Enterprise Risk Management Determinants and Operational Excellence: A Structural Modelling Approach

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Abstract
Operational excellence as a strategy had helped improve the performance of firms across industries. This paper is aimed at determining the role of some enterprise risk management determinants in the implementation of operational excellence in the oil and gas sector. The study provides an improved framework that could help oil firms increase productivity, reduce health and safety issues, and enhance environmental performance. A survey research design was adopted and a structural equation modelling, specifically PLS-SEM was employed in the analysis of data collected from seven subsidiary firms of Nigeria National Petroleum Corporation, purposively selected. The findings suggest that regulatory framework, staff capacity, information technology and firm characteristics could have a significant effect on operational excellence implementation in the oil and gas sector. The findings prepare the firms on how to improve health and safety, operational efficiency by reducing cost and wastage, enhance assets and process reliability and improve environmental performance. The study fills a knowledge gap in the field of operational excellence by exploring a hybrid conceptual model that combine technology and people to explain operational excellence, especially in the Nigerian oil and gas industry. The limitation of the study was its inability to generalise findings because of the purposive sampling technique employed.

Keywords: Operational excellence, regulatory framework, firm characteristics, staff capacity, information technology.

1.0 Introduction
Health, safety and the environment are some of the significant challenges facing oil and gas sector globally. Issues of increasing cost of finding and lifting oil and gas and the volatility of the market are so daring to oil firms today (Mustapha, Umeh and Adepoju 2015). The risky nature of operation in the sector makes it more rewarding for investment, as such pushed stakeholders to demanding for a higher return on investment. Organisations today are operating under increasing pressure to improve productivity, improve quality, reduce cost and waste, minimise lead time, optimise efficient asset utilisation and flexibility (Ernst and Young 2015; Fok-Yew and Ahmad 2014; Kandasamy 2016). Operational excellence was adopted by some of the international oil companies (IOCs) to manage such pressure by reducing containment loss by 40-50% and minimised 98.5% production deferrals (McCreery, Philips and Cigala 2013). Operational excellence (OE) reduces the cost of production, health and safety, increases productivity, efficiency and in the end, more profit was realised (Buckler 1996; Ernst and Young 2015). Unfortunately, only a few National Oil Companies (NOCs) employed the strategy to improve performance to compete with their international counterparts (IOCs).

The challenge of competition and strive to balance it with national revenue results into increasing sacrifices that have to be made by the NOCs. Consequently, that led to inefficiencies, lack of strategic focus, price subsidies, poor maintenance of assets, disturbing health safety and the environment (HSE) situation and lots more (Muazu and Tasmin 2017). Oil and gas is the strength of the Nigerian economy with 37 billion barrels of oil and 188 trillion cubic feet of gas reserves (Natural Resource Governance Institute (NRGI) 2017). Nigerian oil and gas sector has consistently been the major revenue (77%) earner, as it contributed 10.79% to GDP (NEITI 2016).

Revenues accumulated to the government from royalties and penalties from 2014-2016 amounted to 2.1 trillion naira (DPR 2016) and the oil sector remained one of the major foreign investment attractions. The situation in the Niger Delta oil-rich region is worrisome, as issues of environmental degradation are visible, which has continuously given rise to militancy and illegal oil bunkering (Mustapha et al. 2015). Thus oil firms have to contend with an out-of-court settlement of some of these issues, which invariably increases the cost of production and trigger further safety challenges of people and assets (Uzochukwu and Ossai 2016). Figures of HSE incidents are alarming in the Nigerian oil sector. Department of Petroleum Resources (DPR) as a regulator of the industry reported that 00% of incidents increases from 2010-2016. Above all, the country still imports refined petroleum products because the country's three refineries are performing far below capacity negating to as low as 5% to 15% from year 2012-2016 (DPR 2016).

Ostebo et al. (2018) maintained that as a matter of priority, effectiveness of HSE management, cost control, quality and sustainability are top-most in the oil and gas sector; as such it needs a reliable, safe and cost-effective strategy to achieve that. It is therefore essential to note that operational excellence (OpEx) as a strategy offers an opportunity for the oil sector to combine its operational rudiments that guarantee sustainable business ideals (Wilson 2012). It is true that OE is demonstrated through integrated performance across risk, revenue and cost (Heath *et al*., 2017). In essence, the implementation of OE in the oil sector could bring about improved HSE performance, competitiveness, productivity, which in the end boosts revenue generation and eventual growth of the industry.

