International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

Management Related Barriers to Completion of Licensed Modular Refinery Projects in Nigeria

Sadiq Ajibola Ibrahim 1*, Joseph K. Makinde2 and Abdulganiyu A. Oke3

1 MTech Candidate, Dept of Project Management, Federal University of Technology Minna
2 Lecturer, Dept of Project Management, Federal University of Technology Minna
3 Lecturer, Dept of Quantity Surveying, Federal University of Technology Minna

Submitted: 30-07-2021 Revised: 06-08-2021 Accepted: 08-08-2021

ABSTRACT
Modular refinery projects were born out of a bid by the Federal Government of Nigeria to achieve the three-pronged aim of discouraging illegal oil refining, eliminating environmental degradation and boosting local refining of petroleum products. Investors were granted licenses to establish (LTE) modular refineries (MR) of varying operational capacities. The MR policy has been considered timely and necessary, because Nigeria imports almost all of the refined petroleum consumed locally. However, several years after the take-off of the MR policy, none of the licensed MRs has been completed. Some of the licenses have been withdrawn due to stagnation and lack of visible progress on the part of the investors. This paper aimed to assess the factors hindering the progress and completion of MR projects in Nigeria. Secondary data obtained from the Department of Petroleum Resources (DPR) was used to examine the licensing regime, operational characteristics and progress achieved for licensed MRs. The data was further analyzed and examined using frequency count and percentage analysis which revealed that 59.09% of licensed MRs have funding as the major challenge impeding their completion.This barrier might perhaps be best tackled by linking up MR investors with venture capitalists, rather than through direct funding by government. In extreme cases, government might provide some form of guarantees.

Key words: barriers, modular refinery, oil and gas, progress, project

I. INTRODUCTION

Nigeria is undoubtedly one of the world's leading importers of refined petroleum products for over two decades now.(Chikwem, 2016)Despite the fact that the nation is leading in terms of crude oil exploration and belongs tothe Organization of Petroleum Exporting Countries (OPEC), yet the nation has not been able to refined petroleum product locally to serve her local needs and possibly export and improve the nation's economy and foreign reserve.(Akpomera , 2019)

In the midstream sector, the government owned refineries have continued to operate inefficiently. As a result, about 80 per cent of our petroleum products are imported.(Chigioke, 2015). This unenviable position has earned the nation a very bad image among nations of the world. It is very clear that the absence of functional refineries has multiple negative effects on the nation's economy it is a big strain on foreign reserves in particular.(Akpomera , 2019)

Also, the challenge of pipeline vandalism, which has in recent times resulted in disruption of crude supply to the existing refineries in Warri, Port Harcourt and Kaduna thereby crippling their operations. Illegal oil bunkering and proliferation of illegal artisanal refining units around the oil villages leading to environmental pollution have led to a lively debate on the need for modular refineries as a quick fix to the shortages rather than continue to import at very high cost to the nation. (Ogbuigwe, 2017).

Modular refineries aresited next to their crude supply source and as such however avoid disruption from crude oil pipe line vandilization and succeed.(Ogbon, Otanocha, & Rim-Rukeh, 2018)

A modular refinery as the name implies, is a refinery whose parts or equipment are constructed in modules designed to be transported quickly and easily anywhere in the world and comes in a variety of sizes with capacities that range from 500 to 20,000 barrels per day.(Chigioke, 2015)

Modular refinery has several advantages which are its cost-effectiveness in remote areas, flexibility, ease and speed of construction, low capital cost and concentrate on the production of

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

one product at a time.(Ogbon, Otanocha, & Rim-Rukeh, 2018)

Mini/modular refineries are ideally suited for remote locations, rapid production of primary fuels (for consumption)and raw materials or feed (for the petrochemical industries) greater process flexibility (refining units may operate independently or likewise be interconnected in combinations determined by the processing needs). Limited refinery project land space, low or minimal installation cost (using skid-mounted during construction), quicker investment recovery.(Ogbon, Otanocha, & Rim-Rukeh, 2018)

The capital outlay for any 100,000-barrel per day (bpd) refinery is about $1.5 billion or more, while a 24,000 bpd modular refinery is roughly $250 million. Therefore, it is easier to access funds for the modular refining modules.(Chikwem, 2014)

The manufacturing time for plant, equipment and machinery for a plant of 100,000 bpd capacity is within the range of three to four years. Start-up for modular refineries of 24,000 bpd is within 18-20 months.Revenue streams and payback periods are faster with the modular refining format, than with the larger capacity refineries.(Ogbon, Otanocha, & Rim-Rukeh, 2018).

