



KNOWLEDGE MANAGEMENT AND DYNAMIC CAPABILITIES OF THE UPSTREAM OIL AND GAS SECTOR IN THE ERA OF A NEW NORMAL: THE MODERATING EFFECT OF INNOVATION STRATEGY

M. A. Arokodare

Adjunct Associate Professor, American University of Nigeria, Yola, Adamawa State, Nigeria

biodunarokodare@yahoo.com

Abstract

In the era of a new normal occasioned by the COVID-19 pandemic, upstream oil and gas companies in all economies experienced oil price crash due to oil demand shock and clashes of oil prices between OPEC and non-OPEC member countries. Most of these companies were unable to strategically contain the effects of destruction in oil demand and the resulting oil price crash which emerged from the global pandemic. This was a result of failed innovation strategy, inability to dynamically sense the signals from COVID-19 shocks and poor knowledge management of global oil trend. The study examined the moderating effect of innovation strategy on the relationship between knowledge management and dynamic capabilities of the upstream oil and gas industry. Survey research design was employed. Validity and reliability tests of the survey instrument confirmed that items used to measure innovation strategy, knowledge management and dynamic capabilities were valid (0.578, 0.753 and 0.684) and reliable (0.713, 0.801 and 0.729). Hierarchical regression method was used for data analysis. Findings revealed that innovation strategy significantly moderated the relationship between knowledge management and dynamic capabilities of the upstream oil and gas sector. The study recommended that for operators in the upstream oil and gas sector to sustain their competitiveness, they should harness the knowledge embedded in their firms, re-strategise to

¹ Dr. M. A. Arokodare is Adjunct Associate Professor, American University of Nigeria, Yola, Adamawa State, Nigeria. He is currently the Chairman of First Ally Asset Management Company Limited and CEO of M & G Portfolio Limited. He was formerly Group Executive Director/CFO of Nigerian National Petroleum Corporation.

give optimal attention to knowledge management, engage innovation strategy by bringing in new processes, practices, products, systems and structures, create unique and idiosyncratic dynamic capabilities, and be dynamic in sensing the developments in the global arena in the era of the new normal. Limitations of the study were highlighted and areas of further research were outlined.

Keywords: COVID-19 pandemic, Dynamic capabilities, Innovation strategy, Knowledge management, Upstream oil and gas sector

INTRODUCTION

In today's new normal, organisations whether in oil and non-oil sector cannot wade through pandemic shock and economic pressure without sound and appropriate innovation strategy. Literature have established that for oil and gas companies to survive and sustain global dynamic trend, they must embrace both knowledge management and innovation strategy (Ferreira & Fernandes, 2017; Lim, Thi, & Kadir, 2018). The quest for sustainable dynamic capabilities is an aim to be achieved by many strategic managers especially oil and gas managers. Steady changes in business environment could be tailored towards dynamic and competitive landscape that exercises pressure on oil and gas companies.

The upstream oil and gas sector of the industry is also known as the exploration and production (E&P) sector because it encompasses activities related to searching for, recovering and producing crude oil and natural gas. It is a sector that is highly regulated, usually impacted by global politics (Andrews-Speed & Dannreuther, 2011; Grasso, 2019), technology-intense and with a feature of high risk and high return (Kim & Choi, 2019). Zulkifli, Firmanzah, Balqiah, and Hamsal (2020) argued that the upstream oil and gas industry especially oil and gas exploration and production is characterized by various huge resources, including capital, advanced technology, and complicated activities, as well as increased risk. Across the globe, oil and gas businesses are characterized with high-velocity markets in which dynamic capabilities is imperatives because oil and gas market volatility and technological uncertainty require constant innovation strategies for the oil and gas companies to remain relevant in the industry. Seydi (2020) opined that lack of sound knowledge management on the unpredictability, ambiguity, and volatility that define oil and gas upstream settings do in turn create market disruptions for the companies that operate in the upstream sector. Sumbal, Tsui, Cheong, and See-to (2018) averred that in the upstream oil and gas industry, implementing knowledge management initiatives do enable managers to develop and retain employees while improving competitiveness. Researchers have discovered a drop in performance and dynamic

sustainability owing to knowledge loss in the upstream oil and gas industry (Ranjbarfard, Aghdasi, López-Sáez, & Emilio Navas López, 2014; Seydi, 2020). To combat this, the oil and gas industry has introduced a number of major knowledge management efforts, including virtual seminars, communities of practice, and knowledge management systems (Dalkir & Beaulieu, 2017).