On the theoretical note, majority of studies conducted on operational excellence were majorly focussing on manufacturing and service sectors. For example studies conducted by Moktadir et al. (2020) on leather industry, Soliman (2017), Bellm (2015), Fork-Yew and Ahmad (2014), and Chetiya and Sharma (2014) general manufacturing. Those studies on the service sector include Shehadeh et al. (2016), Sutton (2012) on telecommunication. Other studies industry by in the Nigerian oil sector had shown that there is a lot more to do to get out of the current situation of the industry. A study by Ifeanyichukwu (2010) on the benefits and level of operational excellence had revealed that OE implementation in the oil firm surveyed indicated an improvement in the performance and competitiveness of the firms. Nevertheless, health, safety and the environment (HSE), efficiency were recognised as requiring improvement. Oke and Kareem (2013) researched on the level of efficiency in the Nigerian oil sector and the results shows a 0.51 data envelopment technical inefficiency level, which is not good enough. The researchers recommended that the country's oil industry should strive beyond just cutting the cost of production to adopting international best practices in operations by intensifying staff training to increase competence. Similar findings by Adam (2014) on NNPCs' operational effectiveness, efficiency and economy suggest that NNPC doesn't add value to the petroleum products and poor organisational structure affects its operations, political encumbrance, and incompatible regulatory system also slows down its operational performance. A survey conducted on the Nigerian oil sector by PricewaterhouseCoopers (PwC) (2014) found that authority's interference, poor infrastructure, corruption, and compliance problems are factors responsible for the sector's inability to achieve operational excellence. Other impeding factors are inadequate planning, lack of requisite skills, poor project governance and lack of coherence between operational undertakings and business strategies.

Considering the outcomes of early studies on operational excellence in the oil and gas industry and especially Nigerian, recommendations and the real situation of the sector as explained. This study is aimed at determining the effects of regulatory framework, staff capacity, information technology and firm characteristics on operational excellence program in the Nigerian oil industry. It is believed that the findings will add to the body of knowledge of operational excellence and set a new direction on how to overcome some of the challenges hindering the performance of the sector and perhaps help in improving NNPC competitiveness as an NOC.
The main objectives of the study therefore are:

1. To determine the combined effect of enterprise risk management determinants on operational excellence in the Nigerian oil and gas industry.
2. To determine the individual effect of enterprise risk management determinants on operational excellence in the Nigerian oil and gas industry.
3. To develop a conceptual framework on the relationship between enterprise risk management determinants and operational excellence in the oil and gas industry.

2.0 Literature Review

2.1 Operational Excellence

Operational Excellence (OpEx) is understood as a management strategy with a cohesive system that facilitates performance improvement across all functions of the organisation to meet up with best in class practices. The term 'operational' means assembling and distribution of a product or service to achieve a particular task (Mitchell 2015). Excellence on the other hand is that exceptional practice displayed by companies in management and outcomes accomplishment (European Foundation for Quality Management (EFQM) 1999; Mitchell 2015). Ernst and Young (2015), Mitchell (2015) and Moktadir et al. (2020) considered OpEx as a combination of ideologies that promotes sustainable improvement of critical performance metrics. OpEx originated on the bases of continuous improvement concept of organisational undertakings, such as Lean manufacturing and scientific management (Antony, Escamilla and Caine 2003). OpEx is also in way related with operational performance, which consist of measures on cost efficiency, resource effectiveness, quality, flexibility (Zhu et al. 2018) and waste minimization (Dev, Shankar, and Qaiser, 2020). There are many views of what operational excellence is all about across sectors (Muazu and Tasmin 2017; Hines, Holweg and Rich 2004). Industries such as manufacturing, service, and oil and gas are conceptually looking at operational excellence construct from different dimensions (Muazu and Tasmin 2017). This article focused on oil and gas. Thus the narrowed meaning of OpEx in the sector was discussed.

OpEx is a strategy that focuses on efficient resource management, which is comprised of assets, safety and health of people (Ernest and Young 2015; Van Assen 2012; Duggan 2009). This view of OpEx is peculiar to the oil and gas sector. It was maintained that to achieve OpEx, the philosophy of continuous improvement, employees' involvement is critical (Fok-Yew and Ahmad 2014; Duggan 2009). OpEx is the systematic management safety of process, personal safety, and health, environment, reliability and efficiency to achieve world-class performance (Ernst and Young 2015; Chevron 2010). Russell and Koch (2009) maintained that OpEx is about having a strategy management capability, excellent execution of the plan in a speedy and low-cost manner and continuous processes improvement. OpEx embedded business process improvement approaches in industries for the past three decades, which include Six Sigma, Lean manufacturing, continuous improvement, business process management, and process excellence (LNS 2016; Jaegera, Matyasb and Sihn 2014; Muazu and Tasmin 2017). However, OpEx was also understood beyond just lean management and continuous improvement (Duggan 2011). OpEx is wide-ranging because it prioritised the achievement of the firm's goals and the manner it would be accomplished (Duggan 2011). Accordingly, Moktadir et al. (2020) reviewed key performance indicators of OpEx, which is comprised of management, operation efficiency, environmental performance, customer sati, social (including staff safety), quality and economic. Thus it could be argued that OE expectations in the oil and gas sector are safety management, health, environment, reliability and operational efficiency.

