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Unlocking the potential of the power sector for industrialization and poverty alleviation in Nigeria

Abstract

Nigeria is the biggest economy in Africa, and now, has the potential to play a more active role in the global economy than in the past. Actualizing this potential will depend largely on the degree to which it can achieve industrial development and create the conditions for long term sustained growth and poverty reduction. So far, Nigeria has made very modest progress in terms of manufacturing development due to domestic policy failures, structural and infrastructural constraints and a challenging global economic environment. This paper examines the role of poor power supply services in the challenge of industrialization in Nigeria. It also reviews recent reforms implemented by the Nigerian government to address the power problem and makes policy recommendations on what needs to happen for the power sector to play a more supportive role in the industrial development process.

Key words: Poverty, energy, power sector, industrialization, Nigeria.

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1. Introduction

The advent of civilian rule in Nigeria in 1999 heralded a new wave of optimism that Africa's most populous country had finally put behind it the frequent instabilities caused by military intervention in politics, and could now focus its attention on addressing the core development challenges; namely: the eradication of poverty and unemployment, reduction of inequality, and transformation of its production and export structure to reduce dependence on oil. To some extent, the economic performance of Nigeria over the past two decades suggests that this optimism was justified. Unlike in the 1980s, the country has had a relatively good economic growth performance since 2000, with an average growth rate of real output of 9.5 per cent in the period 2000-2007 compared to a negative growth rate of 1.4 per cent in the period 1980-1989. While the global financial and economic crisis of 2008-2009 had a significant negative impact on Nigeria, it has nevertheless grown at a reasonable rate of about 6 per cent since the crisis, which is much better than its growth performance in the 1980s (Table 1). As a result, real per capita income increased from $1,447 in the 1980-1989 period to $2,344 in the 2008-2014 period. There has also been an increase in foreign capital flows into Nigeria. Foreign direct investment (FDI) inflows increased from 1.7 per cent of GDP in 1980-1989 to 2.3 per cent in 2008-2014, and personal remittances received rose from 0.03 per cent of GDP to 6.1 per cent over the same period. Substantial progress has also been made in the area of macroeconomic stability, with average consumer inflation falling from about 21 per cent in 1980-1989 to about 11 per cent in 2008-2014.

Table 1. Selected macroeconomic data for the Nigerian economy, 1970-2014

	1970-79	1980-89	2000-07	2008-14
GDP per capita (constant 2010 US$)	1878.05	1446.61	1632.23	2344.44
GDP growth (annual %)	7.00	-1.42	9.51	5.99
Population (millions)	63.21	83.11	134.60	164.01
Population growth (annual %)	2.67	2.63	2.57	2.68
Urban population (% of total)	19.60	25.31	37.80	44.34
Life expectancy at birth, total (years)	43.18	46.13	48.02	51.66
Unemployment, total (% of total labor force) (national estimate)		3.90	12.50	14.20
GINI index (World Bank estimate)		38.68	40.06	42.97
Poverty headcount ratio at $1.90 a day (2011 PPP) (% of population)		45.27	53.46	53.47
Services, value added (% of GDP)		30.08	23.59	44.71
Industry, value added (% of GDP)		33.59	41.06	29.66
Agriculture, value added (% of GDP)		36.32	35.34	25.62
Trade (% of GDP)	35.58	37.22	65.01	46.93
Export volume index (2000=100)		108.25	114.88	132.91
Gross fixed capital formation (% of GDP)		18.75	7.73	13.70
Final consumption expenditure, etc. (% of GDP)		74.98	79.37	76.95
Inflation, consumer prices (annual %)	15.81	20.89	12.40	10.92
Net ODA received (% of GNI)	0.45	0.32	2.32	0.60
Personal remittances, received (% of GDP)	0.03	0.03	5.92	6.08
Foreign direct investment, net inflows (% of GDP)	1.58	1.68	3.10	2.31
Current account balance (% of GDP)	-3.19	-1.55	15.24	5.14

Source: Computed based on data from World Development Indicators online (http://data.worldbank.org/data-catalog/world-development-indicators).

Notwithstanding the progress that has been made over the past few decades, poverty and inequality are still high in Nigeria. The poverty headcount ratio increased from 45 percent in 1980-1989 to 53 per cent in 2008-2014. Similarly, the Gini index (a measure of inequality) rose from 39 to 43 over the same period. These stylized facts on poverty and inequality imply that Nigeria's recent economic growth has not been inclusive and that the government has to strengthen efforts to foster social inclusion to enhance prospects for achieving the Sustainable Development Goals (SDGs) by 2030. Another striking feature of Nigeria's recent growth experience is that output growth moved in tandem with an increase in both the export volume and unemployment rate. The export volume index increased from an average of 108 in 1980-89 to 115 in 2000-07 and 133 in 2008-14. During the same period, the unemployment rate rose from 4 percent to 13 and 14 percent respectively. These facts are interesting because economic theory suggests that export is an engine of growth, and an important source of employment creation. Yet, the Nigerian experience has been one of export growth co-existing with both higher output growth and higher unemployment, indicating that export should be regarded as a means and not an end in itself. Exports are useful to the extent that they enable a country to achieve its broad development goals. A major reason why Nigeria's recent export and output growth have not had the desired impact on unemployment and poverty is that the country has not fostered economic diversification and transformation. Nigeria is still heavily dependent on oil, reflecting the fact that it has not had much success in transforming its production and export structure.[1] In this regard, a major policy challenge which policymakers have to address in the short to medium term is how to diversify the production and export structure of the economy to reduce vulnerability to external shocks and engender sustained growth.