Knowledge management and innovation strategy remain constant challenges in the upstream oil and gas sector (Chong & Besharati, 2014; Inkinen, 2016; Ochieng, Ovbagbedia, Abdulai, Matipa, Zuofa, Ruan, & Oledinma, 2018; Sumbal, Tsui, & Lee, 2015) despite the introduction of programs to sustain staff knowledge inside businesses, personal knowledge sharing issues, organizational knowledge sharing barriers, and prospective technology. Knowledge sharing hurdles were also major obstacles in achieving dynamic capabilities and overall performance among oil and gas companies in the upstream sector in developing economies like Nigeria (Ahuja, Singh, & Kumar, 2018; Chong & Besharati, 2014; Nwankwo, 2017; Omotayo, 2015; Seydi, 2020). Similarly, Gajere and Nimfa (2021) pointed out that upstream oil and gas companies in Nigeria lack knowledge of maintaining dynamic capabilities strength due to poor knowledge management and inability to build up global standard in the area of innovation strategy. Although, based on the related studies reviewed, no studies including in Nigeria contexts have examined how innovation strategy moderate the relationship between knowledge management and dynamic capabilities of the upstream oil and gas sector in the era of a new normal. The gap identified informed the current study.

COVID-19 Pandemic and Impact on the Upstream Oil and Gas Sector

Globally, the outbreak and subsequent spread of the Covid-19 pandemic affected many facets of human economic life: from education, agriculture, social life, health, transportation, tourism and hospitality, to oil and gas. The effect of the pandemic cuts across all countries (both oil producing and oil consuming nations), industries and institutions. The consequence of this includes total lockdown of cities and nations, reduced work hours and declining production (Afaha et al., 2020). A breakdown in supply chain of major industries was expected as a result of the damage done by the pandemic on distribution network worldwide. The pandemic even caused changes to most organisational structures and wrecked serious havoc to many critical sectors of the global economy (Arokodare & Falana, 2021).

Furthermore, COVID-19 pandemic has caused setback for many fragile economies like Nigeria who majorly depend on oil revenue for their national economic development. In the early period of COVID-19 pandemic, many developed and emerging economies restricted movements and businesses among citizens within and across national borders. Consequently,

the level of global crude export significantly reduced which particularly triggered a decline in Nigeria national revenue. Natural Resource Governance Institute (2020) asserted that the oil sector accounts for half of government revenue in Nigeria and oil and gas revenues for the first half of 2020 were 65 percent lower than anticipated, which caused critical fiscal budget shortfalls both centrally and at the state level. OECD (2020) stated that majority of fragile oil-exporting countries like Nigeria which is characterized with crude oil resource dependence and already struggling with high levels of debt and social fragility before the inception of COVID-19 pandemic continued to experience economic instability throughout the period of the global crisis. OECD (2020) further established that upstream oil and gas companies experienced decline in their financial performance due to shock in global demand for crude oil.

