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CCSI Policy Paper

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## Key Points

- 1 Nigeria possesses large reserves of crude oil and has historically sought to foster investment in its refining sector to serve its large domestic demand.
- 2 Government attempts to attract foreign investment in the refining industry were met with initial success. Nationalizations, ineffective management and ill-designed policies resulted in production levels of roughly 30 percent of nameplate capacity.
- 3 Low production levels have failed to meet domestic demand and kept Nigeria as a net importer of refined petroleum.

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## Downstream Beneficiation Case Study: Nigeria

### Introduction

The Federal Republic of Nigeria (Nigeria) was selected as a case study due to its long history of trying to develop the downstream sector out of its oil industry through various policies with differing levels of success. Although the country has the 10<sup>th</sup> largest oil reserves in the world and over 90 percent of Nigeria's export revenue and 35 percent of total GDP comes from the oil industry, less than 1 percent of national GDP comes from the downstream oil sector.

For the purpose of this case study, a historical overview of Nigeria's downstream oil industry is given from 1956 to the present day. This overview will examine the downstream oil industry with a focus on Government policies and other factors which influenced the development of the downstream oil sector, emphasizing the reasons the sector failed when many of the pre-conditions for a successful development were in place at the outset.

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## Refining Industry Before 1970

Nigeria's oil industry began with the discovery of crude oil reserves by the Shell Group in 1956.<sup>ii</sup> Nigeria produces a variety of light, sweet oil grades such as Bonny Light and Escravos Beach. Nigerian oil is highly desired by refineries in developed nations as it is less corrosive for refinery infrastructure and is easier to refine into high value products such as gasoline or jet fuel when compared to other types of crude.

Despite the high export value of its crude, Nigeria built its first refinery in 1965 as part of a joint venture by Shell and British Petroleum known as the Nigerian Petroleum Refining Corporation (NRPC).<sup>iii</sup> The refinery was built in Port Harcourt and had an initial capacity of 38,000 b/d. It was built with the intent to produce gasoline for the domestic transportation market.<sup>iv</sup> Production levels remained stable and saw little change during the first four years of private operation. The refinery continued to operate effectively after the Government's passage of the 1969 National Petroleum Act,<sup>v</sup> which vests ownership of all petroleum resources of Nigeria in the state. This act also instated a domestic obligation for international oil companies that required upstream producers to "subsidize" the local refineries by selling around 8 percent of their crude oil production at a price of around \$1.80/barrel, which was about 5 percent of world market price up until around 1985.<sup>vi</sup>

## Refining Industry 1970-2003

In 1970, the Nigerian Government began to take steps to nationalize the downstream oil sector. Throughout the 1970s, the Government progressively increased its participation in the equity of all oil international oil companies' operations in Nigeria, including the NRPC, until it reached 60 percent in 1978.<sup>vii</sup> The Government

### The NNPC

The Nigerian National Petroleum Corporation (NNPC), Nigeria's national oil company, sells close to one million barrels of oil per day, a little less than half of the entire country's production in 2013. The Government created the NNPC in 1977 as "an integrated national oil company engaged in exploration, production, processing, transportation and marketing of crude oil, gas and their derivative." The NNPC is managed by a board of directors appointed by the President of the Federal Republic of Nigeria and, since restructuring in 1988, consists of three main arms: corporate services, operations and national petroleum investments.<sup>i</sup> The NNPC's operations arm manages 11 subsidiary companies including the companies operating the four state-run refineries: Warri Refinery and Petrochemical Company, Kaduna Refineries and Petrochemicals Company and the Port Harcourt Refinery Company.

In 2013, the NNPC was worth an estimated \$41 billion and constituted the Government's largest revenue stream. Despite its large economic value, the NNPC's management has suffered from allegations of corruption, inefficiency and performance failures.<sup>i</sup>

The Domestic Crude Allocation (DCA) has been described as one of the biggest problems. Every day the Government allocates about 445,000 barrels to the NNPC for "domestic crude." The NNPC then sells this crude to its subsidiary, the Pipelines and Product Marketing Company (PPMC). The PPMC is supposed to then transport the crude to one of the four state owned refineries, which then sell the refined product. In these transactions, the NNPC and Government have been exposed to exchange rate fluctuations since NNPC buys the crude in dollars and sells the refined product in Naira. With the Naira exchange rate falling from 0.77 Naira to the dollar in 1982 to around 300 Naira to the dollar in 2017, this has had a disastrous impact on Government refining revenues.<sup>vi</sup>

