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Sensing and Organizational Resilience of Oil and Gas Companies in Nigeria

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Abstract: *The study examined the relationship between two constructs; sensing (independent variable) and organizational resilience (dependent variable), using a cross sectional survey technique. The total accessible population for the study comprised of 190 senior managers and unit heads of 36 organizations in the Nigerian oil and gas sector. Quantitative data was collected using questionnaires. The instrument's items were based on the 5 point likert scale and were validated using Principal component analysis. Instrument items were further subjected to reliability test to ascertain consistency. A combination of purposive and simple random sampling was used in the study and a sample size of 152 was drawn from the population using the Krejcie and Morgan sampling formula. A total of 124 questionnaires were retrieved from the respondents and used for the analysis. The data retrieved was analyzed using the Structural Equation Modeling (SEM) statistical tool on Amos software. The outcome of the analysis showed that organizational sensing has a positive and significant influence on organizational resilience (Measured by adaptive capacity and agility). The study concluded from the findings that oil and gas companies in Nigeria could leverage the benefits of proper environmental sensing to build resilience in the face of enterprise challenges; particularly enabling adaptation and agile response. The study has contributed to knowledge by providing empirical evidence and therefore a valuable knowledge repository that management practitioners and researchers can leverage in their efforts to better understand environmental uncertainty, specifically the principle and practices of sensing as an aspect of management discipline.*

Key words: *Sensing, adaptive capacity, agility, organizational resilience, oil and gas*

1.0 INTRODUCTION

Organizational Resilience is a diversely faceted, sociotechnical concept that explains an entity's routine and preferred response to uncertainty (Lee, Vargo & Seville, 2013). Academic inquiry into organizational resilience is currently multifaceted. However, for all available research perspectives; enabling resilience capabilities within modern day organizations is widely considered important. According to Mallak (1998) resilience transcends the overly simplistic notion of adapting organizations to their environment. Relatedly, the prevalence of globalization as a phenomenon and the deepening relevance of information technology within enterprise tasks; has caused a noticeable and fundamental deviation in the way in which business is actualized and how managers lead complex organizations (Saner, 2001). The demonstration of

adaptive capacity and agility in responding to observable dynamism is one of the paramount motivations for organizational resilience capability. In some instances, resilience efforts within firms are focused on engineering appropriate reactions to crises and disruptive incidences when they have already occurred. In other instances, the target has been "*crises readiness*" strategies, that simultaneously help organization during trouble time and in the moments when routine functions are carried out. Within the petroleum sector, a strong body of evidence has been built to advocate for greater resilience in most organizations. Firstly, oil and gas resources are now being found in tough, unconventional, difficult or conflict ridden places. In 2008, former CEO of Shell, Jeroene Van der Veer made the valid assertion that the era of "easy to find oil" was fast disappearing (Teslik, 2008). Some experts contend that oil resources – as known today – along with all other of its derivatives - are finite, substitutable and more susceptible to the adverse impacts of disruptive forces, including the possible emergence of alternative energy sources. Furthermore, sensing activities within organizations has a variety of use-scenarios within the corporate foresight construct, including in market entry & analysis (*market sensing*), competitor monitoring and in directing organizational development interests. Rohrbeck (2011) investigated corporate foresight maturity within firms, in which dimensions such as sensing, culture, network & people were used as measures of foresight Sensing may be considered a data processing capability that may help organizations perceive and manage risks better. Through the utilization of sensing tools that amplify latent manifestations of change (early enough) firms can both exhibit foresight capabilities and show resilience. As a known measure of corporate foresight practice within organizations "organizational sensing" capabilities may be able to support the strengthening of a firms' adaptive capacity and enable agile responses to change. This study aimed to investigate this potential relationship.