2.2 Regulatory framework

Regulations are viewed as principles, rules, or laws planned to control or govern behaviour of people, group of individuals as organisations or societies (Rabeau 1998). These regulations are made by government, written in the constitution or are prepared by other institutions of government. A regulatory framework is thus considered as the macro-level phases that a regulator must attain to convey regulations to its subjects (Rabeau 1998). A regulatory framework is systematised string of analyses that outline the need for regulations, the implementation instruments aimed at changing or averting certain conducts, and the assessment of the effectiveness and efficiency of the mechanisms in achieving policy objectives (Evans 1998). A regulatory framework could be argued as a combination of fundamental and indispensable structure to a set of rules or laws governing phenomena or system. These combinations have to do with the types of regulations, types of agencies, for which subjects (industry, societies or business), review and enforcement. Those regulatory bodies, regulations and enforcement of the laws governing oil and gas operations in Nigeria are used as dimensions of regulatory framework in this study.

2.3 Firm characteristics

Firm characteristics could be those inner features firms possessed. These features make companies differ, perhaps their nature of business, organisational structure, their kinds of target markets, and maybe size of their operations. Ping and Muthlevoo (2015) and Yazid *et al*. (2012) see firm characteristics as size, investment and the industry affiliation of the firm. Board of directors, ownership structure (limited or public) are what made up firm characteristics (Hartley and Medlock 2012). Those distinctive attributes of a firm like organisational culture, manufacturing, service or oil and gas are all considered as firm characteristics. In the financial sector, they look at the level of stock performance in the capital market, volatility, earnings level, market share, and risk profile as firm characteristics (Kogan and Papanikolaou 2012). Parte-Esteban and Garcia (2014) regarded firm characteristics on market constructs, business strategy, ownership structure, audit function and control variables. Pett and Wolff (2003) considered firm characteristics dimensions as strategy, performance, export experience, and size in a study conducted in the U.S. SME sector. The research had a mixture of both operational and financial dimensions of firm characteristics. Mahfoudh (2013) viewed and used firm size, leverage, liquidity and board size as measures of firm characteristics. Under the current study, firm size, assets, industry, ownership structure, organisational were used as dimensions of firm characteristics.

2.4 Staff capacity

Capacity is the competency and ability of an individual to perform a particular task. It is mainly about skills that could be developed through learning. Capacity building is the process of enhancing the capabilities of individuals, groups, and organisations to marshal and use resources for achieving their objectives on a sustainable basis (UNDP 2002). Capacity building entails activities aimed at increasing the competencies and effectiveness of individuals and organisations (Muazu and Ibrahim 2016; Stryk, Damon and Haddaway 2011). These activities such as training are used as tools for building capacities of employees in organisations. Training is utilised across industries to build and improve capacities of people to engage in productive activities (Muazu, K-Mata and Sagagi 2016). Training and development are exercises used by organisations to update their workforce capacities in attitude and knowledge that would help them accomplish their responsibilities effectively (Raymond, Bawa and Dabari 2016; Okechukwu 2017). It is an injection of new and better ways of carrying out employee’s tasks. It is also expected that training would make staff acquire new skills and competencies on how to improve their job performance for the success of the firm. In the current study training, the frequency of training, types, content, method and evaluation are used as the measures of staff capacity.

2.5 Information technology

The importance of information technology (IT) to organisations is overwhelming. Information technology is a system that commonly accepted and used in carrying out transactions, provide information, record data, make decisions or perform a task across different industries (Lucey 2005). It brings about modernisation and digitisation of work processes, with just a press of a button. IT helps facilitate speed in communication and feedback. The role of IT in the realisation of efficient and cost-effective operation is practically clear as it affects every function in the operation processes of the oil and gas sector. There are three operational enterprises IT capabilities such as cost and performance, service and sourcing (Pearlman and Saunders 2010).

