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Infrastructural services and manufacturing growth in Nigeria: A dynamic analysis

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Abstract

This study examines the direction and the strength of the relationship between infrastructural services and manufacturing output in Nigeria using time series data from 1981 to 2005. The study examines the unit root problem and cointegrating properties of the data. The unit root problem was tested for by using Augmented Dickey–Fuller (ADF) and Phillip Perron tests. To determine which of the shocks are the primary causes of variability in the endogenous variables, the study used Vector Autoregressive (VAR) model. Also Granger causality test was carried out. Results showed that the present transport and electricity service in Nigeria did not cause growth to occur in the manufacturing sector. It was also revealed in the study that telecommunication and education had contributed to the growth in the manufacturing sector. The paper recommends that a centrally coordinated, internally consistent and a holistic approach that would encompass uniform standard, a maintenance culture and a linkage between the various sector of the economy toward the development of infrastructure services is important to the development of manufacturing sector.

Introduction

The importance of infrastructural services to economic development is enormous. As indicated by the Ayogu (2007), Dowall (2001), Boisvert and Senouci (2000), Layourwi (1995), Hultein *et al* (2006) and the World Bank (1994) infrastructure provides the environment for productive activities to take place and facilitates the generation of economic growth. For instance, in the absence of adequate power supply, transport and communication facilities, the production process or locational advantage may not be

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optimized. On the other hand, availability of an efficient infrastructure network can stimulate new investment in manufacturing.

Layourwi (1995), Hultein *et al* (2006) and the World Bank (1994) further reiterated that the provision of infrastructure encouraged investment in less developed areas, allowed wider movement of goods and people facilitates information flow and helped commercialize and diversify the economy.

At the global level, infrastructure will enhance competition. For instance, competition at regional and international markets depends on the availability of adequate and efficient infrastructure. Infrastructural development is one of the major determinants of price and non-price competitiveness in international markets. As infrastructure is an intermediate input low cost and high quality of any form of infrastructure facility will tend to improve price competitiveness. Also, by improving communication between exporters and importers and allowing the timely and safe delivery of goods, infrastructures can improve non-price competitiveness.

Trade and commercial activities are at their best when producers, exporters and consumers are aware of each other's products, product quality, and supply and demand capabilities.

The state of infrastructural facilities has also played an important role in the determination of the direction and magnitude of private capital flows.

The linkage between infrastructure and economic development in which manufacture sector is a factor has been firmly established in the literature. For instance, Rosenstein-Rodan (1943) analyzed the demand side of capital formation and particularly identified one category of physical capital for special attention in the social overhead capital. In his presentation, he showed that infrastructure service is a precondition for private sector investment in manufacturing sector.

Cross-country studies, including Shah (1992), Alex *et al* (1996) and Lee *et al* (1999) of economic growth and infrastructure, particularly those concerned with public investment in transportation and communication and those using capital stock of road, railways and telephone, had shown that infrastructure variables were positively and significantly correlated with economic growth.

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However, in all the cited studies, the transmission mechanism was not clear. Indeed, neither the time series nor the cross sectional studies satisfactorily explain the mechanisms through which infrastructure may affect growth.

However, the case of Nigeria seems to be that infrastructure is not positively correlated with manufacturing output (Nasir, 2007, and Usman, 2008). In the research carried out by Lee and Alex (1989, and 1992) on the impacts of infrastructural deficiencies on the Nigerian industrial sector, results showed that manufacturing undertook significant expenditure to affect deficiencies in publicly provided infrastructural services. This was supported by Adenikinju (2003), in his study on electric infrastructure failures in Nigeria. These studies failed to establish if there is a relationship between infrastructure services and manufacturing output and whether the relationship even subsists in the long-run. The objective of this study is to look at the direction and the strength of the relationship between infrastructural services and manufacturing output. Effort will be made to determine which of the shocks are the primary causes of variability in the endogenous variables. To achieve this, a vector autoregressive model will be used.

Evolution of manufacture and infrastructure sectors of the Nigerian economy: 1960-2006

The manufactured and infrastructural sectors of the Nigerian economy have been evolving since the nation became independent in 1960. It was an open economy (Kilby, 1969) exporting agricultural products and importing manufactured ones. In 1960, the industrial sector accounted for a mere 7.7% of output while the manufacturing sub-sector produced less than 4% of total Gross Domestic Product (GDP). The manufacturing sub-sector contributed 3.8% of output.

The contribution of petroleum to the Nigerian economy became quite pronounced in the 1970s. During this decade the contribution of the industrial sector to GDP rose from 13.76% in 1970 to 37.8% in 1979 while that of manufacturing rose from 3.6% to 8.7%. In the 1970s, the relative contribution of manufacturing production to total output averaged 4.8% while the relative share of industrial output in total GDP averaged 27.5%. The relative share of industrial output in GDP achieved a high level of

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45.57% in 1980 and a low level of 26% in 1986. For the decade of the 1980 the relative share of industrial production in total output averaged 33.7%. The Structural Adjustment Program (SAP) adopted in 1986 to battle the economic crisis and bring about a restructuring of the economy, had a favorable effect on agriculture, but a negative effect on manufacturing (Iyoha and Oriakhi, 2002).