2.0 LITERATURE REVIEW

2.1 Sensing

Management literature on "organizational sensing capabilities" as a concept is situated within the Dynamic Capabilities theory. It's thus an organizational attribute within dynamic capabilities, consisting of "sensing", "seizing" and "reconfiguring". Sensing includes the "analytical systems used to learn and to sense, filter, shape, and calibrate opportunities" and it includes all processes that empower an organization to aggregate and deploy market originated data; learn about customers and familiarize with competitors (Wagner, Wenzel, Wagner & Koch, 2017). Sensing empowers firms to close any information gap relating to near-term and long term incidences, often with immense benefits. Lindblom, Olkkonen, Mitronen and Kajalo (2008) gave the opinion that market-sensing is a crucial aspect of future-oriented behavior. Moreover, sensing emerging strategic risks can position one to optimally avoid risks and also generate risk-powered performance; which turns risk into value (Deloitte, 2015). Cirjevskis (2009) described sensing as "identifying, and assessing new emerging opportunities". Sensing as an organizational capability has been shown through numerous conceptual and empirical studies to provide diverse benefit to a firm by enabling important inputs such as information and broader corporate awareness.

Some scholars argue that the variability in organizational awareness of environments, reflect the variation in management's willingness to carry out sensing activities, where poor sensing activities portrays reasonable vulnerability to environmental challenges. In this perspective, researchers postulate that organizational sensing is usually not a default managerial action, since managers are poised to be bound in their perception or distracted by managerial task of the moment. Jovanovic (2015) noted that manager may manifest a default tendency to mostly concentrate on their firms' ongoing strategies, therefore the proclivity to spot unrelated data and other environmental stimuli, are significantly reduced, and so they may gravitate toward "actively ignoring" data which doesn't align or rally round the strategy. It implies that the proper utilization of sensing as a foresight process is an active and thoughtful management process, typically designed to deliver specific benefits. Jovanovic further noted there may be changes happening in an organization's environment or industry, but managers may simply fail to detect these changes because their attention is on personal strategies. Knowing about the change anticipated in any dynamic environment is a precursor to crafting successful responses (Rohrbeck, 2011). This notion constitutes the premise of all management efforts at environmental sensing. While environmental changes may be sudden or gradual, proponent of sensing as an essential management tool posits that influence of changes and high dynamism in an environment can - in both cases - be ameliorated through proper sensing and responses. Klabish (2018) noted that organizations need to establish formal processes for staying in optimal touch with the space they dwell in and by doing that prepare for uncertainty; create scenario plan: and establish processes for reacting to change.

2.2 The concept of Organizational Resilience

Resilience involves the skill and ability to regain positive posture following adversity, frustration, and misfortune and it is essential for the effective organization (and effective leader too). Also, Jung (2017) suggest that understanding organizational resilience will yield the opportunity to access a diverse spectrum of "adaptive capacities" by leveraging the opportunity to rally resources and facilitate successful adaptation in unpredictable situations. According to Woodman and Musgrave (as cited in Sahebjamnia, Torabi & Mansour, 2018) organizations are increasingly embracing the unfolding truth about having proactive dispositions, including Integrated Business Continuity and Disaster Recovery Planning (IBCDRP) for protecting personal lives, preserving reputation and reducing financial losses. Present research around resilience is predominantly driven by the growing consciousness that some of the inherent capabilities that make organizations resilient overlap with the elements of organizational competitiveness. Thus the resilient organization is a competitive organization. During intense business disruption, only resilient organizations will survive the severe limitations and engineer prosperity over the long term (BSI Group, 2017). The socio-psychological roots of resilience, which informed and shaped opinion on the subject (as a management phenomenon) has numerous examples on the hallmarks of resilience for individuals/organizations and the mechanisms that deliver measurable benefits in moments of crises or severe psychological stress. In addition, Annarelli and Nonino (2016) reviewed organizational resilience literature and reported that extant literature is still far from reaching a consensus on strategies for developing organizational resilience. Given the relatively nascent state of management inquiry into the nature, practices

and influence of organizational resilience on firms; this study will be invaluable in expanding relevant knowledge.