Since independence in 1966, Nigerian policymakers have emphasized the need to diversify the economy and reduce dependence on oil, as evidenced by the fact that industrialization has been an important component of existing national development plans. Between 1966 and 1986, Nigeria promoted industrialization through a policy of import-substitution, which involved protecting and supporting domestic industries. While the subsidies and other forms of support provided under this policy resulted in an increase in manufacturing activities in the country, it also led to a debt and foreign exchange crisis in the early 1980s forcing the government to abandon it and introduce Structural Adjustment Programs (SAPs) from 1986 to 1993. Under the SAPs, efforts were made to deregulate and liberalize the economy, and several support provided to domestic industries were removed. This had a significant negative impact on manufacturing and was a key factor in the deindustrialization observed in the country in the second half of the 1980s and 1990s (Osakwe 2013). At the dawn of the new Millennium efforts were made by the government to revive the industrialization agenda within the framework of the National Economic Empowerment and Development Strategy (NEEDS) unveiled by President Olusegun Obasanjo in 2004 and the Transformation Agenda launched by President Goodluck Jonathan for the period 2011-2015 (NPC 2004). Building on these initiatives, in the first quarter of 2017, President Muhammadu Buhari launched the Economic Recovery and Growth Plan (ERGP) for the period 2017-2020 (FRN 2017). The ERGP is a medium-term plan with three strategic objectives: restoring growth; investing in people; and building a globally competitive economy. It is expected that industrialization will play a crucial role in achieving these strategic objectives. The evidence indicates that these renewed efforts have led to some gains in industrial development. For example, manufacturing value added as a percentage of GDP increased from 3.7 per cent in 2000 to 9.5 per cent in 2015. But there is also the recognition that the level of manufacturing development is still below the peak value of 10.4 per cent achieved in 1983 and, more importantly, also below Nigeria's manufacturing potential.

Against this background, this paper suggests that Nigeria can realize its vision of becoming one of the leading economies in Africa, and playing a significant role in the global economy; but, this would require an effective approach to lifting the binding constraints on industrial development imposed by poor access to affordable and stable power supply. The rest of the paper is organized as follows. The next section examines the structure and performance of the Nigerian manufacturing sector, followed by a discussion of the linkages between power and industrial development, and the evolution, reform and challenges of the Nigerian power sector. This is followed by policy recommendations on how to power Nigeria for transformative development, and concluding remarks.

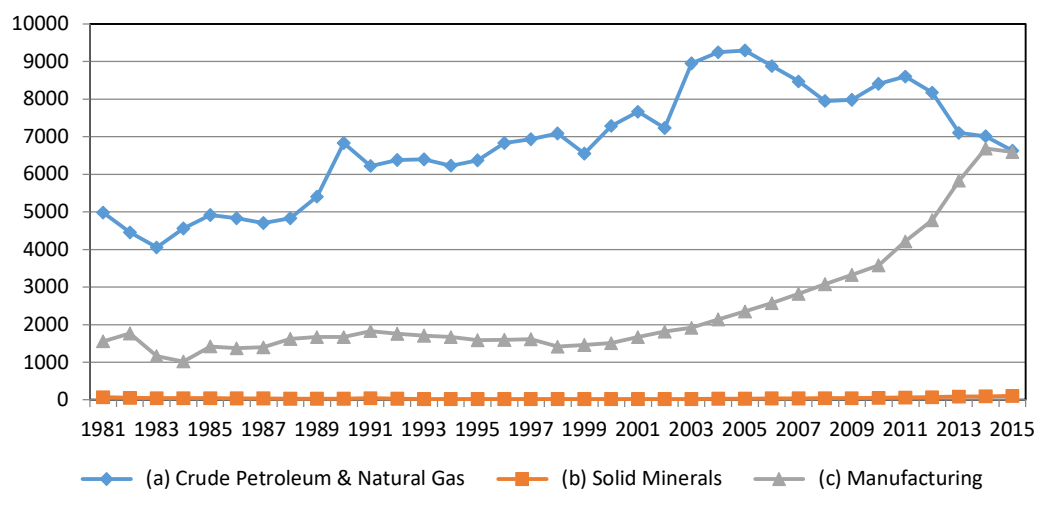
[1] There are other weaknesses in the structure of the economy. For example, it is heavily import dependent and consumption has been the main driver of growth in the economy, reflecting the fact that it is the dominant component of aggregate demand. In the period 2008-2014, consumption accounted for 77 per cent of GDP while investment accounted for 14 per cent.

2. The Nigerian industrial sector: structure and performance

In the medium to long term, developments in the industrial sector will, to a large extent, determine whether Nigeria achieves its development vision, and play a more active role in the global economy relative to its past. Economic theory and evidence suggest that achieving sustained growth and development requires structural change and that industry is the key driver of structural change (Page 2012). Nigeria has a rapidly growing labor force, most of which is currently employed in the agricultural sector. Given the constraint on expansion of agricultural employment imposed by the use of a fixed factor (land) and the need to improve agricultural productivity, labor has to move from agriculture into other sectors of the economy. This resource shift should lead to growth enhancing structural change – assuming that these resources move to more productive activities in manufacturing, agro-industry and tradable services.

Over the past few decades, some structural changes have taken place in the Nigerian economy. For example, the share of agriculture in total value added fell from 36 percent in 1980-89 to 26 percent in 2008-14, but the share of industry also fell from 34 percent to 30 percent over the same period. By contrast, the share of services rose from 30 percent to 45 percent; indicating that the services sector is now the most dominant sector of the economy. These facts suggest that Nigeria is deindustrializing at an early stage in the development process when the industrial sector should be expanding to generate additional employment, and absorb the growing labor force. The decline in the industrial sector's contribution to output over the past few decades has gone hand in hand with a change in the composition of industrial output (figure 1). The share of crude petroleum and natural gas in industrial output declined over the past three decades, while that of manufacturing increased significantly. For example, over the 1981-89 period, crude petroleum and natural gas accounted for 76 percent of industrial output while manufacturing accounted for 23 percent and solid minerals for about 1 percent. However, in the 2010-15 period, the contribution of crude petroleum and natural gas fell to 59 percent while that of manufacturing rose to 41 percent.