In addition, since the four Nigerian refineries can only physically process around 100,000 barrels per day, the reality is that the NNPC re-routes most of the DCA to the export market or petroleum for product swaps. The payments from these transactions, which are the main source of funding from NNPC, enter separate NNPC accounts with no clear accounting rules, such as a set transfer price. NNPC has exerted discretionary withholding on DCA revenues to finance subsidies and cash calls from operations. It has been assessed that in 2004, the NNPC retained about \$1.6 billion or 27 percent of the DCA's full value for that year (with 73 percent sent to the federal level). In 2012, these numbers increased to \$7.9 billion and 42 percent, with only 58 percent being sent to government coffers, depriving the Government of much needed revenues for development priorities.<sup>i</sup> Despite these challenges, successive administrations have done little to reform the NNPC.

established a national corporation through which it could control the Government's share of the international oil operations, called the Nigerian National Petroleum Corporation (NNPC). Throughout this transition, the NPRC continued to operate effectively and, in 1973, the Port Harcourt refinery capacity was expanded from 38,000 b/d to 60,000 b/d to satisfy the growing local consumption.<sup>vii</sup>

The Government's move into the oil industry led to a transformation in the Nigerian workforce. Between 1973 and 1983, the Nigerian Government sponsored 535 scholarships (on average 33 per year) for the education of petrochemical and environmental engineers.<sup>viii</sup> International oil companies sponsored even more Nigerians for training and employment. This helped to increase the number of Nigerians employed by the oil industry both in the upstream and downstream sectors. Figure 1 shows that the number of Nigerians employed by the industry rose between 1972 and 1982 while expatriate employment remained fairly constant (the reason behind the peak in numbers in 1977 remains unclear besides the fact that the peak corresponds to the creation of NNPC). Zooming in on the refinery workforce, in 2010, the workforce of Nigeria's refineries totaled 12,532 employees compared to the 21,794 employed in petroleum extraction. Compared to the total workforce in 2010, refinery employees were roughly .02 percent of the workforce.<sup>ix</sup>

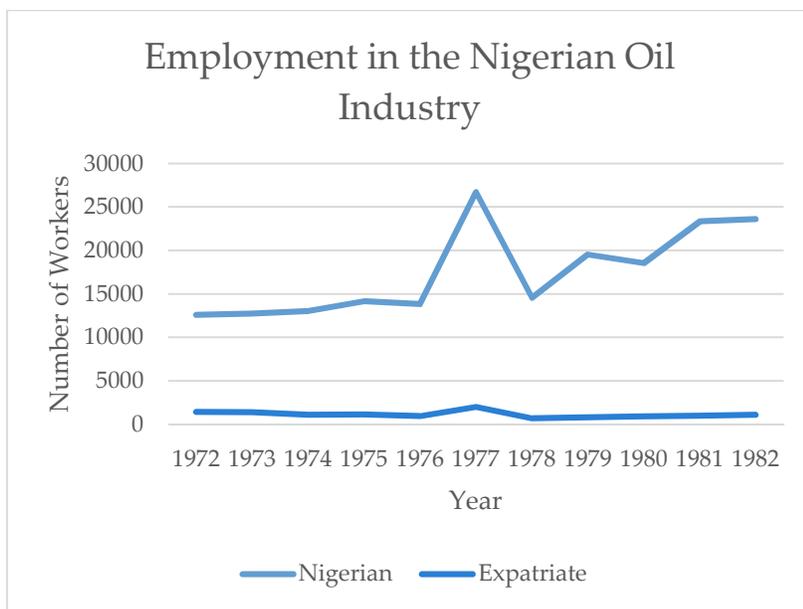


Figure 1 - Data from NNPC Annual Report 1996

While increasing equity participation, the 1970s also saw the Nigerian Government's attempt to attract international contractors in the construction of refineries. To do this, the Government held several international bidding rounds to attract investors. In 1975, the Government awarded the Warri Refinery project to the construction company Snamprogetti SPA of Milan, Italy. The project cost \$478 million and the refinery was completed in 1978 with a production capacity of 100,000 b/d.<sup>vii</sup> The Warri plant was specifically intended to increase the domestic production of motor oil for Nigerian consumption.<sup>iv</sup> In 1976, the Government awarded the Kaduna Refinery project to Chiyoda Engineering and Construction Company of Japan. This project cost \$525 million and was completed in 1979 with a production capacity off 50,000 b/d for regular fuels and 50,000 b/d for lubricating oils, waxes and asphalt.<sup>vii</sup> In order to produce the latter, Nigeria began in 1982 to import heavy crude from Venezuela that had the desired quality to yield the lubricating oils, waxes and asphalt. The agreement with Venezuela ended in 1988 officially due to "upgrades to the Kaduna refinery" but more likely due to market prices for asphalt not justifying the cost of production. After Nigeria terminated the agreement with Venezuela, it began to import crude from Saudi