2.2.1 Adaptive Capacity

Adaptive capacity is a system's means of orchestrating adjustment, modification, or changes in its traditional ways, for the purpose of moderating any potential damage; taking advantage of unfolding opportunities or coping with shock (Jones, Ludi & Levine, 2010). Within the dynamic capabilities theory, adaptive capacity is a recognized strategy for optimizing competitiveness. This is relevant because, when confronted by serious environmental dynamism, effective organizations should act in tandem with the requirement to re-align existing competencies in other to reflect current realities.

Brooks *et al*., (2004) noted that adaptive capacity is a systems' inherent ability to alter its characteristics or behavior and expand its coping range. To confer resilience on an organization, adaptive capacity should bring the company to reform its course or known pathway. Studies suggest that the inability to achieve a commensurate shift in paradigm when situation calls for it; will have unpleasant and even undesirable outcomes. In contemporary management thinking; that exemplifies a low or non-existent adaptive capacity. Smith and Wandel (as cited in Kolka, 2013) noted that adaptability requires firms to practice self-renewal and achieve deviations in trajectory when necessary. Using adaptive capacity to access resilience is common among management theorists and practitioners. Adaptive capacity may be *reactive*, (Adapting to present conditions and reacting to changes) or *proactive* (ability to forecast changes based on signals) (Gorley, 2012). Reactive adaptive capacity confers resilience capabilities on organization while proactive capabilities utilize foresight (sensing and seizing) to also deliver resilience for organizations. Since its common to see firms pass through notable dynamism such as shifts in consumer lifestyle, increased competition or abrupt transformation in technology; the overriding postulation of adaptive capacity is that meaningful environment shifts must be matched by a commensurate shift in routine activities, resources or response strategy.

2.2.2 Agility

Organizational agility describes the firm's tendency to sense change and achieve a swift response to unpredicted changes, by flexibly assembling resources, processes, knowledge and capabilities (Yang & Liu, 2012 as cited in Applebaum *et al*., 2017). While organizations should react to variations, it's been noted that within rapidly changing and high uncertainty environment, the *speed and rapidity* of organizational response to change will be the paramount factor of success. Sherehiy and Karwoski (2014) noted that agility is an enabler of competitive business advantage and good business performance. Agility within management discipline has originated from to the idea of "agile manufacturing" in production; an attempts to empower organizations toward meeting the expectations of a changing marketplace; achieve rapid alteration in product and factor evident flux in customer need (Zitkiene & Deksyns, 2018).

Furthermore, organizational agility emphasizes speed and flexibility as the most desirable attribute of resilience (Gunasekaram, 1999 as cited in Nafei, 2016). The 2011 study by

Bessant et al., (as cited in Nafei, 2016) defines agility as the proactive posture to change. Agility prompts practice and perfection of a timely use of the workforce, resources and "know-how" in order to achieve a response to environmental dynamism or perceived change. It suggests that organizations that are constrained by slow systems and bureaucratic decision making routines may be incapable of reacting speedily to change and may thus fail to overcome inherent challenges.

Thus organizational agility encompasses all the dispositions of a company that aids responsiveness. Sarker and Sarker (2009), viewed agility as a diverse idea demonstrating three aspects, namely: the resources, some processes and linkages. Hitt *et al*., (as cited in Nafei, 2016) reported that organizational agility is a forward-looking administrative status and strategy that targets resources stabilization and the fulfillment of customer desires in a timely manner. Agility enables the elimination of procedural and behavioral barriers to a timely reaction in every day activity. Agility also provides the right kind of structural versatility needed for thriving in dynamism.

Objectives of the study

a) To examine the relationship between sensing and adaptive capacity
b) To determine the relationship between sensing and organizational agility

Research Hypotheses

H_{01}: There is no significant relationship between sensing and adaptive capacity of oil and gas firms in Nigeria

H_{02}: There is no significant relationship between sensing and organizational agility of oil and gas firms in Nigeria.