The Federal Government of Nigeria out of efforts to achieve the three-pronged aim of discouraging illegal oil refining, eliminating environmental degradation and boosting local refining of petroleum products come up with modular refineryproject policy and granted investors licenses to establish modular refineries of varying operational capacities. The MR policy has been considered timely and necessary, because Nigeria imports almost all of the refined petroleum consumed locally. (Chikwem, 2016)

Apart from putting the conducive environment for public private investment in modular refineries, the government has also secured incentives on reduced import duty rates (customs duty waiver for the importation of modular refinery machinery, equipment and components) to encourage investment in modular refineries ((Ogbuigwe, 2017).

There has been corresponding interest by many in the private sector to invest in construction and operations of refineries so as to take advantage of the opportunities presented by the very high spend in importation of petroleum products. Conservative estimates put consumption of petroleum products in Nigeria at approximately 55 million litres per day, with Premium Motor Spirit (PMS) and diesel accounting for 35 million and 12 million litres respectively. Dual Purpose Kerosene (DPK) demand is put at about 8 million litres per day. There were periods when PMS demand was as high as 45 million liters per day, most of it imported. This is the driver for the interest in refining.(Agaptus, et al., 2020)

According to Ogbon et al 2018, even at revamping the presentfour refineries in Nigeria to produce at an established capacity of 445,000 bpsd, and the coming on stream of the Dangote 650,000 bpsd there will still be deficit in supply of refined petroleum products which modular refineries can fill. He further stressed that if the Nigeria four refineries working at full capacity for 334 days in a year will give 445 x 0.31781 x 159 x 334 = 7,510,539,948 liters of PMS per year.Also, assuming a maintenance period of 31 days in a year, the PMS yield at 31.781% per barrel volume for the Dangote refinery, will give 650,000 x 0.31781 x 159 x 334 = 10,970,451,610 liters of PMS.(Chigioke, 2015)

If the Dangote refinery comes on stream by 2020 and all four (4) local refineries working at 88% ADU efficiency, the total quantity of PMS that will be available will be 7,510,539,948 + 10,970,451,610 = 18,480,991,560 liters per year. The projected demand of PMS by 2020 is at 20,233,197,507.59 + 2,800,000,000 = 23,033,197,507.59 liters. By the year 2020, with PMS demand at 23,033,197,500 liters, Nigeria will still be saddled with PMS importation of 4,555,205,940 liters and this will also translate to a total of 33 modular refineries of 10,000 bpsd capacity. Furthermore, if the epileptic production nature of the local refineries is not halted, PMS importation will be at 10,373,379,257.59 liters which translate to 74 modular refineries of 10,000 bpsd with a maintenance period of 31 days in a year and a PMS yield at 31.781% per barrel volume.(Ogbon, Otanocha, & Rim-Rukeh, 2018)

However, several years after the take-off of the MR policy, none of the licensed MRs have been completed. Some of the licenses have been withdrawn due to stagnation and lack of visible progress on the part of the investors. According to refinery status updates by the department of petroleum resources (DPR) dated April 2018, forty-five (45) private refineries were granted licenses out of which thirty (30) are modular plants capable of producing different variety of refined petroleum products. Only six (6) out of them are indicated to likely break ground and could be said having a little progress having obtained license to construct and are likely on site, nine (9) of them have their licenses expired while majority of others are at fundsourcing.

The barriers hindering the progress and completion of modular refinery project in Nigeria

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

has therefore become an area of research interest by many researchers. According to Michael, 2017, investorswho were awarded licenses to build refineries, had, over the years, cited the non-deregulation of the downstream sector as the major reason for their inability to invest in the building of refineries in Nigeria. They argued that it would be difficult and near impossible to recoup their investments in the refineries with the current state of things in the downstream petroleum sector. They called on the Federal Government to fully deregulate the sector and allow market forces determine the prices of petroleum products.

