trust, information sharing and long term commitment to achieving common goals, thus ensure common benefits of integrated value networks (Tanzidul, 2012). Porter (2001) has argued that supply chain integration enables different functions to work in tandem linking with other cross functional units of business through information technology.

2.1 Measures of Supply Chain Integration

This study shall look at supply chain integration measures from three dimensions: information integration, knowledge integration and process integration.

Information integration: this is a collaboration and collective responsibility across functions such as product design, procurement, production, sales and distribution to meet customer requirements at a low total system cost (Wong et al., 2011; Fluman et al., 2010; Braunscheidel et al., 2010). The above is the midstream activities of supply chain network and its means of information sharing among the functional areas of the firm. The efforts break down functional barriers and facilitate sharing of real time information across key functions. Lee et al (2007) posit that information integration provides an easy access to operational data from the integrated database, linking information system to internal departments in the organization, accessing to inventory information throughout the supply chain, retrieving inventory status in real time, utilizing a computer based planning system between marketing and production. According to yam et al. (2010) and Vickey et al. (2003), information integration ia a prerequisite to external integration with suppliers and customers. When employees work together, they can easily adapt their cooperative culture and integration practices to external supply chain partners. Sharing online information throughout the supply chain network enables the connected firms/units to integrate value chain and entire value systems. through sharing real time information and maintaining close communication within the supply chain network, better customer service can be ensured, more accurate demand can be forecasted, companies can get market information in real time and more accurately. We therefore propose as follows:

H1: There is a significant and positive relationship between integrating online information throughout the supply chain network and operational success.

Knowledge sharing: the firm is viewed as a social community that specializes in the creation and transfer of knowledge (Koght & Zander, 1996 cited in Aludah, 2008). This view is based on the premise that knowledge is

a central resource and that it is the heterogeneous stocks and flows of knowledge in a firm that provide it with unique resources and performance capabilities.

Knowledge is conceptualized and operationalize as explicit and tacit knowledge. Explicit knowledge can be expressed in some symbolic form, making it easier to communicate and difficult to formalize (Alavi & Leidner, 2001). However, no matter the distinction, knowledge is knowledge and can be stored and managed in organization. Our core premise is that supply chain network performance is a function of its ability to integrate knowledge throughout the supply chain network and to use knowledge integration to achieve operational success.

Knowledge integration is a measure of supply chain integration (SCI). Alavi (2000) states, coherent and synergistic organizational knowledge is generated through collaboration, interactions, and relations among individuals while knowledge is "owned" and 'enacted' in the minds of individual employees, the integration of this knowledge to a collective level is both necessary and fundamental (Okhuysen & Eisenhardt, 2002). Individuals work in organizations share their tacit knowledge, learn from each other's tacit knowledge to interpret explicit knowledge and further evolve the collective knowledge base on the supply chain network. Davenport and Prusak (2000), cited in Ebenisks (2006) argued that the spontaneous, unstructured exchange of knowledge is a critical ingredient for creating and integrating knowledge in organizations. Given the importance of socialization, the supply chain network should involve a significant amount of communication and shared contextual experience among its suppliers, organizations, distributors, retailers and customers to facilitate knowledge integration (Defranco et al., 2004). Bennitta (2009) argued that there should be collaborative exchange as the degree to which informal communication exists among participants in the supply chain process. This collaboration should provide the contextual specificity necessary to meaningfully create and share supply chain members, this will enhance operational success. From our discussion, we hypothesize:

H2: There is a significant relationship between knowledge integration across the supply chain network and operational performance.

Process integration: this is the third dimension of the supply chain integration. Process integration involves collaborative work between buyers and suppliers, Joint product development, common systems and shared information. According to Lambert and Cooper (2000) cited in Dannis and Kampton (2010) operating an integrated supply chain requires continuous information flows which in turn assist to achieve the best product flows. However, in many companies, management has reached the conclusion that optimizing the product flows cannot be accomplished without implementing a process approach to the business. The key supply chain process stated by Lambert (2004) are as follows: 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. However, these processes are not applicable to all industries. The number of process is determined by the industry one is studying.

Customer service management process concerns with the relationship between the organization and its customers. Customer service provides the customers with real-time information on promising dates and product availability through interfaces with the company's production and distribution operations.

