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Full Length Research Paper

Evaluation of the Determinants of the Nigerian Manufacturing Sector Ability to benefit from the Nigerian Oil and Gas Industry Content Development Bill Using Vector Auto Regressive Model (VAR)

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ABSTRACT

On March 2010, The Nigerian government has introduced the Nigerian Oil and Gas Industry Content Development Bill, which aims at supporting local providers of goods and services as well as giving the first and the top priority in employment to the Nigerian workers. This Bill provides many opportunities for the Nigerian Manufacturing sector. However, the question is whether the Nigerian business climate can enable this sector to seize this chance. This paper is an addition to previous studies that were conducted to determine the factors affecting Capacity Utilization (CU) in Nigeria. The paper depended on SWOT analysis for the Nigerian manufacturing sector as well as literature review, and then followed by applying the Vector Auto Regressive Model (VAR) to determine the most influential factors affecting Nigerian Manufacturing sector ability to benefit from Local Content Development Bill. The results show that the most influential factors are Electricity Generation (ELEC), Capital Goods Imports (IM) and Interest Rates (IR). The paper recommends the Nigerian government to focus on modernizing the efficiency of existing power stations and establishing new power stations, There is also an importance to decrease the applied tariffs and apply drawback regimes on capital goods imports to support the Nigerian manufacturing sector to modernize production equipment so as to be able to produce competitive goods complying with the high technology specifications of oil and gas sector. In addition, the sum of one percent of every contract awarded to any operator in the oil and gas sector is inadequate for the Nigerian content development fund. Therefore, the government must support the fund with annual sufficient budget.

Keywords: VAR, Nigerian Oil and Gas Industry Content Development Bill, Capacity Utilization, SWOT Analysis.

INTRODUCTION

There is an ascending interest in African oil countries such as South Africa, Angola, Ghana and Nigeria regarding the application of local content policies in the oil and gas sector. The oil sector in Nigeria contributes with 74 percent of total Nigerian revenues and 72 percent of Nigerian exports but as a capital intensive sector it contributes only with 1 percent of total employment. The Nigerian Content Development and Monitoring Board (NCDMB) reported that Pre-Nigerian content implementation (Before 2006), over 95 percent of oil industry's spending were done abroad, The estimated capital flight reached US 380 billion in thirty years (1956-2006) and the estimated lost job opportunities reached two million. These facts coincide with increasing unemployment rate that reached 38 percent among Nigerian youth in 2013 according to World Bank Estimates. This matter enforced the Nigerian government to issue the Local Content Development Bill in order to

Table1. Nigerian content (NC) levels

Fabrication and Construction			Materials Procurements		
Description	NC (%)	Measured Unit	Description	NC (%)	Measured Unit
Terminal/Oil Movement Systems	%80	Volume	Steel Plates, Flat Sheets, Sections	%100	Tonnage
Drilling Modules/Packages	%75	Tonnage	Steel Pipes	%100	Tonnage
Piles, Anchors, Buoys, Jackets, Bridges, Flare Booms, Storage Tanks, Pressure Vessels	%80	Tonnage	Low Voltage Cables	%90	Length
Umbilical	%60	Tonnage	High Voltage Cables	%45	Length
Process Modules and Storage Modules	%50	Tonnage	Valves	%60	Number
Accommodation Modules	%70	Tonnage	Drilling Mud – Barite, Bentonite	%60	Tonnage
Subsea Systems	%60	Tonnage	Cement Portland	%80	Tonnage
Pipeline Systems	%100	Tonnage	Cement Hydraulic	%60	Tonnage
Risers	%100	Tonnage	Heat Exchangers	%50	Number
Utilities Packages	%50	Tonnage	Steel Ropes	%60	Tonnage
--	--	--	Protective Paints	%60	Litres
--	--	--	Glass Reinforced Epoxy (GRE) Pipes	%60	Tonnage

Source: Nigerian Oil and Gas Industry Content Development Bill, 2010.

maximize the value addition of oil and gas sector to the Nigerian economy.

Nigerian Local Content Development Bill

The Nigerian President Goodluck Jonathan ratified the Nigerian Local Content Development Bill on March, 2010 aiming at giving the first priority to Nigerian goods and services providers as soon Nigerian workers. The bill consists of three parts and 107 sections. The Bill Annex determines the Nigerian content level that oil and gas operators and companies (NOC and IOC) must achieve in their annual procurements regarding 279 different activities. For the manufacturing sector, there are 22 activities that have been stated under the fabrication and construction sector (10 activities) and materials and procurements sector (12 activities), Table 1.

