The Potentials of Illegal Petroleum Refining Technology for Economic Development in Nigeria

By

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Abstract

The paper contends that petroleum refining technology indeed exist in Nigeria and therefore it is the responsibility of the Federal and State governments to encourage public and private sector research in order to modify and evolve the existing technology presently regarded as illegal into a safer, durable, and more sustainable technology. This will halt the huge amount being expended in foreign exchange to import petrol (PMS).It will significantly shrink the demand for the United States dollar and improve the exchange rate between the dollar and the Naira in favour of the latter; significantly reduce the market price of the product; reduce cost of transportation as well as cost of production in industries dependent on self generating energy and set the country on the path to industrialissation. It would significantly reduce inflation. This will boost the country's foreign reserve and therefore strengthen the value of the currency. The intention of this study is to interrogate the potentials of the phenomenon known in Nigeria as "illegal" refinery for appropriate authority to identify existing indigenous technologies in various sectors and upgrade same for national development

Keywords: Illegal refinery, indigenous technology, fuel importation, foreign exchange, National reserve, inflation, fuel subsidy

Introduction

Technology emerged as a result of man's effort to profitably preserve surplus products, as well as explore various use values of organic and inorganic

substances around in his environment. In the endeavour to provide for themselves the basic needs of food, clothing, shelter and security, the people of the Niger Delta, from earliest times, consistently applied rationality to the design, innovation and fabrication of implements to enable him tackle effectively the challenges in his particular environment. The Palm fruit, palm wine, sugar cane, sea water, roots and stem of mangrove plant and later crude oil are some of such substances they derived multiple uses from. (Derefaka,2002)

The loss of political sovereignty which resulted from the British colonisation of the Niger Delta in the last quarter of the 19th century according to Andah, (1988:185) impeded further evolution of indigenous technology which under better circumstances would have progressed at a sustainable pace dictated by events within and around the region, and not by conditions imposed by an external sovereign. Hence the country missed out on the industrial revolution.

The faulty economic structure (Ake,1981) imposed by the British which cast African colonies in the role of producers and exporters of raw material whose value was, and still is, significantly lower than that of her imports, exacerbated matters as it resulted in deficits in their balance of trade accounts. Unfortunately, the dependence of successive leaders in Nigeria on Western technology regardless of the cost has made it near impossible for them to make deliberate attempt to harness indigenous technology, or adapt Western technology to set the country on the path to modern industrialisation.

About three decades ago, the indigenous gin distillation technology was modified by Nigerians, albeit without license, and is continually being evolved, to refine crude oil into petroleum products of acceptable standard to meet a growing demand and fill the gap created by failed refineries, and inadequate imports by successive federal governments (Purefoy,2010)

The research is based on certain key premises, namely, Petroleum refining technology exist in the Niger Delta region of Nigeria; the technology is indigenous and derived from that employed in gin distillation; that the path to sustained industrialization lies in the creation of the enabling environment for indigenous inventors and enterprises to thrive side by side with foreign technology; the

continued budgeting and release of scarce funds by successive governments in Nigeria for turn-around maintenance of refineries – that a former executive of the National NPC corporation (NNPC) Mr. Ogedengbe adjudged obsolete as at 2009 and thus operating far below their intended respective capacity - (Ogedengbe,2009) amounts to an economically wasteful venture for the country.

The failure of successive administrations to build new refineries has paved the way for further wastage in the form of fuel importation further depleting the country's scarce foreign exchange earnings. This condition was made worse by the subsidy the Federal government claimed it paid to licensed importers of fuel.

Establishment of Refineries in Nigeria and Importation of Fuel

The Warri and Kaduna refineries were completed in 1978 and 1979 respectively. Both were expanded in 1985 to meet increasing demand of petroleum products. In 1989, a new refinery with a 150,000b/d capacity was constructed close to the existing refinery at Port Harcourt bringing the total installed capacity in the country to 445,000b/d. (Ogedengbe,2009)

Products derived from crude oil are numerous and the applications are equally many and beneficial. They are so indispensible they can be aptly described collectively as some of the drivers of the modern economy. Mobility of goods, services and individuals become highly enhanced. The pharmaceutical, cosmetics, fertilizer and plastic industries also extract derivatives from crude oil. In a state where industries are functioning efficiently, employment opportunities are created in related sectors especially in the organised and un-organised private sector. It provides a boost for the economy sufficient to act as a catalyst for industrialization.

