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SECURING SUPPLY CHAIN PERFORMANCE THROUGH CHANGE MANAGEMENT COMPETENCE IN NIGERIA OIL AND GAS INDUSTRY

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Abstract: *In this study, the impact of change management competence on supply chain performance of the oil and gas industry in Nigeria was investigated with the moderating influence of information agility. It explored the importance of supply chain in the oil and gas industry of Nigeria and the shortcomings found in the system as it relates to the delivery of the value proposition of the industry to the Nigerian economy. The study highlights that supply chain management, SCM, seeks to provide for effective and efficient use of supply chain resources. Whereas the effectiveness of resources here means that the supply chain is capable of delivering the right product at the right quantity timely to the right customers and is known to be focused on the needs and taste of the customer, efficiency is internally focused and seeks to improve the supply chain processes to reflect a reduction in cost, time, and resources. These are in addition to providing customer values of affordability and availability of its products and/or services. With the help of extant theories of change, for example, Resource-based View theory, Dynamic Capabilities theory, the case for an effective change management competence was made for an efficient and effective supply chain management and performance. Further, because supply chain management systems of modern organisations are dependent on quality information availability, the importance of an effective information system, one which espouses information agility, was advocated, and tested empirically. Results show that a significant relationship exists between change management competence and the supply chain performance of firms in the upstream sector of the oil and gas industry in Nigeria. Again, results are consistent with findings of earlier research in the field of supply chain management.*

Keywords: *Change Management Competence, Resource-Based View, Supply Chain Management, Dynamic Capabilities*

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1.0 Introduction

Companies, in contemporary times, do not compete amongst themselves alone as was the case decades ago. Competition has broadened, from amongst industry players, to amongst supply chains in a particular industry. This is due to the emergence of global markets with their interconnectedness, and the increase in collaboration amongst firms across various regions of the world (Ebrahimi, Koh, Genovese, & Kumar, 2018; APICS, 2013; Flynn, Huo, & Zhao, 2010; Trkman, McCormack, de Oliviera&Ladeira, 2010; Sangari, Hosnavi& Zahedi, 2014). In Porter's (1996) opinion, any activity in an organisation's value chain that does not add desired value or present a means of competitive advantage should be outsourced to another organisation that can provide a cost advantage. What this does is extend a firm's supply chain beyond the internal arrangement of that firm. The company gains a competitive advantage but also needs to upend its game in information sharing, communication across organisational boundaries, particularly between supply chain participants, namely, suppliers, manufacturers, customers (Eisman, 2007).

In its basic arrangement, a supply chain depicts an interconnection of three entities, viz. a supplier, a producer, and a customer; that has the sole objective of delivering products and/or services from the raw material stage through the manufacturing and distribution processes to the end-user with the aid of engineered flow of primary products, information, and cash. In its extended form, a supply chain involves many other entities, such as the suppliers' supplier, warehouses, transport companies, distribution centres, retailers, customers' customer, all involved in the delivery of finished products or services to the end-user. It stands to reason then, that a supply chain needs to be adequately managed to sustain the value added to an organisation's bottom line.

Four supply chain evolution phases have been identified in the literature. They are the multiple dysfunction organisation (first evolution), semi-functional enterprise (second evolution), the integrated enterprise (third evolution) and the extended enterprise (fourth evolution) (APICS, 2013). Most organisations are at the third evolution phase of the supply chain (integrated enterprise) including the companies in the upstream of Nigerian oil and gas industry. The integrated enterprise offers great value in efficient replenishment, more accurate demand planning, improved logistics, balanced expectations of cost-effectiveness and high customer service. Therefore, the performance of this supply chain configuration is based on quality information availability across the various internal units and business functions in a real-time or near real-time condition (Lu, Huang & Heng, 2006) and the level of responsiveness of organisational leaders and other decision-makers concerning the use of the available information (Hugos, 2018; Sillanpaa, 2015).

Supply chain management is a mechanism that coordinates the various processes that are ensued by different departments and functional areas of a firm or the organisations that make up the supply chain. SCM is the systematic coordination of business functions within a singular company and across companies participating in a supply chain for a long-term improvement in performance and/or the delivery of net value of the individual firms and the entire supply chain (Park & Koh, 2015; Lee & Pai, 2003; Cohen & Roussel, 2013). Further to the sustenance of competitive advantage through collaboration or the leveraging of the strength of all supply chain partners, SCM seeks to provide for effective and efficient use of supply chain resources.

In the upstream sector of the petroleum and natural gas industry (exploration and production), product differentiation is very narrow or completely absent as products (petroleum and natural gas) are the same (Chima, 2007). Companies cannot differentiate themselves from one another based on products either by introducing a new product. The only opportunity available for differentiation is the ability to economically explore and produce oil and natural gas efficiently more than competing firms by looking inwards to the supply chain processes. The opportunities in these markets lie in higher customer service provision via on-time delivery, high order fill rates and in the optimization of internal operational activities of the firm, particularly in the sustenance of low inventory.

There are a few empirical research works centred in the petroleum and natural gas sector with a focus on SCM practices and project completion (Oisamoje&Areloegbe, 2014); the external integration of SC, with little or no emphasis on the internal integration of the supply chain. For instance, Amue and Ozuru's (2014) study on the supply chain integration in the Nigeria petroleum and natural gas industry was at the broader external integration of supply chain between the upstream, midstream, and downstream firms. Similarly, the study by Erakpotobo (2018) was focused on the broader supply chain integration. This study, however, takes back the investigation of supply chain integration to the internal settings of the various petroleum and natural gas companies in the country with the singular view that efficient internal integration of supply chain informs a well-structured external integration and provides the desired competitive advantage (Porter, 1980; Porter, 1996). Moreover, studying supply chain integration at the interfirm level in the country seems much like a virtual study because the sophistication level of information technology, IT,infrastructure, and the trust level in information sharing leaves little to be desired across various industries.