Figure 1. Industrial output by sub-sectors, 1981-2015 (in billion Naira at constant 2010 prices)

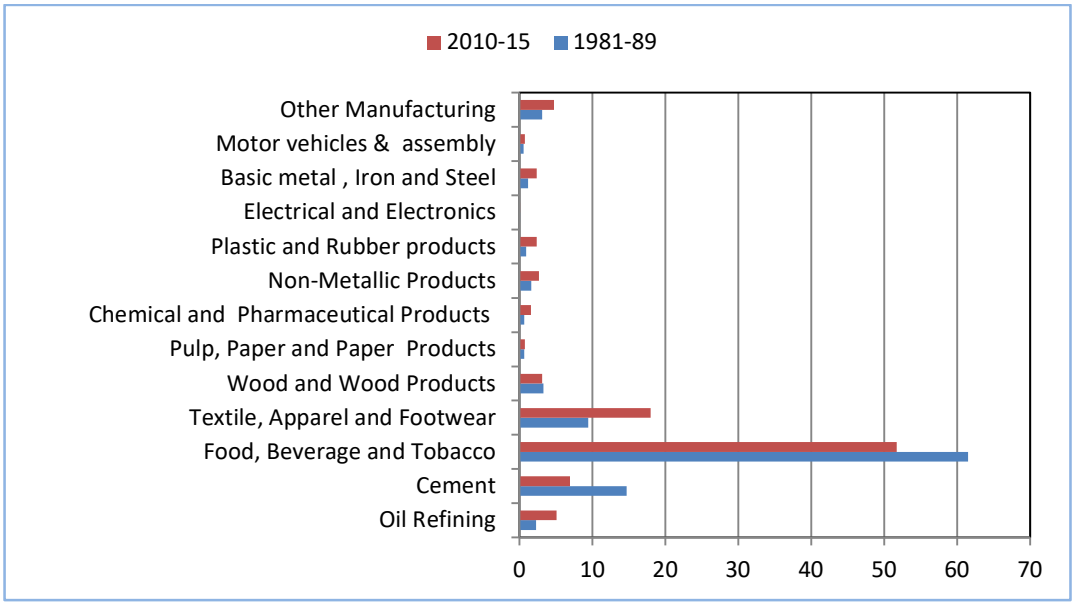


Source: Compiled using data from CBN (2015).

Within the manufacturing sub-sector, the category "Food, Beverages and Tobacco'" is the most dominant component of manufacturing followed by "Textiles, Apparel and Footwear" (figure 2). In terms of changes taking place in the manufacturing sub-sector, there are both positive and negative developments. For example, manufacturing has experienced significant growth over the past few decades. The average annual growth in

manufacturing value-added increased from 1.6 percent in the 1980-89 period to 13.2 percent in the 2008-14 period (figure 3). Another positive development is that the share of manufactures exports in total merchandise exports increased from 0.1 percent in 1980-89 to 4.4 percent in 2008-14. Notwithstanding these positive developments, the contribution of manufacturing to total value added remains very low and this should be of concern because Nigeria depends heavily on manufactures imports, which indicate that there is a huge domestic demand for manufactures that is not being met through domestic production. Figure 3 shows that over the past three decades, the share of manufactures imports in total merchandise imports has been above 70 percent. The high dependence on manufactures imports has serious negative consequences for foreign exchange, the development of local industries, and employment creation. In this context, there is the need for the Nigerian government to make the reduction of dependence on manufactures imports a key item on its priority list in the medium term. There is also the need for the government to recognize that addressing this issue will require novel policy measures to effectively tackle the perennial challenges facing manufacturing and the private sector in general.

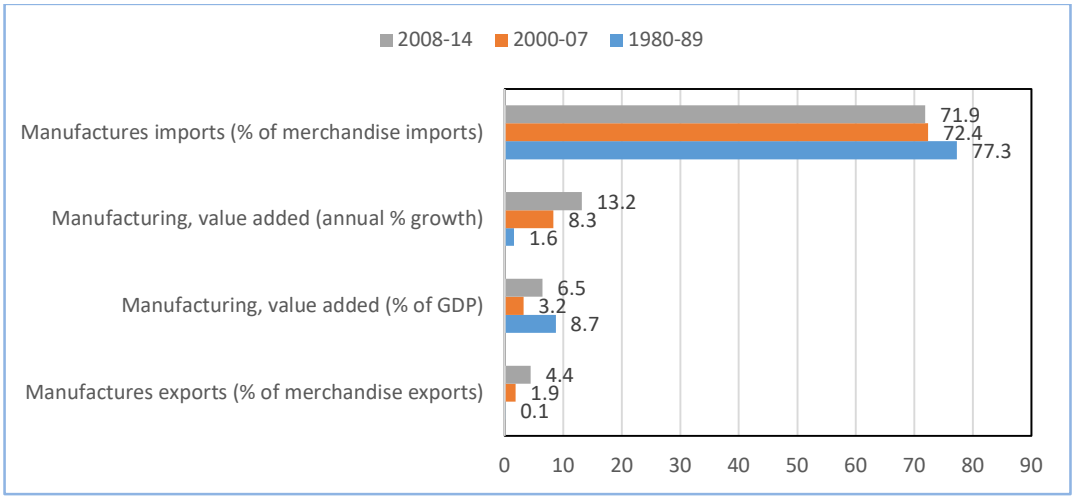
Figure 2. Share of sub-sectors in manufacturing output (%), 1981-2015



Source: Compiled using data from CBN (2015).

One of the main challenges facing manufacturing and the private sector in Nigeria is lack of access to stable and affordable power supply. Power supply is difficult to access, unstable and expensive. The power problem is a challenge and is an important factor militating against the ability of producers and consumers to effectively participate in the growth and development process. Relative to other developing countries, access to electricity in Nigeria is very low. For example, in 2013, the electrification rate in Nigeria was 45 percent compared with the developing countries average of 78 percent, and the North African average of 99 percent (IEA 2015). The Manufacturers Association of Nigeria estimates that in 2014 an average manufacturer experienced power outages 5 times per day, and was supplied electricity for just 6 hours per day (Jacobs 2015). A study by the World Bank found that power outage is a more serious problem in Nigeria compared to countries such as: Brazil, China, Cote d'Ivoire, Ethiopia, Ghana, Kenya, Russia and South Africa. An average manufacturing firm in Nigeria losses about 17 percent of its sales due to power outages compared with less than 1 percent for firms in China and Russia, 1 percent for those in South Africa and 5 percent for those in Ethiopia (World Bank 2016).

Figure 3. Manufacturing Sector Performance, 1980-2014



Source: Computed based on data from World Development Indicators online (http://data.worldbank.org/data-catalog/world-development-indicators).