3.0 Methodology

A quantitative survey research approach was utilised in the current study and questionnaire were administered on a sample of 179 respondents from seven subsidiaries of Nigeria’s NOC (NNPC). A purposive sampling was used because a technique that allows choice of respondents by the researcher based on certain qualities, experiences or characteristics they possess (Etikan, Musa and Alkasim 2016; Tongco 2007) is. In the current study, the focus was on engineers and managers from operations, Health Safety and Environment (HSE), engineering and maintenance, and human resources departments. A five-point Likert scale was considered for the response measurement. SPSS was used for the preliminary data analysis, and structural equation modelling was used for the data analysis, specifically PLS-SEM. For reliability, validity and other measurements of the data are presented in Table 1 as well as thresholds and criteria for performing such an assessment.

Table 1: PLS-SEM assessment criteria

Proven and suggested benchmarks	Measurement Value	Purpose	Classification of assessment models
Hair et al. (2014)	≥ 0.708	Variable variance measurement for causal construct	Indicator reliability
Nunally and Bernstein (1994) Hair et al. (2010)	$a \geq 0.70$	internal consistency measurement of latent constructs	Cronbach's Alpha
Nunally and Bernstein (1994) Hair *et al*. (2010)	$pc \geq 0.70$	Measurement of internal consistency	Composite reliability
Fornell and Lacker (1981), Hair *et al*. (2010)	AVE > 0.50	Average variation measurement amongst items of a construct	Average Variance Extracted
Fornell and Lacker (1981)	AVE > latent variables correlations	Measures distinction among variables and their variability of indicators	Fornell-Larcker criterion
Variable loading on any two or more factors	> 0.50	The minimum factor loading	Cross-loadings
Hair, Ringle and Sarstedt (2011)	0.25 weak 0.50 moderate 0.75 strong	Measures predictive power of the independent variables (exogenous) on the dependent variable (endogenous)	R^2 (Coefficient of determination
Higher indicator indicates strength to cause variance	nearer to 1	Measures individual variable strength of variance in the dependent variable	Beta coefficient
Cohen (1988), Rice and Harris (2005)	f^2= 0.02 weak f^2= 0.15 medium f^2= 0.35 large	Measures of relative impact of an independent variable on dependent variable	Effect size f^2

3.1 Conceptual Framework

The conceptual framework depicts the flow and direction of variables relationship in the study. It shows how firm characteristics, staff capacity, regulatory framework and information technology as independent variables relates to operational excellence as the dependent variable. The diagram in Figure 1 shows the conceptual framework that showed the linkage between the study variables. It indicated that regulatory framework, information technology, firm characteristics and staff capacity are positioned as the independent variables, while operational excellence (OpEx) was the dependent variable. The conceptual framework in Figure 1 further shows the flow of influence or direction of the hypothesised relationship between variables of the study.

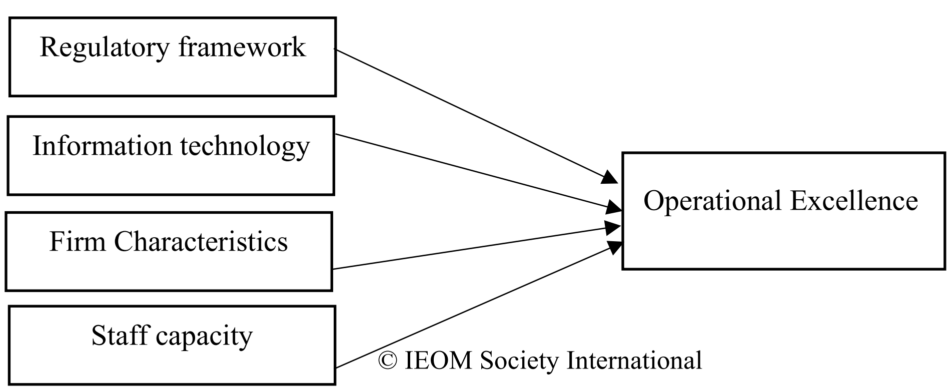

Figure 1: Study conceptual framework

4.0 Results of analysis

4.1 Structural model measurement and validation

There are four exogenous independent variables (latent constructs) and one dependent variable (endogenous constructs), a total of five variables (constructs). The five constructs indicators are reflective in direction and comprise both first and second order constructs. Hair et al. (2014) posited that confirmation of reliability and validity of the data is essential in PLS-SEM.

Composite reliability indicated that operational excellence (OpEx) constructs had 0.929, 853, 0.817 and 0.841 for safety and health (OSH), operational efficiency (OEF), the reliability of assets (ORA) and environmental performance (OEP) respectively as the endogenous construct. While regulatory framework (RFR) - 0.902, firm characteristics (FCH) - 0.893, information technology (IT) - 0.864 and staff capacity (SCP) - 0.933. The result in Table 2 indicated that the 0.7 thresholds adopted as suggested by Hair *et al*. (2012) were even exceeded. It is an indication that constructs item were adequate and reliable enough to measure the constructs of the study.