In the oil and gas industry globally, extreme losses were suffered from the pandemic. Afaha et al. (2020) highlighted some challenges faced by new projects in this industry in the areas of project execution, planning and risk management. The global oil and gas demand shock that was witnessed during the pandemic led to falling crude oil prices which eventually and negatively affected exploration and production activities. One of the implications of the industrial slow-downs and travel restrictions include cut downs of capital and operating expenditures which eventually had cascading effects on suppliers and oil servicing companies (Deloitte Nigeria, 2020). Offshore Technology (2021) also confirmed from data that one of the consequences of the impact of the pandemic on the oil and gas sector was the drastic reduction both in the number of patent applications and patent applicants, post-pandemic. These two indices indicate the level of innovation in the sector. They found that while there were over 60,000 applications in Q3 2018 and 12,000 in Q3 2020, there was less than 2,000 applications in Q3 2021. Other impacts of the pandemic on the oil and gas sector include liquidity crisis for some companies, a development that may eventually drive them out of business; changes in business model for some larger and healthier companies; and when the market resuscitates, shortage of skilled manpower will be experienced in the industry following massive layoffs during the global crisis. Therefore, companies in this sector will need to adopt new technologies, new innovation strategies, and new ways of working as they adapt to the new realities engendered by the pandemic.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

The study conceptual definitions focused on knowledge management (KM), dynamic capabilities (DC) and innovation strategy (INS). For the purpose of this study, KM was defined by Yee, Tan, and Thurasamy (2019) as the process of capturing, disseminating, and efficiently employing knowledge. The study conceptually defined KM as exact management of an

organization's knowledge assets in the process of creating value and achieving tactical and strategic requirements so as to achieve targeted goals. It is the concept, skill, experience and vision that provides a framework for creating, evaluating and using the information (Soltani & Navimipour, 2016). Knowledge management refers to identifying and leveraging the collective knowledge in an organization in order to help the organization to compete (Barao *et al.*, 2017); and the process of capturing, sharing, developing, and using the knowledge efficiently. Rezaei, Khalilzadeh, and Soleimani (2021) conceptually asserted that KM could be affected by the following six factors: organizational structure, appropriate strategies, technology, culture, leadership and trust.

Dynamic capabilities (DC) are the specific capabilities that enable firms to properly and adequately adapt to rapidly changing environments and hold on to their competitive advantage (Akpobi, 2017). Cyfert, Chwiłkowska-Kubala, Szumowski, and Miśkiewicz (2021), emphasized dynamic capabilities as a category of capabilities that are key and important to organisations in striving to adapt to changes in the environment. Cyfert *et al.* (2021) further outlined the model of developing DC, covering five activities such as searching for opportunities, knowledge management and learning, coordination, configuration and reconfiguration, and organizational adaptation. Therefore, DC indicate learning processes, the accumulation of experience, the articulation of knowledge and the codification of knowledge, and that they relate to specific and identifiable processes related to the integration, reconfiguration, acquisition and release of resources (Zollo & Winter, 2002).

Innovation strategy, according to Celtekligil and Adiguzel (2019), is defined as a process. It is also an effort to plan, implement, eliminate problems and take action. It guides decisions on resource utilization necessary to meet business innovation objectives in order to attain competitive advantage (Katz, Preez, & Schutte, 2010). Innovation strategy is multidimensional since they handle many various issues such as managerial innovation, organizational innovation, and financial innovation, in addition to new items and services presented to the market. Innovation strategy could be incremental or radical (usually termed disruptive), proactive, active, or passive. Zartha, Montes, Vargas, Velez E, Hoyos, Hernandez and Novikova (2016) stated that innovation strategy follow one of the three strategies: necessity identifiers, market readers and technology proponents. Each of these strategies has a distinct ensemble of capabilities that, due to their performance, are identified as the most critical. Zartha *et al.* further stated that three main aspects that determine a basic innovation strategy were process improvement, product improvement, and market expansion. It is a decision framework that assists corporate management to decide when to abandon their past and focus on the business of the future (Pisano, 2015). In contemporary times, Nysten and Holmstrom (2015) observed that

due to increasing importance of digital technology, firms are forced to challenge their prior assumptions about their product and service portfolio by reviewing their digital environment and ways of organizing innovation work.