3.0 RESEARCH METHODOLOGY

A quasi-experimental research design was used for the study. Cross sectional survey was carried out with the aim of investigating the relationship between organizational sensing and organizational resilience (resilience measured by adaptability and agility) of oil and gas companies in Nigeria. The study population consisted of 190 senior managers and unit heads of 36 oil and gas companies covering upstream, midstream and downstream companies. Sampling was done using both purposive and random sampling techniques. Out of this accessible population, a sample was drawn using the Krejcie and Morgan sampling formula which yielded a sample size of 152 respondents. Survey data was collected through questionnaire. The predictor variable sensing was adapted from the work of Rohrbeck (2011). One measure of the criterion variable adaptive capacity was adapted from the work of Lee et al., (2013), while the other measure "agility" was adapted from the work of Waribugo (2018). All variables where measured based on the 5 point liker scale. The study instrument was duly subjected to a test of reliability using the Cronbach Alpha test, with results obtained meeting or exceeding the 0.7 Cronbach Alpha value considered a threshold by Nunnally, (1978). Principal Component Analysis (PCA) was used to determine the eigenvalues of the instruments items, which was

used to ascertain the contribution of each statement. The eigenvalues were above the threshold of 1.0 (Kaiser's criteria). Inferential statistics carried out on the data collected was done with Structural Equation Modeling (SEM) and the outputs was deployed to test the hypotheses and predict the relationship between the two main constructs of sensing and organizational resilience.

4.0 RESULTS AND DISCUSSION

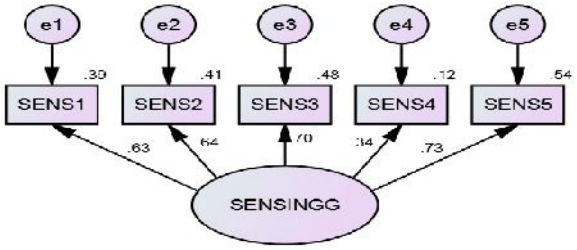

Figure 1.0: Measurement Model of Sensing

Table 1.0: Measurement Model Analysis of Sensing

Model	**Chi square significance**	**GFI**	**NFI**	**CFI**	**RMSEA**	**MODEL**	**FACTOR LOADINGS**	**SQUARED MULTIPLE CORRELATION**
SENSING CAPABILITY	(2df)=3.898 p=0.142 CMIN/DF=1.949 Acceptable Limits	1.000	.999	1.000	0.000	SENS1	.625	.391
						SENS2	.640	.409
		.90	.90	.950	.080	SENS3	.696	.485
						SENS4	.340	.115
						SENS5	.735	.540

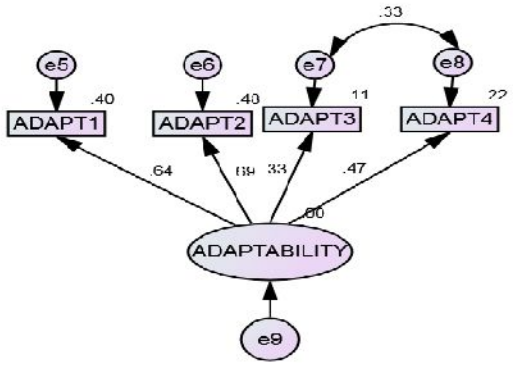

Figure 2.0: Measurement Model of Adaptive capacity

Table 2.0: Measurement Model Analysis of Adaptive Capacity

Model	**Chi square significance**	**GFI**	**NFI**	**CFI**	**RMSEA**	**VARIABLE**	**FACTOR LOADINGS**	**SQUARED MULTIPLE CORRELATION**
	(1df)=1.133	0.995	0.984	.998	0.033	ADAPT 1	.635	.404
FIRM	p=0.287					ADAPT2	.691	.477
ADAPTIVE CAPACITY	CMIN/DF=1.133							
	ACCETABLE LIMIT	0.90	0.90	0.95	0.08	ADAPT3	.333	.111
						ADAPT4	.474	.225