Furthermore, following the extant research works on this topic at the reach of the authors, no study was found to have been carried out on the effect of change management competence of firms on SCM system performance both in the manufacturing and oil and gas industry despite the strategic importance of the change management concept in the contemporary business environment. An overview of the reviewed studies reveals that the very few studies on change management capability or effectiveness on SCM performance are foreign. This evoked a strong need to embark on this empirical study to fill the missing link. The problem of the study, therefore, is to investigate the extent of the relationship between change management capability and the supply chain performance of oil and natural gas companies in Nigeria.

The study aims to examine the extent of the relationship between change management competence and the performance of supply chains of oil and gas companies in Nigeria with the moderating influence of information agility. The objectives of the study, in precise and clearly defined terms, are as follows:

1. To determine the extent of the relationship between the acquisition of change management (CM) competence and customer relationship management (CRM) utility.
2. To ascertain the extent of the relationship between the acquisition of CM competence and information management (IM) utility.
3. To ascertain the moderating influence of information agility on the relationship between the acquisition of CM competence and CRM utility.

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The following statistical hypotheses, which will be tested at a 0.05 level of significance, have been developed to guide this study.

1. **$H0_1$**: There is no significant relationship between CM competence and CRM utility.
2. **$H0_2$**:There is no significant relationship between CM competence and IM utility.
3. **$H0_3$**: Information agility has no significant mediation influence on the relationship between CM skills and CRM utility.

2.0 Literature Review

This work is anchored on two theories: Resource-Based Theory and Dynamic Capabilities Theory. These theories are very relevant in this study because the oil and gas industry involves products that cannot be differentiated to provide superior or extra satisfaction to customers. Competition is, therefore, based on the ability which firms have to organise their internal resources in a way that brings about efficiency and effectiveness and further advance their advantage over their competitors (Chima, 2007). Supply chain management provides an ultimate source of competitive advantage for firms in contemporary times (Thomas, 2018; Ebrahimi et al., 2018; APICS, 2013; Flynn et al., 2010; Trkma et al., 2010).

Supply chains are still at their evolving stages with firms discovering ways of advancing their information-sharing capability across corporate boundaries and between supply chain entities in a way to continuously improve on their performance. This know-how or capability constitutes an intangible resource that could exhibit the VRIN attributes, in line with the RBV theory, and afford a firm the desired competitive advantage. Modern supply chain management systems are information technology-dependent, thus, requires that organisational members be equipped and ready to accept and apply the needed skills, based on the acquired knowledge from training and their tacit industry experience, to deliver on set objectives.

Following the dynamic capabilities theory, because the oil and gas industry is unpredictable and uncertain in its outlook, having a supply chain management know-how alone may not suffice, particularly when an uncertain business environment arises. The possession of unique capabilities, by managers and business leaders alike, for the conscious creation, integration, and reconfiguration of firm resources when the situations demands, is particularly important to the success of and desired performance of a supply chain.

2.1 Concept of Change Management Competence

Change is a movement from a current state to a desired new state. Change management thus reflects the systematic management of the process of movement to a desired new state (Park & Koh, 2015; Lee & Lee, 2007). An example is the adoption of an integrated supply chain management system in an oil and gas firm. The concept of change management is very vital in the long term survival of an organisation in the contemporary business environment, which has been described by scholars (Child, 2005; Lee & Lee, 2007; Burke, 2018; Burnes, 2014; Cummings & Worley, 2015; Eisenhardt & Martin, 2000; Nohria & Beer, 2000), business leaders and entrepreneurs as turbulent and unpredictable, characterized by changing workforce demographics, changing customer taste and preferences, short product life cycles, technological advancement and intense competition amongst industry players.

Change management skill or competence, therefore, is the incorporation of change readiness with available techniques, tools, and the right perspective to make change seamless and successful. Change is part of the normal business routine. Change management skill is the capability, which an organisation possesses in managing the people aspect of change on all change initiatives (Hiatt & Creasey, 2012). This covers the skills possessed by executives, managers, and all employees in the entire organisation. The introduction of a new way of work, in this case, an integrated supply chain system, offsets the normal way of carrying out supply chain activities. This may trigger resistance from the employees at the frontline, where such employees are not adequately equipped or trained to fit into the new ways of delivering on their work targets. Change management skill is required at all levels, particularly at the shop floor because at this level the change initiative could lead to radical change to what is considered the norm (Kotter, 2012; Hiatt and Creasey, 2012; Burke, 2018). A cost avoidance measure aimed at scaling down the number of failed change projects could be achieved by way of building the competency to manage change effectively throughout the organisation. The importance of building competency in change management is evident: competitive advantage; increased number of successful change projects; consistent approach and application; and change-competent employees (Battilana, Gilmartin, Sengal, Pache& Alexander, 2010).