Arabia as a substitute, which ended up as an aberration as Venezuela's crude oil and Saudi Arabia's cannot be swapped, since they have different qualities.<sup>iv</sup>

Throughout this time, the Nigerian Government continued to expand its influence in the refining industry and, in 1978, fully nationalized the Port Harcourt Refinery by acquiring the remaining 40 percent of equity from Shell and BP. Although all three refineries were producing by 1980, product shortages of gasoline persisted and the Government began working to increase output to meet domestic demand. In 1985, the Government commissioned debottlenecking projects for both the Warri and Kaduna refineries that increased nameplate capacity at the Warri refinery by 25,000 b/d and 10,000 b/d at the Kaduna refinery.<sup>vii</sup>

In 1985, the Government of Nigeria also began an initiative to export refined petroleum from the Port Harcourt Refinery. Contracting with a consortium of two Japanese firms, JGC Corporation and Marubeni Corporation, along with Spie Batignolles of France, the NNPC commissioned a second refinery at Port Harcourt for a cost of \$850 million. The refinery was completed in 1989 with a capacity of 150,000 b/d. Its completion began a brief period of surplus production, which allowed Nigeria to become a net exporter of refined petroleum over the next two years.<sup>vii</sup>

By the end of 1991, however, decreasing production at the Warri and Kaduna refineries coupled with naturally increasing domestic demand for refined petroleum stopped exports from the new Port Harcourt refinery.<sup>vii</sup> Since that time, the Nigerian refining industry has not been able to produce sufficient levels of refined petroleum to meet domestic demand and has been a net importer of refined petroleum products.

## Refining Industry 2003-Present<sup>x</sup>

In 2003, the Nigerian Government began to take steps towards re-privatizing the refining sector. The National Energy policy of 2003 laid a framework for further development of the refining sector. Its goals included:

1. "Maximizing and expanding the refining capacity in the country to cater fully for local consumption and export of petroleum products."
2. "Ensuring adequate geographical coverage of oil refining and petroleum products distribution network."
3. "Ensuring the availability of adequate strategic reserves of storage capacity for refined products for at least 90 days of forward consumption."
4. "Creating a domestic supply of oil from tar sands to feed into the Kaduna Refinery, which refines imported heavy crude with similar properties."
5. "Rehabilitation of refineries, petroleum products distribution infrastructure, power plants, transmission and distribution networks."
6. "Improvement and promotion of the provisions put in place for the establishment of export refineries."
7. "Commercialization of the operations of existing refineries while taking steps to promote private sector participation in the refining business."

In 2015, the Government signed a memorandum of understanding with Epic Refinery Group for the construction of a 100,000 b/d refinery in Delta Bayelsa State.<sup>xi</sup> Aliko Dangote, the concrete magnate and one of Africa's wealthiest businessmen, has begun development of a massive, 650,000 b/d refinery on the

outskirts of Lagos.<sup>xii</sup> Scheduled for completion in 2019, the Dangote Lekki refinery would more than double the country's current refining capacity.<sup>xiii</sup>

Another major effort to attract private investment in the refining sector has been to repeal the decades long fuel subsidy. Indeed, in 1973, the federal Government began its controversial petroleum subsidy program. This program set a fixed price for petrol at the fuel station pump and required the Government to pay the difference to petroleum marketers. This subsidy had an adverse impact on the refining sector (as explained in the box on the right). In December 2015, President Buhari stated that the 2016 budget would no longer provide funding for petroleum subsidies. This was a landmark decision that was approved in May 2016, creating far-reaching effects in the Nigerian economy.<sup>xiv</sup>

### Effects of the Fuel Subsidy

The Government subsidy had the direct effect of increasing consumption so that Nigeria's unreliable refineries rarely managed to produce enough for domestic demand. Additionally, significant quantities of petroleum products found their way into neighboring markets where oil prices were as much as fifteen times higher. For example, in 1993 some oil industry sources noted that up to 100,000 b/d of refined petroleum was being smuggled by land to Benin, Cameroon, and Niger.<sup>iv</sup> The World Bank notes that the amount of petroleum smuggled is routinely close to 10 percent of operating capacity.<sup>iv</sup> Smuggling helped maintain the gap between domestic consumption and production.