However,this paper uses the data obtained from investors by the Department of Petroleum Resources (DPR) Status Update 2018, to establish the barrier hindering the completion of modular refinery projects and seeks expert opinion on how it can be surmounted. It is in view of this that the study seeks to address the following research objectives:

i) Examine thelicensing regime for modular refineries in Nigeria

ii) Examine the operational characteristics of MR that has been licensed.

iii) Examine progress achieved in establishment of MR in Nigeria.

iv)Identify challenges hindering the completion of modular refineries and ways of overcoming such challenges.

II. RESEARCH METHODOLOGY

Research Design

A research design has been described as an action plan upon which an entire research is built(Ohiare, 2017). In providing a broad overview of how researchers plan for the collection and analysis of data in order to achieve the objectives of a study as stated, Kothari (2004) posited that a research design must be relevant to the research purpose. Since the entire procedure for conducting a study is always detailed in the research design, a research design effectively generates a road map of a study in terms of how and what size of sample is to be taken, the instruments to be used to collect data from the sample and how the data thus collected will be analysed, so that relevant inferences can be drawn.

A research design must specify the research approach to be adopted, which may be either quantitative or qualitative or a mixture of both (mixed approach).This study adopted a quantitative method approach. Furthermore, a research design provides details of the research strategy that was used in a study. This study employed a survey alongside document study as data collection strategy. Data for achieving the objectives of the research were obtained from detailed study of the research population carried out using secondary data from published documents.

Data Collection

The different types of information in the form of data that was needed for the study to be carried out were identified and described in this section. The following represented the main types of data were required and collected in this study:

i. Data on the licensing regime for modular refineries in Nigeria, which included information on the scope of modular refineries, the application process and applicable fees;
ii. Data on the operational characteristics of licensed modular refineries in Nigeria, including the technical specifications of licensed refineries;
iii. Progress achieved in the establishment of modular refineries in Nigeria, mainly in terms of the currency of the various types of licenses for the refineries;
iv. Challenges hindering the completion of modular refineries and ways of overcoming such challenges.

Sources of Data

Data for the study was obtained mainly from a secondary source; this was the Information Unit of the Department of Petroleum Resources (DPR), which is a department under the Federal Ministry of Petroleum Resources.

Primary Sources

Based on the data collection strategy adopted for the study, primary data was not collected. All attempts to get primary data from the relevant officials in the DPR were rebuffed, and the researcher was directed to the website of the agency. The study thus relied entirely on the use of secondary sources of data.

Secondary Sources

The main secondary sources of data that were explored to provide documented and statistical data on licensed modular refineries included two government publications that were found to be relevant for the purposes of the study. These were:

i. General Requirements And Guidance Information For The Establishment Of Modular Refineries In Nigeria;
ii. Refinery Status Update April 23 2018;

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

Research Population

Research population refers to the group of entities to which the researcher intends to make an inference; such entities usually possess some unique common characteristics, or common, binding trait (Mollel, 2017). Since this study was interested in discovering how project management factors have affected the progress of licensed modular refinery projects, all of the modular refineries licensed by the DPR comprised the research population for the study.

Sample Frame.

A sample frame consists of the list of entities from which the specific entities to be sampled are selected. The sampling frame thus represents the accessible portion of the population that a researcher is interested in. For this study the sample frame comprised the entire population of licensed modular refineries; this was because the availability of data from the DPR rendered it unnecessary to collect data from only a sample of the licensed modular refineries.

Sample Size.

Sample size refers to the number of entities that are selected for the purpose of providing data in the survey (Zamboni, 2017). For the purpose of this research, since as stated in the preceding section the availability of data from the DPR rendered the taking of a sample unnecessary, there was also no need for the determination of the sample size. The study rather conducted a census of the entire population of 44 licensed modular refineries. This also meant that no sampling technique was employed.

Sampling Technique.

Where it is necessary to select a small quantity from the entire population for the purposes of study, two main kinds of sampling procedure are available. The first is the probability sampling techniques, which provide the most reliable representation of the whole population, because it gives each respondent an equal chance to be captured. The second kind is the non-probability sampling techniques, which rely on the judgement of the researcher, thereby making generalization on the population difficult and not justifiable (Walliman, 2011).

However, in cases where it is possible to collect data from the entire population, there is then no need to choose a sampling technique. This was the case of this study; the adoption of a census meant that data on the whole 44 modular refineries that have been licensed by the DPR would be employed in the study.