2.2 Concept of Information Agility

One of the core capabilities, which every firm that competes in a volatile or turbulent business environment must possess is agility. Agility defines the pace at which an organisation can react to the smallest or pervasive changes in its industry of play or business environment. It goes beyond the mere response to vagaries in the business environment, which may be termed reactionary, but includes the ability of a firm, company, or organisation to manage changes with foresight by creating greater opportunities from such changes (Park & Koh, 2015; van Hoek, 2001; Booth & Philip, 2005; Tsourveloudis&Valavanis, 2001).

Weber (2002) suggests that agility is an attempt by firms to effectively manage the changes that are occurring as the firms continuously transit toward an information-based supply chain management in the bid to eliminating inventory waste and associated logistics cost. Thus agility, according to Sharifi and Zhang (2001), is defined by two major concepts of speed and flexibility gained through real-time information acquisition and analysis (Tsourveloudis&Valavanis, 2001).

In the Nigerian petroleum and natural gas industry, agility translates to the speed of replenishment of inventories and information sharing and alignment. It is a direct function of variations in the condition of the business environment. The import of this is evident in that the more the changes in the business environment, the more agile the organisation needs to be to effectively respond to the changes (Sharifi & Zhang, 2001; Weber 2002).Our submission, therefore, is that the application of agile principles can be very helpful in achieving a high performing supply chain, especially for having to cut down on the lead time of ordered items in the bid to eliminate disruptions to production schedules and incurring deferments.

2.3 Supply Chain Performance

To measure the performance of a supply chain effectively, the elements of measurement should be aligned to the business strategies of the operating firm (APICS, 2005; APICS, 2013). For the oil and gas industry, the overall business strategy is to sustain plant uptime at full capacity with minimal deferments. Thus, it is very important that participating assets (the internal customers) in the supply chain be satisfied in terms of supply chain reliability, and responsiveness, which are customer-facing qualities and information orientation qualities.

The measures of supply chain performance adopted in this study are customer relationship management (CRM) utilityand information management (IM) utility. These measures cut across the information orientation approach balanced scorecard approach and the Supply Chain Operation Reference (SCOR) model.

2.3.1 Customer Relationship Management Utility

CRM utility in this work defines the satisfaction level derived by customers in a supply chain network concerning the orders received from the contracting and procurement (or purchasing) department of an organisation. Measurement here is based on two Level 1 metrics of the SCOR model: perfect order fulfilment; and order fulfilment cycle time; under the performance attributes of supply chain reliability and supply chain responsiveness respectively (APICS, 2013; APICS, 2005).

APICS (2013) defines supply chain reliability as its performance measured by the correct delivery of the product to the right customer timely, to the place, quantity, and in good condition and packaging. The definition of supply chain responsiveness is given as the speed of provision or delivery of products or input materials to customers in the network.

2.3.2 Information Management Utility

This measure indicates a firm's capability to effectively utilise available information for the improvement of business performance. It draws from the seminal work of Marchand, et al. (2000) and has been applied in many research works measuring the performance of supply chain (Park & Koh, 2015); Enterprise Resource Planning (Lee & Lee, 2007); Customer Relationship Management (Fazlzahdeh, Ghaderi, Khodadadi & Nezhad, 2011); and other seminal works. The adoption of this measure in this research work follows the implementation of an information-dependent supply chain management system across many firms and industries, which involves planning and the management of all activities needed in sourcing, purchasing and all logistics management.

It stands to reason then that the capability which a firm possesses in effectively managing information relating to its supply chain operational activities equates to a higher supply chain performance of that firm (Bhardwaj, 2000; Park & Koh, 2015; Lee & Lee, 2007). Further, put in a clearer way, information has been described by USAID (2011) as the mechanism that drives the entire supply chain. Information is need for decision making; having a robust information management capability thus guarantees quality decision making. Information management utility is the aggregation of the values of information gathering, analytics and maintenance (Park & Koh, 2015).

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2.4 Empirical Review

In their seminal work on the impact of change management effectiveness on ERP implementation, Lee and Lee (2007) proposed a conceptual framework that highlighted the importance of change management after a firm implements an information-dependent management system, in their case, Enterprise Resource Planning, ERP. Their research model was tested empirically by carrying out a field survey amongst firms under the Korean Ministry of Commerce, Industry and Energy. Firms whose ERP implementation had spanned at least one year made up the population list of the study. A sample size of 470 firms was chosen, however, only 207 organisations participated in the survey work yielding 170 effective returns of survey response for analysis after the elimination of unusable responses.

Their unit of analysis was the organisational level, as expected for this sort of study, thus, only one response was returned from each firm. The survey respondents were carefully chosen to represent the overall assessment of their ERP implementation. The researchers used a newly created instrument for the measurement of change management effectiveness owing to the paucity of instruments for operationalising the construct. The instrument used was based on the satisfaction with change management and the perceived usefulness of change management. Further, ERP implementation effectiveness was measured using three sub-constructs: information utility, information management and information behaviours and values as adopted from Marchand et al. (2000). All measurement items were on a 7-point Likert scale. The data gathered was analysed using confirmatory factor analysis, CFA, to establish the convergent and discriminant validity of the constructs and further, path analysis to test the research hypotheses. The result of the analysis conducted showed that the success of ERP systems depends on the effectiveness of change management after the implementation of the ERP system. While Lee and Lee's (2007) study had measured change management based on the perception of its effectiveness, this current study intends to measure the change management capability of firms based on the highlighted dimension.