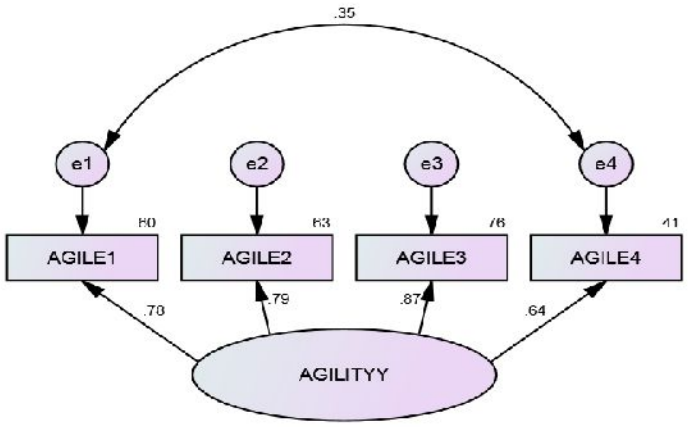

Figure 3.0: Measurement Model of Agility

Table 3.0: Measurement Model Analysis of Agility

Model	**Chi square significance**	**GFI**	**NFI**	**CFI**	**RMSEA**	**VARIABLE**	**FACTOR LOADINGS**	**SQUARED MULTIPLE CORRELATION**
AGILITY	(1df)=.607 p=0.436 CMIN/DF=.607	0.998	0.997	1.000	0.000	AGILE 1	0.775	.601
						AGILE2	0.791	.626
	ACCETABLE LIMIT>>>	0.90	0.90	0.95	0.08	AGILE3	0.871	.758
						AGILE4	0.637	.405

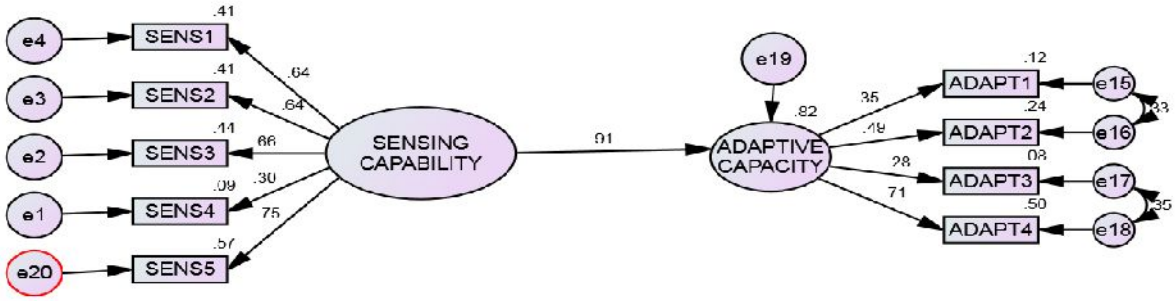

Figure 4.0: Structural Model of Sensing and Adpative Capacity

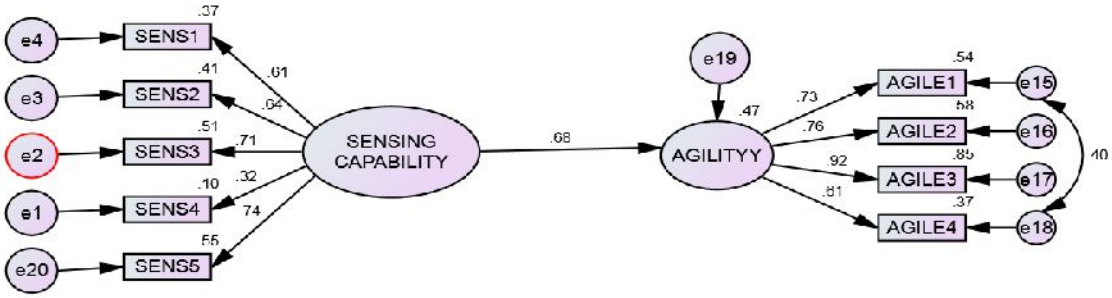

Figure 5.0: Structural Model of Sensing and Agility

Test of Hypothesis

H_{01}- There is no significant relationship between sensing and adaptive capacity