In Nigeria as in many other African Countries, SAP only led to a process of industrialization and rising unemployment (ILO, 1996). A close look at the relative contribution of manufacturing production to GDP will show that SAP, indeed, triggered a shrinking of the manufacturing to GDP in Nigeria. In 1980, manufacturing accounted for 8.4% to GDP. This relative share rose to 9.9% in 1983, and was still 8.7% in 1986. However, with the adoption of SAP, the manufacturing sector's relative share in output began to fall and reached a low level of 5.29% in 1989. In the 1980s, the manufacturing sector's share in GDP averaged 8.2%.

In the post-SAP period, the manufacturing sub-sector has not performed well. Its relative share in output has fluctuated between a low of 4.0% in 1993 and a high of 5.9% in 1991. For the decades of the 1990s, the relative share of manufacturing production in GDP has averaged an anemic 4.96%.

Figure 1 shows the evolution of manufacturing output in Nigeria while figure 2 shows the growth rate of manufacturing output and GDP.

Figure 1: Evolution of manufacturing output in Nigeria

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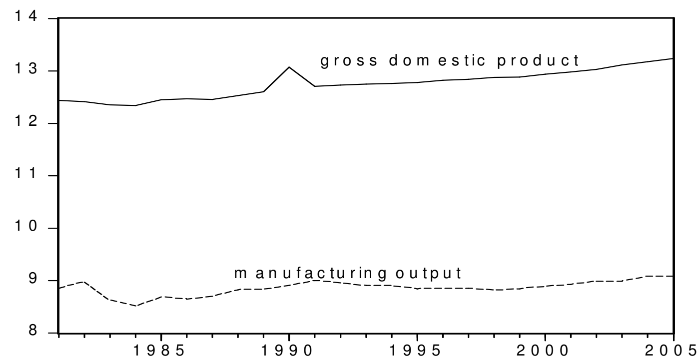

Figure 2: Growth rate of GDP and manufacturing output in Nigeria 1981-2005

Appropriate infrastructure facility is good for manufacturing growth. For this study infrastructural facilities such as electricity, telecommunication, transport and education were considered. The Nigerian power sector operates well below its estimated capacity with power outages being a frequent occurrence. In 1970 total installed electricity capacity and total generation in mega watt (mw) were 804.7mw and 176.6mw respectively, out of which 91.4mw was available for industrial consumption.

However by 2005 total installed electricity capacity and total generation were 6,8616mw and 2,779.3mw respectively, out of which only 182.3 were available for industrial consumption (CBN 2005). Figure 3 shows the trend of electricity installed capacity, generation and consumption from 1970 to 2005.

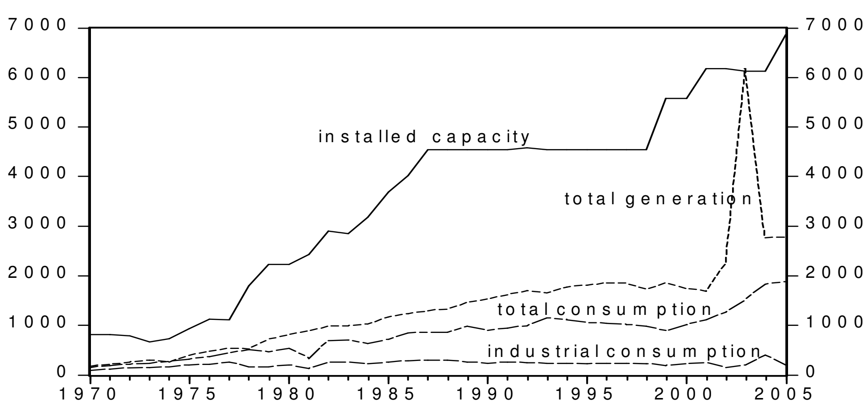

Figure 3: Electricity generation and consumption in Nigeria 1970-2005

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For telecommunication, improvement seems to have taken place. In 2006, the telephone main line in use is 1.688million while telephone mobile cellular is 32.322million (CIA, 2008).

In case of education, according to Adedeji and Bamidele (2002) and Owoeye (2006), there has been an increase in student enrolment in Nigeria universities since the first university was established in 1948. Student enrolment grows dramatically from 104 in a single university in 1948 to 3,639 in five universities in 1962. This represents a growth rate of 3,399%. It jumped from 17,039 in six universities in 1972 to 146,906 in 20 universities in 1990. As at 1999 student enrolment stood at 302,877,9 in 24 universities. All these universities are federal universities. It excluded enrolment in state and private universities.

All these trends and development point to the fact that some of the infrastructure in Nigeria has developed while some seemed not to develop. The issue now is to know the relationship that the present infrastructure maintains with manufacturing output and to determine which of the infrastructures shocks are the primary causes of variability in the manufacturing output. Forecast error variance decomposition and impulse response function were used to track the evolution of economic shocks through the vector autoregressive system.