Procurement process develops strategic plans with suppliers to support manufacturing flows, management process and development of new products. The desired outcome is a win-win relationship where both parties benefit and reduction times in design cycle and product development is achieved.

Product development and commercialization process. Here, customers and suppliers must be integrated into the process, thus to reduce time to market. As products must be developed and successfully launched in very short time-scheduled to remain competitive. Lambert and Copper (2002) cited in Dennis and Kampton (2010), posit that managers of the product development and commercial process must integrate with customer service to identify customer articulated needs select materials and suppliers in conjunction with procurement and develop production technology in manufacturing flow to manufacture and integrate into the best supply chain flow.

Outsourcing and partnering is also a process. Outsourcing here is not limited to procurement of materials and components, but also includes sourcing for services that were traditionally provided in-house where the company does not have comparative advantage. Outsourcing has prevalent in logistic, warehousing, material handling, inventory control etc. To manage and control this network of partners and suppliers requires a blend of both central and local involvement.

The above processes in the supply chain are interwoven and linked to themselves. For the activities of a process to succeed, it must depend on the next process. Therefore, these processes need to be integrated to enhance operational performance. We hypothesize as follows:

H3: The greater the process integration in the supply chain network, the greater is the influence on the operational performance.

2.2 Information Technology Capability

Information Technology Capability affects the influence of supply chain integration on operational performance. Here, we argued that IT-capability mobilizes and deploys IT-based resources (Bharadwaj, 2000). IT-capability enables other resources in the supply chain, such as knowledge assets, information and physical It infrastructure to influence performance. IT-capability is instrumental in enhancing the effectiveness of technology-based means of transaction, it is particularly important in exploiting demand because IT facilitate the mass customization of product and service (Varadarajan &Yadav, 2002).

IT-capability is instrumental in decreasing customer service costs and other coordination and transaction cost and changing the speed and nature of business processes (Amit & Jean, 2005). This study conceptualized IT-capability as physical IT infrastructure and human IT resources (Bharadwaj, 2000 cited in Johasin and Celeb 2008). This study assess It-capability with three items – IT infrastructure; IT-support staff and IT skills. This study therefore hypothesized as follows:

H4a: IT-capability affects the interaction between information integration throughout the supply chain network and operational performance.

H4b: IT-capability influences the interaction between knowledge integration and operational performance.

H4c: IT-capability moderates the influence of process integration on operational performance.

3. Research Methodology

This study selected oil and gas industry in Nigeria as the context for our research because oil business ranked very high in Africa, making it viable for the study of supply chain integration. The oil and gas industry was chosen because the industry consists of three set of players. The first is upstream sector involving exploration and production. Second, the midstream given support to the upstream and thirdly the downstream sector which deals with refining, marketing and distribution. The upstream sector is an external supplier to the downstream sector.

Given the nature of the industry, this study constructed our sampling frame to cover the upstream supply chain network to include suppliers – external stakeholders who understand the supply network. 20 sourcing managers were sampled from five major oil firms in the country.

At the midstreams which include the company, we sample 40 procurement specialists who understand how the department deals with supplier and other streams of supply chain, 25 business planning managers from marketing and 15 sales manager were sampled.

At the downstream, this study sample 30 distribution managers from external partners, 15 outsourcing partners and from the customer touch points, this study sample 100 respondents who have knowledge of value added opportunities from service point of view. The above gave us a total of 230 responses in all. This composition mirrors the supply chain network and indicates that our sample is a true reflection of the supply chain process.

Strata	Size of population	Actual size of sample
Upstream	20	20
Midstream	80	75
Downstream	145	135
Total	245	230

4. Measures

The study model presented in figure 1 include five concepts, information integration was measured using three items that were almost similar to items used in the work of (Clarkson, 2007; Brodaler & Smith, 2008). Studies related to information sharing have shown that the best way to express Shared information is to share the information with others (e.g., Kaseniemi and Rautiainen 2002 cited in Adrobest, 2009). Thus, we included one item that referred to information sharing with others in measuring information integration.

Knowledge integration was measured using three items: sharing knowledge to others and sharing knowledge to outsourcing partners. Process integration was measured using three items also. Paying good remuneration to

outsourcing partners; involvement of upstream members in their decision making process and involving other functional areas.

