Empirical Investigation of the Unit Technical Cost of Oil Production and Critical Petroleum Investment Challenges in Nigeria

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ABSTRACT

The inability of the market economy to withstand the impact of periodic fall in global oil price in Nigeria may be attributed to high unit technical cost of oil, exchange rate volatility, government policies, corruption, and insecurity, among others. Hence, the main aim of this study is to determine if the current unit technical cost of producing oil in Nigeria is sustainable for economic growth and attractive to investors. The study objectives include investigating the current unit technical cost of oil production and its sustainability for economic growth in Nigeria, establishing critical controls on the cost per barrel of oil, and finally identifying critical investment challenges for oil operation and production in Nigeria. Both primary and secondary data were sourced and analyzed using ordinary least square regression, descriptive statistics and inter-rater reliability statistical test. Primary and secondary dataset of Nigeria oil industry operation and economic variables between 2008 and 2018, with specific focus in the period of global oil price change between 2014 and 2018 were analyzed. The primary data include survey data collated from a sample population across technical professionals and managers in multinational and indigenous companies operating in Nigeria. The secondary data set for this study were sourced from Wood Mackenzie database, Knoema statistical database, Central bank of Nigeria (CBN) database, Nigeria National Petroleum Corporation (NNPC) database, and the National Bureau of Statistics (NBS). The study uses multiple regression techniques to investigate the relationship that exist between macroeconomic variables. Also, inter-rater statistics of within-group agreement and average deviation were used to test the reliability of survey findings. The study concludes that security expenses, field operation and maintenance, community-related expenses, and engineering hardware importation increases unit technical cost of production in Nigeria. Also, fluctuation in crude oil price; exchange rate volatility and inflation have significant influence on gross domestic product (GDP), economic growth and sustainability. The critical factors that control the cost per barrel of oil in Nigeria include high security and community-related expenses, high importation cost, and inefficient government policies. Delay in the passage of the Petroleum Industry Bill and the Petroleum Industry Governance Bill hampers investment into the oil sector by international oil firms. Finally, the study has shown the critical investment challenges for oil operation and production in Nigeria to include high-cost per-barrel of oil production, security challenges and ineffective government policies.

Keywords: Unit Technical Cost; Petroleum; Oil Prize; Investment Challenge; Exchange Rate; Economic Growth

INTRODUCTION

Nigerian is ranked the 10th largest producer of oil, as well as the 6th largest exporter of oil in the world and has generated billions of dollar revenue for over fifty years from the oil sector (Esira and Ikechukwu, 2013). Oil was discovered in the Niger Delta in Nigeria over half a century ago by Shell. Since then, Shell and other multinational oil companies including Chevron, Agip, Texaco, Total, Exxonmobil, and the state-owned oil company, Nigeria National Petroleum Corporation (NNPC) as well as local indigenous companies, have become the main investors in the country's oil and gas sector. However, irrespective of being an oil-producing major for decades Nigeria is still considered one of the poorest nations in the world. Over the years the Petroleum Industry had played a dominant and strategic role in the economic development of Nigeria (Azaikki and Shagari,

2007). Income generated from crude oil sales accounted for approximately 80% of government revenue in Nigeria. In fact, the revenue generated from crude oil sale is being used to benchmark government budgets and the subsidization of domestic petroleum product price annually (Cashin et al, 2004). Oil price responds to demand and supply, with a direct impact on economic activities in the country. Hence, according to Madueme and Nwosu (2010), increase in global oil price may lead to rise in oil-per-barrel cost of production and consequently production cut by national and multinational oil companies. A wall street Journal survey of twelve oil-producing countries had placed Nigeria third behind United Kingdom and Brazil as one of the most expensive nation to produce oil with an average of $28.99 cost of production per barrel (SPTEC Advisory from Energy Mix Report, 2017).

AIM AND OBJECTIVES OF THE STUDY

The main aim of this study is to determine if the current unit technical cost of producing oil in Nigeria is sustainable for economic growth and attractive to investors.

The specific objectives of this study include

1. To investigate if the current unit technical cost of oil production is sustainable for economic growth in Nigeria.
2. To establish the factors that controls the cost per barrel of oil in Nigeria.
3. To identify critical investment challenges for oil operation and production in Nigeria.