Methodology

The model

In this study the model used by Goyal and Puyari (2004) was adapted. Consider a VAR (ρ) model, which may be expressed as follows:

$$Y_t = \beta + B_1Y_{t-1} + B_2Y_{t-2} + \dots + B_pY_{t-p} + e_t \qquad (1)$$
$$= (1 - K - K_2 - K_p)\, Y_t = \beta + e_t$$
$$= B(L)\, Y_t = \beta + e_t, \qquad e_t \sim N(0, \Omega)$$

Where Y_t is a covariance stationary vector, B(K) is the matrix of lag operator, β is the intercept vector, e_t is an error vector. The Wold (moving average) representation of Equation 1 therefore becomes

$$Y_t = F(K)\, e_t \qquad (2)$$

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Where $F(K) = B(K)^{-1}$ and $F_0 = I$. In this pattern, the elements of e_t are contemporaneously correlated.

If the behavior of Y_t is governed by independent structural shocks (innovations), which need to be identified so as to determine the movement of the components of Y_t with respect to the individual shocks. If the Wold representation with the structural shocks takes the following form:

$$Y_t = A(K)\, e_t, \quad \text{where } e_t \sim N(0, I) \qquad (3)$$

Recall that, the components of e_t are orthogonal to each other, which need to be identified. Identification is important, otherwise it will yield less parameter than the structural equation (Simalele, 2003 and Adebiyi, 2006). The SVAR approach intends to identify such structural innovations. Many methods can be used to remove this, out of which we will follow the one, suggested by BQ (Blanchard and Quah, 1989), which makes the use of long run restrictions. Let us discuss how to identify the components of e_t. From Equations 2 and 3,

$$e_t = H_0\varepsilon_t \text{ and } F_jH_0 = H_j \qquad (4)$$

$$= F(K)H_0 = H(k) \qquad (5)$$

$$= \Omega = H_0H_0 \text{ Since Var } (\varepsilon) = I \qquad (6)$$

After obtaining the H_0 matrix it can be used to identify ε_t with the help of e_t.

In a bi-variate model, H_0 consists of four elements, which necessitates four restrictions for identification. The symmetry of the matrix Ω = Var (e_t) and the normalization conditions impose three restriction. Therefore, we need only one more restriction to identify H_0. Following BQ, if we can impose a long run restriction, then the structural innovations can be identified. In a bi-variate set up like ours, the long run expression of Equation 3 can be written as:

$$\begin{pmatrix} Y_{1t} \\ Y_{2t} \end{pmatrix} = \begin{pmatrix} H_{11}(1) & H_{12}(1) \\ H_{21}(1) & H_{22}(1) \end{pmatrix} \begin{pmatrix} \varepsilon^1 \\ \varepsilon^2 \end{pmatrix}$$

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Where H(1) = $\sum_{j=0}^{\infty} H_j$ is the long run matrix of H(K). With a long-run restriction H_{12} = 0, H(1) will be a lower triangular matrix. From equation 4, $F(1)H_0 = H(1)$. With equation 5,

$$= F(1)H_0H'_0F(1)' = H(1)H(1)'$$

$$= F(1)\Omega F(1)' = H(1)H(1)' \qquad (8)$$

Given the estimate of Ω and F(1), H(1) will be the unique lower triangular Choleski factor of F(1) ΩF(1)′, since H(1) is lower triangular. The structural shocks can now be easily computed by using

$$H_0 = F(1)^{-1}Q,$$

Where M is the lower triangular Choleski decomposition of Equation 7. The structural shocks would be obtained with the help of H_0 and e_t using the relation $e_t = H_0\varepsilon_t$, where e_t is the residual from estimating the reduced form VARm i.e. Equation 1.

In the present context, Y comprises change in the manufacturing output and infrastructural services M and I. Their behavior is governed by the following kinds of structural innovations, that is, manufacturing shocks and infrastructural shocks. We estimate VAR models with these variables. In both the models, however, the order of the structural shocks remains the same. Manufacturing shocks are ε^1 infrastructure shocks are ε^2 respectively. The variation in manufacturing output is decomposed as the sum of manufacturing own shocks and infrastructure shocks respectively:

$$M = \sum_{j=0}^{\infty} H_{21}(j)\varepsilon^1(t-j) + \sum_{j=0}^{\infty} H_{22}(j)\varepsilon^2(t-j)$$

The variation in infrastructure services is decomposed as the sum of manufacturing shocks and infrastructure own shocks are respectively.

$$I = \sum_{j=0}^{\infty} H_{21}(j)\varepsilon^1(t-j) + \sum_{j=0}^{\infty} H_{22}(j)\varepsilon^2(t-j)$$

Data Source and Definition of Variables

Secondary data used for this study come from the CBN (2005) Statistical Bulletin, which is a publication of the Central Bank of Nigeria (CBN). The data uses are

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manufacturing output, transport services, telecommunication service, education and electricity. All the data are expressed in real terms. Annual data from 1981 to 2005 are used to estimate the VAR model in the study. The following variables were used in the study: Manufacturing output (MAN), Electricity (ELEC), Transport services (TRAN), Telecommunication (TEL) and Education (EDU). The value of each of these are in the national currency of the country, that is naira million and the value of each of the variables is taken to be its contribution to the GDP. The log of GDP was used as the measure of GDP growth rate and this was used for Figure 2. Also data on electricity generation and consumption was used for Figure 3 and these were measured in mega watt per hour.