Information technology capability as a moderating variable was measured using three items that include IT physical infrastructure, IT support staff and IT skills. Finally, we measured operational performance using a four-item that adapted from Kapathin's (2008) study. All items are shown in table 1.

The respondents indicated their agreement with a set of statements using a 7-point likert-type scale that ranged from strongly disagree to strongly agree. Information technology capability, the moderating variable was measured with 7-point likert-type scale of bipolar adjectives. This means, standard deviation, and reliability of these variables are reported as in table 1.

This study tests the discriminant and convergence validity of the variables in our model; we included items in a factor analysis of the five factors. Our analysis showed that the factors explained 78% of the variance in the material (see table 1). This study also find that the convergence validity of the information sharing scale was somewhat low, with a factor loading of 0.52 for the first item (table 1). This very item has low discriminant validity, with a factor loading of 0.36 on the operational performance factor.

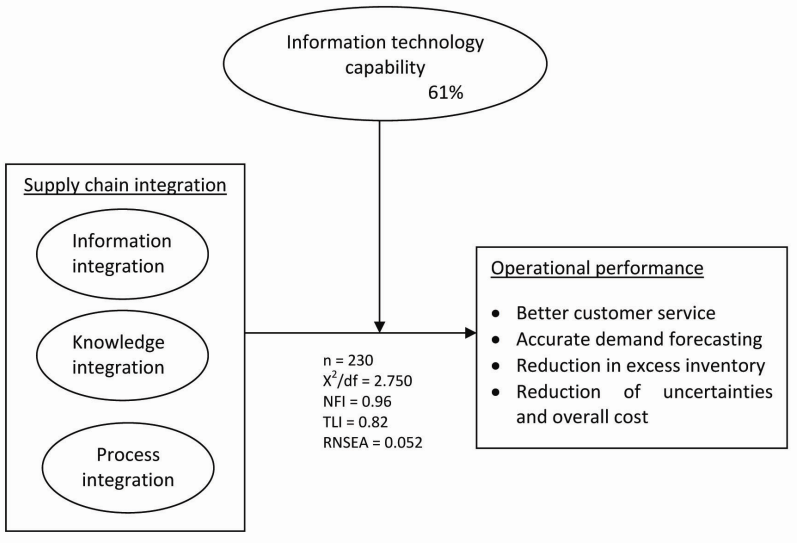

Figure 1. Conceptual model of supply chain integration and operational performance

Source: Conceptualized from review of related literature, 2013 and modified according to purpose of the study.

Table 1. Composits analysis of all measurement items

Variables/communalities (c) and loading	C	1	2	3	4	5
Information Sharing						
we often share information with upstream, midstream and down	.52	.25	.15	.18	.20	.36
stream	.86	.23	.12	.10	.21	.12
	.72	.20	.08	.14	.12	.06
Knowledge Sharing						
we often share knowledge with upstream, midstream and down	.69	.82	.84	.20	.15	.13
stream	.90	.76	.82	.22	.16	.14
	.70	.86	.80	.23	.16	.15
Process Integration						
we carry out process integration within functional area, midstream	.86	.25	.24	.30	.73	.10
and down stream	.66	.22	.23	32	76	.12
	.69	.12	.20	.40	.71	.13
Information Technology Capability						
IT infrastructure	.82	.17	.19	.17	.15	.11
IT support staff	.84	.14	.16	.19	.12	.01
IT skills	.83	.16	.17	.20	.13	.05

Operational Performance						
Better customer service	.87	.16	.16	.20	.17	.14
Accurate demand forecasting	.88	.20	.21	.15	.10	.15
Reduction in excess inventory	.79	.17	.17	.18	.09	.16
Reduction of uncertainty and overall costs	.86	.15	.20	.22	.03	.17
Eigen values		11.60	2.60	1.74	1.52	0.71
Variance		42.61	10.00	6.51	6.02	2.28
M		3.25	4.76	4.15	3.71	3.60
SD		1.70	1.53	1.71	1.86	2.12
Cronbach's alpha		0.886	0.93	0.88	0.82	0.90

5. Result

In figure 1, we showed fit index, standardized coefficients and explained variances for the suggested model. The fit indexes are within acceptable intervals. X^2/df is sensitive to sample size and when all the 230 responses are used, the fit indexes NFI, TLI and RMSEA more correctly reflect model fit (Hair et al 1998). Thus, this study concluded that the model fit is considered acceptable. The structural model explains 78% of the variance in operational performance of the investigated oil and gas firms and explains 61% of the variance in the moderating variable of supply chain integration on operational performance. This observation show that the explanatory power of the model is good when compared with previous studies in supply chain.

