

QUALITY MANAGEMENT TECHNIQUES AND OPERATIONAL PERFORMANCE: EMPIRICAL INSIGHTS FROM OIL AND GAS SERVICING COMPANIES IN NIGERIA

BY

Mbaa BARIATE

Garden City Premier Business School, Port Harcourt, Nigeria

mbaa_bariate@gacpbs.edu.ng

Nsikan JOHN

Covenant University, Ota, Ogun State, Nigeria

nsikiman5000@gmail.com

Abstract

This study investigates the relationship between quality management techniques and operational performance among oil and gas servicing companies in Nigeria. Using the descriptive survey, primary data were collected from 242 operations managers, quality assurance managers, and quality control technicians who were randomly drawn from the oil and gas sector. Data analysis was achieved through the multiple regression analysis and the factor analysis. The results indicate that Quality Audit, ISO 9000 certification, Benchmarking, and Business Process Re-engineering were positively related to operational performance in terms of service delivery, learning, and growth. The study therefore recommends, among others the full-scale implementation of quality management techniques (Quality Audit, ISO 9000, Benchmarking, and BPR) to improve their service delivery and organisational learning. The adoption of these techniques can result in reduced costs, increased efficiency, foster innovation, and build an operational competitive advantage.

Keywords: *Quality Management, Quality Audit, Benchmarking, PBR, Organisational Learning and growth*

Introduction

The oil and gas industry plays a significant role in the sustenance of national and global economies- they promote industrial development,

reduce poverty, create massive job opportunities, and provide public revenue through tax income. Other strategic roles they play in an economy include the provision of skilled manpower and high technology for the oil industry, the provision of infrastructure and social amenities in the host communities as well as provisions for the general economic well of their staff, state, and the nation at large (Mohrman & Von Glinow 2018; Chai, 2019). As such, they are key factors in the value chain of the oil industry and economic development of developed and developing economies (Vujovic 2008; Soon, 2015). More so, as these firms continue to operate in an environment characterized by high uncertainty, and invest more in technology, manpower, and research and development (Oluleye 2022).

Collaborating with this view, Adam (2014) also noted that the operating environment of oil servicing companies in Nigeria is extremely complex, volatile, and prone to rapid changes. Complexity in this subsector of the oil industry stems from fluctuation in oil prices, technological innovation, government regulatory policies, and the high cost of labour, while volatility of this subsector of the oil industry stems from increased demands from oil-bearing communities and youth restiveness in the country among others.

Equally, the subsector is prone to rapid changes arising from changes in quality, speed, methods, and techniques of service delivery to oil companies. To succeed in the volatile environment of the oil industry, oil servicing firms rely on technical change, heavy investment in high technology, and intellectual capital to sustain performance and attain competitive advantage (Bruton & Wan, 1994; Mohrmana & Von-Glinow 1990). On the contrary, Kaynak and Hartley (2005), and Sharma (2006) have argued that in the long run, oil servicing firms must adopt good quality management practices to sustain improved performance and competitive advantage in the oil industry. Supporting this view, Pfeffer (2001) suggested that firm-specific skills and the adoption of quality management techniques can help oil servicing firms improve their performance and sustain competitive advantage. The authors further noted that the effective use of quality management techniques also explains performance variance among oil servicing firms in the oil industry in developed and developing countries.

According to Sharma (2006), quality gurus have put forth several quality management techniques that can help organizations in different industries improve performance and sustain competitive advantage. Some of these techniques include total quality management (TQM), Six Sigma, top-down and bottom-up approach, cost of quality, quality circle, quality audit, kaizen, Iso, benchmarking, business process re-engineering among others (Fernandes, 2014; Milanoi, 2016).

In the opinion of Lakhal, Pasin and Liman (2006), effective implementation of these quality management techniques can improve the overall business performance of firms by reducing costs, rework, waste, scrap etc. It can also improve productivity, service delivery, sales, market share and enable firms to offer their products and services at lower price (Sousa & Voss, 2002). Quality management techniques can also help firms improve efficiency, sustain competitive advantage, and increase returns on investment and profitability. In the same line of thinking, some studies (Kaynak & Hartley 2005; Popa 2011; Barros, Sampaio & Sarvia, 2014; Milanoi 2016) have explored the impact of quality management techniques and other quality management improvement efforts on the performance of firms in different industries in developed and developing countries. Their findings revealed that quality management techniques have inconsistent and complex impacts on the overall performance of firms as well as variability in their operational performance in different industries.

On the contrary, there are empirical studies ((Powell, 2005; Flynn, Schroeder & Sakakibara, 1995; Easton & Jarrell, 1998; Kaynak, 2003; Montes, Jover & Fernandez, 2003; Pinho, 2008) which found that the application of quality management techniques consistently improves general performance of firms in different industries. As such, there is a link between quality management techniques and the performance of firms in different industries.

However, empirical research in extant literature has not specifically explored the relationship between the broad bundle of quality management techniques and the performance of oil servicing firms in Nigeria. Hence, this study is set to fill the gap empirically by investigating the link between quality management techniques and performance of oil servicing companies in Nigeria. Delic *et al.*, (2014) suggested that management of oil servicing

firms need to adopt quality management principles and practices in their principles and their operations to improve performance.