Expected Opportunities for The Nigerian Manufacturing Sector

Methodology: We can estimate the expected effects of the Bill on manufacturing sector using local content index that assumes the full application of the NC stated in table 1, also assumes the capability of Nigerian manufacturing sector to substitute the manufacturing imports in the required quantity and quality. Local content index can be calculated as following:

$$Local\ Content\ Index = \sum_{i=1}^{n} (P \times L\ C\ R)$$

i Manufacturing Activities (Materials Procurements and Fabrication)
P Average Annual Expenditure
LCR Local Content Ratio

Data: NCDMB estimates expected expenditures on materials procurements and fabrication for the period (2007-2016) by U.S 12.7 billion annually. Referring to local content ratios indicated in table 1, we can determine the local content ratio by an average of 68.75 percent for materials procurements and 72.5 percent for fabrication and construction.

Calculating Local Content Index: Depending on the collected estimated data, we can say that there are expected opportunities for the Nigerian manufacturing sector to provide oil and gas sector by U.S 8.8 billion annually, Table 2.

Determinants of Capacity Utilization (CU) in The Nigerian manufacturing sector: The Paper depended on Capacity Utilization as a proxy dependent variable to represent the performance of manufacturing sector. According to Slack et al., 2007) Capacity Utilization is

Table2. Local Content Index Estimates for Nigerian Manufacturing Sector

Items	Annual Expected Expenditure (U.S Billion)	Average Local Content Ratio (%)	Local Content Index (U.S Billion)
Materials Procurements	10.7	68.75	7.356
Fabrication and Construction	2	72.5	1.45
Total	12.7	70	8.8

Note: Calculations are based on: Nigerian Content Development and Monitoring Board,
"**Leveraging Nigerian Content for Greater Opportunities**", A Paper Presented at the PETAN OTC Panel Session,2012.

Table3. SWOT Matrix for Nigerian Manufacturing Sector

Strengths	Weaknesses
1. The youth status of the population. 2. Increased medium technical education graduators. 3. Low labor cost. 4. Elasticity in hire and fire practices. 5. Easy procedures to issue building licenses. 6. Easy procedures to enforce contracts. 7. Private sector interest in Modernizing Equipment. 8. High ability for Creativity and Innovation.	1. Low number of higher technical education graduators. 2. Land shortages, high cost, expensive licenses, difficulty of registration. 3. Financing problems. 4. Decreased public and private R&D Expenditures, low quality of research institutions and weak cooperation with manufacturing sector. 5. Low number of Industrial Patents. 6. Low number of ISO and Quality Assurance Certificates. 7. Energy and electricity problems.
Opportunities	**Threats**
1. Quality of governmental legislations. 2. Improved climate of Voice and Accountability. 3. Technology transfer from FDI. 4. Investment Attractiveness Climate for FDI. 5. Tax incentives. 6. Governmental Prepared studies for existing investment opportunities. 7. Expected increase in oil and gas future procurements. 8. Government assurance for increasing local content. 9. Opportunities in Government Procurements Act (GPA). 10. Opportunities in Local Content Development Bill. 11. Wide supply chains. 12. Increasing quantity and quality of local sourcing.	1. Difficulty of companies' registration procedures. 2. Low level of infrastructure. 3. Corruption. 4. Decreased performance of government Effectiveness. 5. Political instability. 6. Low role of law. 7. Contradictions and interplay between local content policy and WTO commitments (TRIMS). 8. Decreased applied tariffs regarding oil and gas equipment imports (competition before enfant industries). 9. Increased applied tariffs on raw materials imports. 10. Low level of trade facilitation indicators and increased cost of imports.