Empirically, several studies such as Al-Ahbabi, Singh, Gaur, and Balasubramanian (2019) and Erandi and Sachitra (2021) examined how KM practices affect and enhance firm competitive advantage and overall firm performance within private and public sectors. Their study found that KM significantly determine and enhance competitive advantage as well as overall performance. However, their studies failed to establish how KM affects DC among various segments within the private and public sectors. Iqbal, Latif, Marimon, Sahibzada, and Hussain (2019) and Rezaei, Khalilzadeh, and Soleimani (2021) investigated and identified the factors affecting the empowerment and implementation of KM in organizations as well as the impact of KM on organizational performance. Their studies revealed that there is a positive effect of variables of structure, culture, leadership, and trust on KM in an organization. Also, KM influences the organizational performance, both directly and through the mediating variable of human capital. Gyemang and Emeagwali (2020) investigated the roles of DC, innovation, organisational agility and knowledge management on competitive performance in the telecommunication industry in Nigeria and found that KM was associated with DC, competitive performance and innovation. Santoro, Thrassou, Bresciani, and Giudice (2019) investigated the relationship among KM orientation, DC and ambidextrous entrepreneurial intensity in Italian ICT firms and how this relationship affects the overall firm performance. They found that KM has positive and significant impact on ambidextrous entrepreneurial intensity and performance, especially when the firm had substantial DC.

Cyfert et al. (2021) empirically focused on the process of developing dynamic capabilities and also investigated the impact of dynamic capabilities on intellectual capital and innovation performance. Their study empirically established that the individual activities in the process of developing dynamic capabilities are interconnected, and through mutual interactions and couplings, they positively affect the economic effectiveness of an enterprise. In the study of Ali, Hussin, Haddad, Alkhodary, and Marei (2021), they found that the employees' levels of intellectual capital significantly increased toward innovativeness through the moderating role of dynamic capabilities between intellectual capital and innovation performance in the commercial banking sector for better competitive advantages. Though literature indicated knowledge as one of the most important intangible resources available to the organization, however, the seizing dimension of dynamic capabilities enables the renewal and integration of these resources in order to sustain competitive advantage (Buenechea-Elberdin, Sáenz, & Kianto, 2019). Some studies posited that if a firm's capabilities can change the business environment according to its

seizing, other competitive firms cannot strive with it because it would be too expensive for them (Hendry, Stevenson, Macbryde, Ball, Sayed, & Liu, 2018). Therefore, the performance of such a firm increases because of this competitive advantage, confirming the existence of an indirect relationship between seizing capability and intellectual capital. Specifically, in the upstream oil and gas sector, Stadler, Helfat and Verona (2013) used data from this sector to analyse dynamic capabilities that supported activities directed at accessing resources and further commercially developing these resources. They found that firms with more sophisticated dynamic capabilities did undertake greater amounts of activities to access resources and further develop them prior to commercial use and they actually have greater success in these activities.

Empirically, the impact of innovation strategy (INS) on diverse organisational outcomes have been tested in literature. Ezzi and Jarboui (2016) studied the effect of INS on the financial, social and environmental performance of Tunisian companies. Using the R & D intensity as proxy for firm INS, they found that INS had a crucial impact on the performance of the companies that were investigated: while R & D had a positive and significant impact on the financial performance of the companies, INS had positive impact on corporate social performance. Karabulut (2015) explored the effects of INS on the performance of manufacturing firms in Istanbul, Turkey and found that INS explained the financial dimension of firm performance than other dimensions. Hervas-Oliver, Sempere-Ripoll and Boronat-Moll (2014) posited that a firm's INS depends on its existing capabilities and knowledge stock. Therefore, a firm's innovation capability is highly correlated with its INS and both depend on its repository of resources and competences generated both internally and externally. They found that when SMEs are conducting a process INS, they rely substantially on the acquisition of external sources of knowledge to complement their internal innovative capabilities. Dlamini and Groenewald (2019) found that organisations need to go beyond product and process innovation and develop more comprehensive INS to ensure attainment and sustenance of competitive advantage. They confirmed that the success of INS was influenced by factors like technology, employee motivation and leadership with organisational support giving a major enhancement.