Method of Data Analysis and Presentation.

Data has been defined as information obtained in a course of a research study (White 2015); data analysis on the other hand was described by Ohiare (2017) as involving the examination and transformation of data in order to draw useful inferences from the patterns thus observed in the data. For the purpose of this research, the collected data was analysed using descriptive analysis in relation to the stated objectives as presented in Table 1. The data for Objective 1 was analysed using document study method. The data for Objectives 2, 3 and 4 was analysed using descriptive statistical method (count and percentage analysis). The analysed data was presented in tables.

Table 1: Methods of Data Analysis

S/N	Objectives	Data Tools	Analysis Instrument
1	i. examine the licensing regime for modular refineries in Nigeria	Review of published public literature	Document study
2	ii. examine the operational characteristics of licensed modular refineries in Nigeria	Review of published public data table	Count; percentage analysis
3	iii. determine the progress achieved in the establishment of modular refineries in Nigeria	Review of published public data table	Count; percentage analysis
4	examine the challenges hindering the completion of modular refineries; suggest ways of overcoming such challenges	Review of published public data table	Count; percentage analysis

Source: Author (2020)

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

III. RESULTS AND DISCUSSION

Licensing Regime for Modular Refineries in Nigeria.

This section presents details of the licensing regime for modular refineries under four separate headings. These are the scope of modular refineries, application process, fees applicable and types of incentives provided for modular refineries in the study area.

Scope of Modular Refineries in Nigeria.

The scope of modular refineries (as detailed in Table 1) derives from the four objectives which underpin the entire modular refineries policy. This policy was conceived in order to promote availability of petroleum products while conserving scarce foreign exchange, since the level of importation will reduce. At the same time the policy also aimed to promote socio-economic development of the Niger Delta area of the country, thereby quelling restiveness and criminality associated with the area. Finally, the policy seeks to stem the age-long environmental degradation experienced in the area; this will be done through replacement of illegal refining activities with licensed modular refineries.

It should be noted that only petroleum refining plants whose capacities do not exceed 30,000 barrels per day, qualify to be described as modular refineries. Beyond this threshold, refineries are no longer referred to as modular. They are simply described as normal refining plants.

Table1: Scope of modular refineries

ASPECT OF SCOPE	OVERVIEW OF SCOPE ELEMENTS
Objectives	To promote availability of petroleum products in the country To conserve foreign exchange utilization for the importation of Petroleum Products. To promote socio economic development in order to stop restiveness, criminal and illegal refinery activities thereby sustaining peaceful coexistence in the Niger Delta Region To mitigate and eliminate environmental degradation associated with illegal refinery activities, crude oil theft and pipelines vandalism
Plant Capacity	design capacity not more than thirty thousand barrels per day (30,000BPD)
Legal Framework	Policies and Regulations promulgated by the Ministry of Petroleum Resources and Minister of Petroleum Resources Regulation (2) and (3) of the Petroleum Refining Regulations (PRR) of 1974 made under section 9 of the Petroleum Act 1969 under Regulation 47 of the PRR, the Director, Petroleum Resources may from time to time, give directions as to the manner of compliance with any matter provided for under the PRR regulations
Location	shall be strategic and influenced by proximity to the source of crude oil, producing marginal fields and tie-in to supply infrastructure or clusters Based on the acceptable carrying capacity indices of each state which is determined by the production capacity, access to infrastructure and limit of the environmental degradation.
Business Model	private-sector led partners include state government or its agencies (equity participation); registered local cooperative societies; regional refinery stakeholders private investor retains majority equity and operates the Joint Venture

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

ASPECT OF SCOPE	OVERVIEW OF SCOPE ELEMENTS
Investors Categorization	A. Private Investor with financial and technical capacity, preferably with established Nigerian presence or partnership B. Public-Private Partnership with credible participation from relevant stakeholders such as foreign technical partners, State Government, MDAs, Local Govt. Council, organized private organizations, cooperative societies, community equity contribution etc. C. Regional refinery stakeholders involved in artisanal activities with focus to converting the vocationally acquired skills to cognitive technical skills. They shall be considered for equity partnership with technical and financial partners

The modular refineries policy derives its legality from two main sources. The immediate source is the Petroleum Refining Regulations (PRR) of 1974, while the remote source is the Petroleum Act of 1969. These legal instruments empower the Department of Petroleum Resources (DPR) to provide policies that further the aim of the PRR. It should be noted that the Minister of Petroleum Resources has very wide ranging powers in this regard. The legal instruments cited vest most powers in the Minister; for everyday running of the DPR however, the Minister devolves such powers to the Director, Petroleum Resources.