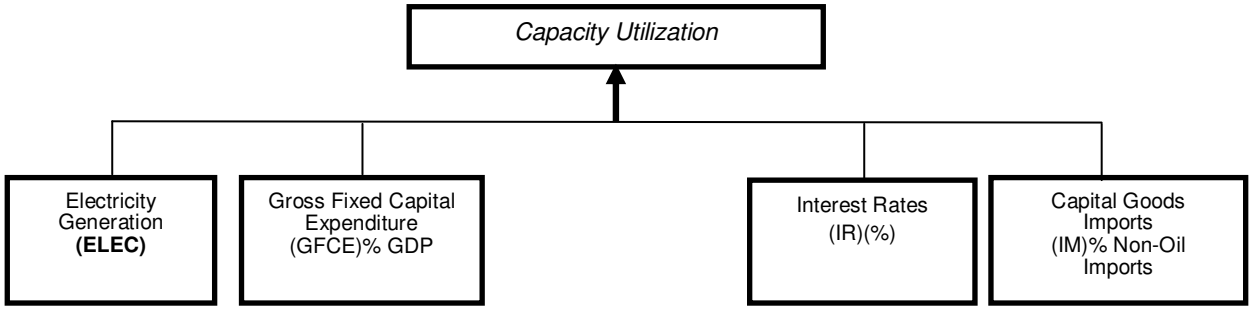
Source: Author's Estimation.

defined as the ratio of actual output to design capacity. There are many factors affecting capacity utilization in any country. For Nigeria, the paper will depend on the results of SWOT analysis in addition to literature review.

SWOT Analysis of the Nigerian Manufacturing Sector: This paper has attempted to determine the strengths and weaknesses factors of the Nigerian Manufacturing Sector and the opportunities and challenges factors that face the manufacturing sector in order to benefit from Local Content Development Bill. The analysis depended mainly on previous literatures, World Bank Doing Business Reports, World Economic Forum Global Competitiveness Reports, Central Bank of Nigeria and National Bureau of Statistics published reports and data, the results are summarized in table 3.

The influence of different factors on Capacity Utilization has been documented by (Atoyebi, et al., 2013; Rath, 2013; Simon and Awoyemi, 2010; Eniola, 2009; Adenekan, 2010; Seth, 1998 and Goldar and Renganathan, 1991). The macroeconomic variables that were identified include: Inflation Rate, Exchange Rate,

Graph1. Capacity Utilization Model for Nigerian Manufacturing sector



Source: Prepared by the Author depending on literature review and SWOT analysis results.

Ratio of Manufacturing Imports to GDP, Ratio of Government Expenditures to GDP and Ratio of Foreign Direct Investment to GDP. Also the paper has taken into consideration SWOT analysis results regarding some measurable variables especially financing problems (Interest Rates), Energy problems (Electricity Generation) and Low level of infrastructure (Gross Fixed Capital Formation).

Capacity Utilization model can be summarized in graph 1, depending on the availability of the longest time series data (1981-2009), the independent variables will be: Electricity Generation (Million Megawatt), Gross Fixed Capital Expenditure (as a Percentage of GDP), Interest Rates (%) and Capital Goods Imports (as a Percentage of Non-Oil Imports).

MATERIALS AND METHODS

The vector autoregressive (VAR) model is one of the simplest forms of multivariate models. Its popularity for analyzing the dynamics of economic systems is due to the influential work by Sims (1980). It is particularly convenient for the estimation and provides the simplest model-based framework for relating leading indicators to coincident variables and for the construction of regression based composite indexes (Eklund, 2007).

Let Y_t be a set of M coincident variables, and X_t a set of n leading indicators. Collecting the variables Y_t and X_t in the (m+n) dimensional column vector $Z_t = (Yt', X't)$. The vector autoregressive model with P lags, VAR (P), can then be defined as follows:

$$zt = c + \Phi 1\, zt - 1 + \cdots + \Phi P zt - p + \mathfrak{E}t, t = 1, \ldots T$$

Where c is a column vector of constants, $\Phi 1, \ldots \Phi P$ are parameter matrices, and $\mathfrak{E}t$ is a (m+n) dimensional. Assuming normally distributed errors, the model parameters can be estimated by maximum likelihood, or equivalently by ordinary least squares equation, see for example Hamilton (1994). To diagnose and control the assumptions of the regression modeling, we carried out some tests on the variables as well as the residual: Augumented Dickey-fuller (ADF) Unit root test, Johansen Co-integration Test (Maximum Eigenvalue), Portmanteau for testing Autocorrelations, Heteroskedasticity test and Cholesky for testing Normality of residuals.