The subsidy also created a significant burden for the Nigerian economy. In 1993, a Petroleum Argus survey indicated that the cost to the Nigerian economy was 1,606 million US dollars.<sup>iv</sup> This represented roughly 17 percent of the country's oil export earnings.

Repeal of the subsidy, however, was politically difficult. An attempt to repeal the subsidy in 2012 led to protests across the country and the eventual reinstatement of the policy for another four years.

All of these efforts are intended to turn Nigeria from a net importer of refined petroleum to a net exporter with sufficient fuel capacity to supply its domestic market.

Figure 2 compares domestic production of refined petroleum to refined petroleum imports from 2006-2015. It is easy to see the trend that Nigeria is regularly importing more petroleum than it produces to satisfy domestic demand (the drop in imports in 2011 seems to be due to issues with data collection). In 2015, the petroleum refined domestically made up a little more than 5 percent of the petroleum products consumed in the country. This suggests that there remains a sizable market for domestic refineries to serve.

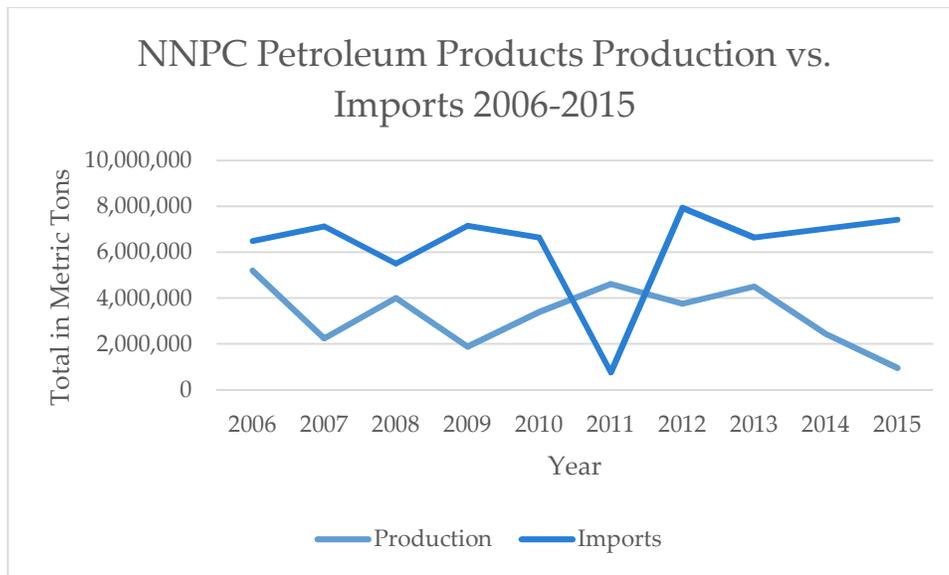


Figure 2 – Made Using Data from NNPC Quarterly Petroleum Reports

## Problems Faced By the Nigerian Refining Industry

The inability of Nigerian refineries to meet domestic demand stem mainly from poor management at the hands of the NNPC. Many reports by independent observers and the Nigerian Government itself have identified factors responsible for the failure of Nigerian refineries.

First, the opaque mishandling of the money collected from crude sales as mentioned in the box above has debilitated the financial health and credibility of NNPC.

Second, the lack of autonomy of NNPC from the Government has led to conflicts of interest. For example, there has been political interference in terms of compulsory staff appointments, promotions or retirements as well as procurement issues and arbitrary appointment of contracts.<sup>vii</sup>

Third, inadequate funding and long decision-making processes delay important investments. Sometimes one approval requires as many as 27 signatures.<sup>vi</sup> Spending on maintenance and aging infrastructure has often been delayed. Securing appropriate equipment, supplies or contractors is very difficult for individual managing directors as well as for the IOCs, joint-venture partners of NNPC.<sup>vii</sup>

Fourth, the technical services departments of refineries have not provided adequate support. Lack of experienced staff due to poor hiring decisions or lack of training have led to poor monitoring of refinery systems and an inability to make necessary improvements or innovations to improve refinery activities.<sup>vii</sup> This has led to frequent shutdowns of units or entire refineries. Fires have occurred frequently at NNPC operated refineries. While most international companies would consider more than one or two fires a year as a serious issue, NNPC refineries have much higher rates of incidence for fire. Figure 3 tracks NNPC reported fires between 2002 and 2011.