Again, Park and Koh (2015) in their research work on the effect of change management capability on the performance of a supply chain in a real-time environment, discovered similar result. Their premise was that all management systems dependent on an information system, like customer relationship management (CRM), ERP, SCM systems, are similar and require that business leadership takes change management very seriously for the success of such system implementation. The population of their study was all firms listed in the South Korean Stock Market, which have implemented a supply chain management system for at least one year period. Amongst the sample size of 500 firms, 181 usable responses were collected for the analysis given a response rate of 36%. The following constructs were used: change management capability (predictor variable) based on awareness and acceptance, communication, education, and training. Real-time enterprise capability (moderating variable) based on the sub-constructs of information visibility and agility; supply chain performance (criterion/outcome variable) based on a surrogate construct of Information Orientation, IO, as adapted from existing literature (Marchand et al., 2000; Lee & Lee, 2007).

Statistical analysis utilized SAS 9.13 and SMART-PLS 2.0 to carry out Partial Least Squares (PLS) considering the sample size and the use of surrogate constructs as in supply chain management performance. PLS does not impose a strict requirement on sample size as structural equation modelling. Further, confirmatory factor analysis was implemented to

assess the measurement model. The analysis result showed that there exists a positive direct influence of change management on supply chain performance as measured by IO. Further, it showed the moderating influence of information system capability (visibility and agility) on supply chain performance. Their study corroborated the early affirmations of a positive effect of change management on business performance. Whilst the moderating variable is the same as Park and Koh's (2015) survey, this work differs in the area of location, as the survey was done in Nigeria. Also, the outcome variable, SC performance, was measured based on the SCOR model and not IO as in Park and Koh's (2015) work.

3.0 Methodology

In line with the internal realist ontology and the positivist epistemological worldview, the correlational design was adopted in this study. The authors investigated the extent of the relationship between paired variables: change management competence and supply chain performance; and the moderating influence of information system capability between these variables.

A correlational study involves the determination of a relationship that may be linking two or more variables with an indication of the magnitude and direction of such relationship(Nwankwo, 2016; Nworgu, 1991; Anyakoha, 1988). They opined that whatever conclusion will be drawn at the end of the research study will reflect relationships between variables (predictor variables, criterion/outcome variables and moderating variables) and not causation as no variable will be manipulated to obtain data for another variable.

Three sets of data were collected from respondents using three instruments:organisational change management capability assessment (OCMCA) questionnaire, information system capability assessment(ISCA) questionnaire; and SCM performance assessment (SCMPA) questionnaire.

3.1 Population of the study

The population of the current study consists of all the oil and gas firms in the upstream sector or the exploration and production phase of the industry and their associated servicing firms operating in the same industry. This includes both the indigenous and multinational firms that have implemented an SCM system for at least one year. Very few of these companies are listed in the Nigerian Stock Exchange, others are either not yet ready for listing or are listed in foreign stock exchanges.

The exploration and production oil and gas firms and their associated servicing firms in the Nigeria petroleum industry have been chosen for this study for the reason that there are lots of materials that are used as input items and spares, such as valves, pumps, compressors, heavy and light equipment, helmets, gloves, coveralls, that are manufactured outside the shores of Nigeria. Implicitly, the supply chains of these firms experience a high flow of information, material and cash requiring efficient management for improved business performance. Further, the companies are known to operate some sort of information-dependent supply chain management system, which is the centrepiece of this study.

3.2 Sampling and sampling techniques

A sample size of 495 supply chain experts, managers, supervisors, and company professionals was used in this study. A homogeneous purposive sampling technique was used to determine the sample size because the exact population size of identified firms could not be obtained. Further, this sampling technique was aimed at achieving a homogeneous sample across the identified firms.

The sample involved employees in the supply chain department of their firms including managers, supervisors, supply chain leaders etc., to effectively answer our research questions in the study (Nwankwo, 2016; Nworgu, 1991). An equal number of the measurement instrument was dispatched to each company identified for this study to obtain a representative sample from the population. Fifteen (15) copies of measurement instruments were dispatched to each company in the population of 33 oil and gas companies to make up the sample size of 495 respondents.

Change management competence was measured using the organisational change management capability assessment (OCMCA) questionnaire; information agility was measured using the information system capability assessment (ISCA) questionnaire, while supply chain performance was measured using supply chain management performance assessment (SCMPA) questionnaire. Reliability values for the instruments showed a Cronbach's alpha value of 0.98, 0.94 and 0.93 for change management competence, information agility and supply chain performance, respectively.

3.3 Method of data analysis

The statistical tool employed in the analysis of data in this research work is Structural Equation Modelling via the IBM SPSS AMOS Software 26.0. Before the ensuing hypotheses testing, the measurement model was validated using the confirmatory factor analysis (CFA) method. Models whose fit indices do not meet the requirements of the set standard indices cannot be used in the carrying out hypotheses testing as they will give erroneous results or, better put, lead to a type I error (Kline, 2011; Brown, 2006; Kenny, 2015).

Three key analysis were performed in this process of CFA: unidimensionality test, validity, and reliability of the latent constructs. This was done before proceeding to model the inter-relationship between constructs or the hypotheses testing in the structural model.

4.0 Results and Discussion

Three hundred and eighty-nine (389) participants out of the overall sample size of four hundred and ninety-five (495) in our participating companies responded to the 42-item questionnaire dispatched electronically to them making a very high rate of response of 78.6 %. This is indeed unprecedented following the low response rate that has plagued a lot of research efforts in our country. Perhaps the very important nature of this study at hand has informed this level of response. The returned responses were coded into the SPSS software and subjected to various intensive statistical data screening processes including missing data, outliers, normality (shape, skewness, kurtosis), linearity, and multi-collinearity tests.