Theoretical Foundation

Theoretically, this study was predicated on the Dynamic Capabilities Theory (DCT) which was defined as "the firm's ability to integrate, build, innovate and reconfigure internal and external competences to address rapidly changing business environments and it examines how firms address or bring about changes in their turbulent business environment through reconfiguration of their firm-specific competencies into new competencies (Teece, 2007). The DCT explains how the responsiveness and innovativeness of firms become timely, rapid and

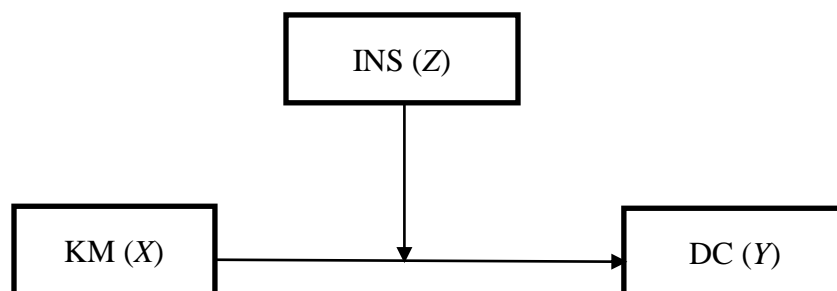
flexible especially in dynamic markets (Kuncoro & Suriani, 2018) as in the oil and gas industry. Thus, the theory affirms that those firms with greater dynamic capabilities will outperform those with less. This is because an enterprise with strong dynamic capabilities will be able to innovate and respond to or create changes in the market by profitably building and renewing resources, assets and capabilities in the appropriate way (Teece, 2018). Literature is replete with empirical findings on the impact of dynamic capabilities on diverse indicators of organisational outcomes: development of innovation capabilities (Froehlich, Bitencourt, & Bossle, 2017); support for activities directed toward accessing resources and further developing those resources in the upstream oil and gas industry (Stadler *et al.*, 2013); innovation performance (Buenechea-Elberdin *et al.*, 2019); indirect effect on firm performance through impact on operational capabilities (Protogerou, Calghirou, & Lioukas, 2012); facilitation of innovation (Zhou, Zhou, Feng, & Jiang, 2019); and competitive advantage and service capabilities (Kuo, Lin, & Lu, 2017). The study of Hernandez-Linares, Kellermanns and Lopez-Fernandez (2021) investigated how the four dimensions of dynamic capabilities (sensing, learning, integrating and co-ordinating) individually affect firm performance and confirmed that not all the dimensions are equally important for SME performance. Likewise, Wilden, Gudergan, Nielsen, and Lings (2013) found that the effects of DC on firm performance are contingent on the organisational structure of and the competitive intensity faced by the firms.

Despite various past studies reviewed on the link between knowledge management, dynamic capabilities and innovation strategy within and outside Nigeria contexts, studies on how Innovation Strategy (INS) moderates the relationship between Knowledge Management (KM) and Dynamic Capabilities (DC) were close to no existence in literature. Based on this empirical gap identified, this study hypothesized that:

H₀: Innovation strategy has no significant moderating effect on the relationship between knowledge management and dynamic capabilities of the upstream oil and gas sector in the era of a new normal in Nigeria

The relationship between the variables in the hypothesis is depicted in the conceptual model shown in Figure 1 below.

Figure 1: Conceptual framework



The figure 1 indicates the conceptual model representing the hypothesis of the study. A firm's capability to sense and seize opportunities in its environment (DC) is enhanced by proper use of knowledge management processes which harnesses the intellectual capital of its employees (KM) and eventually contributes significantly to the firm's achievement of competitive advantage (Nguyen & Neck, 2008). In addition, the process of creating new product and process ideas (INS) further improves the capacity of the organization to engage KM processes that improve the DC of the organization to create a sustainable competitive advantage (Koentjoro & Gunawan, 2020). Likewise, Chierici, Mazzuchelli, Garcia-Perez and Vrontis (2019) had agreed with Carneiro (2000) in identifying KM as an antecedent of innovation. They posited that KM grasps the changes that occur in the environment and supports firms in integrating, building, and reconfiguring their competences. In an earlier empirical study of the hospitality industry, Nieves, Quintana and Osorio (2016) found that knowledge and knowledge-based processes played outstanding roles in fostering innovation in the hotel firms. Lim, Thi and Chen (2016) also affirmed that KM, management innovation and DC are critical for firms to sustain their competitive advantage over their competitors.