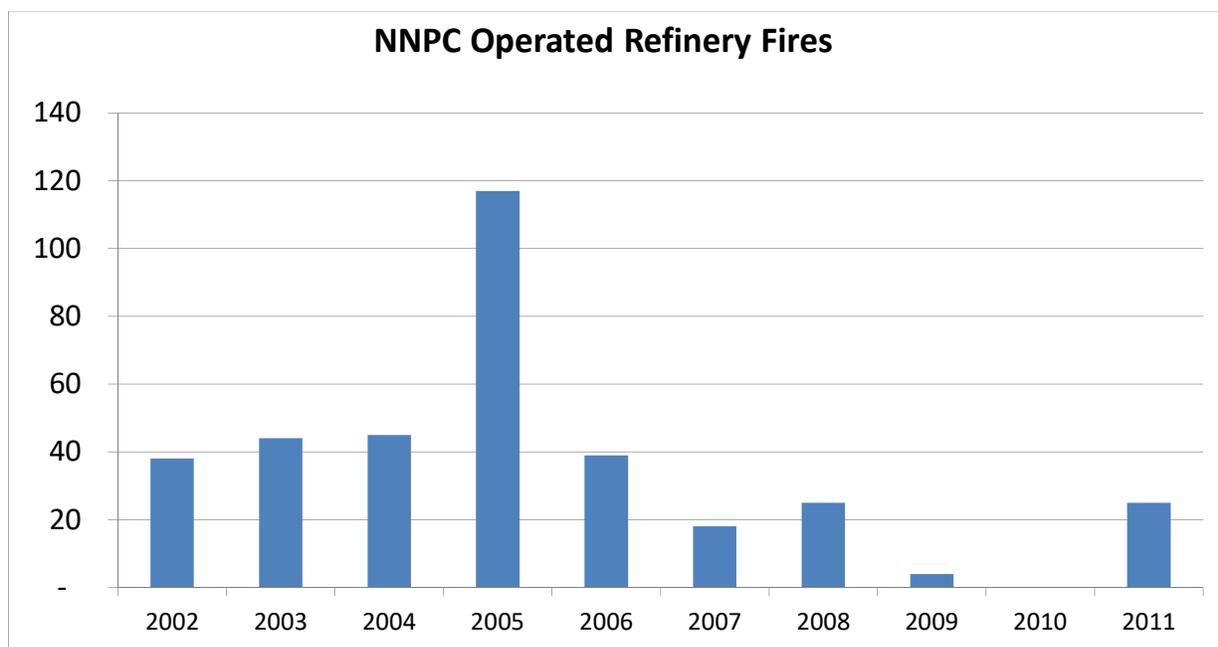


Figure 3 - Made Using Data from the NNPC

Fifth, maintenance has often been neglected due to shortages of spare parts and a lack of systematic maintenance activity. Turnaround maintenance (TAM)<sup>1</sup> should be completed after every 24-36 months of continuous operation. The NNPC has been notoriously slow to complete maintenance requested by the refineries. For example, the Port Harcourt refinery had its first TAM in 1991, on time, its second in 1994, one year late, and its third on 2000, three years late.<sup>vii</sup> Such failure to hold regular maintenance is a major contributor to equipment failure and chronic shutdowns.

Sixth, disruption of distribution networks has resulted in losses. At this time PPMC reports losing more than 40 percent of all products to sabotage, theft and equipment failure.<sup>i</sup> Pipeline vandalism has forced unscheduled downtime of refineries. Figure 4 shows the large number of vandalism events that have occurred on the distribution network between 2002 and 2011. In 2011 for instance, NNPC reported “Pipeline vandalism increased by 224 percent over the previous year. A total of 2,787 line breaks was reported on NNPC pipelines out of which 2,768 was as a result of vandalism, while 19 cases were due to system deterioration resulting in a loss of 157.81 mt of petroleum products worth about N12.53 billion. There were 25 cases of fire incidents during the year under review.”<sup>xv</sup>

This vandalism is often associated with “bunkering” or smuggling of petroleum products to neighboring countries without price controls like in Nigeria (see box above on subsidies). It became a major source of corruption for Government officials and fed off of poor accounting, controls and unpredictable operability in the refineries. Until recently, being caught for smuggling would be sanctioned by a death penalty.

<sup>1</sup> Turnaround maintenance (TAM) refers to the process of taking the refinery offstream for a period of time to perform extended maintenance. Standard practice is that refineries should be shut down every 2 years for 45-60 days. Turnaround maintenance can be very expensive if mismanaged due to the lost production as well as the substantial costs of labor, materials and equipment.