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4.1 Measurement Model for Change Management Skill

Fig 1

First-order measurement model for Change Management Skills

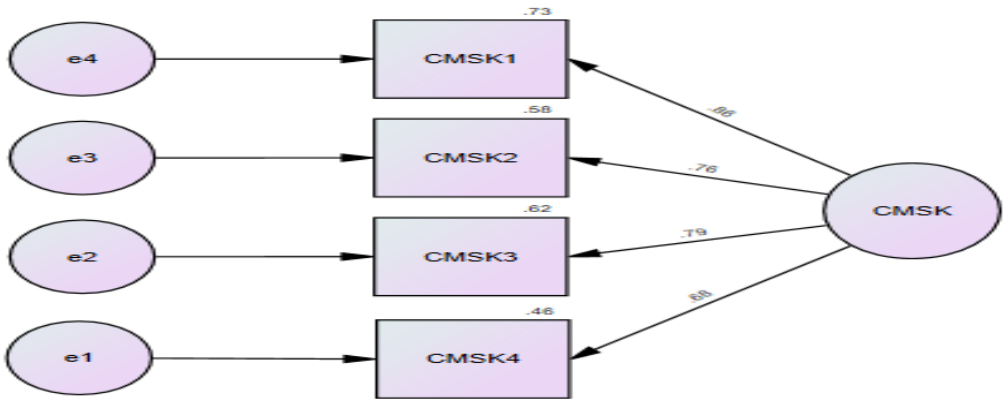

Table 1

Fit indices for change management skills measurement model

SN	Name of group	Name of index	Threshold	Current model
1	Absolute fit	P-value	(> .05)	.680
		GFI	(> .90)	.999
		RMSEA	(< .08)	.000
2	Incremental fit	AGFI	(> .90)	.995
		CFI	(> .90)	1.00
		TLI	(> .90)	1.00
		NFI	(> .90)	.999
3	Parsimonious fit	Chisq/df	(< 3)	.385

Source: AMOS 26.0 model fit output, 2020; Hu and Bentler (1999)

From the table above the measurement model for change management skills fits the data as all the indices in the various categories (absolute, incremental, and parsimonious) of model fit satisfy the requirements. The figures in parentheses show the threshold values for the fit indices while the figures under the 'Current model' tab represent the actual model fit index. For instance, the threshold for GFI is > .90, the actual model fit index is .999, which is so many times greater than .90. Thus, the condition for a good model fit in terms of this index is satisfied. Further, the factor loadings of .68, .79, .76 and .86 for the items in the model are positive and higher than 0.5 showcasing a good unidimensionality for the model.

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4.2 Measurement Model for Information Agility

Fig 2

First-order measurement model for Information System Agility

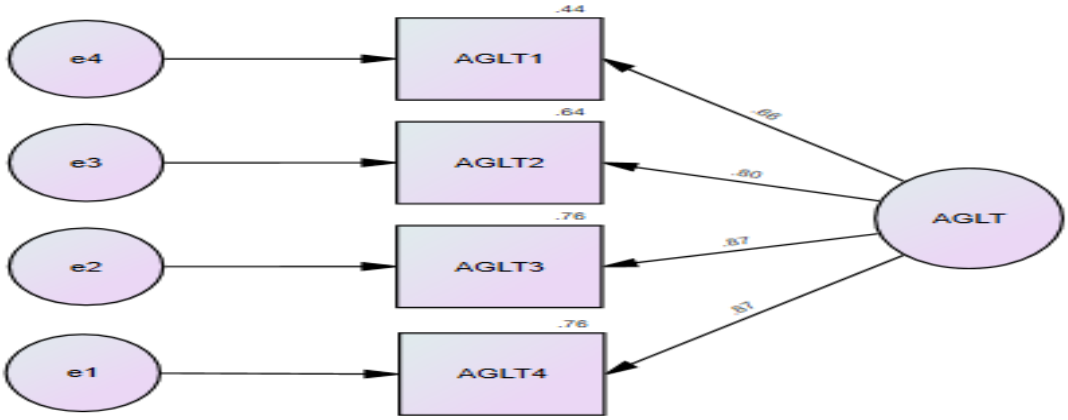

Table 2

Fit indices for information system agility measurement model

SN	Name of group	Name of index	Threshold	Current model
1	Absolute fit	P-value	(> .05)	.197
		GFI	(> .90)	.996
		RMSEA	(< .08)	.068
2	Incremental fit	AGFI	(> .90)	.978
		CFI	(> .90)	.998
		TLI	(> .90)	.995
		NFI	(> .90)	.996
3	Parsimonious fit	Chisq/df	(< 3)	1.623

Source: AMOS 26.0 model fit output, 2020; Hu and Bentler (1999)

From the table above the measurement model for information system agility fits the data as all the indices in the various categories (absolute, incremental, and parsimonious) of fits satisfy the requirements. The figures in parentheses show the threshold values for the fit indices while the figures under the 'Current model' tab represent the actual model fit index. For instance, the threshold for RMSEA is < .080, the actual model fit index is .068; this value is lesser than the threshold. Thus, the condition for a good model fit in terms of this index is satisfied. Further, the factor loadings of .87, .87, .80 and .66 for the items in the model are positive and higher than 0.5 showcasing a good unidimensionality for the model.