The convergent validity was assessed by the AVE values accepted from 0.5 (Hair *et al*., 2014). The AVE for all the variables as presented in Table 2 shows that AVE for the endogenous constructs is 0.652, 0.543, 0.532, and 0.638 for OSH, OEF, ORA and OEP respectively. These of the exogenous are FCH – 0.550, IT – 0.624, RFR – 0.865 and SCP – 0.639. The results indicated that all the AVEs are well above the acceptable benchmark.

Table 2: Constructs model assessment

Constructs	Indicators	Composite reliability	Indicator loadings	AVE
1. Operational excellence:				
safety and health	8	0.929	0.738 - 0.808	0.652
operational efficiency	4	0.853	0.584 - 0.817	0.543
reliability of assets	4	0.817	0.595 - 0.839	0.532
environmental performance	3	0.841	0.779 - 0.820	0.638
2. Firm characteristics	8	0.905	0.569 - 0.856	0.550
3. Information technology	5	0.892	0.697 - 0.860	0.624
4. Regulatory framework	5	0.865	0.696 - 0.798	0.561
5. Staff capacity	8	0.933	0.626 - 0.865	0.639

The indicator loadings as seen in the measurement model in Figure 2 indicated that operational excellence dimensions had factor loadings ranging from 0.738 - 0.808 for OSH, 0.584 - 0.817 for OEF, 0.595 - 0.839 for ORA and 0.779 - 0.820 for OEP. That of the exogenous constructs FCH ranges from 0.569 - 0.856, IT starts from 0.697 - 0.860, RFR 0.696 - 0.798 and SCP ranges from 0.626 - 0.865. All the factor loadings are well above the 0.50 adopted for the current study, where any item below that was removed from the structural model.

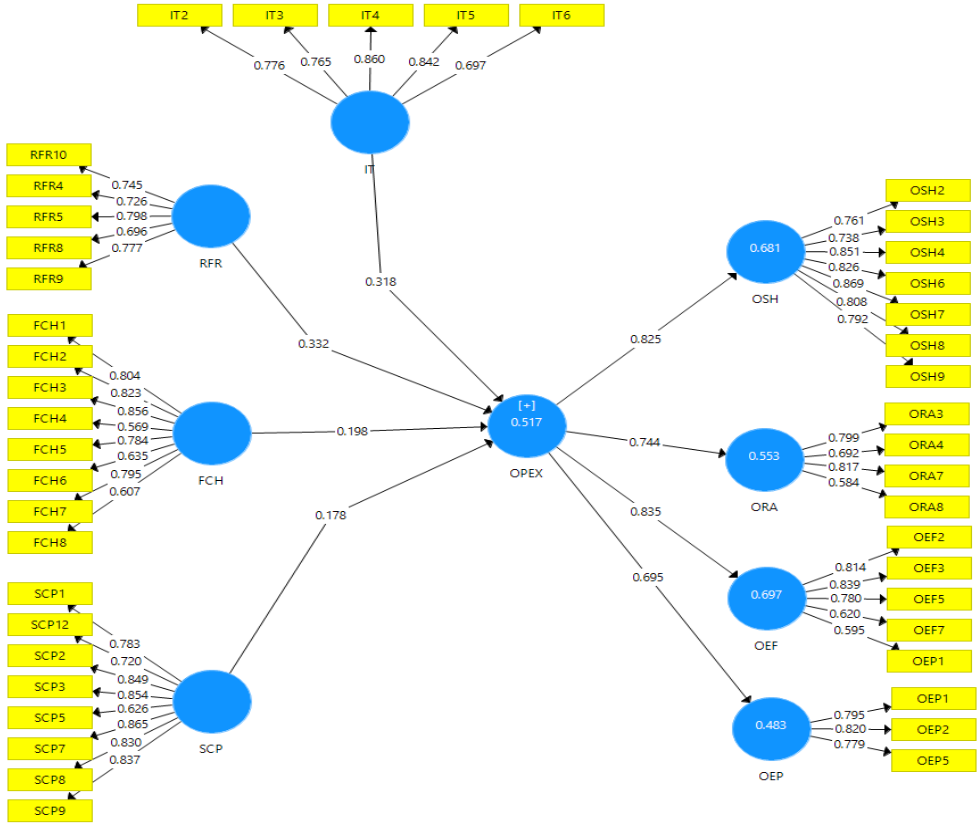

Figure 2: Measurement Model

The discriminant validity was measured by Fornell-Larcker criterion. The results in Table 3 showed that the coefficients of the square roots of the AVE (shaded) are all larger than the correlations between model constructs, which means that the criterion requirement is met as opined by (Henseler and Fassott, 2010).