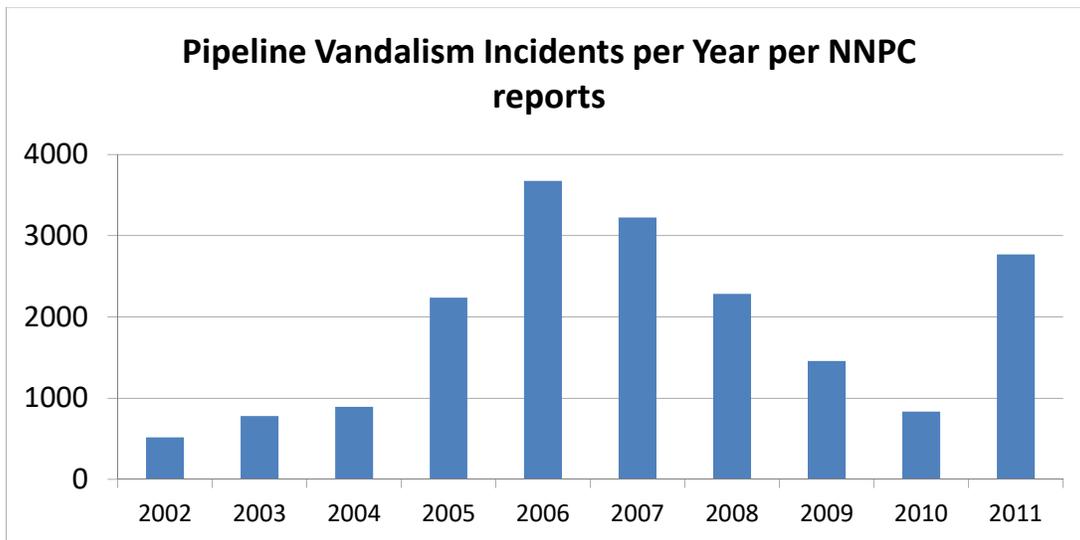


Figure 4 - Made using Data from the NNPC

Supposedly to cope with the pipeline theft, NNPC and PPMC resorted to two solutions. The first one was to hire guards. PPMC initially hired community members as guards, but then replaced them with the military when they ended up participating in the theft themselves. Under the soldiers' watch, sabotage continued so NNPC hired ex- Niger Delta militant leaders for a cost of at least \$39.5 million a year. Despite this enormous cost, according to NNPC's records pipeline losses went up.<sup>i</sup> The second solution was to arrange deals with private firms to transport the crude by water to refineries: in 2011 such a deal was arranged for the Warri refinery and in 2014 for the Port Harcourt ones. According to Nigeria's petroleum minister, NNPC was spending an average of \$7.52 per barrel to transport domestic crude to the Port Harcourt and Warri refineries by ship in 2014. This fee is to be compared to PPMC's charge of only ₦0.30/liter (or roughly \$0.03 per barrel) to transport oil through pipelines. Adding to the confusion is the fact that PPMC does not seem to have held a competitive bid to award the original transport deals and the government never disclosed the terms of the contracts. In addition, NNPC records show that oil is moved through the Escravos-Warri refinery pipeline well after the ship transport arrangements started when the latter was supposed to stop transportation by pipeline.<sup>i</sup> Both solutions illustrate how mismanagement through opaque deals drains the public resources.

Seventh, labor productivity remains a recurring difficulty for Nigerian refineries. While salaries were increased in 1979, 1983 and 1985, the productivity levels of workers did not keep pace. In some cases at the Warri refinery, some workers were accused of idleness even when their wages were paid.<sup>xvi</sup>

All of these problems have led Nigeria's refineries to produce significantly less than their nameplate capacity. Additionally, these factors restrict the extent to which cost advantages linked to scaled production can be applied to Nigeria's refineries.<sup>xvi</sup> In the case of the Warri Refinery from 1985-1988, production declined as the plant produced 2.8 mmt; 2.2 mmt; 1.7mmt and 1.5 mmt respectively. At the same time output was decreasing, the refinery's total costs increased from 16.13 million naira in 1979 to 58.9 million naira in 1983 and 172.06 million naira in 1988. Over this time, variable costs, including material and labor costs, comprised 85 percent of the total cost.<sup>xvi</sup> This suggests mismanagement of the refinery's budget since more money was being spent on salaries and payments for fuel and other input costs even though output was decreasing. Furthermore, as a result of this situation of stagnant to declining refinery outputs, NNPC accumulated over \$3 billion in debts to fuel suppliers that it settled partly by mortgaging 15,000 barrels per

day of future oil production in exchange for a syndicated bank loan. However NNPC has still over \$1 billion in arrears.<sup>i</sup>

Figure 5 illustrates the continued inefficiency of Nigeria’s refineries. Utilization of nameplate capacity never rose above 50 percent between 2006 and 2015 and sank into the single digits in several years whereas the global average is around 85 percent.<sup>xvii</sup> This chronic underutilization of the installed refining assets presents one of the downstream sector’s greatest problems.