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4.3 Measurement Model for Customer Relationship Management Utility

Fig 3

Measurement model for Customer Relationship Management Utility

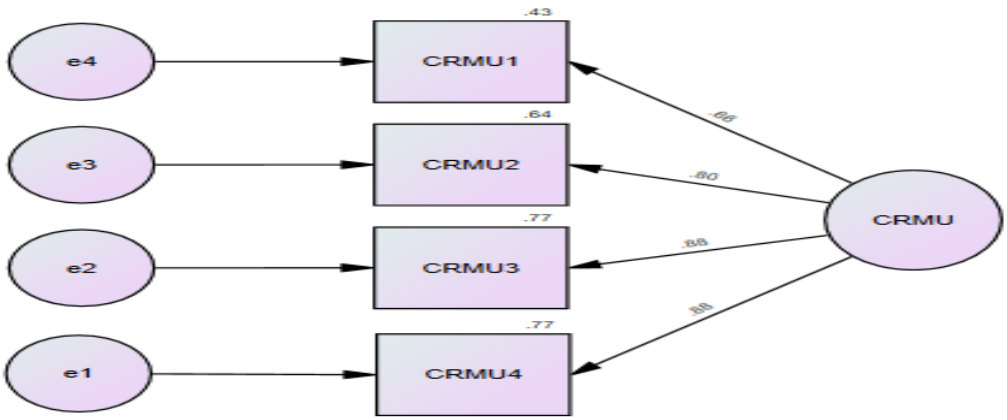

Table 3

Fit indices for Customer Relationship Management Utility measurement model

SN	Name of group	Name of index	Threshold	Current Model
1	Absolute fit	P-value	(> .05)	.256
		GFI	(> .90)	.996
		RMSEA	(< .08)	.032
2	Incremental fit	AGFI	(> .90)	.982
		CFI	(> .90)	.999
		TLI	(> .90)	.997
		NFI	(> .90)	.997
3	Parsimonious fit	Chisq/df	(< 3)	1.364

Source: AMOS 26.0 model fit output, 2020; Hu and Bentler (1999)

The table above shows the model fit indices for customer relationship management utility. Examining the threshold values and the actual values shows that the model fits the data as all the indices in the various categories (absolute, incremental, and parsimonious) of fits satisfy the requirements. The figures in parentheses show the threshold values for the fit indices while the figures under the 'Current model' tab represent the actual model fit index. For instance, the threshold for p-value is > .05, the actual model fit p-value is .256, which is greater than the threshold. Thus, the condition for a good model fit in terms of this index is satisfied. Again, the factor loadings of .88, .88, .80 and .66 for the items in the model are positive and higher than 0.5 showcasing a good unidimensionality for the model.

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4.4 Measurement Model for Information Management Utility

Fig 4

First-order measurement model for Information Management Utility

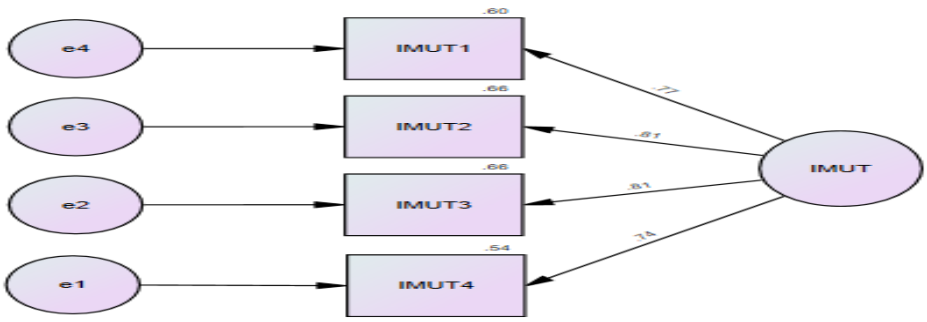

Table 4

Fit indices for Information Management Utility measurement model

SN	Name of group	Name of index	Threshold	Current model
1	Absolute fit	P-value	(> .05)	.086
		GFI	(> .90)	.993
		RMSEA	(< .08)	.063
2	Incremental fit	AGFI	(> .90)	.966
		CFI	(> .90)	.996
		TLI	(> .90)	.987
		NFI	(> .90)	.993
3	Parsimonious fit	Chisq/df	(< 3)	2.452

Source: AMOS 26.0 model fit output, 2020; Hu and Bentler (1999)

The table above shows the model fit indices for information management utility. Examining the threshold values and the actual values shows that the model fits the data as all the indices in the various categories (absolute, incremental, and parsimonious) of fits satisfy the requirements. The figures in parentheses show the threshold values for the fit indices while the figures under the 'Current model' tab represent the actual model fit index. For instance, the threshold for Chisq/df is < 3, the actual model fit Chisq/df is 2.452, which is less than the threshold. Thus, the condition for a good model fit in terms of this index is satisfied. Again, the factor loadings of .74, .81, .81 and .77 for the items in the model are positive and higher than 0.5 showcasing a good unidimensionality for the model.