RESEARCH HYPOTHESES

In order to achieve the objectives of the study, the following null (H0) and alternative (H1) hypotheses were tested:

H0: Oil price has no significant effect on GPD and economic sustainability in Nigeria.

H1: Oil price has significant effect on GDP and economic sustainability in Nigeria.

H0: Security, community, safety and environment expenses are not the critical cost drivers for high operating oil production cost in the Niger Delta Nigeria.

H1: Security, community, safety and environment are the critical cost drivers for high operating oil production cost in the Niger Delta Nigeria.

H0: Government policies do not have any impact on oil operation and investment in Nigeria.

H1: Government policies have significant impact on oil operation and investment in Nigeria

DATA SET AND METHODOLOGY

The study employed primary and secondary dataset of Nigeria oil industry operation and economic variables over a period of 10 years between 2008 and 2018 with specific focus in the period of global oil price change between 2014 and 2018. The primary data include survey data collated from a sample population of the Nigeria oil industries operating in the Niger

Delta onshore fields. For purpose of confidentiality the field names and onshore fields were not disclosed. Hence, survey questionnaire was designed to facilitate primary data collation which was used to validate the analysis and interpretation of the secondary data. The questionnaire was emailed online to 50 respondents across technical professionals and managers in multinational and indigenous companies operating in Nigeria.

DESCRIPTION OF RESEARCH VARIABLES

The variables for this study are grouped into economic variables and cost variables. The economic variables include gross domestic product, exchange rate, inflation; while the cost variables include crude oil price, cost-per-barrel of oil production, field support service expenses, field safety and environmental expenses, field security service expenses, field community expenses, work-over and rig-related expenses, core operations and maintenance expenses. The variables are generally classified as dependent and independent variables. The dependent variables include GDP and operating cost of per-barrel of oil production, while the independent variables include oil price, exchange rate, inflation, and component production costs.

MACRO ECONOMIC MODEL SPECIFICATION

The impact of crude oil price, inflation, and exchange rate on GDP was estimated. Also, the cost impact of security, field operations and maintenance, work-over and rig operations, host communities, safety and environment, and field logistics on cost-per-barrel were analyzed. The following models were formulated to investigate the relationship between variables.

Y=a0 + a1 +a2 +a3 +a4.....equation 1

Where Y=GDP, a0= regression constant, a1, a2, a3, and a4 are unknown parameters.

GDP=f (Oil price + exchange rate +inflation)

This implies that

GDP=a0 + a1Oil price +a2exchange rate +a3inflation…… equation 2

Similarly

X=b0 +b1 +b2 +b3 + b4 + b5 +b6…… equation 3

Where X=Cost-Per-Barrel of Oil, b0= regression constant, b1, b2, b3, b4, b5, and b6 are unknown parameters

Cost-Per-Barrel= f (Security + Field Operation & Maintenance + Work-over & rig operation +Host community + Safety & Environment + Field logistic).

This implies that

Cost-Per-Barrel= b0+b1Security + b2Field Operation & Maintenance + b3Work-over & rig operation + b4Host community + b5Safety & Environment + b6Field logistic……equation 4

DATA PRESENTATION AND ANALYSIS OF RESULT

The impact of oil price, exchange rate volatility, and inflation on gross domestic product was investigated using multi-regression analysis. Oil

price, exchange rate and inflation were used as the predictor variables, and gross domestic product as the outcome variable. The regression statistics gave values of the multiple regression and square of regression as are 0.91 and 0.83 respectively, as well as probability value 0.021 for the analysis of variance (Table 1). The square of regression of 0.83 implies that 83% of the predictor variables can be attributed to GDP, while the probability value of 0.021 shows the result is statistically significant. Also, unit technical cost of oil production was analyzed using security expenses, field operation cost, logistic cost, field operation and maintenance expenses work over and rig expenses, safety and environmental related expenses as predictor variables. Similarly, the regression statistics for the operating cost components gave values of the multiple regression and square of regression as 0.75 and 0.57 respectively, as well as probability value 0.02 for the analysis of variance (Table 2). The regression statistics shows that 57% of the predictor variables can be attributed to the unit technical cost of oil production, while the probability value of 0.02 implies that the results are statistically significant. Table 3 shows the within-group agreement rating and average deviation among respondents for the Likert-scale multiple choice research questions.