This study calculated inter-variance correlations, share variances and composite reliability as in table 2. The composite reliability of all the variables in the table show value that were well above the recommended level of 0.5 (Hair et al, 1998). All variables should share more variance with their indicators than with other variables (Agarwell and Karahanna, 2000). In table 2, we show the square root of the average shared variance between items and scale variance on the diagonal. Off-diagonal elements have correlations among variables. We find that all variances share more variance with their indicators than with the other variance in the study. Again, we estimated our measurement model fit as we have earlier said before, the results show X^2/df = 2.75, normed fit index (NFI) = 0.96, tucker-Lewis index (TLI) = 0.82, and root means square error of approximation (RMSEA) = 0.05. Thus, the fit of the measurement model is considered acceptable as this study have earlier indicated.

Table 2. Inter-variable correlations, root average shared variance and composite reliability

	1	2	3	4	5	6	7	8	9	10
Composite reliability	.85	.92	.80	.95	.88	.75	.91	.90	.91	.89
Supply chain integration	.74									
Information sharing	.65	.93								
Knowledge sharing	.51	.56	.81							
Process integration	.40	.45	.58	.90						
Operational performance	.61	.50	.52	.39	.80					
Customer service	.50	.58	.60	.52	.60	.67				
Demand forecasting	.66	.60	.52	.48	.60	.51	.70			
Reduction in excess inventory	.70	.53	.45	.56	.60	.59	.60	.73		
Reduction in of uncertainty	.67	.75	.72	.50	.48	.45	.61	.80	.84	
Information technology capability	.72	.61	.51	.48	.56	.60	.69	.70	.62	.81

Having confirmed the fitness of our measurement model, the various relationships among the constructs in the model can be examined to see whether the suggested hypotheses were supported statistically.

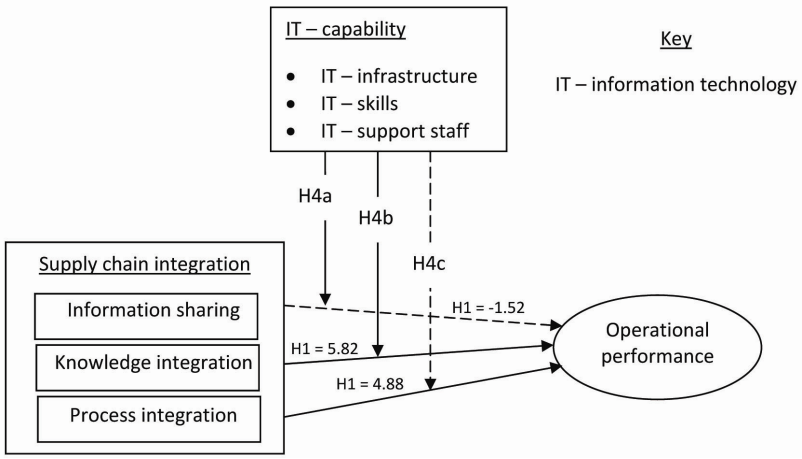

Figure 2. Showing relationships and hypothesized moderating effects of the relationship

5.1 Information Integration and Operational Performance Relationship

Hypothesis 1 suggested a significant and positive relationship between information sharing throughout the supply chain network and operational performance. This hypothesis was not supported in the present study as the impact of information integration on operational performance was insignificant (P = 0.78), which is not consistent with result of previous studies (Tamzidual, 2012; Christopher, 2010; Bagchi & Larsen, 2004; Frohlich & Westbrook, 2011; Lee, 2000). Our results shows lack of information sharing on stock levels of different products, forecasting and campaigns information, supply chain strategy are not integrated. The result justifies management's quest to improve information sharing along the supply chain network by focusing on involvement strategy.