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4.5 Confirmatory Factor Analysis of the combined Measurement Model

Fig 5

Combined model confirmatory Factor Analysis

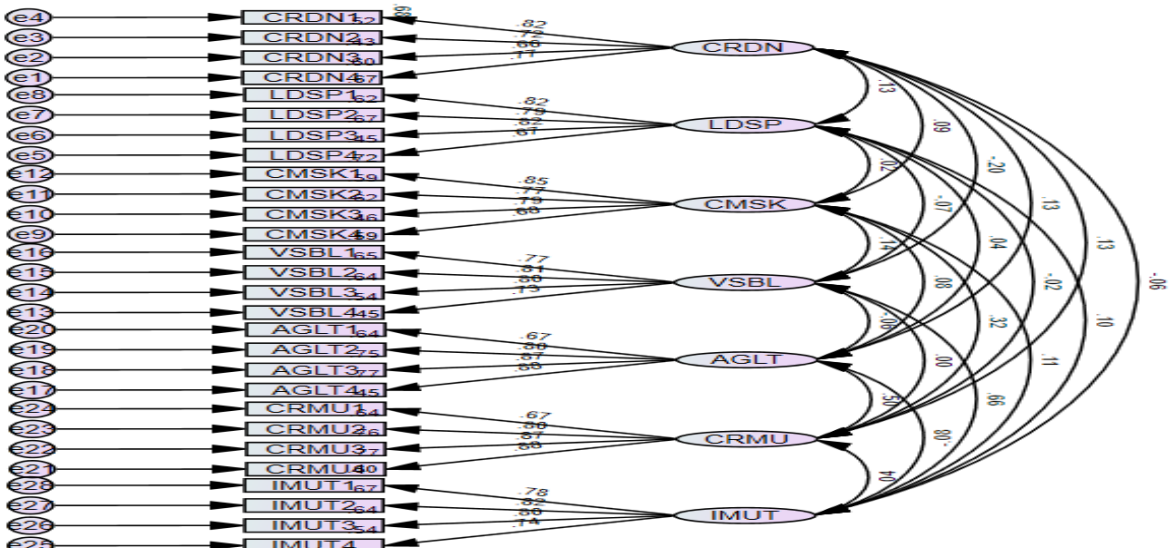

Table 5

A factor correlation matrix with the square root of AVE on the diagonal

	CRMU	IMUT	AGLT	CMSK
CRMU	0.809			
IMUT	0.042	0.768		
AGLT	0.497	-0.077	0.806	
CMSK	0.324	0.109	0.085	0.774

Source: Validity Master computation output, 2020; Stat Wiki (2017)

Table 6

Validity and Reliability Table

	CR	AVE	MSV	H
CRMU	0.882	0.654	0.247	0.902
IMUT	0.864	0.614	0.433	0.867
AGLT	0.880	0.650	0.247	0.898
CMSK	0.856	0.598	0.105	0.867

Source: Validity Master computation output, 2020; Stat Wiki (2017); *MSV maximum shared variance, AVE average variance extracted; CR composite reliability; H maximum reliability*

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On obtaining a good model fit for all first-order variables, we combined the models and carried out a confirmatory factor analysis as shown in Fig 5 above. Tables 5 and 6 above show the factor correlation matrix with the square root of the AVE on the diagonal from the CFA carried out. The square root of AVE must be greater than inter-factor correlations (Gaskin 2017; Brown 2006; Kenny, 2015). Further, the convergent validity is deduced from the values of AVE, all values greater than 0.5 for each construct. For discriminant validity to hold, the values of maximum shared variance, MSV, must have a value less than the value of AVE and the square root of AVE must be higher in value than inter-construct correlation. The composite reliability figures all show values above 0.70 indicating a reliable model (Nunnally, 1978).

4.6 Structural equation modelling

On obtaining a satisfactory result from the confirmatory factor analysis, CFA carried out, factor score weights were computed from the CFA model. Factor score weights have the properties of the structural model and give a singular score for each latent construct. AMOS software provides an easy computation for the factor score weights. Factor score weights are also useful in overcoming the problem of multicollinearity especially when there is high inter-correlation amongst independent variables (Frost, 2017; Gaskin, 2017).

Fig 6

Path modelling for the research objectives

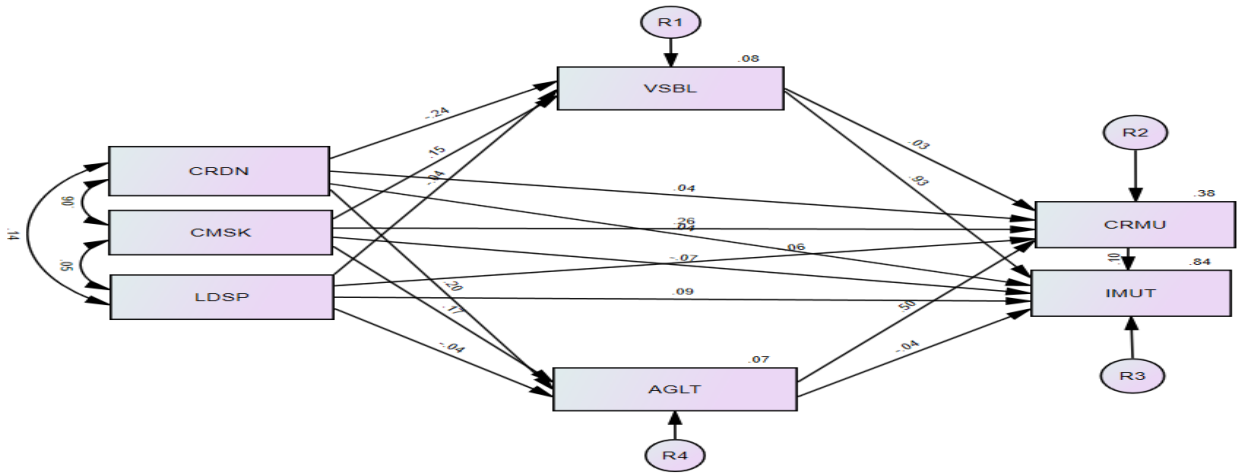

Table 7 and 8 below provide the standardized regression weights and model fit summary for the path model. From the model fit summary table, all obtained model fit indices satisfy the threshold for model fit as could be seen in the figures under the 'Current model' tab. This means that meaningful deductions could be made from the path model as per the relationships in the research objectives and or hypotheses.