Table 1: Regression Result of Macro Economic Variables

Regression Statistics						
Multiple R	0.91					
R Square	0.83					
Adjusted R Square	0.74					
Standard Error	58.69					
Observations	9					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	3	86881.871	28960.624	8.408	0.021	
Residual	5	17222.171	3444.434			
Total	8	104104.042				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	442.28	130.13	3.40	0.02	107.76	776.79
X Variable 1	1.62	0.87	1.86	0.12	-0.62	3.86
X Variable 2	1.84	0.59	3.10	0.03	0.31	3.37
X Variable 3	-41.27	8.31	-4.97	0.00	-62.63	-19.92

Table 2: Regression Results of Operation Cost Components

Regression Statistics						
Multiple R	0.75					
R Square	0.57					
Adjusted R Square	0.40					
Standard Error	5.45					
Observations	23					
ANOVA						
	df	*SS*	*MS*	*F*	*Significance F*	
Regression	6	622.42	103.74	3.49	0.02	
Residual	16	475.82	29.74			
Total	22	1098.24				
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95.0%*
Intercept	1.41	3.38	0.42	0.68	-5.75	8.57
0.12	3.63	3.09	1.17	0.26	-2.93	10.18
2.09	-0.38	0.27	-1.39	0.18	-0.96	0.20
0.02	8.68	16.34	0.53	0.60	-25.97	43.33
1.21	10.61	4.30	2.47	0.03	1.51	19.72
4.85	-0.40	0.55	-0.73	0.47	-1.56	0.76
0.73	-2.66	1.27	-2.09	0.05	-5.36	0.04

Table 3: Interrater Reliability Agreement Test

Respondents	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1	4	4	5	5	4	4	4	4	5	4	4	5	5
2	5	2	4	2	2	4	4	4	5	4	4	5	5
3	5	4	5	5	4	4	3	3	5	5	5	4	4
4	4	3	4	4	4	4	2	2	3	2	4	5	4
5	4	3	5	4	4	4	3	3	4	3	2	3	3
6	5	4	5	5	4	4	3	3	4	3	5	5	4
7	4	4	5	5	4	4	4	4	5	4	4	5	5
8	5	4	4	4	4	4	4	3	4	5	4	5	3
9	4	4	5	4	2	3	4	3	4	3	4	5	4
10	3	3	4	4	3	4	4	3	4	3	5	5	5
11	4	3	5	2	2	4	4	5	4	5	5	5	5
12	5	4	5	4	5	4	4	4	4	2	4	5	4
13	3	3	5	5	5	4	5	4	5	4	3	5	5

14	4	4	4	4	3	4	3	4	4	4	4	4	5
15	5	3	3	4	4	5	2	4	5	3	5	5	4
16	5	5	5	4	4	4	2	2	3	4	4	5	5
17	3	4	5	4	3	4	4	3	5	5	5	4	5
18	3	4	5	4	2	4	5	3	5	5	5	5	4
19	3	4	5	4	4	4	4	4	4	4	4	5	5
20	4	4	5	3	4	2	2	2	4	3	4	4	4
21	3	3	5	4	4	4	3	3	4	4	3	4	3
22	3	4	4	4	3	4	4	4	4	4	4	3	3
Within Group reliability interrater agreement on multiple items, rWG(j)=0.985													
Average deviation of respondents rating on multiple items, Adm(j)=0.007													

DISCUSSION OF RESULTS

Hypothesis 1 predicts gross domestic product from oil price, exchange rate volatility and inflation. The multilinear regression results show strong positive relationship between GDP and the oil price as well as exchange rate volatility. Because Nigeria depend mainly on the oil sector for revenue generation, the fall in oil price and the resultant currency devaluation implies reduced earnings and decrease in GDP. Consequently, the null hypothesis is rejected, and the alternative hypothesis accepted. Hence, the hypothesis H1: Oil price has significant effect on GDP and economic sustainability in Nigeria. GDP remain a very important measurement index for economic growth and sustainability. In the last decade, oil price has remained critical variable for benchmarking budget. In 2015 the oil price per dollar decreased below the annual budgeted oil price benchmark, and the country went into economic recession (Figure 1). Also, regression analysis shows a positive relationship between unit technical cost of oil production and the different cost components including security, logistic, field operation and maintenance, workover and rig, safety and environment, as well as community-related expenses. Consequently, the null hypothesis for the unit technical cost of production is rejected and the alternative hypothesis accepted. The alternative hypothesis, H1 implies that security, community, safety and environment are the critical cost drivers for high operating oil production cost in the Niger Delta Nigeria. Among the different cost components, security expenses have the greatest impact on unit production cost in Nigeria (Figure 2). The persistent unrest and militant activities including oil facility vandalization and kidnap for ransom has worsen security situation in the oil-rich communities of Nigeria. Consequently, oil companies operating in Nigeria spend so much