Unit Root Test

Augmented Dickey-fuller (ADF) Unit root test reveals that all the variables have unit root in their level for ADF, since their T. Statistics values in absolute terms were less than the critical values in absolute term. Based on these results, we failed to reject the null hypothesis of unit roots at the level. However , when we performed the ADF test at 1stDifference, the results showed that all the variables are stationary since, T. Statistics values in absolute terms exceed the critical values in absolute terms at 5%. This means that after we have taken the 1stDifference of all the variables, we discovered that there is no evidence of the existence of unit roots; Table 4.

Co Integration Test

For testing the Co Integration, the paper used Johansen Co Integration Test. Maximum Eigen value reveals that the calculated value for Max-Eigen Statistic(30.6) is less than critical value (33.87) at 5 percent, we can thus accept the null hypothesis (there is no co-integration, r=0) and therefore there is no co integrating relationship, table 5.

RESULTS AND DISCUSSION

In order to analyze the effect of the independent variables (ELEC,GFCE,INT,IM) on Capacity Utilization (CU) of manufacturing sector in Nigeria. VAR model was adopted using Eviews 7 statistical package including two period lags of variables (Minimum Value for Akaike Information Criterion (AIC) that equals -4.26). The estimated model can be summarized in the equation below.

The model is good fitted, as the value of R-squared (R^2) the coefficient of determination is 75 percent and this

Table4. Augmented Dickey-fuller (ADF) Test

Variables	Level		1st Difference	
	T. statistics Value	Critical value (5%)	T. statistics Value	Critical value (5%)
Log _CU	-2.892598	-2.971853	-5.785375	-2.981038
Log _INT	-2.622927	-2.971853	-6.656551	-2.976263
Log_ ELEC	-0.812035	-3.689194	-6.423203	-2.976263
LOG_IM	-2.462672	-2.971853	-5.734966	-2.976263
LOG_GFCE	-2.965690	-2.971853	-4.685620	-2.981038

Source: EViews 7.

Table5. Johansen Co Integration Test (Maximum Eigen value)

Hypothesized No. of CE(s)	Max-Eigen Statistic	Critical Value %5	Prob
None	30.65281	33.87687	0.1157
At most 1	23.87277	27.58434	0.1392
At most 2	9.839481	21.13162	0.7596
At most 3	6.279639	14.26460	0.5776
At most 4	0.000410	3.841466	0.9857

Source: EViews 7.

Table6. The Results of VAR Model Estimates

Variables	Relation Type	Relation Significance	Hypothesis	Final decision
CU(-1)	Negative	Not significant	Positive and significant	Reject Hypothesis
CU(-2)	Negative	significant	Positive and significant	Reject Hypothesis
ELEC (-1)	Positive	significant	Positive and significant	Accept Hypothesis
ELEC(-2)	Positive	Not significant	Positive and significant	Reject Hypothesis
GFCE(-1)	Positive	Not significant	Positive and significant	Reject Hypothesis
GFCE(-2)	Positive	Not significant	Positive and significant	Reject Hypothesis
INT(-1)	Negative	Not significant	Negative and significant	Reject Hypothesis
INT(-2)	Negative	significant	Negative and significant	Accept Hypothesis
IM(-1)	Positive	Not significant	Positive and significant	Reject Hypothesis
IM(-2)	Positive	significant	Positive and significant	Accept Hypothesis

Source: Estimation based on VAR Model results and Hypothesis.

$$D\,LOG(MCU) = +0.011866 - 0.315599 * DLOG(MCU(-1)) - 0.563387 * DLOG(MCU(-2)) + 0.940659\ DL(ELEC(-1)) + 0.302290 * DLOG(ELEC(-2)) + 0.194241 * DLOG(GFCF(-1)) + 0.018149 * DLOG(GFCF(-2)) 0.212469 * DLOG(INT(-1)) - 0.626315 * DLOG(INT(-2)) + 0.416499 * DLOG(IM(-1)) + 1.314157 * DLOG(IM(-2))$$

means that the explanatory power or independent variables explain jointly the variation in CU by 75 percent of the total variations leaving 25 percent unexplained due to random chance. The tests on the residuals had shown that there is no Autocorrelation among errors, there is no Heteroskedasticity and residuals are distributed normally, tables 6 and 7.