Table 3: Fornell-Larcker Criterion Discriminant Validity Test

Constructs	**FCH**	**IT**	**OEF**	**OEP**	**ORA**	**OSH**	**RFR**	**SCP**
Firm Characteristics	0.741							
Information Technology	0.289	0.790						
Operational Efficiency	0.410	0.510	0.737					
Environmental Performance	0.360	0.433	0.692	0.799				
Reliability of Assets and	0.430	0.385	0.653	0.499	0.729			
Safety and Health	0.248	0.427	0.483	0.414	0.435	0.808		
Regulatory Framework	0.342	0.395	0.474	0.461	0.412	0.496	0.749	
Staff Capacity	0.122	0.291	0.290	0.279	0.265	0.350	0.247	0.799

4.2 Structural model estimation

The PLS-SEM model evaluation is a combination of four steps, which include testing of level relationship (significance or non-significance) between exogenous and endogenous constructs, collective power of variance (R^2), effect size assessment and evaluation of model predictive strength (Hair *et al*., 2014; Henseler *et al*., 2014). The path coefficients, t-values, and factor loadings of the model are shown in Figure 3 below.

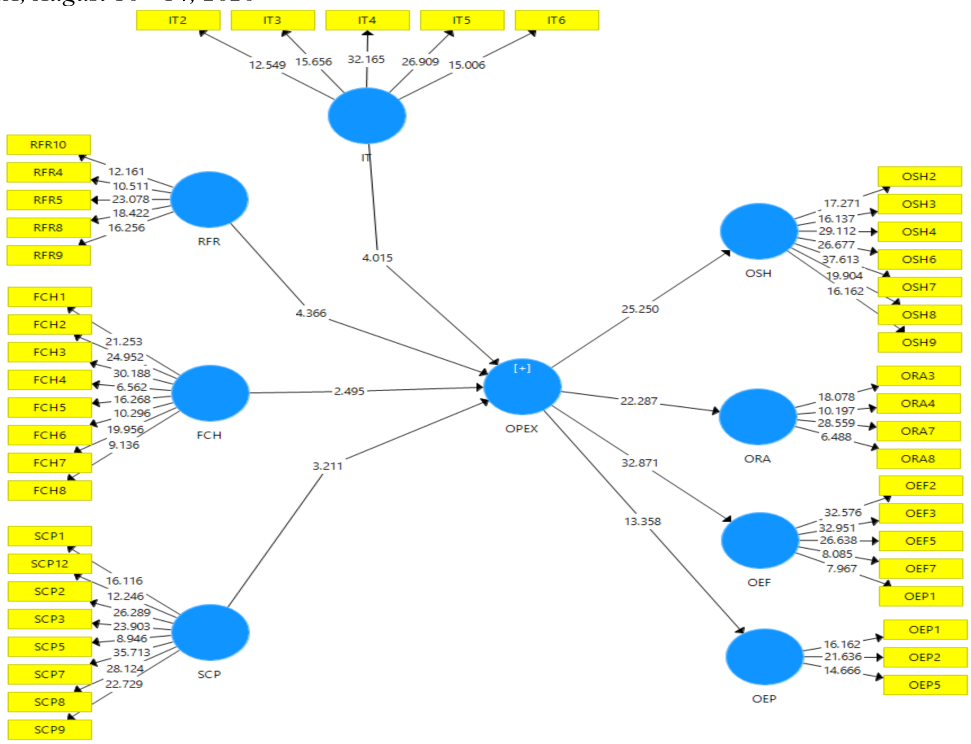

Figure 3: Study Structural Model

4.3 Path coefficients and determination

The relationship between the exogenous latent constructs (regulatory framework, firm characteristics, staff capacity, and information technology) and OpEx was determined through path coefficient. Level of significance and strength of the estimations were used to measure the level of the relationship. Positive path coefficients near 1 means the relationship is strong and positive, and vice-versa. After bootstrapping the t-values, effect size and the p-values are arrived at in PLS-SEM. The p-values are significant at < 0.05 and $\mathbf{f^2}$ 0.02, 0.15 and 0.35 are considered small, medium and large effects respectively (Cohen, 1988; Hair et al., 2010). The findings are shown in Table 4 below indicated that all path coefficients are positive, which means that the exogenous latent constructs have a positive relationship with the endogenous in the model. Also, all the exogenous latent constructs p-values are within the threshold of $p<.05$. The effect (f^2) size result shows that small and medium are the effect sizes in the relationship in the model.