Despite this, however, the Government has done little in recent years to reform NNPC operations.

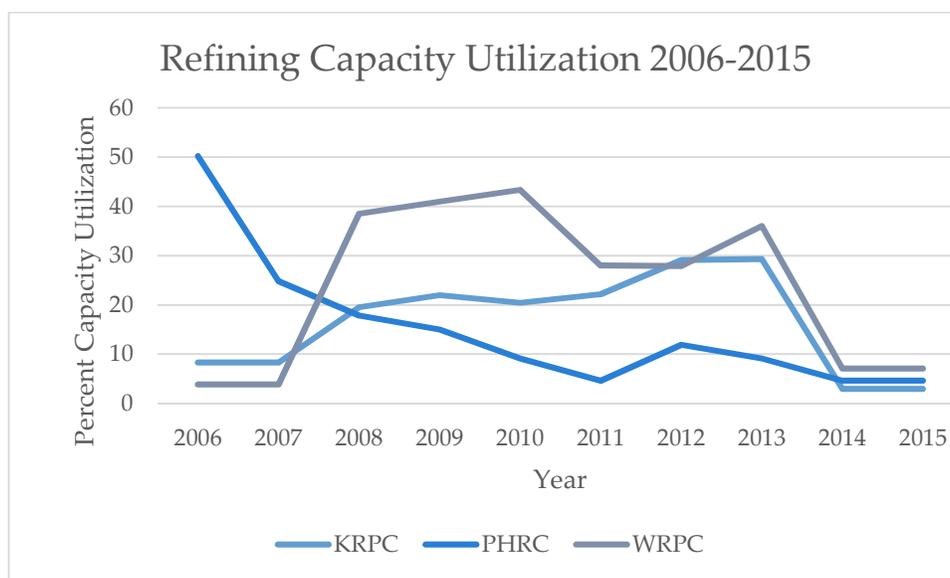


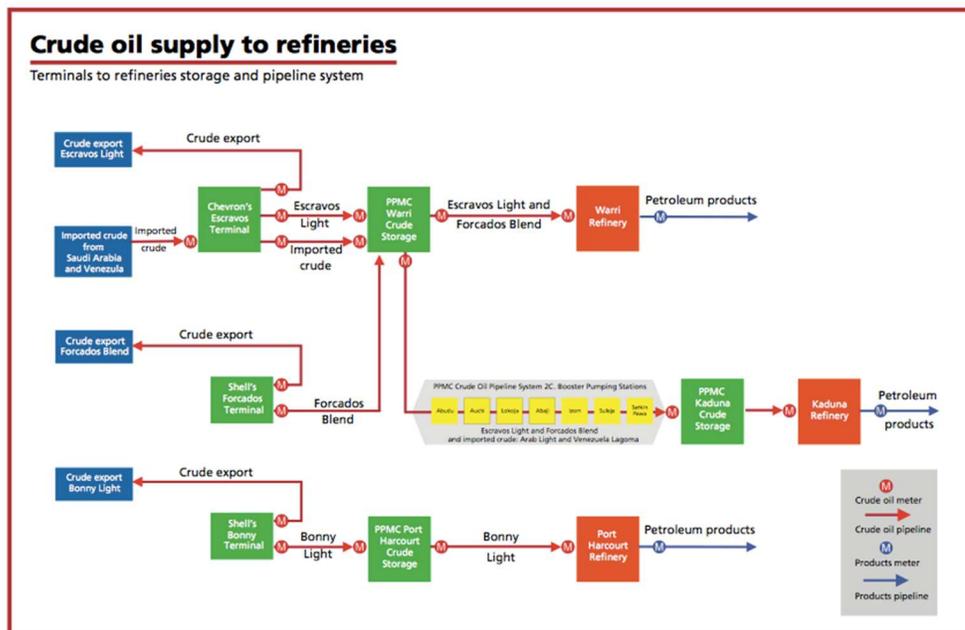
Figure 5 - Made Using Data from NNPC Quarterly Petroleum Reports