5.2 Knowledge Integration and Operational Performance Relationship

Hypothesis 2, suggested that there exist a relationship between knowledge integration and operational performance of the oil and gas firms. As can be seen in figure 2, our results supported this hypothesis as knowledge integration had a moderate significant positive impact on operational performance (P = 0.000). of the three study model, knowledge integration had the greatest impact on performance.

Similarly, hypothesis 3 suggested that process integration of oil and gas firms would have a positive impact on operational performance. Indeed as we see in figure 2 above, process integration had a significant positive impact on performance (P = 0.000). Consequently, this study supported hypothesis 3. It is important to note that process integration had a smaller impact on performance than did knowledge integration. Thus, with the exception of the information sharing and operational performance relationship (i.e., hypothesis 1), all the hypothesized relationships were statistically supported in the model. With the main dimensions of the model tested as reported, it was now appropriate to test the hypothesized moderating effects of information technology (IT) capability relationship on supply chain integration and operational performance.

Empirical techniques for evaluating moderating effects include moderating regression analysis and multiple-group causal analysis (Joreskog & Sorborm, 1993). Which moderated regression analysis is widely accepted in marketing studies, for the purpose of this study this study will prefer multiple-group analysis. This is because the technique will take account of the relationship between latent constructs (Honburry & Giering, 2001). Consequently, a multiple-group causal analysis, suggested by Joreskog and Sornon (1993), was used to examine the moderating effect of information technology relationship in the study.

Tables 3 shows the results obtained from the analysis of the moderating effect of the three dimensions of IT-capability.

As depicted on table 3, the chi-square difference for the relationship between supply chain integration and operational performance was 12.05, which was significant only at 0.1 level (the critical value was 7.68 with 4 degree of freedom). Suggesting IT-infrastructure had only a marginal moderating effect on the relationship. However, a closer examination of the moderating effects of IT-infrastructure on the three dimensions of supply chain integration and operational performance relationship found IT-infrastructure have a fairly significant

moderating effect as the chi-square difference values were significant at 0.5 level (critical value 2.78 with 1 degree of freedom)

Table 3. Multiple-group analysis – IT infrastructure as a moderating variable

Path Dimensions	Path Coefficients (subgroups)		Chi-square difference	Degree of freedom
	Low	High		
Supply chain integration – operational performance			12.05*	4
Information sharing – operational performance	0.62	0.41	3.15**	1
Knowledge sharing – operational performance	0.40	0.32	2.45	1
process integration – operational performance	0.28	0.10	2.36	1

*Significant at the 0.1 level, ** Significant at the 0.05 level, ***Significant at the 0.01 level.

The moderating effects of physical infrastructure on knowledge integration show a marginal moderating effect on the relationship. The chi-square difference for the moderating effect of IT-physical infrastructure on the link was marginally below the critical value at the 0.1 level.

This study can as well examine the moderating effect of IT-skills using the multiple group analysis also.

Table 4. IT-skills as a moderating variable

Path Dimensions	Path Coefficients (subgroups)		Chi-square difference	Degree of freedom
	Low	High		
Supply chain integration – operational performance			17.69***	4
Information sharing – operational performance	0.59	0.22	5.45**	1
Knowledge sharing – operational performance	0.32	0.19	0.60	1
process integration – operational performance	0.21	0.45	0.36	1

*Significant at the 0.1 level, ** Significant at the 0.05 level, ***Significant at the 0.01 level.

Table 5. It-support staff as a moderating variable

Path Dimensions	Path Coefficients (subgroups)		Chi-square difference	Degree of freedom
	Low	High		
Supply chain integration – operational performance			1.92	4
Information sharing – operational performance	0.56	0.36	1.60	1
Knowledge sharing – operational performance	0.40	0.39	2.40**	1
process integration – operational performance	0.20	0.16	0.20	1

*Significant at the 0.1 level, ** Significant at the 0.05 level, ***Significant at the 0.01 level.

As depicted on table 4, the chi-square difference for the link between supply chain integration and operational performance was 17.69, which is significant at the 0.01 level (critical value 15.20 with 4 degree of freedom), suggesting information technology skills had a significant moderating effects on the relationship. A close look at the effects of IT-skills on supply chain integration and operational performance had a significant effect (chi-square difference of 5.45) at 0.05 levels (critical value of 3.28 with 1 degree of freedom) on the link between supply chain integration and performance.