to secure the facilities and staff. Inter-rater statistical reliability test shows that government policies have significant impact on oil operation and investment in Nigeria. The delay in the passage of the petroleum industry bill and the petroleum industry Governance bill for the past decade has discouraged foreign investment in the oil sector and hampered economic growth. Generally, the within-group reliability of 0.985 and average deviation of 0.007 from the statistical rating of the primary survey data are consistent with the results of the multilinear regression analysis of the secondary data. According to James et al (1984), a within-group reliability value of 1 for multiple items indicates complete agreement between raters, while within group reliability value of 0 implies that the agreement is equal to the null distribution. According to Burke and Dunlap (2002), the average deviation measures the average variance of the respondent ratings from the group-scale mean; hence very low-value average deviation indicates higher agreement rating between respondents. The regression analyses among macroeconomic variables and cost variables are associated with probability value less than 5%. According to Banerjee et al (2012), the probability value in hypothesis testing is the probability of being wrong. The probability value is a test statistic that is required to reject or not to reject a null hypothesis, and values less than 5% indicate high level of statistical significance.

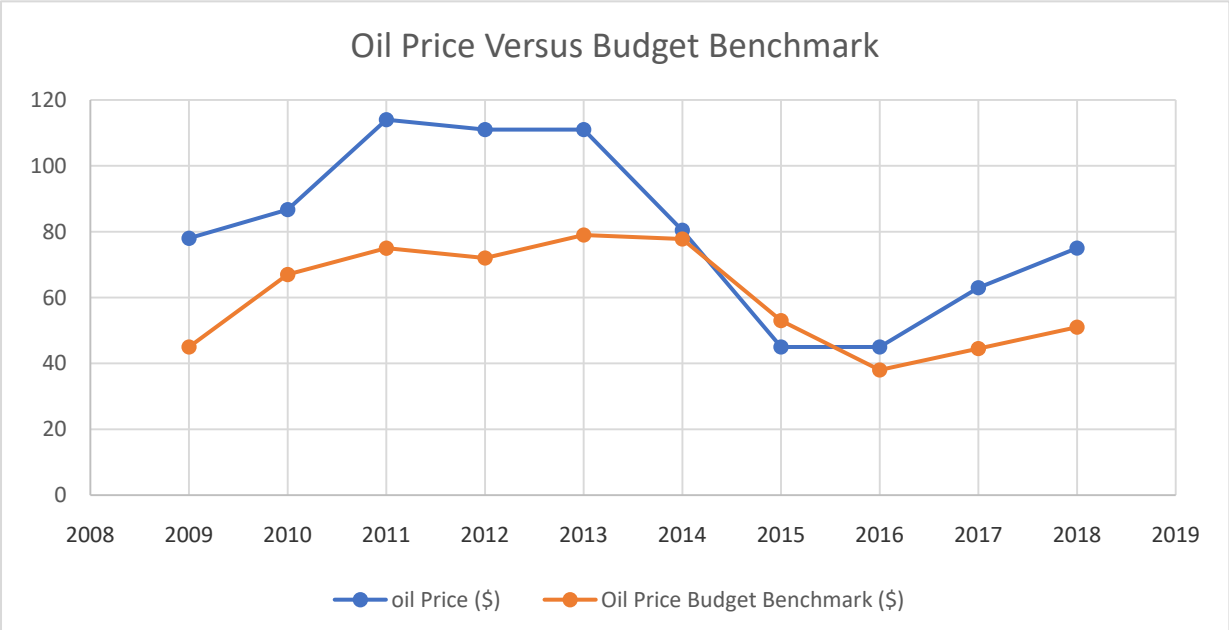

Figure 1. Oil price and budget trend in Nigeria

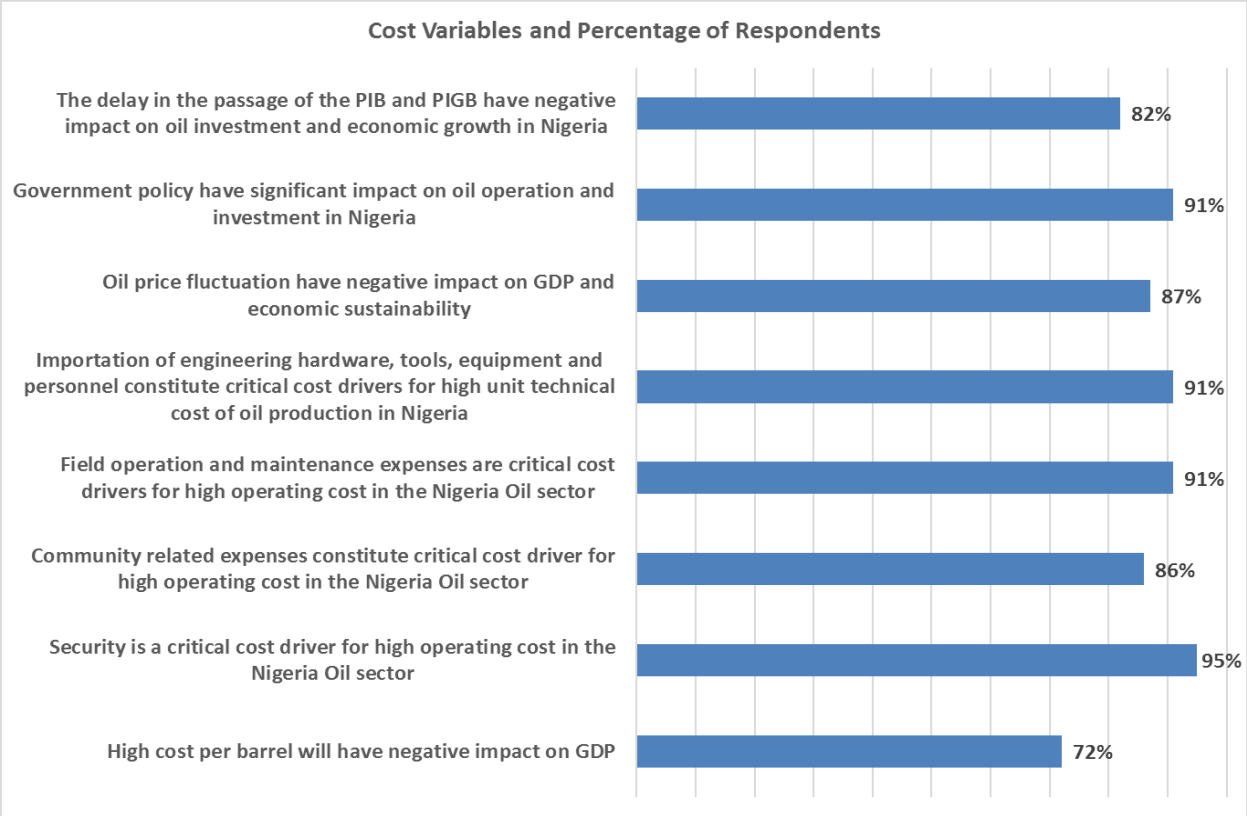

Figure 2: Cost variables in the Nigeria Oil sector and respondent rating

CONCLUSIONS

GDP, economic growth and sustainability in the Nigeria oil sector are negatively affected by periodic fall in the global oil price and the Nigerian exchange rate volatility. Also, cost per-barrel oil production in Nigeria is relatively high due to high cost of security, core field operation and maintenance, community-related expenses and importation cost of engineering hard wares, equipment and personnel. The delay in the passage of the PIB and the PIGB into law, as well as unrealistic government policies have negative impact on economic growth and oil investment in Nigeria. Oil price fluctuation and high-cost per-barrel have negative on the GDP and profitability index. In fact, this study shows that Nigeria economy experienced recession in 2015 because oil price fell below the budget benchmark.

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