Tables 5 and 6 show that there is a positive and significant relation between Electricity Generation ($ELEC_{-2}$) (in 2 lagged) and Capacity Utilization (T. Statistics value = 2.55), and the parameter value shows that a unit change in ($ELEC_{-2}$) will result 0.94% change in Capacity Utilization (parameter value = 0.94), which

Table7. Results of VAR Model using EViews 7

Vector Auto regression Estimates
Date: 01/23/14 Time: 22:55
Sample (adjusted): 1984 2009
Included observations: 26 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	DLOG(MCU)	DLOG(ELEC)	DLOG(GFCE)	DLOG(INT)	DLOG(IM)
DLOG(MCU(-1))	-0.315599	0.224274	0.242896	0.085224	-0.240690
	(0.21950)	(0.19606)	(0.31291)	(0.36892)	(0.17761)
	[-1.43780]	[1.14388]	[0.77625]	[0.23101]	[-1.35515]
DLOG(MCU(-2))	-0.563387	0.131467	0.001198	-0.467004	-0.344630
	(0.22323)	(0.19939)	(0.31822)	(0.37518)	(0.18062)
	[-2.52385]	[0.65935]	[0.00376]	[-1.24474]	[-1.90799]
DLOG(ELEC(-1))	0.940659	-0.500261	0.802201	-0.331474	0.398071
	(0.36845)	(0.32910)	(0.52524)	(0.61926)	(0.29813)
	[2.55305]	[-1.52007]	[1.52731]	[-0.53528]	[1.33523]
DLOG(ELEC(-2))	0.302290	-0.174168	0.487218	0.087593	0.296479
	(0.36735)	(0.32812)	(0.52367)	(0.61741)	(0.29724)
	[0.82290]	[-0.53080]	[0.93039]	[0.14187]	[0.99744]
DLOG(GFCE(-1))	0.194241	-0.049482	0.124088	0.169022	0.239569
	(0.16889)	(0.15086)	(0.24076)	(0.28386)	(0.13666)
	[1.15010]	[-0.32800]	[0.51540]	[0.59544]	[1.75305]
DLOG(GFCE(-2))	0.018149	0.158053	-0.371988	-0.088736	-0.031656
	(0.13551)	(0.12104)	(0.19317)	(0.22775)	(0.10965)
	[0.13393]	[1.30582]	[-1.92569]	[-0.38962]	[-0.28871]
DLOG(INT(-1))	-0.212469	-0.020045	0.083839	-0.463400	0.138017
	(0.16488)	(0.14727)	(0.23504)	(0.27711)	(0.13341)
	[-1.28866]	[-0.13611]	[0.35670]	[-1.67225]	[1.03453]
DLOG(INT(-2))	-0.626315	0.116901	-0.387620	-0.390975	-0.221049
	(0.14992)	(0.13392)	(0.21372)	(0.25198)	(0.12131)
	[-4.17756]	[0.87295]	[-1.81365]	[-1.55160]	[-1.82216]
DLOG(IM(-1))	0.416499	-0.408057	1.059964	0.407815	0.161597
	(0.43286)	(0.38664)	(0.61706)	(0.72751)	(0.35025)
	[0.96221]	[-1.05540]	[1.71777]	[0.56056]	[0.46138]
DLOG(IM(-2))	1.314157	-0.061885	0.508307	1.104248	0.074170
	(0.41359)	(0.36943)	(0.58960)	(0.69514)	(0.33466)
	[3.17741]	[-0.16751]	[0.86212]	[1.58853]	[0.22163]
C	0.011866	0.037964	-0.060477	0.048605	0.014679
	(0.03142)	(0.02806)	(0.04479)	(0.05280)	(0.02542)
	[0.37769]	[1.35286]	[-1.35036]	[0.92050]	[0.57742]
R-squared	0.755161	0.221367	0.578920	0.403159	0.456354
Adj. R-squared	0.591934	-0.297722	0.298200	0.005265	0.093923
Sum sq. resids	0.275970	0.220182	0.560826	0.779576	0.180686
S.E. equation	0.135639	0.121156	0.193361	0.227973	0.109753
F-statistic	4.626466	0.426453	2.062270	1.013233	1.259148
Log likelihood	22.19987	25.13577	12.98132	8.699911	27.70577
Akaike AIC	-0.861528	-1.087367	-0.152410	0.176930	-1.285059
Schwarz SC	-0.329257	-0.555095	0.379862	0.709202	-0.752788
Mean dependent	0.008834	0.020383	-0.024703	0.026023	0.015165
S.D. dependent	0.212334	0.106354	0.230814	0.228576	0.115301

Determinant resid covariance (dof adj.)	2.20E-09
Determinant resid covariance	1.41E-10
Log likelihood	110.4183
Akaike information criterion	-4.262949
Schwarz criterion	-1.601591

Table 8. Literature Evidence for Energy Problems in Nigeria

Literature Results	Sources
Nigeria has ranked as number 185 out of 189 economies in getting electricity indicator in Doing Business Report, and getting electricity in Nigeria costs 960.5 percent of Income per capita.	World Bank, Doing Business Report, 2014.