The Coefficient of determination R^2 measures the combined effect of all exogenous latent constructs on the endogenous latent construct in a structural model (Hair *et al.*, 2014). The R squares (R^2) in the structural model is shown in Table 4 below. Operational excellence is $R^2 = 0.517$ which is equal to 57.1% variance made on the endogenous construct by a combination of all the latent exogenous constructs. The R^2 results point out that the exogenous latent constructs have significant effects on the endogenous construct (Operational excellence) in the Nigerian oil and gas industry.

Table 4: Path Coefficients and Determination

Relationship	Beta	t-values	p-values	f^2	R^2
Firm characteristics > OpEx	0.198	2.495	0.013	0.069	
Information technology > OpEx	0.318	4.015	0.000	0.163	0.517
Regulatory Framework > OpEx	0.332	4.366	0.000	0.176	
Staff capacity > OpEx	0.178	3.211	0.001	0.058	

The result indicated that regulatory framework > OpEx (β=.332, t=4.366, p=.000) is having the most robust relationship with OpEx as shown in Table 4. The result of the p-values, beta and t-values mean that there is a strong positive and significant relationship between regulatory framework and operational excellence in the Nigerian oil and gas sector. Also, the effect size $f^2 = 0.176$ shows a strong medium effect of regulatory framework on operational excellence.

Information technology > OpEx (β=.318, t=4.015, p=.000) was the next higher in the relationship with the endogenous construct as shown in Table IV below. The result of the p-values, beta and t-values suggest that there is a strong positive and significant relationship between information technology and operational excellence in the Nigerian oil and gas sector. Also, the effect size $f^2 = 0.163$ shows a medium effect of information technology on operational excellence.

Staff capacity > OpEx (β=.178, t=3.211, p=.001) was the third in the strength of the relationship. The result of the p-values, beta and t-values presented in Table IV indicated that there is positive and significant relationship between staff capacity and operational excellence in the Nigerian oil and gas sector. Also, the effect size $f^2 = 0.058$ shows a small effect of staff capacity on operational excellence.

The fourth in result in the ranks is that of Firm characteristics > OpEx (β=.198, t=2.495, p=.0013). The result presented in Table 4 of the p-values, beta and t-values show that there is a strong positive and significant relationship between firm characteristics and operational excellence in the Nigerian oil and gas sector. Also, the effect size $f^2 = 0.069$ shows a small effect of firm characteristics on operational excellence.

5.0 Discussion

The findings of the current study had established that regulatory framework could play a significant positive role in operational excellence in the oil and gas industry. The oil and gas sector as one of the most regulated industries in the world due to its inherent risky operations, it is believed the result is in tune with realities in the sector. The HSE factor compliance, reliability of assets and process are the directly affected inner constructs of operational excellence in the oil and gas by regulatory framework, as such there are enormous regulations and regulatory bodies governing the sector's operations. The findings further revealed the importance of regulatory framework in the operational performance of the oil sector, as it provides the enabling environment for the companies in the industry to function. The findings of the current study are in line with what earlier studies found. Studies such as these of Ramanathan *et al*. (2017); Bolu (2011); Kassinis and Vafeas (2006); Majumdar and Marcus (2001); and Viscusi (1986), their findings also shows that regulatory bodies, regulations, enforcement, and penalty positively affects operational excellence. What distinguished the current study in the application of regulatory framework with other studies is that they used regulatory agencies, regulations, and enforcement as distinct independent variables while this research combined them to form the regulatory framework.

The findings of the current study revealed and reaffirmed the roles IT could play in the oil and gas operations, from the oil rig-refining-filling station. It is often deployed for surveillance of people, assets, products delivery to customers, corrosion cases, leakages and maintenance needs. IT had been used for work process integration, such that problems from the oil rigs could be communicated to the control centre via video conferencing in real time. Such that flying engineers via choppers to fix such kinds of problems may not arise except for severe cases of emergency. It means that time and resources would be saved, and process reliability would be improved. In the end, efficiency would be achieved, and health, and safety as well as downtime maintenance and environmental performance could be optimised. The current result is also in conformity with the position of Lucey (2005) that IT helps in simplifying and reducing physical jobs skills and therefore integrating production and operations processes. It thus means that oil and gas companies should invest in information technology enhance their performance towards excellence. The findings of the current study further correspond with earlier results from studies conducted by Ratna and Kaur (2016); Bellm, (2015); and Wang, Chen and Benitez-Amado (2015). Explicitly, IT integration (Wilson *et al*., 2015; Amue and Ozuru, 2014), IT infrastructure, competencies and security (Jeffers *et al*., 2008; Ward and Zhou, 2006; Ajamieh, 2016) were as well found to be significantly related to operational excellence as the present research shows.