Table 4.1

Regression Weights	1.107
Standardized Regression Weight(**β**)	0.908
Squared Multiple correlation (R^2)	0.821
Critical Ration (CR)	2.322
p-value	0.020<0.05

To test this hypothesis, a structural model of scope of scanning and Adaptive capacity was created. The results of the analyses are shown in below. Model parameters: (Standardized Regression Weight (β) = 0.908; Squared Multiple correlations (R^2) =82.1%, p-value = 0.020<0.05). This means that when sensing goes up by 1 standard deviation, **Adaptive capacity**

goes up by 0.908 standard deviations. Thus an increase in corporate foresight in terms of Sensing Capability results also in an increase in organizational resilience (as indicated in firm's adaptive capability).

H_{02}- There is no significant relationship between sensing and agility

Table 4.2: Result of standardized and unstandardized regression estimate of the model

Regression Weights	1.737
Standardized Regression Weight(**β**)	0.684
Squared Multiple correlation (R^2)	0.467
Critical Ratio (CR)	2.931
p-value	0.003<0.05

This hypothesis attempted to investigate the relationship between a company's sensing capability and organizational Agility by using the above structural model. The results are shown thus: Model parameters: (Standardized Regression Weight (β) = 0.684; Squared Multiple correlations (R^2) =46.7%, p-value = 0.003<0.05). This means that When **Sensing capability** goes up by 1 standard deviation, **Agility** goes up by 0.684 standard deviations. Thus an increase in corporate foresight in terms of sensing capability results also in an increase in organizational resilience (as indicated in firms Agility).

Interpretation of results and discussion of finding

For hypothesis H_{01}: given that the model fit results shown above have confirmed that the structural model used in the analysis was fit enough in representing the relationship between the data and the hypothesized relationship, and based on the fact that model parameters: **(β =.908 , R^2=82.1%; p= 0.020<0.05);** indicates that a positive and significant relationship exists between the sensing capability of firms and organizational adaptive capacity. These empirical results do not support the Null hypothesis 01 (H_{01}) which states that There is no significant relationship between sensing capability and adaptive capacity. Rather, this study asserts that corporate foresight (measured using firms sensing capability) has a positive and significant effect on firms adaptive capacity.

For the second hypothesis (H_{02}): since the model fit results shown above have confirmed that the structural model used in the analysis was fit enough in representing the relationship between the data and the hypothesized relationship, and based on the fact that model parameters: **(β =.683, R^2=46.7%; p= 0.003<0.05);** indicated a positive and significant effect of sensing capability of firms on organizational Agility. These empirical results do not support the Null hypothesis five (H05) which states that There is no significant relationship between sensing

capability and Agility. The study concludes that corporate foresight (measured using firms sensing capability) has a positive and significant effect on firms Agility.

5.0 CONCLUSIONS

The study provides practical clues for applying organizational sensing; in building the important capabilities of adaptability and agiltty, thereby helping organizations to craft resilience. If proper sensing enables upstream, midstream and downstream companies to act resiliently, these organizations will then be capable of effectively managing and thriving in moments of crises. They can as well respond quickly in the face of challenges, by quickly assessing and deploying all necessary resources. Furthermore these organizations shall also sustain positive adaptive postures, reinvent themselves and change when required.

5.1 Recommendations

1. Nigerian Oil companies should understand the measures of resilience namely: Adaptive capacity and Agility, in order to optimize the potential benefits of any organizational sensing efforts since these variables provide evidence of resilience capability when they are acquired through sensing.
2. Furthermore, Sensing and proper management of information arising from it ought to be well developed for managing future opportunities and unseen problems.

5.2 Contribution to Knowledge

This study has provided empirical evidence and a valuable knowledge repository which management practitioners and researchers can leverage in their efforts to better understand the nature of environmental uncertainty; specifically the benefits, principles and practices of Organizational Sensing, as an aspect of management discipline. It also provides an empirical foundation for any corporate discussion and activity that targets organizational resilience.

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