Similarly, Popa (2011) Opine that effective use of firm specific skills, multi skills and quality management techniques would help organizations overcome low performance problem. Collaborating this view, Ferhandes (2014) submitted that oil servicing firms need to consistently implement quality management techniques in their operations to achieve optimal performance and effective customer service delivery in the oil industry. As Tuchman and Seashome (2017) noted, oil servicing companies in recent time have adopted quality management techniques in their operations, yet the problems of low performance still continue unabated.

Milano, (2016) conducted a study on quality management technique and performance of service providers in oil industry of Indonesia. The objective of the study was to assess the relationship between quality management technique and performance of service providers in the oil industry of Indonesia. The research design was descriptive survey method. A sample of 70 service providers in the oil industry of the country was selected which is 12.75% of the target population. Data were collected using a structured questionnaire and analysed using descriptive and inferential statistics. The results of the study revealed a positive relationship between quality management techniques and performance of service providers in the oil industry of Indonesia. Hence the study recommended that service providers should adopt and implement other quality management techniques that would improve their performance in the oil industry of Indonesia.

Nangi (2016) studied quality audit and performance of oil servicing companies in Nigeria. The objective of the study was to examine, the relationship between quality audit and performance of oil servicing companies in Nigeria. The study adopted a survey design. Data were collected through a questionnaire instrument using Likert's five-point scale. The data were analysed using Pearson's Product Moment coefficient of correlation and regression analysis. The findings of the study revealed a statistically positive correlation between quality audits and the performance of oil servicing companies. The study recommended continuous quality audit practices by all oil servicing companies to enable them to sustain improved performance in the industry.

The review above shows that several research studies have been conducted on quality management techniques and the performance of oil servicing companies. However, the review shows a paucity of such studies on the operational performance of oil servicing organizations. Also, there seems to be no study conducted on quality management techniques and performance of oil servicing companies in the Niger Delta region of Nigeria where there are a plethora of oil and gas activities. Hence, this study is carried out to fill the above-stated knowledge gap by examining the relationship between quality management techniques and operational performance in the Nigerian Oil and Gas sector.

Methodology

The study was carried out using the survey research design because of its suitability for the collection of qualitative data and its general acceptability in management and social sciences research to which this study naturally belongs. Moreover, survey designs enable wide generalization of findings. In this study, a descriptive survey approach was employed. This was chosen in recognition of its appropriateness in dealing with the complex variables that existed in the study. Data for this study were collected through the questionnaire, using the face-to-face approach. The data was obtained from 242 operation managers, quality assurance, and quality control managers in the sector using a simple random sampling method. The Cronbach's Alpha coefficient was used to test the reliability of the research instrument. The results of the Cronbach Alpha analysis are shown in Table 1.

Table 1 Cronbach Reliability Statistics

Variables	Dimensions/Measures	Alpha Value
Quality Management Techniques (Predictor)	Quality Audit	0.868
	ISO 9000 Practices	0.864
	Benchmarking	0.832
	Business Process Re-engineering	0.804
Performance of Oil Servicing Companies (Criterion)	Customer Service Delivery	0.807
	Learning and Growth	
Moderating	Management Leadership	0.843
	Average Reliability Statistics	0.800

Results and Discussion

Factor Analysis

Firstly, factor analysis was used to test if the related independent variables could be analysed in one factor. Factor analysis is an analytic method of discovering the general dimensions represented by a collection of actual variables. These general dimensions or factors are calculated hypothetical dimensions that are not perfectly represented by any of the empirical variables under study but are highly associated with a group of empirical variables.

Table 2: Confirmatory Factor analysis test using the KMO

Variables	Determinant	KMO Sampling Adequacy	of Sig
Quality Audit	0.6475	0.9291	0.000
ISO 9000 Practices	0.8051	0.7651	0.000
Benchmarking	0.6051	0.7921	0.000
Business Process Re-engineering	0.8924	0.7451	0.000
Customer Service Delivery	0.9383	0.8802	0.003
Learning and Growth	0.9693	0.7174	0.016
Management Leadership	0.7311	0.8802	0.000
Technology	0.901	0.7281	0.001

The output above shows all determinant statistics to be above 0.0001. The KMO (Kaiser-Meyer-Olkin) of sampling size is greater than 50% (0.5) in all employed dimensions and measures further showing that each principal component deduced from the myriad of items in the questionnaires is true representative of the questionnaire items and are therefore very reliable. The significance levels are all below 0.05(5%) which leads to the rejection of the null hypothesis of no structure detected. These therefore confirm the suitability of our principal components and as such show the variables viable for subsequent tests.

Parametric Checks

Due to the nature of the Pearson Product Moment and Regression analysis, the internal parameter of study variables will be carried out using the normality test.