Table 1: Descriptive statistics

	TRAN	**TEL**	**EDU**	**ELEC**	**MAN**
Mean	368.0752	1938.938	615.8872	11239.74	7063.316
Median	226.7000	1239.900	601.6000	10540.90	6964.400
Maximum	854.8000	7815.780	964.5200	19855.84	8720.000
Minimum	167.4000	603.7000	464.7000	7460.100	4926.200
Std. Dev.	236.5085	1735.477	122.4707	3162.090	942.5021
Skewness	0.929389	2.288639	1.220895	1.400005	-0.324563
Kurtosis	2.297339	7.341114	4.231666	4.235998	2.819157
Jargue-Bera	4.113321	41.48209	7.790976	9.758074	0.472988
Probability	0.127880	0.000000	0.020333	0.007604	0.789391
Sum	9201.880	48478.46	15397.18	280993.6	176582.9
Sum Sq. Dev.	1342471.	72285115	359978.0	2.40E+08	21319446
Observations	25	25	25	25	25

Source: Data Analysis

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Empirical results

In an attempt to investigate infrastructure and manufacturing growth in Nigeria, this section begins by examining the descriptive statistic of the data series employed in the study. These include descriptive statistics for manufacturing, transport, telecommunication, education and electricity for the period 1981 to 2005. Table 1 shows that electricity has the largest standard deviation while education has the smallest standard deviation. Apart from manufacturing that is negatively skewed, other variable are positively skewed. The Jargue-Bera (JB) statistic indicates that most of the data series are normally distributed. This is indicated by the probability value of JB statistic which for most series are significantly different from zero at 1% significant level.

Table 2 shows the correlation matrix. With this table the degree of association between all the economic indicators were displayed. Then the first row of the matrix showed the relationship between manufacture output and infrastructure services. This shows that between manufacture and transport there is positive correlation of 62.5%. Between manufacturing and telecommunication it was 67.4%, for manufacturing and education it was 70.3% while it was 66.3% between manufacture and electricity.

Table 2: Correlation matrix

	MAN	**TRAN**	**TEL**	**EDU**	**ELEC**
MAN	1.000000	0.624755	0.673789	0.702864	0.662615
TRAN	0.624755	1.000000	0.829251	0.912075	0.877361
TEL	0.673789	0.829251	1.000000	0.921475	0.918593
EDU	0.702864	0.912075	0.921475	1.000000	0.909556
ELEC	0.662615	0.877361	0.918593	0.909556	1.000000

Source: Data Analysis

In the literature, it is well posited that a priori, many economic time series will be non stationary integrated (Granger and Newbold, 1974). To ascertain the degree of stationarity of variables employed in this study, the ADF and Phillip Perron (PP) Unit root test were carried out in Table 3.

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As a preliminary step to testing for cointegration in the VAR models as used in this study we execute ADF and PP unit root tests statistics on the series used in the study. Results in Table 3 showed that transport telecommunication, education are stationary at the level while manufacturing and electricity are stationary at the first difference.

Table 3: Testing the order of integration or unit root test

Level series	ADF T Statistic	Phillip-Perron Statistic	S/NS
Manufacturing	2.224476***	-1.374591	NS
Transport	-2.658695*	2.268172	S
Telecommunication	5.293075***	6.486974	S
Education	6.131936***	3.591136	S
Electricity	1.032415	1.032415	NS
Critical value @ 10%	-2.63512	-2.635542	
FIRST DIFFERENCE			
Electricity	-4.044836 -4.318519	-5.119648 -4.320058	
Critical value @ 10%	-2.638752	-2.638752	

Source: Data Analysis

To be able to know whether there is long run relationship, we then tested whether the linear combination of the variables in the model might be stationary, that is, we found out if the regression residual was cointegrated. For cointegration, a pair of integrated, or smooth, series must have the property that a linear combination of them is stationary (Granger, 2004).

The results of trace and max-Eigen statistic tests are summarized in Tables 4 and 5 respectively. The tests assumed linear deterministic trend in the series and uses one log in differences. Irrespective of which set of critical value one uses, there seems not to be agreement between the test results based on the trace statistic and the Max-Eigen statistic.