## Key Conclusions

Nigeria is a country that presents a challenge for analysis. It has many factors often thought to encourage the development of a domestic refining industry including large reserves of crude oil, a domestic demand for refined petroleum that far exceeds current production and historical Government efforts to encourage a domestic industry. Despite the presence of these factors, Nigeria has rarely been able to meet its domestic demand and has only been able to become a net exporter of refined petroleum twice in more than fifty years of production. The deficient production stems from a host of issues with Nigeria’s four state-owned refineries but primarily comes from poor policy at the federal level and poor operations and maintenance at the hands of the NNPC. Voices for full privatization of the downstream sector have risen on the grounds that “ordinary citizens are not the main beneficiaries of NNPC’s unreliable refineries” and those only benefit “the traders, service contractors, government officials, powerbrokers, middlemen, police and soldiers, smugglers, militants, gang members and other criminals.”<sup>i</sup> While several government-commissioned reports have argued for the deregulation of the sector and the removal of NNPC from this business, there is still no clear plan to undertake it.<sup>i</sup> A transitory solution could be to eliminate the DCA for the reasons stated above and remove PPMC from refinery sales. A tolling structure could be adopted, whereby NNPC would grant the refineries operational independence and lease refining capacity from them. NNPC could do this in exchange for supplying refineries crude that it would buy from its upstream partners on behalf of the refineries. The [Downstream Beneficiation Case Study: Nigeria](#)

volumes would be capped at the refineries' actual capacity.<sup>i</sup> A range of models seems possible as long as there is political will to embark on a transformative reform of the refinery business.

## Annex:



Source: NEITI 2006

Figure 6 – From upstream to downstream for the four refineries

## Bibliography

- <sup>i</sup> Sayne, Aaron. Natural Resource Governance Institute. "Inside NNPC Oil Sales: A Case for Reform in Nigeria" Aug 2015
- <sup>ii</sup> NNPC. "History of the Petroleum Industry"  
<http://www.nnpcgroup.com/NNPCBusiness/Businessinformation/OilGasinNigeria/IndustryHistory.aspx>
- <sup>iii</sup> Ibanga, Ifiok. "The Economics of Privatizing and Deregulating the Nigerian Downstream Oil Sector".  
<http://www.florin.com/valore/ifiokibanga.html>
- <sup>iv</sup> Kahn, Sarah. Nigeria, the Political Economy of Oil. Oxford Press 1994. p. 138-140
- <sup>v</sup> Laws of Nigeria. "National Petroleum Act of 1969." <http://lawsfnigeria.placng.org/laws/P10.pdf>.
- <sup>vi</sup> Interview with expert, March 2017
- <sup>vii</sup> Ogedegbe, Alexander. The Nigerian Academy of Engineering. "The Nigerian Petroleum Refineries: History, Problems and Possible Solutions." 11 Jun 2009
- <sup>viii</sup> Chima, R.I. "Technology Transfer and Acquisition in the Oil Sector and Government Policy in Nigeria." African Technology Policy Studies Network. 2002
- <sup>ix</sup> National Bureau of Statistics. National Generation Stock and Employment Generation Survey. 2010
- <sup>x</sup> See Annex for a visual of the refineries in relation to upstream as they are today.
- <sup>xi</sup> Bivbere, Godfrey. Vanguard. "Firm signs agreement for 100,000 bpd private refinery". <http://www.vanguardngr.com/2016/01/firm-signs-agreement-for-100000bpd-private-refinery/> Published 12 Jan 2016.

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- <sup>xii</sup> Whiteside, Logan and Giokos Eleni. CNN Money. “Can this Massive Refinery Solve Nigeria’s Energy Crisis” <http://money.cnn.com/2016/06/06/news/economy/nigeria-dangote-energy-oil-refinery/> Published 06 Jun 2016.
- <sup>xiii</sup> Onyekakeyah, Luke. The Guardian. “The Dangote Lekki Refinery”. <http://guardian.ng/opinion/the-dangote-lekki-refinery/> Published 12 Jul 2016.
- <sup>xiv</sup> Gaffey, Connor. Newsweek. “Nigeria Removes Fuel Subsidy, Prompts Mixed Reactions” <http://www.newsweek.com/nigeria-removes-fuel-subsidy-prompts-mixed-reactions-459159> Published 12 May 2016.
- <sup>xv</sup> NNPC Draft Annual Statistics Bulletin, 2011.
- <sup>xvi</sup> Ayodele, A. ‘Sesan. Nigerian Institute of Social and Economic Research. Production and Cost Structure in Nigeria’s Public Enterprises: The Case of NEPA and Warri Refinery Plant. Niser Monograph Series. 1991. p. 30
- <sup>xvii</sup> NEITI, 1999-2004 Process Audit: Refineries and Product Importation, 2006