METHODOLOGY

Study and the Instrument

The study employed cross-sectional survey research design targeting upstream oil and gas companies in Lagos State, Nigeria. The questionnaire was designed to obtain information required for the analysis of the independent, dependent and moderating variables respectively. The number of items for each variable are 8 (eight) for dynamic capabilities, 6 (six) for knowledge management and 6 (six) for innovation strategy. Each variable question on the independent, dependent and moderating variables was designed in the form of a modified 6-point Likert-type scale format of Very High (VH) = 6, High (H) =5, Moderately High (MH) = 4, Moderately Low (ML) = 3, Low (L) = 2 and Very Low = 1. The study employed hierarchical regression method of analysis in order to analyse the above stated hypothesis.

Validity and Reliability of Research Instrument

The research instrument was validated using constructs validity. Exploratory Factor Analysis (EFA) was done to establish construct validity of the questionnaire using Varimax Extraction Method. The factor loadings of these items were used to establish the Average Variance Extracted (AVE). Average Variance Extracted (AVE) greater than 0.5 was treated as additional evidence of convergent validity. The construct validity of all variables involved in the study was therefore ascertained. The construct and convergent validity are presented in Table

1. Also, Kaiser-Meyer-Olkin Measure (KMO) and Bartlett's test of sphericity of Sampling Adequacy Test were carried out to support the EFA. The result in Table 1 indicated that the KMO was greater than 0.6 with a significant Bartlett's test of sphericity value, indicating that the sample size was large enough to assess the factor structure and that the data were sufficient to proceed for the factor analysis and reliability. Composite reliability that achieved 0.70 or above means the scale has good reliability. In general, composite reliability was greater than 0.7 and average variance extracted (AVE) was greater than 0.5, indicating that the reliability of this model was good.

Table 1: Exploratory Factor Analysis

S/N	Variables	No. of Items	AVE	KMO	Bartlett Test	Composite Reliability	Cronbach's Alpha Coefficient
1	Dynamic capabilities	8	0.684	0.692	0.000	0.865	0.729
2	Knowledge Management	6	0.753	0.627	0.000	0.773	0.801
3	Innovation Strategy	6	0.578	0.749	0.024	0.883	0.713

The reliability of the data collected was ascertained using internal consistency method and Cronbach's alpha co-efficient was obtained using Statistical Package for Social Sciences (SPSS) version 24.0 (Table 1). The result of the test carried out suggested that the instrument used for evaluation was highly reliable based on the 0.70 benchmark (Serbetar & Sedlar, 2016).

Sample

Total enumeration was adopted since the population of the study is small: one hundred and twenty (120). Out of fifty-one (51) upstream oil and gas companies in Nigeria registered with the Department of Petroleum Resources (DPR) as at 31st December, 2020, forty (40 or over 70% of these companies) have their head offices located in Lagos State (DPR Report, 2021). This served as the justification of the study to focus on upstream oil and gas companies in Lagos State.

Data Collection

The study considered three respondents in each upstream oil and gas company: Planning and Budget Manager, Finance Manager, and Oil Exploration & Production Manager as

these officers served as the most appropriate and experienced respondents to give sound and relevant information regarding the flexibility, innovation trend and nature of upstream oil and gas operations. The 40 upstream oil and gas companies in Lagos State were considered and three copies of the questionnaire were given to planning and budget manager, finance manager, and oil exploration and production manager which summed up to 120 respondents while 112 copies of the questionnaire were completed and retrieved from the respondents. All of the completed copies of the questionnaire were adjudged good for further processing, giving a response rate of 93.33% while 8 (or 6.67%) copies were not returned and therefore did not form part of those used for analysis. Outliers in statistics are observations that fall far from the mass of data. Therefore, this study dropped those outliers items and proceeded to carry out a hierarchical regression method of analysis.