Its moderating effects on the relationships network information sharing, knowledge integration and process integration were not significant even at a 0.1 level. That is, the lower the IT-skills, the greater the influences that supply chain integration had on operational performance.

As can be seen in table 5, the chi-square difference for the relationship between supply chain integration dimensions to operational performance was 1.92 which was not significant even at 0.1 level (critical value of 6.28 with 4 degree of freedom), suggesting IT-support staff did not moderate the relationship. An examination of the moderating effect of IT-support staff on the three dimensions of supply chain integration variables and

performance, reinstate the view that IT-support staff did not moderate the influence of information sharing and process integration, but has a moderating effect on knowledge sharing.

6. Discussion

This work extends the conceptualization and measurement of supply chain integration to the oil and gas sector. We attempted to answer three questions that concern supply chain network in organizations: (1) Is firm effectiveness better explain when the construct is measured in operational performance rather than other performance measure? (2) How do the various dimensions of supply chain integration influence operational performance in oil and gas context? And (3) does information technology capability moderate the effect of the various supply chain integration dimensions on operational performance?

The first question relate to the theoretical and measurement applicability of supply chain integration. The remaining question relates to the managerial relevance of our findings.

The first question sought to determine the effect supply chain integration had on operational performance, when various forms of performance measure are used. This became an issue of interest following Tega's (2008) suggestion that, besides operational performance, organizational effectiveness can be measured as financial performance and/or marketing performance. Tega and Bassey (2009) suggested that these three forms of performance measures have varying degree of effectiveness and that, the higher the degree of performance, the better the effectiveness of the firm.

The second research question examined the relationship between the dimensions of supply chain integration and operational performance with varying impact. There have been previous studies on supply chain integration, however there is lack of agreement about the dimension of the construct. Again, the present study explored the impact supply chain integration had on performance using supply chain integration dimensions adapted from recent studies (Tamzidul, 2012; Christopher, 2010). The supply chain integration dimensions included in the present study were information sharing, knowledge integration and process integration.

The final question suggested, if information technology capability moderate the influence of supply chain integration on operational performance. This led to an examination as to whether firms adopted this dimensions positively to build more value additions. Value addition can be built in the present of information technology capability which serves as a moderating variable to enhance value adding opportunities in the form of IT-physical infrastructure, IT-skills and IT-support staff. The final research question examined whether such T-physical infrastructure or support staff moderate the effect supply chain integration has on performance.

7. The Result and Their Implications

The conceptual model in figure 1, supply chain integration was measured as a three dimensional constructs, with information sharing, knowledge integration and process integration dimensions. Consistent with the findings of previous studies that examined the effects of supply chain integration on operational performance in different contexts (e.g., Chopra et al., 2007; Chritopher, 2010; Bagchi & Larsen, 2004). The present study suggested supply chain integration was a strong determinant of performance. It is important for oil and gas sector to invest in providing value added opportunities so as to influence customer patronage which will enhance operational performance.

The present study showed how oil and gas firms can integrate and different functions work more efficiently linking with other cross functional units of business. The only way this can be made possible is by information sharing, knowledge sharing and process integration. The following sections discuss the implications of these results for the oil and gas industry.

7.1 Information Integration

We argued that information integration provide the ability to share online information across the supply chain network which facilitate our operational performance. We do not find statistical support for the interaction between information sharing and performance, the results indicate marginal evidence (-1.52). This results deviate from previous studies. Our study is saying that there is lack of information integration in the oil and gas sector. Demand information is not always shared with upstream supply chain members, this impact supplier capacity planning and some time the supplier may not meet up delivery date. In the oil and gas sector, strategic planning is done at the midstream, there is no involvement of the upstream and downstream supply chain members. This stakeholders are not aware of the strategic direction of the company or forecasting information. Campaign planning is not well coordinated. Sales and marketing departments run various campaign separately deplicating functions and wasting the organizational resource because lack of information sharing. The study's results present major challenges to oil and gas operators. The significant impact information integration has on

operational performance means companies in the sector should focus on improving information sharing across the supply chain network.