Petrol scarcity resulting from less than installed capacity, increased population, coupled with 30% minimum wage increase in 1975, facilitated by the oil boom increased consumer power resulted in increased demand and consequently fuel scarcity between 1973 and 1974 (Ohiorhenuan,1989:143). Consequently, in 1975 the General Yakubu Gowon Federal government began importing fuel into the country to augment that produced locally. Then the value of the Naira was quite strong so the impact on the economy was not felt very much. The practice has

continued till date and increased demand on the dollar has impacted negatively on the Naira leading to high cost of living generally

Fuel Subsidy

The high demand on the United States dollar has led to a downward spiral of the Naira (from N460/ US1 as at May 2023 to to N1550/$1 in 2025, significantly raising the cost of all items including the pump price of petroleum. Susidy was therefore introduced by the President Olusegun Obasanjo Federal government in 1999.

Between 1999 and 2006, Chief Olusegun Obasanjo, spent about N 812 billion on fuel subsidy. His successor President Umar Yar'Adua spent N 794billion between 2007-2009, while President Goodluck Jonathan spent N3.9 trillion as subsidy payments between 2010 and 2014. President Muhammadu Buhari paid out the highest amount, N11 trillion as subsidy between 2015 and 2023. (Abubakar,22 May 2023). By 2023, it had become obvious that the amount required for subsidy payments had become too much of a burden for the state. Consequently, he omitted it in the 2023 budget when he was about to leave office, and his successor, Alhaji Ahmed Tinubu announced that he would not reinstate it when he was sworn in in May 29 2923. (subsidy removal

Privatisation and Deregulation of the Downstream Sector

Deregulation simply means allowing the forces of demand and supply to dictate prices of petroleum products. It indicates a switch from subsidy regime to solely commercial endeavour and the participation of the private sector. The Weekly Trust, (2004) reported that in 2004, the chief Olusegun Obasanjo government, announced its intention to sell 51% of its shares in each of the refineries but could not get serious buyers. In October 2004 his government granted eighteen (18) licenses to various firms and by March 2007, the DPR cancelled all 18 licenses since the licenses were dormant. Later one has been re-issued.

BBC Moble, (6 JULY,2010) reported that the plan by President Goodluck Jonathan to construct three new refineries in the country failed. A public-private partnership between the Nigerian government (20%), the Lagos State government (to provide land}, and a Chinese firm (80% of total cost) to build an $8million refinery was unsuccessful as well. The effort of his administration to encourage

solely private sector driven initiatives in this sector which the NNPC code named Greenfield refineries in the mega, medium and micro refineries also failed. .
The Alhaji Aliko Dangote 650 000 barrels per day commenced operations in 2024 at very great cost ($19 billion) (Channels Television, 12 January,2024) using foreign technology and is yet to meet the fuel demand in the country. The Tinubu Administration recently granted new licences to four firms to import fuel. The cost is still high though it has reduced a little. Illegal refiners continue to fill the gap in the hinterlands of the Niger Delta.

Approach of the Federal Government to Illegal Refineries

Successive governments in Nigeria declared the indigenous petroleum refinery operators "illegal" and have made concerted effort to stamp them out, on the surface, for three reasons.(Azubike,2009-01-19:23). They argued that their source of obtaining the crude oil through pipeline vandalism is illegal, an act of economic sabotage. This act is harmful to the government fiscal arrangements since it experiences a reduction in volume of products exported daily. They also argued that the technology is harmful to the ecosystem of the host communities due to oil spillage and improper disposal of industrial waste on the environment. In addition there are frequent fatal fire outbreaks. Thus between May and September, 2008, the Joint Task Force (JTF) destroyed about 300illegal refineries (Chigbo, 2009-01-19:17).

Poisonous gaseous substances emitted by the refineries is said to reduce life span. (Purefoy,2009). Finally there are fears that the products may be of low quality, harmful to both car engines and life. The assessment is true. However, the benefits accruable by far outweigh the numerous challenges if the technology is upgraded and made to function in a less hazardous way

Indigenous Petroleum Refining Technology in Nigeria

Indigenous simply means something or an idea which has always existed in a particular place or location. Refinery is a factory where substances such as metal, sugar or oil is refined. Summers, (2000:1187) defines refine simply as to improve upon a method, a plan, or system by gradually making changes to it. The primary advantage of refining is that significant use, and monetary values are added. Technology according to summers (2000:1481) is "knowledge about scientific or

industrial methods or the use of these methods". Technology could also be used to refer to machines and equipment used or developed as a result of this knowledge.

Andah, (1988:185) describes technology as man's effort at transforming his knowledge of specific scientific laws with the help of his personal (subjective) skills, into concrete objects or thoughts.