RESULTS AND DISCUSSIONS

Table 1: Model Summary of Hierarchical Regression Analysis for Moderating Effect of Innovation Strategy on the Relationship Between Knowledge Management and Dynamic Capabilities of the Upstream Oil and Gas Sector

Models		B	T	Sig.	R ²	R ² Change	F Change	Sig. F Change
1	(Constant)	9.522	3.206	.002	.391	.391	70.510	.000
	Knowledge Management	.789	8.397	.000				
2	(Constant)	2.929	.951	.344	.490	.100	21.277	.000
	Knowledge Management	.578	5.914	.000				
	Innovation Strategy	.508	4.613	.000				
3	(Constant)	9.457	.799	.426	.492	.002	34.821	.009
	Knowledge Management	.360	3.912	.044				
	Innovation Strategy	.235	5.480	.032				
	Knowledge Management*Innovation Strategy	.209	4.571	.001				
a. Predictors: (Constant), Knowledge Management								
b. Predictors: (Constant), Knowledge Management, Innovation Strategy								
c. Predictors: (Constant), Knowledge Management, Innovation Strategy, Knowledge Management*Innovation Strategy								
d. Dependent Variable: Dynamic Capabilities								

The results presented above represent the hierarchical regression analysis on the moderating effect of innovation strategy on the relationship between knowledge management and dynamic capabilities of the Upstream Oil and Gas Sector. The finding of step one indicates a statistically significant effect of knowledge management on dynamic capabilities of upstream oil and gas sector ($B = 0.789$, $t = 8.397$, $p\text{-value} = 0.000$) indicating that there is a linear dependence of dynamic capabilities of the upstream oil and gas sector on knowledge management. The result implies that for every unit increase in knowledge management, dynamic capabilities increase by 0.789 units. The result also revealed that knowledge management accounts for 39.1% of the variation in dynamic capabilities of the upstream oil and gas sector ($R^2 = 0.391$). The F value (ANOVA) is statistically significant ($\Delta F_{(1,110)} = 70.510$, $p\text{-value} < 0.05$) indicating that the effect of knowledge management on dynamic capabilities is positive and statistically significant in the model.

In model two, the results revealed a statistically significant coefficient for innovation strategy ($B = 0.508$, $t = 4.613$, $p\text{-value} = 0.000$) indicating that there is a linear dependence of dynamic capabilities of upstream oil and gas sector on innovation strategy. The result indicates that innovation strategy has a positive and significant effect on dynamic capabilities of the upstream oil and gas sector. This shows that for every one unit increase in innovation strategy, dynamic capabilities of the upstream oil and gas sector increase by 0.508 units. Further, the result shows R square change of 0.100, indicating that the introduction of innovation strategy in the model increases R square from 0.391 to 0.490, meaning that innovation strategy accounts for 49% of the variation in dynamic capabilities of the upstream oil and gas sector above the effect of knowledge management which is statistically significant at 5% significance level. The F value is statistically significant ($\Delta F_{(2,109)} = 21.277$, $p\text{-value} < 0.05$) showing the significant effect of innovation strategy in the model.

In model three, the introduction of the interaction term on controlling for the two independent variables (aggregated knowledge management and innovation strategy [KM*INS]) revealed a positive and significant effect ($B = 0.209$, $t = 4.571$, $p\text{-value} = 0.001$). The coefficient of interaction term was statistically significant. Furthermore, the change in coefficient of determination is 0.2% ($\Delta R^2 = 0.002$) with the interaction of aggregated knowledge management and innovation strategy. This implies that the interaction term brought about an additional contribution to the variation in dynamic capabilities in the model, the R square increases from 0.490 to 0.492 meaning that the interaction term accounts for 49.2% variation on dynamic capabilities of upstream oil and gas sectors. The significance of the interaction term indicated a possibility of both knowledge management and innovation strategy being independent contributors to the dynamic capabilities of the upstream oil and gas sector. This means that the

introduction of the moderator (innovation strategy) has a positive and significant effect on the relationship between knowledge management and dynamic capabilities ($B = 0.209$, $\Delta R^2 = 0.002$, $\Delta F_{(3,108)} = 34.821$, $p=0.001$).