Table 3 Summarized Parametric Test Check Output

	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability	Observations
Quality Audit	1.000000	-1.61892	3.584707	2.091734	0.0226	214
ISO 9000 Practices	1.000001	-1.52853	3.177841	1.704938	0.0251	214
Benchmarking	1.000000	-1.24505	1.698484	8.946257	0.0018	214
Business Process Re-engineering	1.000001	-1.37634	2.626869	1.251868	0.0119	214
Customer Service Delivery	1.000001	-1.40631	2.982724	1.368203	0.0100	214
Learning and Growth	1.000000	-0.94353	1.201620	4.177134	0.3098	214
Management Leadership	1.000021	-0.63815	1.176240	3.794031	0.0398	214
Technology	1.000001	-1.64281	3.906274	1.187503	0.0270	214

Based on the above table, it can be easily identified that the standard deviation of all variables is one. The rule of thumb for a normally distributed data in light of the standard deviation is that the statistics or deviation must lie between 1 or be close to one. This is easily the case as seen from table above which therefore shows good parametric tendencies in the study variables as deduced from the deployed questionnaires.

As a rule of thumb, a skewness should be between -1 and -0.5 or 0.5 and 1. Any skewness less than -1 or greater than 1 shows that the distribution is highly skewed of all employed variables. The average responses associated to these variables must most likely be evenly distributed over the four-point Likert scale. While for other dimensions and measures, their respective responses must most likely be “highly” skewed negatively. Similarly, a skewness close to zero shows a non-normally distributed data which is not the case with our study variables. The kurtosis which shows the sharpness and height of the central peak is meant to be with the range of -2 and 2 and in some cases -3 and 3 (Kim, 2013). It can be seen that majority of the variables fall between this bracket and are therefore seen as normally distributed.

The Jarque-Bera probability level shows that all variables have probability level greater than 0.05(5%), this therefore reaffirms the evidence of normal

distribution in the sample as the null hypothesis of normal distribution is highly upheld in the model.

Table 4 Model Summary 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.826 ^a	.817	.805	.1946593
a. Dependent Variable: customer service delivery in oil servicing companies				
b. Predictors: (Variable), quality audit, ISO 9000 practices, Benchmarking and business process re-engineering				

Table 5: Model Summary 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.741 ^a	.713	.709	.130525872
a. Dependent Variable: learning and growth in oil servicing companies				
b. Predictors: (Variable), Quality Audit, ISO 9000 practices, Benchmarking and business process re-engineering				

From the result in the above tables, it was discovered that the independent variables employed for the study accounted for 82% variations in model 1 and 71% variations in model 2. This indicates a good fit in the two models as the remaining 19% variations in model 1 and 29% variations in model 2 were accounted for by other variables not captured in the employed models.

Table 6 ANOVA 1

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	5.554	5	1.388	4576.395	.015 ^b
	Residual	315.446	217	.995		
	Total	221.000	222			

a. Dependent Variable: customer service delivery in oil servicing Companies

b. Predictors: (Variable), Quality Audit, ISO 9000 Practices, Benchmarking and business process re-engineering

Table 7 Anova 2

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	6.024	5	1.388	3676.518	.021 ^b
	Residual	356.496	231	.995		
	Total	331.000	236			

a. Dependent Variable: learning and growth in oil servicing companies

b. Predictors: (Variable), Quality Audit, ISO 9000 practices, Benchmarking and business process re-engineering

From the ANOVA result presented above which is a test of the variables employed in both models, it shows if the predictor variables of the study significantly affect the dependent variable. From the outcome of the test, a significant value of 0.015 percent was unraveled and this connotes that the predictor variables of the study significantly affect the criterion variable.

The study observes from the adjusted R-square value of 0.735 that all employed dimensions jointly accounted for up to 73.5 percent of the variation in the criterion variable as captured in the above model. The F-statistics value of 4576.395 at a significance level of 0.005 which is lower than the 0.05 significance shows that the model is well-fitted. This means that the employed variables go hand-in-hand and as such are well-blended.

Conclusion and Recommendations

There is evidence that quality audit has a positive significant relationship with customer service delivery. Thus; we conclude that quality audit is a significant variable that influences customer service delivery of oil servicing companies in the study area. There is evidence that quality audit has a significant and positive association with learning and growth. Thus, we conclude that quality audit significantly and positively affects the learning and growth of oil companies in the study area. There is evidence that ISO 9000 Practices and customer service delivery are significantly and positively related. Thus, we conclude that ISO 9000 practices have a significant and positive effect on the customer service delivery of oil companies in the study area. There is evidence that ISO 9000 practices influence learning and growth. Thus, we conclude that ISO 9000 practices

affect learning and growth in the study area. The following recommendations are made:

- Managers of oil servicing companies should strategically improve effectively and efficiently their firms' quality management techniques to ensure robust enhancement of their performances.
- Oil servicing companies should be technology savvy. Technology is a critical moderating and influencing variable concerning the performance of oil servicing companies. A high-tech oil servicing company, *Ceterius paribus*, should perform excellently well.
- Employees in oil servicing companies especially in the area of total quality management should be constantly trained and educated so that their skills and technical competence can be employed in driving the quality management techniques.
- Governments are advised to create and enforce a regulatory framework that encourages and supports the adoption of quality management practices by oil and gas firms. This is capable of promoting sustainability, protecting the environment, and advancing national interests.

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