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Table 4: Cointegration Rank Test (Trace Statistic)

Hypothesized no of CE(s)	Eigenvalue	Trace statistic	5% critical value	1% critical value
None **	0.905250	118.8685	68.52	76.07
At most 1 **	0.705710	62.66870	47.21	54.46
At most 2 *	0.568474	34.53536	29.68	35.65
At most 3*	0.311165	15.20550	15.14	20.04
At most 4 *	0.250504	6.632161	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5% (1%) level

Trace test indicates 3 cointegrating equation(s) at the 5% level but the Max-Eigen test indicates 2 cointegrating equation(s) at the 5% level

Table 5: Cointegration test (Max-Eigen statistics)

Hypothesized no of CE(s)	Eigenvalue	Max-Eigen statistic	5 percent critical value	1 percent critical value
None **	0.905250	54.19985	33.46	38.77
At most 1 *	0.705710	28.13334	27.07	32.24
At most 2	0.568474	19.32986	20.97	25.52
At most 3	0.311165	8.573340	14.07	18.63
At most 4 *	0.250504	6.632161	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5% (1%) level

Max-eigenvalue test indicates 2 cointegrating equation(s) at the 5% level
Max-eigenvalue indicates 1 cointegrating equation(s) at the 1% level

Table 4 and 5 showed that there are 3 and 2 cointegrating vectors in the infrastructure and manufacturing growth function respectively. This indicates that a long run equilibrium relationship exists between variables in the infrastructure and manufacturing growth of the VAR model, which means that they do not diverge away from each other where it shows similar behavior. This is so since the calculated values of trace in Table 4 are 118.8685, 62.66870, 34.53536, are greater than the critical value of

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68.52, 47.21 and 29.68 respectively at the 5 percent levels. This was supported by the results of Max-Eigen value displayed in Table 5. The Max-Eigen value calculated of 54.19985 and 28.13334 and greater than the critical value of 33.46 and 27.07 respectively.

Table 6: Pairwise Granger causality tests

Null Hypothesis:	Obs	F-Statistic	Probability
TRAN does not Granger Cause MAN MAN does not Granger Cause TRAN	23	2.27123 0.01710	0.13196 0.98306
TEL does not Granger Cause MAN MAN does not Ganger Cause TEL	23	3.70101 0.91243	0.04504 0.41933
EDU does not Granger Cause MAN MAN does not Granger Cause EDU	23	7.34808 0.01095	0.00464 0.98912
ELEC does not Granger Cause MAN MAN does not Granger Cause ELEC	23	0.81006 1.96655	0.46040 0.16887
TEL does not Granger Cause TRAN TRAN does not Granger Cause TEL	23	0.28579 3.48357	0.75477 0.05262
EDU does not Granger Cause TRAN TRAN does not Granger Cause EDU	23	16.3907 7.80080	8.8e-05 0.00363
ELEC does not Granger Cause TRAN TRAN does not Granger Cause ELEC	23	0.78932 6.36271	0.46926 0.00813
EDU does not Granger Cause TEL TEL does not Granger Cause EDU	23	2.13485 4.52040	0.14724 0.02566
ELEC does not Granger Cause TEL TEL does not Granger Cause ELEC	23	1.21570 1.55786	0.31972 0.23768
ELEC does not Granger Cause EDU EDU does not Granger Cause ELEC	23	0.98923 2.57384	0.39120 0.10396

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Granger Causality Testing

Johansen cointegration method confirmed the existence of a long-run equilibrium relationship of the variable of the VAR models, but this method does not say which of the variables cause the other (Granger 1969). Granger causality test helps to determine the direction of causality between two variables of the VAR models. The pairwise Granger causality test between manufacturing and transport services including telecommunication, education and electricity are examined in Table 6.

The results indicated that no causality exists between Transport services and manufacture, electricity and manufacture, electricity and telecommunication and electricity and education. Why there is no causality between transport service and manufacture and between electricity and manufacture may be as a result of the poor position of the transport system and electricity. The results from the causality test indicate that there is a unidirectional causality between telecommunication and manufacture and that the causality runs from telecommunication to manufacture. Unidirectional causality is also noticed between education and manufacture. The causality runs from education to manufacture. Also bilateral causality exists between telecommunication and transport, between education and telecommunication. The causalities run from transport to telecommunication, transport to electricity and telecommunication to education respectively. One outcome of interest is the bilateral causality that exists between education and transport. Why this is so as subject further investigation.

Forecast Error Variance Decomposition (FEVD)

The short-run dynamic property of VAR model in this study is further supported by forecast error variance decomposition tests. As a result of this the variance decomposition in this section provides information about the relative importance of each random innovation affecting the variables in the VAR model. Table 7 provides result of the FEVD. The forecast error for the study is defined as the difference between the actual values of manufacture, transport, telecommunication, education and electricity and their forecast value. This forecast error is due to shocks of the variable in each period.

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The variance decomposition gives the percentage of the forecast variance due to each innovation, with each now adding up to 100 while the second column labeled S.E. contains the forecast error of the variable for each period.

Since cointegration is present in the estimation and for forecast error variance decomposition to be consider in the long run (see Watson 1994) the VAR must be restricted. Therefore the forecast error variance decomposition results for variables used in the study are presented in the Table 7a, 7b, 7, 7d and 7e respectively.