Poor access to affordable finance is also an important factor that militates against manufacturing development in Nigeria. In a 2014-15 enterprise survey, 33 percent of firms reported access to finance as the main obstacle for the private sector, while 48 and 45 percent reported electricity and corruption, respectively, as major obstacles. The survey also indicates that small firms are more affected by poor access to finance relative to large firms (World Bank 2016). One indicator of the degree of access to finance by domestic enterprises is domestic credit to the private sector as a percentage of GDP. Table 2 shows that in the 2008-14 period, domestic credit to the Nigerian private sector as a percentage of GDP was about 20 percent. This is very low compared with the average for Sub-Saharan Africa (51 percent), Latin America and the Caribbean (43 percent) and East Asia and the Pacific (136 percent). In addition to the low level of credit provided to the private sector in Nigeria, there is also the issue of the high cost of finance. In the period 2008-14 the average domestic lending rate was about 17 percent and the risk premium on lending was about 8 percent (table 2). The high domestic interest rates faced by domestic enterprises deter investment and is not conducive to the promotion of private sector development.

Table 2. Financial indicators for the Nigerian economy, 1970-2014

	1970-79	1980-89	2000-07	2008-14
Domestic credit to private sector (% of GDP)	7.23	15.10	15.07	19.85
Domestic credit provided by financial sector (% of GDP)	11.81	36.97	14.31	24.15
Risk premium on lending (lending rate minus treasury bill rate, %)			6.94	8.14
Real interest rate (%)	-7.85	-6.49	4.82	2.86
Interest rate spread (lending rate minus deposit rate, %)	3.61	2.42	7.38	7.76
Lending interest rate (%)	6.83	11.75	20.15	16.79
Domestic credit to private sector by banks (% of GDP)	6.79	14.96	14.96	19.82

Source: Computed based on data from World Development Indicators online (http://data.worldbank.org/data-catalog/world-development-indicators).

Another factor that has had a negative impact on manufacturing development is exchange rate volatility. Over the past decade, there has been a significant depreciation of the Nigerian Naira against most major currencies. For example, on the 13th of April 2010, the Naira was being exchanged for the US dollar at I47 Naira to the dollar and by the 13th of April 2017 it had depreciated to 305 Naira to the dollar. Big exchange rate changes of this magnitude present problems for domestic enterprises because they depend heavily on imported

intermediate inputs. In 2014, about 54 percent of the raw materials used by manufacturing firms in Nigeria were imported (Jacobs 2015). When imported intermediate inputs represent a large percentage of the inputs used by domestic firms, big depreciations of the exchange rate result in a significant increase in production costs and have a negative impact on investment decisions.

The other challenges of manufacturing in Nigeria include industrial disputes and the dumping of fake, counterfeit and smuggled goods in the domestic market. The manufacturers in the country have to grapple with the challenge of dealing with frequent industrial disputes. In 2014, Nigeria had 234 industrial disputes out of which 175 resulted in strikes. About 1,610 workers in the manufacturing sector were involved in these disputes and the sector lost about 355,128 man-days (NBS 2016). Nigerian manufacturers have also raised serious concerns about the issue of fake, counterfeit and smuggled products dumped on the domestic market thereby displacing locally produced goods. In 2015, the Manufacturers Association of Nigeria called upon the government to address this issue because it negatively impacts local initiative and makes it challenging for domestic firms to compete and thrive (Jacobs 2015).

3. Power and industrial development in Nigeria: linkages and impact

The history of industrial development in both advanced and emerging economies indicates that power plays a vital role in the industrialization process. Energy was a major driver of the English Industrial Revolution, and no country has been able to initiate and sustain an industrialization program without access to good, stable and affordable power supply (Wrigley 2013; Stern 2004).[2] Against this backdrop, success in promoting industrialization in Nigeria depends largely on the extent that the government can effectively deal with the energy challenge, which has and continues to constrain the development of domestic enterprises. There are at least three principal channels through which the poor access, unstable supply, and the high cost of electricity in Nigeria has had a deleterious impact on industrialization. This includes: low manufacturing capacity utilization rates, low competitiveness of manufacturing firms, and lack of firm growth, particularly for small and medium enterprises (SMEs). One of the main effects of lack of access to stable and affordable power supply in Nigeria is its impact on the ability for firms to operate at full capacity. It also results in underinvestment in the sector, thereby, limiting the ability of domestic firms to expand capacity when need arises in the future.

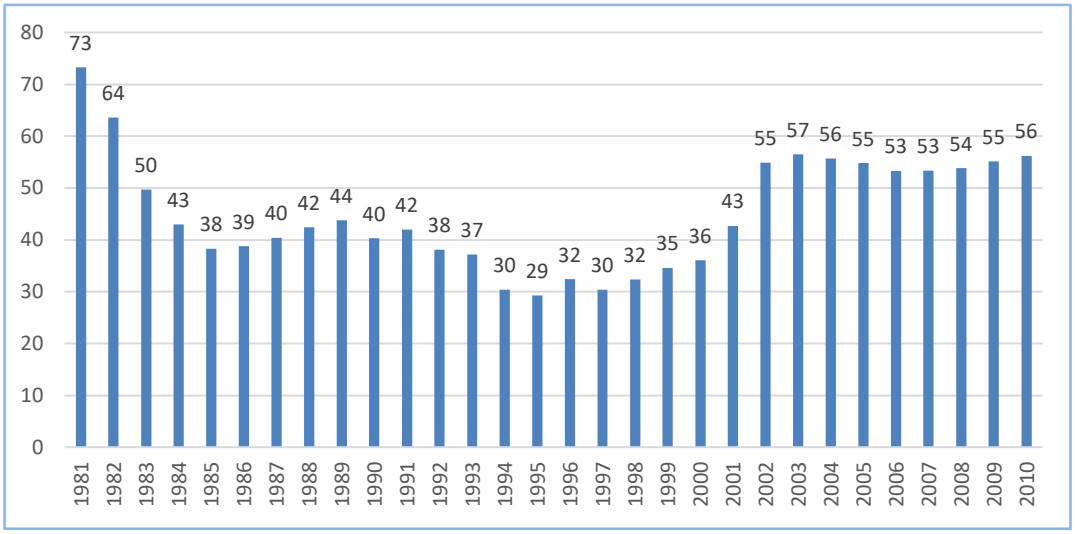
Low rate of capacity utilization has been a major feature of manufacturing in Nigeria despite the high demand for manufactured goods in the country (figure 4). Between 1981 and 2010, the annual average rate of capacity utilization in the manufacturing sector fell from a peak of 73 percent in 1981 to a low of 29 percent in 1995. Since 1998 the manufacturing capacity utilization rate has displayed an upward trend, increasing from 32 percent in 1998 to 56 percent in 2010. It is worth noting that the upward trend in the average manufacturing capacity utilization rates masks the fact that there are several sub-sectors of manufacturing that have experienced significant declines in utilization rates relative to the 1980s. For example, in the "Saw Milling" sub-sector, capacity utilization rates fell from 57 percent in 1981-90 to 36 percent in 2001-08 (table 3). Over the same period, capacity utilization rates in the "Leather Footwear" sub-sector fell from 64 to 46 percent and in the "Beer and Stout" sub-sector it fell from 65 to 51 percent.