Operational efficiency (minimal cost of production, improved quality, minimal wastage) could be achieved when staff have the requisite capabilities. Furthermore, when staff have a new culture on safety, health and environmental incidents caused by human factors such as forgetfulness, inexperience, wrong instructions or carelessness could be minimised. The result, therefore, suggests that when the staff capacities of an organisation are built through regular professional training and they are being evaluated we could argue that operational excellence could be achieved when staff have the aptitude to perform their jobs. The findings of the current study reaffirm earlier results from earlier studies carried out by Danziger and Dunkle (2005) training and involvement; Parast *et al*. (2011) skills; Sung and Choi (2011) and Wang *et al*. (2015) competence. However, the findings of Jalil *et al*. (2014) shows that staff training have an insignificant relationship with operational excellence. The inference for the result is that assets and process reliability, as a dimension of OpEx, could be attained with staff who possess the technical expertise to run and maintain machineries and as well manage operational processes.

The current study findings imply that ownership, size, nature of business, organisational culture, the industry of affiliation and volume of assets could influence operational excellence in the Nigerian oil and gas sector. The result of Hartley and Medlock (2015) has shown that government ownership structure of NOCs negatively affect operational efficiency in the oil sector. This structure gives room for political interference and corruption, and it also causes a lot of wastage in a system. Organisational culture (information flow, work ethics accountability) as characteristic of the firm could as well influence how employees communicate and take responsibilities of operational activities in the firm. The volume of assets and size of the firm is another factor that influences operational excellence in the oil and gas as the result suggested. It is therefore essential to note the importance firm's characteristics in the prediction of operational excellence. The findings of the current study are similar to those of past studies. Their results indicated significant effect of firm characteristics on operational excellence (Hartley and Medlock, 2012; Kheni, Dainty and Gibb, 2008; Grace, Leverty and Shimpi, 2010; Kisengo and Kombo, 2012; Anderson *et al.*, 2004; Yazid, Razali and Hussin, 2012; Hoyt andLiebenberg, 2008; Waweru and Kisaka, 2012). However, very few studies findings were contrary to exixting standings on the relationship between firms chracteristics and operational excellence. For example research conducted by Hartley and Medlock (2012), their results showed a negative relationship between firm's characateristics and operational excellence.

The few study objectives outlined in the second section of the current study were all achieved in the following manner. Firstly, determining the combine effect of enterprise risk management (ERM) determinants on operational excellence was achieved using the R^2 coefficient of 0.517, representing 51.7% variance in operational excellence. It is very sufficient to say that the determinants of ERM could predict OpEx in the oil and gas and it has attained and exceeded the minimal acceptable threshold of 0.25 variance (Hair *et al*., 2014). Secondly, determining the individual effects of the ERM determinants on OpEx was also achieved by using Beta P. values of the variables. In Table 4 all the beta coefficients and P. values were quite above the adopted thresholds and therefore could be argued that the second objective of the study was achieved. Thirdly, developing a conceptual framework was as well been done as seen in Figure 1 above, depicting the flow and direction of the relationships among the study's postulated variables.

6.0 Conclusion
The study investigated how enterprise risk management determinants influence operational excellence. The research was able to establish how regulatory framework, information technology, firm characteristics and staff capacity influences operational excellence in the Nigerian oil and gas sector. It signifies how important regulations compliance and regulatory bodies are in the undertakings of oil and gas firms for attaining operational excellence. The importance of investment in information technology and deployment in the operations of oil and gas firm was pointed out, as it relates to areas of security surveillance of assets and people, work process integration,

supply chain management and maintenance needs. The importance and need to build staff capacity to achieving organisational goals was emphasised in the current study as suggested by the findings. Also, the role of firm characteristics could play in operational excellence implementation was discussed. This papers' contribution to the body of knowledge was the use of enterprise risk management determinants on operational excellence as against change management factors that were used by some previous studies. The current research laid a foundation for further research in operational excellence in the oil and gas because very few studies focussed on the sector, as most of the studies were on the manufacturing and services sectors. The limitation of the study was the focus on national oil companies and the purposive sampling method, which will not allow generalisation of findings in other contexts. Future studies could be a mixed of change management factors and enterprise risk management determinants as variables to explain operational excellence. Also, a random sampling technique could be employed for the survey and maybe combine both privately owned and public oil and gas firms in Nigeria as respondents. More importantly, an introduction of a mediating variable could further broaden the findings of the current and previous researches in the relationship between enterprise risk management and operational excellence.

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8.0 Biographies

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