Table 7a shows the FEVD for the manufacture. Own shocks for manufacture ranged between 11.19 percent and 100 percent over en years period. It is clear from the FEVD that the effect of manufacture shock on itself falls after one year period. The telecommunication shock seems to have sustained impact on manufacture output accounting for 18.57 percent in the second year and going up to 64.99 percent in the tenth year.

Table 7a: Variance decomposition of MAN

PERIOD	S.E.	MAN	TRAN	TEL	EDU	ELEC
1	358.4391	100.0000	0.000000	0.000000	0.000000	0.000000
2	480.7491	69.95609	8.477706	18.57446	0.050289	2.941453
3	595.0082	46.30488	5.536480	18.34249	13.18082	16.63533
4	669.6310	36.64693	4.625763	26.15799	11.73685	20.83247
5	769.0232	28.63026	4.668677	39.88133	10.94950	15.87023
6	886.9321	22.28624	4.657140	48.87830	11.83588	12.34244
7	1030.692	17.92077	5.751025	54.92087	11.55006	9.857272
8	1198.063	15.34279	6.803094	59.76745	9.988349	8.098320
9	1375.515	13.22706	8.225630	63.15819	9.990204	6.508917
10	1550.624	11.19469	10.54581	64.98970	9.098087	5.171709

When the forecast error variance decomposition of transport services was considered, in the Table 7b, the forecast error (E.E) ranges between 20.2 to 74.31 for the ten periods. The own shock for transport services seems to have a sustained impact on

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itself with an initial impact of 89.05 percent coming down but staying substantial at 41 percent by 10 years, followed by the variation in telecommunication, manufacture, education and electricity respectively. It can be seen that manufacture output do have a sustained effect in the variation that occurred to transport service. This is so as the effect was 10.95 percent in the first year and became 11.71% in the tenth year.

Table 7b: Variance decomposition of TRAN

PERIOD	S.E.	MAN	TRAN	TEL	EDU	ELEC
1	20.19598	10.95153	89.04847	0.000000	0.000000	0.000000
2	27.37366	16.17889	67.62546	8.486236	7.673363	0.036050
3	35.42570	18.11829	61.91235	14.48330	5.369397	0.116674
4	43.97208	18.62192	51.64938	25.61055	3.810151	0.308000
5	51.82446	16.73311	46.82539	32.65358	2.810255	0.977665
6	58.29870	14.30899	43.35190	37.97464	2.228718	2.135743
7	63.35473	12.26405	41.67479	40.69795	2.248468	3.124746
8	67.09167	11.00886	41.31490	40.81237	3.082549	3.781327
9	70.18792	10.85906	41.65987	38.24692	5.078098	4.156048
10	74.31217	11.71233	41.23165	34.28783	8.612659	4.155531

It is clear from the FEVD in Table 7c that the own shock in telecommunication has a large impact on itself. Own shocks constitute the predominant source of variation in telecommunication. The variation range between 91.69 percent in the first period and 61.36 percent at the end of the tenth period. Form the result it was found out that the shock in transport service seems to have a long run effect on telecommunication. This is so since the value range between 1.49 percent in the first year to 29.37 percent in the tenth period. However, the effect of the shock in electricity on the variation in telecommunication is not felt as it ranges between 0.0 percent in the first year and 0.66 in the tenth year.

The shock in telecommunication affects the variation in education. The variation ranges between 21.83 percent in the first year to 64.24 percent in the tenth year. The own

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shock in education seems to have fallen after the first year. It was quite substantial in the first year as it was 45.94 percent and dropped to 9.29 percent in the tenth year. This is reflected on Table 7d. The effect of manufacture output on education decreased immediately after the first year.

Table 7c: Variance decomposition of TEL

PERIOD	S.E.	MAN	TRAN	TEL	EDU	ELEC
1	374.6284	6.823905	1.485862	91.69023	0.000000	0.000000
2	517.8075	8.956756	1.828616	77.55035	10.81792	0.846352
3	645.5988	7.291796	2.887709	79.32518	9.946076	0.549235
4	791.4563	7.288861	5.463860	78.24050	8.509407	0.497373
5	933.5498	6.511908	7.093366	78.65995	7.236930	0.497847
6	1073.132	5.433415	10.18093	77.10429	6.874819	0.406543
7	1208.403	4.468005	14.01796	74.93678	6.231305	0.345953
8	1348.475	3.647503	18.60880	71.68699	5.685482	0.371220
9	1491.070	2.987310	23.72833	67.45065	5.355967	0.477752
10	1642.934	2.460974	29.37927	62.35724	5.137709	0.664800