Another channel through which the power problem affects industrialization is the reduction in the competitiveness of domestic firms both on the domestic and international markets. Nigerian firms face frequent power cuts and they respond to these outages by buying generators which are expensive not only in terms of cost; but, operation and maintenance as well. Survey data indicate that 71 percent of Nigerian firms use generators (World Bank 2016). In addition, generator fuel alone accounted for about 23 percent of the total costs of intermediate inputs used in manufacturing in the 2010-12 period (NBS 2014). It is also estimated that energy accounts for about 40 percent of the production costs of Nigeria's manufacturing firms (Jacobs 2015). Incessant power cuts impose additional costs on firms both in terms of wastage of raw materials and deterioration of machinery. They also increase the cost of production and maintenance of factories, making

[2] See Asafu-Adjaye (2000) and Osigwe and Arawomo (2015) for a review of empirical studies linking energy to economic growth in developing countries.

domestic manufactured goods uncompetitive. Enterprise surveys suggest that the total factor productivity (TFP) of Nigeria's manufacturing sector is below its expected value relative to the country's per capita income (World Bank 2016). For example, although Nigeria has a higher per capita income than Ethiopia and Ghana, the median manufacturing firm in Ethiopia has TFP that is two times higher than that of Nigeria, and in Ghana the median firm has TFP that is about three times higher than that of Nigeria. In principle, a country with a low TFP could remain competitive if it has relatively low wages. However, in Nigeria unit labor costs are higher than in some African countries. For the median firm in Nigeria, unit labor costs are about 31 percent of output compared to 10 percent in Ethiopia, 12 percent in Kenya, and 17 percent in Ghana. That said, the median firm in Nigeria has a lower unit labor cost than the median firm in South Africa (45 percent) and Cote d'Ivoire (34 percent).

Figure 4. Annual average manufacturing capacity utilization rates (%)



Source: Computed using data from CBN (2015).

Lack of firm growth, particularly in relation to small scale enterprises (SSE), is another channel through which the power problem has had a negative impact on industrialization. To build and sustain a dynamic and vibrant manufacturing sector, domestic firms have to grow and make the transition from small to medium and large firms. Good access to finance is vital to the survival and growth of small firms. Unfortunately, small firms in Nigeria have very limited access to finance. Table 4 shows that commercial banks' loan to SSE in Nigeria is small and has declined significantly over the past few decades both in terms of value and shares. In 1992 commercial banks lent 20.4 billion Naira to SSEs representing 27 percent of total credit. By 2015 lending by commercial banks to SSEs had declined to 11.3 billion Naira; representing 0.1 percent of total credit.[3] One of the reasons for the low access of small firms to bank credit is that commercial banks are often reluctant to lend to them because of the perception that; given the power supply problems, the risks of non-performing loans are likely to be much higher for small firms than for large ones. The power problem also affects small firms' access to finance through its impact on the cost of funds. Energy cost is an important component of the operating costs of banks, and thus, affects the interest rates they charge for loans (Sanusi 2013). In sum, the problems facing small firms in the power sector in Nigeria works against their effective participation in the domestic credit market, with serious consequences for manufacturing sector development.

[3] Up until 1 October 1996, banks were required to allocate at least 20 percent of their total credit to SSE wholly owned by Nigerians. However, between 1993 and 1996 banks did not meet this requirement (table 4).

Table 3. Manufacturing capacity utilization rates, by sub-sector (%)

Sub-sector	1981-90	1991-2000	2001-2008
Meat & Dairy Products	44.8	33.4	62.0
Vegetable & Grain Mill	39.2	26.9	51.1
Bakery Product	48.3	27.5	58.9
Sugar Cocoa Confectionery	47.7	32.3	40.2
Miscellaneous Food Preparation	36.7	43.8	46.3
Beer & Stout	64.7	46.2	51.1
Soft Drinks	34.9	35.0	53.4
Textiles	55.5	41.3	48.0
Knitting Carpet & Rug	37.9	39.7	32.3
Leather Products	49.8	40.1	42.7
Leather Footwear	63.5	29.8	45.6
Saw Milling	57.3	34.8	36.4
Wood & Cork Products	49.8	38.1	48.7
Paper Manufacture & Products	41.1	31.7	45.4
Printing Publishing	52.0	35.6	50.4
Basic Industrial Chemical	51.5	38.6	52.5
Paints	42.3	39.4	41.4
Drugs & Medicine	49.3	37.4	48.3
Soap & Perfumes	43.6	36.6	48.6
Other Chemical & Petroleum Products	50.6	42.2	53.3
Tyres & Tubes	48.4	31.1	45.3
Plastic Products	46.9	38.1	58.3
Glass & Glass Products	38.8	35.3	57.6
Cement & Cement Products	63.1	38.7	56.0
Basic Metal Industries	35.1	27.3	47.1
Structural Metal Products	36.9	35.9	58.7
Fabricated Metal Products	38.1	40.4	58.1
Radio, T.V & Communication Equipment	34.7	35.0	52.8
Motor Vehicle Assembly	35.4	38.0	31.6
Roofing Sheets		39.8	34.6
Wine, Spirits & Distillers		36.8	37.9
Average Manufacturing Capacity Utilization	47.4	34.3	53.1

Source: Computed using data from CBN (2015).