As Schonfield (1998) suggested, when real time demand information is shared, the firm provides customer orders. Replenished needs regularly and also can forecast the real market demand. All the parties can reduce excess inventory, reduce lead time and provide better customer service. Through information sharing within the supply chain network, all the parties can benefit.

7.2 Knowledge Integration

Knowledge integration provides the requisite synergy to enhance operational performance. We argued that knowledge integration provides the supply chain network with the ability to take advantage of value opportunities. Our results show that, as we hypothesized, the interplay between knowledge integration and operational performance is quite complex. First from the standpoint of human resource capacity, there is strange evidence to suggest that upstream and downstream supply chain members have a limited knowledge. Our results have evidence of a moderate significant positive impact on operational performance (P = 0.000). Secondly, the interaction between information technology capability and knowledge sharing does not affect operational performance, contrary to our hypothesis, the interaction between IT-support staff and knowledge integration influences performance. Different stakeholders especially the outsourcing service points have very limited access to different systems and therefore need to rely on back and support service staff. Therefore, IT-support staff moderates the effect of knowledge integration on operational performance. Other dimensions of information technology (IT) capability such as IT-infrastructure and IT-skills do not moderate knowledge integration on operational performance.

This study find statistical support for process integration and operational performance (H3 = 4.88). Process level integration within the oil and gas firms shows very positive results (4.88). The processes at many stages are very complicated and required a number of approvals at different stages. The planning process follows a top down approach and does not consider people at an operational level. Because of complicated nature in various processes, such as the forecasting process, there need to be high level of integration. Finally, our study also document s the impact of IT-capability on the link between process integration and operational performance.

8. Conclusions

Most past studies attempted to link supply chain integration to operational performance. This study attempted to build a more holistic model of supply chain network. In addition to information integration, this study also incorporated less often discussed constructs such as knowledge sharing and process integration into the operational model. The study reported that knowledge sharing is indeed an important driver of operational performance, given that knowledge sharing explained the highest variation in the dependent variable. However, knowledge sharing certainly does not seem to be the sole concern of the supply chain members because knowledge sharing which do not incorporate the upstream and downstream members also appeared to be unacceptable. Supplier is being viewed as a short term trader not a business partner and this is the most reason why the company is very rapid about integrating and involving them. The relationship should be build on a long term sustainable commitment and by so doing they can achieve common goals off different organizations which is missing between the upstream suppliers and other parts of the supply chain network . in this context, the oil and gas industry should improved in real time demand information with its suppliers and third party logistics providers and providers customer orders, inventory level and replenishment needs regularly to its component supplier. By so doing, its component suppliers can forecast the real market demand and plan their capability accordingly to avoid waste and cost.

The roles of information technology (IT) capability appeared to bring mixed blessings of sadness and joy to supply chain network members. Indeed, businesses are likely to be in a positive to take advantage of IT-competencies in the organizations through this firm electronically share customer orders and sales information from its company agents across the globe. However, the effect of IT-infrastructure and IT-skills on information sharing and knowledge integration was statistically only marginally significant and further, was unlikely to be particularly significant. IT-support staff had impact on knowledge sharing, confirming previous claims in research that different stakeholders' especially the outsourced service points have very limited access to different systems and therefore need to rely on back end support service staff. The oil and gas industry requires balance of integration between upstream and downstream to stabilize the organizational operations. There need to be more integration with upstream supply chain members through sharing of information and development of collaborative relationships. There should be more supply chain integration in the downstream sector of the oil and gas industry in order to improve outsourced customer touch points.

9. Limitations and Future Studies

This study was limited by the fact that it was on cross sectional survey data. Further study should consider a longitudinal design to delineate more clearly the causal attribute hypothesized in our model.

With respect to our measurement variables, our study is limited to subjective measure based on key informat data, the results are constrained by issues related to common method variance, and the data could suffer from bias. The pattern of findings exhibited in this study needs to be replicated in other industry contexts, it would be interesting to determine whether the supply chain integration is also helpful or vary from context to context. This study also looked at linear relationships between the various consults while the linear relationship between information integration and performance in the oil and gas sector was non-significant, plausible arguments could indeed be developed because previous studies said there was a significant relationship. Therefore, future studies could look at this differing view of the current work and previous studies.

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