Table 7d: Variance decomposition of EDU

PERIOD	S.E.	MAN	TRAN	TEL	EDU	ELEC
1	9.722063	14.68648	17.54534	21.82953	45.93865	0.000000
2	15.07929	17.42983	10.90762	35.92656	34.85902	0.876961
3	23.39716	16.08522	9.254317	47.34545	26.13866	1.176349
4	32.59433	14.85101	8.472105	54.68790	20.95794	1.031040
5	43.36007	13.00489	9.006383	60.09935	17.12377	0.765613
6	55.20541	11.09826	10.19383	63.64554	14.50378	0.558600
7	68.17904	9.220002	12.09666	65.64384	12.61635	0.423155
8	82.20814	7.566913	14.59420	66.27178	11.20745	0.359664
9	97.37857	6.175950	17.59117	65.74483	10.12199	0.366072
10	113.7993	5.039923	20.98904	64.23907	9.293527	0.438438

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From Table 7e, result shows that own shocks constitute the highest cause of the variation in electricity own shocks for electricity ranged between 70.48 percent in the first period and 26.39 percent in the tenth year. The impact of the shocks in manufacture on the variation in electricity was low toward the end of the tenth year.

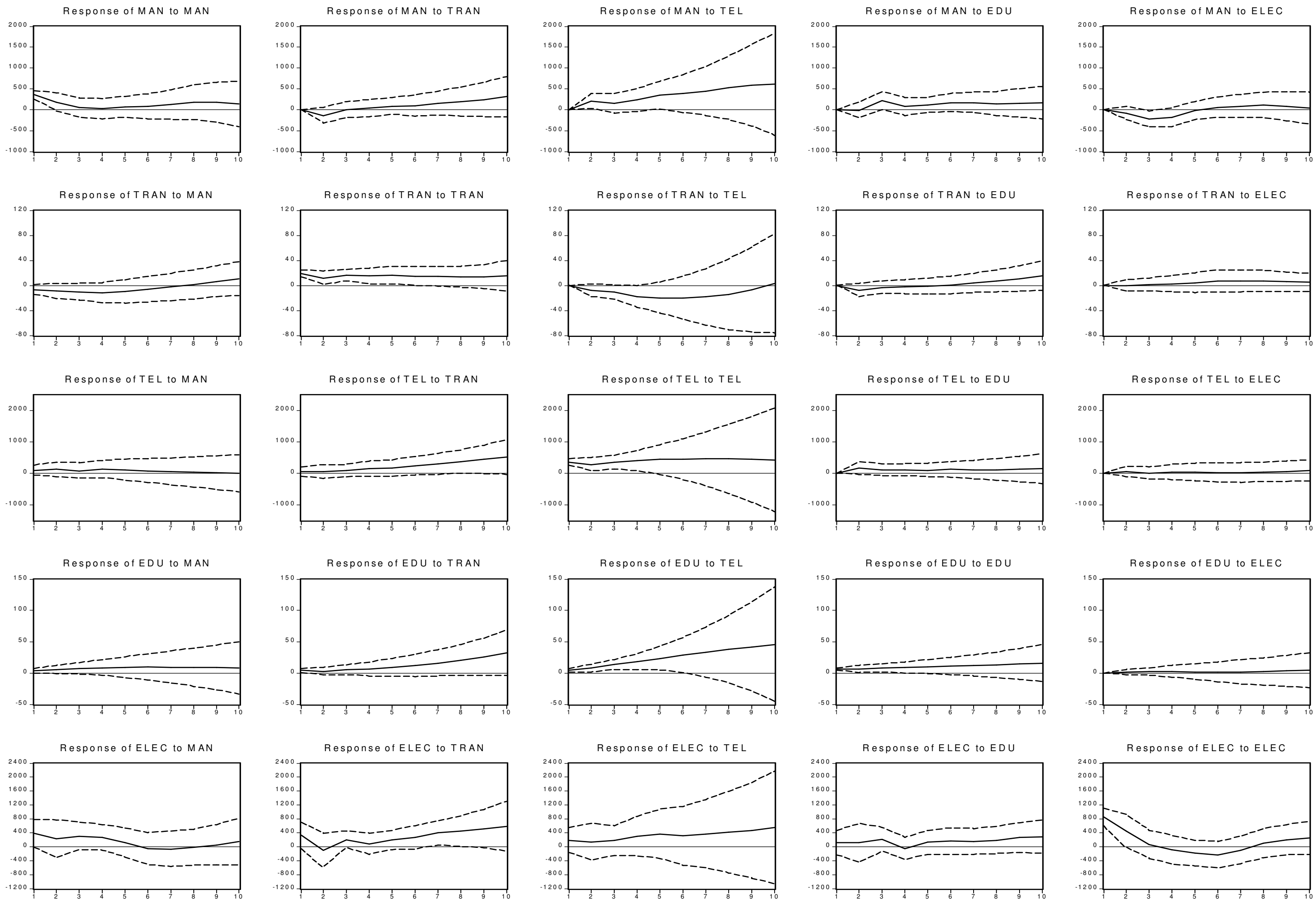
Table 7e: Variance decomposition of ELEC