Table 4. Commercial Banks' loans to small scale enterprises (SSE), 1992-2015

Year	Commercial banks' loans to SSE (million naira)	Commercial banks' total credit to the private sector (million naira)	Commercial banks' loans to SSE (% of total credit)
1992	20,400.0	75,456.3	27.0
1993	15,462.9	88,821.0	17.4
1994	20,552.5	143,516.8	14.3
1995	32,374.5	204,090.6	15.9
1996	42,302.1	254,853.1	16.6
1997	40,844.3	311,358.4	13.1
1998	42,260.7	366,544.1	11.5
1999	46,824.0	449,054.3	10.4
2000	44,542.3	587,999.9	7.6
2001	52,428.4	844,486.2	6.2
2002	82,368.4	948,464.1	8.7
2003	90,176.5	1,203,199.0	7.5
2004	54,981.2	1,519,242.7	3.6
2005	50,672.6	1,991,146.4	2.5
2006	25,713.7	2,609,289.4	1.0
2007	41,100.4	4,820,695.7	0.9
2008	13,512.2	7,799,400.1	0.2
2009	16,366.5	9,667,876.7	0.2
2010	12,550.3	9,198,173.1	0.1
2011	15,611.7	9,614,445.8	0.2
2012	13,863.5	10,440,956.3	0.1
2013	15,353.0	11,543,649.9	0.1
2014	17,424.3	12,511,671.5	0.1
2015	11,307.8	13,568878.1	0.1

Source: Compiled using data from CBN (2015).

4. Evolution, reform and challenges of the Nigerian power sector

For many decades, government ownership, management and control of power supply was a major feature of the Nigerian power sector. The National Electric Power Authority (NEPA) was the utility company in charge of electricity supply in post-independence Nigeria. It was established in 1972 through a merger of the Electricity Corporation of Nigeria (created in 1951) and the Niger Dams Authority (created in 1962). Throughout its existence, NEPA had an image problem because it was unable to provide stable and uninterrupted electricity, and bridge the gap between power demand and supply.[4] Up until 1999, successive governments tried to grapple with the power problem without much success and Nigerians responded to the inefficiency and ineffectiveness of NEPA by buying generators to generate their own power. At the dawn of the new Millennium, the administration of President Olusegun Obasanjo began a series of bold reforms aimed at overhauling the power sector value chain and transforming the sector for better development results. The power sector value chain has four principal stages: provision of primary energy (gas, coal, water etc.) as an input into power generation; generation of power; transmission of generated power; and distribution of power to end users.

One of the key measures taken by the government to overhaul the power sector was the adoption of the National Electric Power Policy in 2001 with an emphasis on privatization, establishment of a regulator, and setting new rules, codes and processes for the sector. In 2005, the Electric Power Sector Reform Act was passed and NEPA was transformed into the Power Holding Company of Nigeria (PHCN). An independent regulator, the Nigerian Electricity Regulatory Commission (NERC) was also established. In addition, the PHCN was unbundled into 6 generation companies (known as GenCos), 11 distribution companies (known as DisCos) and 1 Transmission Company, known as the Transmission Company of Nigeria (TCN). Following the unbundling of the PHCN, in 2010 the government launched the Roadmap for Power Sector Reform to accelerate implementation of the Electric Power Sector Reform. As part of the roadmap, the generation and distribution companies were privatized while the transmission company was left under government ownership. But the actual handover of the generation and distribution companies to private owners took place in 2013.

In terms of power generation, table 5 shows that Nigeria has 25 grid-connected power plants, including the six generation companies previously under the PHCN, and those associated with Independent Power Producers (IPP) and the National Integrated Power Projects (NIPP).[5]

Several key agencies are involved in policy setting, regulation and operation of the reformed power sector in Nigeria. The Ministry of Power, Works and Housing is responsible for the development of power policy while the NERC is in charge of regulation of the sector. The development and maintenance of transmission infrastructure, system operation, and administration of power market rules are under the responsibility of the TCN while the Nigeria Bulk Electricity Trading (NBET) company is tasked with bulk purchase and resale of power from generators. Despite the scope and depth of the reforms undertaken over the past decade, Nigeria is still bedeviled with incessant power outages and there is growing dissatisfaction with the performance of the privatized generation and distribution companies.

[4] Power consumption in Nigeria is very low compared to what is observed in countries with either similar population or level of income. For example, in 2015, power consumption per capita in Nigeria was only 151 kWh compared to 682 kWh in the Philippines and 1,877 kWh in Egypt (PwC 2016).

[5] The NIPPs were initiated by the government in 2004 as a public-sector effort to boost generation capacity and improve transmission, distribution and gas supply infrastructure (KPMG 2016a).

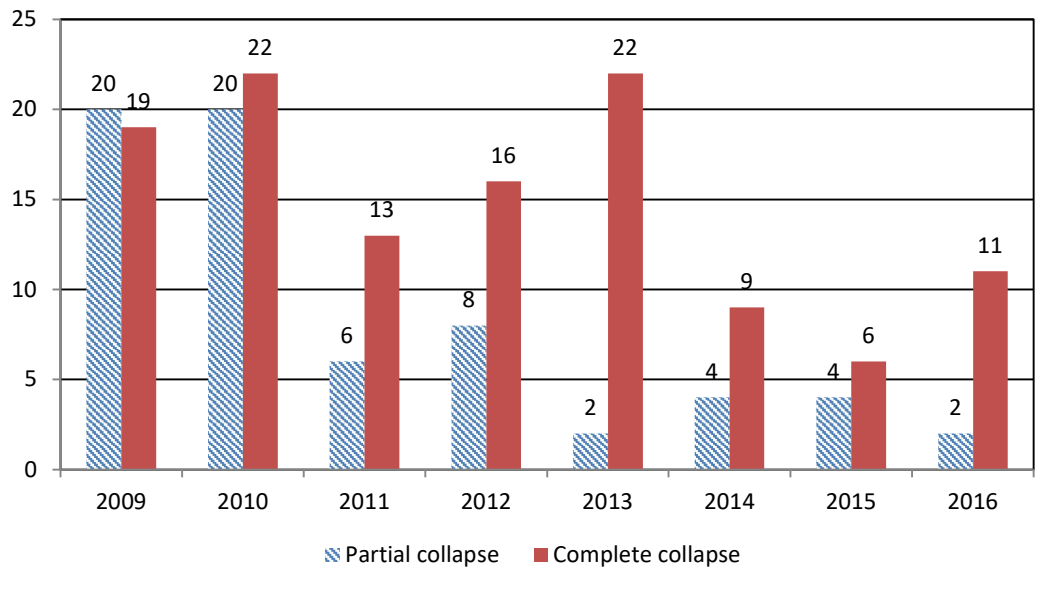
Table 5. Power generation plants in Nigeria and their capacity in 2015