Table 9. Percentage of Capital Goods Imports of Total Imports in Nigeria comparing with some oil countries

Country	Average (2006-2011)
Nigeria	25%
Malaysia	46%
Indonesia	24%
Brazil	26%
Kazakhstan	27%

Source: Author's Computation Using WITS Depending on BEC Classification.

Table 10. Literature Evidence for financing problems in Nigeria

Literature Results	Sources
The second important problem facing the private sector in Nigeria is financing problem especially SMEs and 70 percent of investors depend on personal funding.	World Bank, An Assessment of the Investment Climate in Nigeria, (Washington D.C,2009).
Financing problems in Nigeria are the third influential factor affecting manufacturing Capacity Utilization in Nigeria.	Vassily Baberopoulos, Challenges Facing the Manufacturing/Fabrication Sector over Local Content Production, A Paper presented at NSE/NCDMB Workshop, Port Harcourt, 10 July 2012.
Nigeria has got 2.1 point from 7 points in the financing assessment indicator in status of Competitiveness.	World Economic Forum, The Global Competitiveness Report, 2011-2012.
About 10.7 percent of Nigerian total population can obtain government financing.	Nigeria Census Bureau, Annual Abstract Statistics, 2010.

confirm our theoretical framework and hypothesis, so we fail to accept null hypothesis.

The results show also that there is a positive and significant relation between Capital Goods Imports (IM_{-2}) (in 2 lagged) and Capacity Utilization (T. Statistics value = 3.17), and the parameter value shows that a unit change in (IM_{-2}) will result 130% change in CU (parameter value =1.3), so we fail to accept null hypothesis.

In addition to those two significant relations the results assure that there is a negative and significant relation between interest rates (INT_{-2}) (in 2 lagged) and Capacity Utilization (T. statistics value = 4.17), and the parameter value shows that increasing (INT_{-2}) by a unit change will lead to a change in CU by 0.62%, so we fail to accept null hypothesis.

Regarding all other assumptions, we accept the null hypothesis because the results reveal that they are all not consistent with the paper assumptions.

CONCLUSION AND POLICY RECOMMENDATION

The paper was an attempt to investigate the most influential factors affecting Nigerian Manufacturing Capacity Utilization (CU), and thus affects its ability to benefit from the opportunities of Nigerian Content Development Bill. Literature review and SWOT analysis revealed that there are some factors that have an important effect on (CU). The paper has determined both of Electricity Generation, Gross Fixed Capital Formation, Interest Rates and Imports of Capital Goods as independent variables. The VAR model estimates revealed a significant relation between both of Electricity Generation (in two lagged), Capital Goods imports (in two lagged) and interest rates (in two lagged) as independent variables and Capacity Utilization as dependent variable.

In context with the results, the paper recommends the Nigerian government to give the energy sector a great interest through modernizing the existing power stations to solve the problem of inefficiency and establishing new stations and plants in order to enable the manufacturing sector to benefit from the Local Content Development Bill by increasing the level of Capacity Utilization.

The paper also recommends the Nigerian government to encourage the manufacturing sector to modernize the production equipment through decreasing the applied tariffs and activating draw back regimes.

World Trade Organization (WTO) Tariff Data shows that the average applied tariff on Nigerian electrical machinery imports reached 9.8% (Maximum = 20%) in 2012. Table 9 shows that capital goods in Nigeria reached 25% of total imports compared to 46% in Malaysia.

The results and previous literature stated in table 10 reveal that financing problem in Nigeria influences the Manufacturing Sector negatively. Therefore, the Nigerian government must decrease the interest rates applied by the Nigerian Industrial Bank, the main lending authority for manufacturing sector in Nigeria. Also, the resources of Nigerian Content Development Fund established according to the Bill, must not only depend on the sum of one percent received from every contract awarded to any operator in oil and gas sector, but also the Nigerian government should support its resources by a sufficient annual budget.

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