PERIOD	S.E.	MAN	TRAN	TEL	EDU	ELEC
1	1008.254	14.26403	10.67592	3.258726	1.323630	70.47770
2	1143.348	14.92687	9.122696	3.985576	1.911453	70.05340
3	1231.281	18.92633	10.48326	5.438488	4.468520	60.68340
4	1300.896	21.08131	9.747308	10.15271	4.172627	54.84605
5	1387.577	19.14232	10.44936	15.75117	4.504091	50.15306
6	1475.537	17.07401	12.43656	18.34889	5.192450	46.94809
7	1481.343	15.03090	16.94319	21.33896	5.336735	41.25922
8	1707.052	12.90650	21.23143	24.29490	5.869765	35.69739
9	1873.571	10.78743	25.17155	26.49307	6.757472	30.79048
10	2079.234	9.218449	28.48901	28.55444	7.351644	26.38646

Impulse Response Functions (IRF)

According to Mitchell (2000) and Adebiyi (2006), impulse response analysis is used to uncover the dynamics relationship between macroeconomics variable within vector-autoregressive (VAR) models. It measures the time profile of the effect of a shock or impulse on the (expected) future values of a variable. Figure 1 shows the result of the IRF for the VAR model fitted in this study. The first row panel represents IRF of manufacture due to itself and other variables. Own shock raised manufacture in the first two year that came down to neutralize and slightly rose thereafter. The shock in transport had no early effect on manufacture but later had slight positive effect on manufacture. Telecommunication and education had an immediate positive impact on manufacture, which rose in later years, but the increase in telecommunication was more pronounced.

Response to Cholesky One S.D. Innovations ± 2 S.E.



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Electricity had an immediate negative impact on manufacture and slightly turns to be positive in the long run.

The second row of the panel represents IRF of transport services to itself and other variables in the VAR model. Manufacture had an immediate negative impact on transport services that lasted till the sixth year before getting neutralized towards the end of the period. Own shocks had an immediate and sustaining positive impact on transport services. However telecommunication had prolonged negative impact on transport services but neutralized at the end of the tenth year period. Electricity had an early negative impact on transport services, getting neutralized and thereafter had positive impact on transport services as from the sixth year. The shocks in electricity had no impact on transport services up to the end of fourth year and there after had slight positive effect on transport services.

The third row panel represents IRF of telecommunication to other variables in the VAR model. It is clear that both education and electricity seems to have permanent neutral or no impact on the telecommunication except a slight positive impact by education. Both transport and telecommunication had permanent positive impact on the telecommunication. However manufacture had early slight positive impact on telecommunication but gets neutralized in the long run.

The fourth row panel represents IRF of education to other variables in the VAR model. The shocks in both manufacture and electricity have no impact on education while transport services; telecommunication and education had an immediate and sustaining positive impact on education.

The last row panel represents IRF of electricity to other variables in the VAR model. The shocks in manufacture had positive impact on electricity in the short run but getting neutralized in the long run period. Both transport services and electricity had an immediate positive impact that fell to negative and thereafter rose again. Both telecommunication and education had immediate and sustaining positive impact on the electricity except that education caused electricity to be neutral in the fourth year.

The impulse response function for all the variables fitted in the VAR model in the study suggest that there is both short-run and long-run impact of infrastructure

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provision which include transport service, telecommunication, education and electricity on manufacturing output in Nigeria.

Policy implications and conclusion

This study examined the infrastructural services and manufacture growth in Nigeria. Some selected infrastructural services, transport services, telecommunication, education and electricity were critically evaluated and their contributions, to the development of manufacturing sector were examined. The following are the findings and possible areas of intervention:

1. The study reveals that the transport system in Nigeria does not cause growth in manufacturing sector. This is against the study of Laryourwi (1995) and the World Bank (1994) that the provision of infrastructure of which transport is major one, will encourage investment in manufacturing in less developed areas, which will lead to development. This finding accords the position of Usman (2008). As a result, the government of Nigeria should put in place serious reform in its transportation system.
2. Result showed that the present electricity services do not cause manufacture to grow. The reason for this can be attributed to the structural rigidities and the institutional weakness, which are characteristic of the electricity sector. For instance the president of the country revealed that $10b was spent on the sector between 2000 and 2007 with nothing to show for it (The Nation, 2008). There is need for government, to declare a state of emergency in the power sector to enable it tackle the electricity problem.
3. It was revealed in the result that both telecommunication and education have contributed to the growth in the manufacturing sector. As a result, the government of Nigeria should try to maintain its present developmental efforts in both the telecommunication and education sectors.

In conclusion, there is no gainsaying the fact that a centrally coordinated, internally consistent and a holistic approach that would encompass uniform standards, a maintenance culture and a linkage between the various sector of the economy towards the

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development of infrastructural services are important to the development of manufacturing sector. Accordingly, government should encourage private sector participation in the provision of infrastructural services. This can be achieved by creating a conducive environment for foreign direct investment through providing a level playing ground and a regulatory framework in the form of public – private – partnership initiative that would make manufacturing business survive. The government should imbibe and encourage a maintenance culture, which would ensure longer life span of infrastructural facilities. To ignore these suggestions is to endanger the manufacturing sector in Nigeria.

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