All three definitions emphasise the exercise of man's knowledge about certain basic scientific principles for the creation and recreation of things. Long before illegal refineries were established in the Niger Delta kerosene was produced using indigenous technology and during the Nigerian civil war petroleum products were refined in Nigeria.

Indigenous Kerosene production during Colonial Rule

During colonial rule, it was reported by the colonial authorities that some persons in the Niger Delta produced kerosene which was used for lighting domestic lanterns. (Archival file: crim,24/12/1931). The Items included: 3/4 bottle of petrol spirit, ¼ bottle of engine oil, 2 packets of sugar, 2 ½ gallons of palm oil.

The procedure was quite simple but ingenuous. The petrol and engine oil were mixed together while the sugar was dissolved in the palm oil. Both solutions were then properly mixed together and allowed to ferment for three days. Thereafter, the mixture is drained and 'washed' and is ready for use(Archival file: crim,24/12/1931)..

The product was very effective because there were no reports of kerosene explosions during this period. The Police Commissioner was particularly disturbed by a publication in the Nigerian Daily Times captioned "Local Manufacture of a Fuel suitable for Burning in Kerosene Lamps. A price list seized from the arrested persons showed that with a £30 registration fee anyone could be taught to produce kerosene for commercial purposes. (Archival file: Crim. 24/12/1931). This attests to a lot of ingenuity on the part of the people of the Niger Delta especially if one takes into consideration the fact that no refinery had been established in the country at the time and that there is nowhere in the world where

palm oil and sugar constitute some of the raw materials used in the refining of kerosene. (Archival file: Crim,24/12/1931). This of course was not allowed to continue as members of the group were arrested and tried for illicit distillation of gin in line with the deliberate policy to discourage indigegenos manufacturing in the colonies (Faluyi,1996).

The Biafra Refinery

The Biafra petroleum refinery was invented using water distillation technology by chemical scientists of the Research and Production unit of the secessionist army of Biafra Republic in Eastern Nigeria in response to the military blockade imposed on them by the government of the Federal Republic of Nigeria during the 1967-1970 civil war. Ogbudinkpa (1985) stated that violent conflicts inspire nations to innovate and invent such things that are needed for the successful prosecution of the war. He gave a clear description of the refinery. It consisted of a dome shaped drum which is placed on a kiln. At the sides of the drum are pipe through which the various refined products are let out. The pipes conveying the products had to first pass through a cooling system of "ice cold water" designed essentially to prevent fire outbreak. The refined products flow though the hollow pipes into the separate receptacles..

A dome shaped drum is placed on a Kiln and a specified quantity of thick mud is poured into it. The 44 gallon drum, with taps turned-off is filled with viscose crude oil. Fire is lit under the drum. Initially coal was used but with the capture of Enugu by the Federal Army, locally sourced logs from the 'Iroko, oil bean, and acoid bateri trees were used. Products from the Biafra refinery included super petrol, kerosene, and diesel.

The content was carefully heated to a temperature of 180 c and super was produced. Consequently, the product outlet was turned on to enable it pass through the cooling zone and thereafter to the super petro receptacle. At a temperature of 120 degree centigrade, it was possible to produce petrol. However, it was discovered that petrol produced at this temperature was harmful to vehicle engine as a result of the high octane content. It was consequently improved upon. At 19 degree centigrade, kerosene is produced; from above 19-21 degree centigrade, diesel is produced, and from above 21degree centigrade, lubricating

oil is produced. However emphasis was more on the production of petrol, kerosene and diesel. A major challenge for the scientists was how to tell when the product has reached the right temperature. They solved this by inserting a thermometer.

After collecting the three products, the tap designed to let out the bottom is opened and it is collected and used for other purposes. The refining technology used during the civil-war years was ingenuous and indigenous and could be improved upon and perfected for the good of the country.

Illegal Petroleum Refineries in the Niger Delta

The indigenous petroleum refining technology is similar to that used in traditional gin distillation. The refineries emerged as a result of acute shortages of petroleum products, especially diesel, which is in high demand in the country. In addition, the absence of infrastructural facilities and social amenities coupled with the challenges posed by the terrain made it difficult for private entrepreneurs to invest in the region since cost of production would strip the investor of significant profit. The floating petrol stations commissioned in the hinterland communities in Delta by Chief E. K. Clark decades ago are no longer in existence. Ijaw Monitoring Group (2010-03-19)

Furthermore, the absence of infrastructural facilities meant even the inhabitants could do very little to improve on their standard of living having lost their means of livelihood as a result of oil exploration and exploitation activities of the multinational oil companies.