Power Plant	Type	Installed capacity (MW)	Operational capacity (MW)
Egbin	IPP	1320	539
Afam VI	Privatized PHCN	685	455
Okpai	IPP	900	375
Delta	NIPP	480	374
Jebba	IPP	570	262
Olorunsogo Gas	Privatized PHCN	335	189
Ihovbor NIPP	Privatized PHCN	434	182
Geregu NIPP	Privatized PHCN	450	179
Kainji	NIPP	720	173
Olorunsogo NIPP	IPP	760	171
Omotosho NIPP	NIPP	500	169
Omotosho Gas	Privatized PHCN	335	163
Shiroro	Privatized PHCN	600	153
Geregu Gas	NIPP	414	131
Sapele NIPP	IPP	450	111
Ibom	Privatized PHCN	190	76
Sapele	NIPP	504	69
Alaoji NIPP	IPP	720	67
Odukpani NIPP	Privatized PHCN	561	64
Afam IV-V	NIPP	724	2
Asco	IPP	294	0
Omoku	Privatized PHCN	110	0
Trans Amadi	NIPP	150	0
AES Gas	Privatized PHCN	180	0
Rivers IPP	IPP	136	0

Source: Compiled based on information from APT (2015).

There are several reasons why the power sector reforms adopted so far have not had the expected impact on power supply. Although Nigeria has an installed power generation capacity of 12,522 megawatts (MW), only about 30 percent of this capacity is operational due largely to insufficient gas and water supply, inadequate and poorly maintained transmission infrastructure, and high frequency due to demand imbalances (APT 2015). The main sources of primary energy for power generation in Nigeria are thermal power (gas and oil) and hydropower. In 2015, thermal power accounted for about 82 percent of power generation while hydropower accounted for about 18 percent (PwC 2016). Because of the heavy dependence on gas for power generation, inadequate gas supply to the domestic market has a significant negative impact on power supply. There is not enough gas supply to the domestic market because of insufficient gas-processing facilities, pipeline vandalism, and the low regulated gas prices, which do not provide an incentive for oil and gas companies to invest in gas production, processing and supply infrastructure (KPMG 2016a). Challenges also exist at the transmission segment of the power value-chain. For example, only 40 percent of the country is covered by the existing transmission grid and there are significant transmission losses across the network (estimated at about 7.4 percent in the first half of 2015). The network also experiences frequent system collapses due to ineffective maintenance and poor system management (APT 2015). While there has been a significant reduction in the number of system collapses over the past decade, it remains a major challenge for the sector (figure 5).

Figure 5. Number of transmission system collapses, 2009-2016



Source: Compiled based on data from TCN, available at https://www.nesistats.org/system-collapses.html

Note: For 2016, the data is for January to May.

Another reason why the reforms have not had the intended impact on power supply to end users is that there are high losses at the distribution segment of the value-chain. For example, in 2014, about 46 percent of the energy delivered to the distribution companies was lost: 12 percent in the form of technical losses; 6 percent in the form of commercial losses (energy used through, for example, illegal connections); and 28 percent in the form of collection losses (energy billed but not paid for) (APT 2015). The high collection losses are due to inefficiencies in revenue collection, low percentage of consumers with meters, and the dissatisfaction of customers with the quality of services provided by the distribution companies. Table 6 shows that the revenue collection efficiency of the distribution companies ranges from 69 percent in Eko to 30 percent in Kaduna. The table also indicates that the percentage of customers with meters is generally low for most of the distribution companies. In an environment of high collection losses and low regulated tariffs, the distribution companies have been unable to generate enough revenue to cover their costs and this has had a negative impact on their ability to undertake new investments. It has also contributed to the poor quality of services delivered to end users.

Table 6. Some facts on electricity distribution companies in Nigeria in 2016

Distribution company	States or territory covered	Share of total energy consumption	Revenue collection efficiency (%)	Percentage of customers metered
Abuja Electricity Distribution Company	Federal Capital Territory, Niger, Kogi, and Nassarawa	12.88	58.48	40.46
Benin Electricity Distribution Company	Edo, Delta, Ondo, and part of Ekiti	7.46	48.08	65.30
Eko Electricity Distribution Company	Lagos	9.20	69.14	56.51
Enugu Electricity Distribution Company	Enugu, Abia, Imo , Anambra and Ebonyi	9.84	54.74	49.31
Ibadan Electricity Distribution Company	Oyo, Ogun, Osun, Kwara and part of Ekiti	11.90	58.83	41.74
Ikeja Electricity Distribution Company	Lagos	11.40	62.54	44.24
Jos Electricity Distribution Company	Plateau, Bauchi, Benue and Gombe	4.44	31.40	29.74
Kaduna Electricity Distribution Company	Kaduna,Sokoto, Kebbi and Zamfara	7.95	30.54	48.55
Kano Electricity Distribution Company	Kano, Jigawa and Katsina	6.47	49.26	23.40
Port Harcourt Electricity Distribution Company	Rivers, Cross River, Bayelsa and Akwa-Ibom	6.64	39.99	43.64
Yola Electricity Distribution Company	Yola, Adamawa, Borno, Taraba and Yobe	3.05	40.88	21.76

Sources: Compiled based on information obtained from www.nercng.org and www.nesistats.org

Note: Data in the third column is for November 2016 while those for the fourth and fifth columns are for the second quarter of 2016. Also the share of energy consumption does not add up to 100 because it does not include consumption by international customers, who account for about 8.76 percent of total consumption.