The unstandardized coefficient of the knowledge management (KM) is positive and statistically significant (KM = 0.360; p -value = 0.004) at 5% level of significance. When the parameter of innovation strategy was added, it shows positive and significant coefficient (INS = .235; p -value = 0.032). Also, the interaction of aggregated knowledge management and innovation strategy (KM*INS) revealed a positive and significant relationship (KM*INS = 0.209; p -value = 0.001) at 5% level. This implies that innovation strategy and interaction of aggregated knowledge management and innovation strategy (KM*INS) significantly increases dynamic capabilities of the upstream oil and gas sector, Nigeria. Therefore, the null hypothesis which states that innovation strategy has no significant moderating effect on the interaction between knowledge management and dynamic capabilities of upstream oil and gas sector should be rejected.

The findings of many past studies supported the current study finding by revealing that businesses that mobilize and manage knowledge can improve the DC of their organisations, thereby allowing for proper business management and growth (Alonso, Kok, & O'Shea, 2019; Ferraris, Mazzoleni, Devalle, & Couturier, 2019; and Zahra, Neubaum, & Larraneta, 2007). Furthermore, these studies also confirmed that the process of mobilizing knowledge on a regular basis strengthens the dynamic skills of businesses to generate new ideas. Similarly, Osorio-Londoño, Bermón-Angarita, Rosado-Salgado, and Osorio-Toro (2021) finding is in line with the finding of the study by establishing that KM significantly impacted on DC measures. Specifically, Tseng and Lee (2016) empirically confirmed that KM enhances the DC of organisations which in turn increases organisational performance and provide competitive advantages. Koentjoro and Gunawan (2020) found that the process of creating new product and process ideas further improves the capacity of the organization to engage KM processes that improve the DC of the organization to create a sustainable competitive advantage.

CONCLUSION AND RECOMMENDATIONS

The study concluded that innovation strategy moderates and affects the relationship between knowledge management and dynamic capabilities of upstream oil and gas sector. To sustain their competitiveness in the turbulent, complex and dynamic business environment space, upstream oil and gas companies must harness the knowledge embedded in their firms, engage innovation strategy by bringing in new processes, practices, products, systems and structures and create unique and idiosyncratic dynamic capabilities. Therefore, based on this

finding, the study recommended that planning and budget managers, finance managers, and oil exploration & production managers should give more attention to knowledge management and innovation strategy so as to achieve dynamic capabilities that will harness their business organisations to successfully wade through business environmental factors that characterized upstream oil and gas companies. Likewise, employees at top, middle and lower levels should be actively communicated and involved in organizational innovation strategy and knowledge sharing across internal organisational boundaries so as to fully achieve superior dynamic capabilities and thus create overall competitive advantage among the upstream oil and gas companies. Furthermore, managers of upstream oil and gas companies in developing economies like Nigeria should emulate and totally adopt equivalent innovative techniques employed by their counterpart managers in developed economies so as to enhance the knowledge management and dynamic capabilities of upstream oil and gas firms in Nigeria.

LIMITATIONS AND FURTHER STUDIES

The study has some limitations to note. First, the study sample was strictly limited to the upstream operators in the industry to the total exclusion of the downstream operators and the oilfield services companies all of which make up the industry value chain. Second, based on the literature review, the study selected the most significant moderating factor, that is innovation strategy, and did not take into account other potential factors that might also enhance the relationship between knowledge management and dynamic capabilities: environmental dynamism, learning capability, and strategic agility. So, other factors that might potentially facilitate the relationship between knowledge management and dynamic capabilities still need to be explored. Future study should investigate how open innovation strategy moderate the relationship between knowledge management and competitive performance of both downstream and upstream oil and gas sectors in the era of a new normal. Furthermore, the impact of organisational size and country of origin of these companies on their performance with the study variables will require future investigation to know if there would be differences especially post-pandemic.

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