The absence of functional educational institutions, especially at the primary and secondary school levels, has contributed to the high level of illiteracy among the creek dwellers. This means that they cannot even fill their own quota in oil companies operating in the region except as low cadre staff such as security men and cleaners. The neglect of the region by the federal and state governments and the series of punitive military raids against whole communities for the offence of a few persons have sufficiently alienated them from the state. To the inhabitants therefore, refining of crude into petroleum products seemed a profitable and

worthwhile thing to do in spite of the obvious risk to life and incarceration when apprehended by agents of government.

The operators are not scientists and because the act is illegal and subject to destruction on discovery, less resources was expended initially in preparing a better model. All they need is a functional facility that would produce petroleum products; and which could be abandoned at short notice with minimum loss. In addition, the models vary, perhaps according to the understanding and financial capability of persons who introduced the technology to the community. Thus there are presently about three models of the same ranking and another which is far superior to the others. Christian Purefoy, a CNN Reporter, described the model "A" as "a crude school science project."

Model A

The refinery consists of a drum used for heating and two other drums kept separately and used for cooling. A hollow pipe connected to the cooking drum is passed through the cooling unit and extends about three or four feet away from the cooling unit from where the refined product flows into a receptacle below. The furnace is an open fire set in a pit with three blocks above the pit acting as tripod stand

Crude oil is poured into a regular sized drum (sometimes two 44 liter drums are merged to become on to increase the quantity per production cycle) which has already been placed on a burner stand. The stand is placed in a six inches pit about the circumference of the base of the drum to help prevent the flame from burning too widely. Fire wood is used and as the embers of the flame go down oil is poured repeatedly on the wood to keep it burning till the right temperature is achieved.

At the right temperature, the vapour passes through the pipe and through the cooling unit where it is condensed before it drips slowly into the receptacle below. Model A is the most dangerous.

Model B

It uses a traditional furnace made of a mud wall to keep the heat concentrated and at the same time controllable. Model B is the same model used for gin distillation. The mud wall is the major difference between model A and B. The procedure is the same. The refinery consists of a mud wall furnace on which the distilling drum

is held firmly in place. A hollow pipe connected to the distilling drum passes through the cooling unit and extends for about four to five feet away from the cooling unit from where the product flows into the receptacle. It is instructive to note that the drums are laid sideways. The distilling drum has a hole on top through which crude oil is poured into it after which it is sealed properly to prevent the vapour from escaping. A fourth part of the cooling drums is cut off to allow sufficient air in.

At the right temperature the vapour passes through the pipe and is condensed when it gets to the cooling unit. It then flows into the receptacle below. The first 20 litres is petrol. The second 20litres is kerosene and the next is diesel. Finally there usually is a drum of engine oil left.

However, the design has a major flaw for it was difficult to tell if the right temperature has been achieved. There was also no valve to open or shut in order to let out the product at the right time. The implication of this is that the products refined were not pure at the initial stage. The petrol may carry some amount of crude. The kerosene, most times appear and smell like petrol.

Another flaw is the way the heat is applied. Like palm wine in gin distillation, the crude oil may just boil over into the pipes without releasing vapour if the temperature is too high. In such circumstances there could be fire outbreak. Instead of products flames may come out of the pipes. It is for this reason that they watch from a distance once the process has begun.

Model C

Model C has the same mud wall furnace, but its cooling unit is made of blocks and constructed like a water reservoir dug into the ground. The procedure is the same as that adopted for model B.

Improved Model

The improved model does not use the traditional furnace but is said to be a contraption resembling a goldsmith's furnace where the bellow is pumped to keep the flames burning at a regular temperature. The improved version has three cooling units and an underground tank into which the product flows.

The zero tolerance approach of government made it difficult for the technology to evolve beyond its crude form until the second half of 2012 when some significant improvement was made.

The first drum contains the crude. The open fire has been replaced with a contraption which looks like a bellow and is designed to keep the fire burning thereby reducing the risk of death by fire.

The three extra drums are for cooling. At the right temperature, the liquid is allowed to flow through a pipe which passes through the three cooling drums and eventually into a tank buried under the surface to evade official surveillance. It is said that a chemical is added though I could not ascertain the name of the chemical or at what point it is added.

Previously, it was easy to identify the products nicknamed Asari, after the freedom fighter, Dokubo Asari, as a result of its low quality. It is gradually becoming difficult to tell the difference between the 'legal' product and the 'illegal' one.