Hypothesis testing was achieved by constraining the path of interest to the researcher (as stated in the research objectives and hypotheses) in the path model and examining the model fit summary. If the model fit summary suggests a non-fit model, then we reject the null hypothesis. If the model fit summary suggests a fit model, then we accept the null hypothesis.

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Table 7

Model fit summary for the path model

SN	Name of group	Name of index	Threshold	Current model
1	Absolute fit	P-value	(> .05)	.296
		GFI	(> .90)	.999
		RMSEA	(< .08)	.017
2	Incremental fit	AGFI	(> .90)	.973
		CFI	(> .90)	1.00
		TLI	(> .90)	.997
		NFI	(> .90)	.999
3	Parsimonious fit	Chisq/df	(< 3)	1.093

Source: AMOS model fit output, 2020; Hu and Bentler (1999)

Table 8

Standardised regression weights for the path model

Endogenous		Exogenous	Estimates	P	R^2
IMUT	←	**CMSK**	**.071**	**.004**	**.84**
CRMU	←	**CMSK**	**.256**	*******	**.38**

Source: AMOS model fit output, 2020

***H_{01}**: There is no significant relationship between change management competence and customer relationship management utility.*

Chi-Sq./df = 15.728; P-value = .000; RMSEA = .214 (Not supported)

***H_{02}**: There is no significant relationship between change management competence and information management utility.*

Chi-Sq./df = 4.445; P-value = .012; RMSEA = .103 (Not supported)

4.7 Mediation Test

***H_{03}**: Information agility has no significant influence on the relationship between change management competence and customer relationship management utility.*

A mediation test was carried out on the relationship between change management competence and customer relationship management utility. Our findings show that information agility provided a partial mediation influence on this relationship, thus the null hypothesis was not supported.

Table 9

Mediation test result

PV	MV	CV	DE	IE	M Type	R^2
CRMU	Info Agility	CRMU	.256 ***	.071 ***	Partial	.38

Source: Researcher's Desk, 2020; *** = Significant at α = .05

5.0 Conclusion and Implications

The results obtained from the data analysis show that the change management competence of oil and gas companies in the Nigerian Petroleum Industry has a far-reaching impact on their supply chain performance. The study further upholds the importance of a robust information system capability as espoused in information agility. This variable mediates the positive relationships which exist between change management competence and supply chain performance measures (customer relationship management utility and information management utility). Results obtained corroborate the results obtained by previous research works with few exceptions in the area of the magnitude of relationships.

5.1 Recommendations

Following our findings and the conclusions given in the previous section on the work on change management competence and supply chain performance, the ensuing recommendations have been put forth.

1. The level of information agility is very low in the Nigerian oil and gas industry. This has to be improved by way of training and retraining workers on the use of information and leaders on a prompt response to shared information because input materials and spares used in oil and gas production on daily basis are not produced in the country.
2. Change management competence is still at the infantry level. There is no plenty of sign of effective change management process in the petroleum and natural gas industry, rather selective change management processes seem to exist. This was reflected in the response statements in the change management sections of our measurement instrument. Change management training for leaders and employees is emphasised in this work. Further, employee involvement in all change effort from the beginning of the project is emphasised in this work.
3. Due to the uncertain nature of the market across various industries existing business strategies is getting obsolete thus, making a superior change management expertise or competence an emerging strategic source of competitive advantage. Organisational leaders must plunge into the study and application of its key success factors (Berhausen& Hannon, 2018).

5.3 Contributions to Knowledge

An important contribution to knowledge offered by this research work is the empirical validation of the relationship between change management competence and the performance of supply chains in the oil and gas companies in Nigeria, examined from two perspectives of SCOR Model Level 1 and information management utility. The study has confirmed the

positive influence of change management competence upon information system agility and the performance of supply chain management system. The positive effect on the performance of supply chain management system is felt both directly on the variables and indirectly through the mediating variable information agility.

Another contribution to knowledge is that the study proves to be the premier empirical study on the role of change management capability on the performance of supply chain management system in the Nigerian oil and gas industry, and thus provides a strong empirical base for ensuing research works and practice in the field of change management and information-dependent supply chain system. This will cater for the successful implementation of a supply chain management system.

5.4 Suggestion for further studies

There was some level of limitations and difficulties met in course of carrying out this study. Suggestions are brought forth here to overcome them in future research efforts. First, some of the oil and gas companies that participated in the studies, particularly on the side of the locally run companies, seem not to have had enough period of implementation of the supply chain management system in place. This may have some impact on the responses given to the questionnaire items. For future research work in this field, participating companies should be such as have got a long-range experience say, 5 years and above of post SCM system implementation. Such companies must have got good hands-on managerial experience in the SCM system.

Future research measurement instrument should be developed in a way that it eliminates biased answers or reduces such answers to the barest minimum; such answers that are skewed towards the interest of the respondents or participating companies. Many of the respondents may have seen the study as contained in the research measurement instrument as a referendum on their company leadership on the handling of their supply chain system, themselves being leaders may have given answers that do suggest a skew towards protecting the image of their company or their department and function.

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