5. Policies to power Nigeria for transformative development

The Nigerian power sector has undergone significant reforms over the past decade. The main lesson that has been learned from these reforms is that privatization in itself is not a panacea for the power problems facing the country. Privatization has to be done the right way and under the right circumstances to yield outcomes that are desired and different from what was experienced during the period of government monopoly over the sector. Furthermore, the design and implementation of policies have to be geared towards lifting the binding constraints to effective and efficient generation, transmission and distribution of power. This calls for a holistic approach to policy design and implementation to ensure that challenges affecting all segments of the power sector value chain are addressed. The 2016 Roadmap for solving the nation's power crises unveiled by the Minister of Power, Works and Housing, with a focus on providing incremental, steady and uninterrupted power supply is a good step towards a holistic approach to power sector development (Fashola 2016; FMPWH 2016). However, going forward there is the need to shift from introducing new policy initiatives to actual implementation of policies and demonstration of results.

Policy coherence is needed to accelerate progress in providing stable and affordable power to consumers. This requires effective collaboration and coordination across Ministries in the light of the fact that the power sector depends on the activities of different government departments and agencies. Although the Ministry of Power, Works and Housing is the agency tasked with providing policy guidance and direction to the power sector, key inputs needed by the sector are under other government departments. For example, water is under the Ministry of Water Resources; coal is under the Ministry of Solid Minerals; and gas is under the Ministry of Petroleum Resources. Given these interdependencies, it is necessary to have a formal mechanism and framework for

coordination of policies across the relevant departments, and also between the federal and state governments, to ensure that actions taken by one stakeholder does not jeopardize the attainment of the overall goal of providing incremental, steady and uninterrupted power supply to end users.

A necessary condition for resolving the power crises in Nigeria is to increase generation, transmission and distribution capacity. For example, in the transmission segment investments are needed to extend the transmission grid to cover more areas of the country and there is also the need for better maintenance of existing infrastructure.[6] New investments particularly from the private sector will be needed to enhance capacity across the power value chain. They are also needed to acquire new technologies crucial for upgrading infrastructure and reducing the high transmission and distribution losses plaguing the power sector. So far it has been challenging to attract additional private sector investments due to the liquidity problems facing the sector. There is the need for the government, regulators and other relevant authorities to find a sustainable solution to the liquidity problem affecting the entire power sector value chain.

The energy generation mix is another area where there is the need for policy action. Nigeria depends heavily on gas, oil and hydro for power generation. But it also has huge potential to generate electricity through solar and wind power which is currently not fully exploited. It is in the long-term interest of the country to strengthen efforts to diversify the energy generation mix, which will reduce vulnerability to shocks and also increase energy security. The development of facilities for electricity storage in the medium to long term is also needed to lower electricity costs and increase energy security. Effort should also be made to explore the possibility of power trading at the regional level. But this will require the development of energy exchanges which currently do not exist in Sub-Saharan Africa.[7]

The experience of the Nigerian power sector since privatization began has shown that the sector cannot function effectively if prices set by the relevant authorities for gas and electricity are so low such that gas and electricity suppliers cannot cover their costs. A key reason for the acute shortage of gas for power generation in Nigeria (despite its enormous gas reserves) is that the regulated tariff set is low relative to what gas suppliers receive from exporting gas. In other words, the domestic price of gas creates an incentive for gas suppliers to export gas rather than supply it to the domestic market for power generation. Similarly, the low electricity tariff faced by distribution companies is one of the reasons for the liquidity problem in the sector which has had dire consequences for investment. The NERC has tried to address this issue through the revised Multi-Year Tariff Order (MYTO) covering the period 2015-2024. Going forward, electricity tariffs should be regularly monitored to ensure that they are at levels that permit distribution companies to meet their financial obligations, make reasonable profit, and thrive in the market.

An increase in stakeholder participation in policy design, implementation and regulation of the power sector is needed to enhance transparency and ownership of the policymaking process and outcomes. Admittedly, the Government has made several efforts to promote transparency through setting up of an interactive website (http://www.nesistats.org/index.html) to provide information to the public on the power sector. It has also (through the NERC) played a lead role in establishing the Network for Electricity Consumers Advocacy of Nigeria (NECAN) to protect the interests of electricity consumers. While these efforts are welcome, there is the need for NECAN or other consumer groups to be officially integrated into the policy design process as well. So far the focus of NECAN has been on regulatory issues and the distribution companies. It would be desirable for the government to find ways and means of formally integrating consumer groups into the policymaking process to ensure that policy decisions reflect the needs of end users. There is also the need for the government to create adequate space for NERC to really function as an independent commission (Amadi 2015).

Capacity building for both government officials and also staff of the privatized generation and distribution companies will play a vital role in the effective implementation of the policies proposed in this paper and also in achieving the goals set for the power sector by the government. The power sector requires highly skilled manpower to design, build, operate and maintain plants and the government acknowledged this need by

[6] Nigeria's transmission grid capacity is currently 7,200 MW, which is below the installed generation capacity of 12, 522 MW and higher than the average operational generation capacity of less than 4000 MW (Nextier Power 2017; APT 2015). This suggests that as existing plants begin to operate at full capacity, the transmission grid will become a major constraint to providing adequate power supply to consumers.

[7] So far, there is very little energy trading taking place in Sub-Saharan Africa and it occurs through regional Power Pools (KPMG 2016b).

establishing the National Power Training Institute of Nigeria (NAPTIN) in 2009 to enhance the skills and capacity of personnel in the sector. Going forward, NAPTIN should forge innovative partnerships with research and training institutes in other countries to benefit from their knowledge base and maximize the impact of its activities. There is also the need for the government to re-examine the educational curriculum of Nigerian universities to ensure that they produce graduates that have skills needed by the burgeoning power sector.

6. Conclusion

There is huge potential for expansion of the manufacturing sector in Nigeria that is currently not being exploited as evidenced by the high domestic demand for consumer products that is currently being met through manufactures imports and the availability of skilled and semi-skilled workforce. Unlocking this potential will require lifting the binding constraint imposed by poor access to affordable and stable power supply. This paper examined the role of power in the challenge of industrialization in Nigeria and identified three main channels through which poor power supply has had a deleterious impact on industrialization in the country: low manufacturing capacity utilization; lack of competitiveness; and lack of firm growth. The paper also examined recent reforms in the power sector and identified policies that the government should consider adopting to power Nigeria for transformative development.

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