According to the Chambers Encyclopaedia, (1970:640) crude oil is separated into fractions by fractional distillation in a conventional refinery. The temperature is highest at the base while it is lowest at the top-most fraction. The distiller refines a different product at each fraction. The procedure includes the separation process, the conversion process, refining and treating process. The separation involves distillation, absorption and solvent extraction. Distillation and absorption separate the hydrocarbons according to the size of the molecules, while solvent extraction ensures that the separation is done according to type, for example, paraffins from aromatics. The hydrocarbons are not changed in structure during these operations and no new compounds are formed.

The plant used in the early days of oil distillation consisted of cylindrical tanks into which the crude oil was charged. The oil was heated and the vapours condensed, no fractionating equipment was used. The residue was then removed from the still and a fresh batch introduced. This is not too far from the Niger delta model.

For a developing country, only the functionality of the refinery and the safety of humans and the environment should matter and Nigeria has sufficient skilled manpower presently as also noted by Ogbudinkpa (1985:41) to construct and operate its own petroleum refineries if given the right support.

Way Forward

The major difference between developed and developing countries is the strength of the industrial and technological capacity of the former. Since technology cannot be transferred (but evolved or stolen) It is therefore in Nigeria's national interest for governments at state and Federal levels to acknowledge the existence of indigenous technologies in the various sectors and give inventors sufficient support through legislation and cheap loans for investment capital. Their recognition would, according to Abam, (2002) demystify and simplify the production processes because modern technology is ever evolving and the time between when a technology is created and obsolete is becoming increasingly shorter.

The challenges indigenous refineries pose presently can be surmounted if the technology is modified and is constantly improved upon through well funded and sustained research. Andah, (1988:214) noted that the growth potential of any country depends upon the structure of the economy, (does primary goods dominate its exports?); the natural endowments and the strategy of development adopted by the state.

The Federal and state governments should provide enabling environment for private sector participants, Research and Development Centers, as well as universities, to take advantage of the indigenous technology, modify them to the extent that the risk involved in the production and storage is reduced to the barest minimum and meets internationally acceptable standard. Regulatory agencies could be empowered to enforce laws and basic refining practices. Brazil's Petrobras model which embraced Partial privatization and enforced strict regulation helped to revive its oil sector

The National Research Institute for Chemical Technology, NARICT, Zaria, has a Fabrication and Engineering Department whose main function it is to breakdown or simplify foreign technology to suit local needs, especially that of cost.

In addition, road side fabricators with very little formal education have also been able to design and construct machines through trial and error to meet the needs of local manufacturers, especially in the seed oil processing sector. Technological advancement in the model of Japan is achievable in Nigeria if the enabling environment - in the form of infrastructural facilities, favourable and consistent economic policies are put in place. UNESCO (1) reports that "Prompted by the need to improve the defences of the nation particularly its sea-going defences in response to foreign threats, industrialization was developed by local clans through second hand knowledge, based mostly on western textbooks, and copying western examples, combined with traditional craft skills. Industrialissation was achieved within a very short space, between 1850s and 1910. Japan became a world ranking industrial nation by the early 20th century. Japanese manufactured goods rose from global disdain to world-wide preference by shheer determination of the state and the people

Furthermore, the drain of the country's foreign reserve from fuel imports would be reduced significantly.

The issue of capital intensive nature of the industry which has prompted government to rely on foreign investors would be overcome as smaller ones (small, medium enterprises) requiring less capital would be established. Operators could be merged to reduce production sites in the region and they should be allowed to purchase crude oil freely

Turn-around maintenance, access to spare parts will be easy, and the challenge of soon to be obsolete foreign technology will be a thing of the past because continuous upgrade is possible locally without dismantling the entire refinery.

Capital flight arising from repatriation of profits would be reduced drastically as the refineries would be substantially owned by Nigerians. Employment opportunities will be created both in the refineries and related sectors in the

organised and unorganised private sectors and reduce youth restiveness in the region.

The huge remuneration for expatriate staff- a drain on foreign exchange earnings would be brought to the barest minimum. The pace of development in the region would be accelerated as a result of private sector backed initiative on infrastructural development and provision of social amenities.

The availability of the product would drastically reduce cost of production and industrialisation would pick up. There will be no need for a reoccurrence of fuel subsidy and the money put to better use.

Significantly, this could become a template for the Federal government to give meaningful support to indigenous effort at innovation, design and manufacturing in other sectors as a right step towards modern industrialization.

Conclusion

The continued dependence of government on foreign refining technology inhibits the blossoming of indigenous effort, whether autochthonous or borrowed, and adapted to suit local circumstances.

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