The location aspect of the scope of modular refineries presents some interesting features. The Policy does not explicitly mention the states in which modular refineries can be sited. However, through conditional phrasing of the Policy, it can be seen that modular refineries can only be sited in the southern part of Nigeria, specifically within the Niger Delta region. The reason for this is because the Policy requires siting of the refineries close enough to sources of crude petroleum as to make prolonged transportation unnecessary. In addition, the numbers of modular refineries that can be allowed within any specific locality will be determined by the availability of infrastructure, crude oil supply and limit of sustainability of the local environment. The general import of the wording of this Policy is that only in Oil Producing States can modular refineries be sited.

The Policy envisages that all modular refineries will be private sector-led ventures; however, it is permitted (and even encouraged) for such private sector investors to have local partners within their areas of operation. Such partners might be local communities (through their development associations), cooperative societies, State and Local Government authorities (through government investment companies) and so on. However, the majority equity shall be retained by the private sector operator. Investors in modular refineries are categorized under the Policy into three groups. These are foreign private investors, public – private partnerships and regional refinery stakeholders.

Application Process for Modular Refineries inNigeria

Modular refineries are licensed in three sequential phases under the Modular Refinery Policy of the Department of Petroleum Resources (DPR). The first phase involves the provision of a License to Establish (LTE), which is awarded after completion of the formalities specified under the Policy. During this phase investors can proceed with the design of the refinery and sourcing of funds for construction. The most important activity during this phase is the Front End Engineering Design (FEED) of the refinery.

The construction phase of the refinery commences when the DPR issues an 'Authority to Construct' (ATC) to investors. Site works can then commence; proprietary parts of the refinery can be constructed off-site and brought for incorporation into the works. At practical completion, the refinery is subjected to an intensive process of testing and commissioning, which involves mainly calibration of the output of the various parts of the refinery. At this point the refinery is ready to be put into commercial operation, but the investor requires a License to Operate (LTO) to commence this last phase of modular refinery policy.

The organizational structure of the business entity that is investing in a modular refinery has also been stated in the Policy. Indigenous companies must fulfill all requirements of the Corporate Affair Commission (CAC), while foreign firms must provide evidence of registration with the applicable agency in their home country. Investors must also complete all the legal formalities related to partnership, joint ventures or consortiums.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

The application process also includes the submission of detailed financial plan prepared by investors, as well as evidence of compliance with regulations applicable to business entities in Nigeria, at least for a period of three (3) years. The source of funds for the modular refinery must be clearly stated, as shown in Table 2.

Table 2: Application process for modular refineries

ASPECT OF APPLICATION PROCESS	OVERVIEW OF APPLICATION PROCESS ELEMENTS
Licensing Phases	License to Establish (LTE), Authority to Construct (ATC) License to Operate (LTO).
Organizational Structure	CAC registration for Nigerian companies/entities foreign companies evidence/reference by Home Country's agency For consortium partnership, legal documents of partnership, certified true copies of Memorandum and Article of Association, joint venture/partnership Agreement, Company Profile
Financial Status	Three (3) years Audited Account Financial report and Tax Certificate for Nigerian companies similar documentation for foreign companies, paid up share capital Investment Type Detailed financial plan with Proof and source of funding sworn affidavit and letter of authority allowing verification of all claims
CASHES (Community Affairs, Safety, Health, Environment and Security)	Health, Safety and Environment (HSE) Plans Quality Management System Security Plans Management of Change Procedure Community Affairs and Corporate Social Responsibility Plans
Local Nigerian Content	maximize the utilization of local human and material resources in line with Nigerian content requirements
Refinery Model	positive crack spread for the chosen refinery design management of light products and by-products (Gasoline, Naphtha, LPG & Heavy-ends), Details of marketing plan/strategy Details of technology Crude assay and Source Front End Engineering Design (FEED) no relocation of refineries older than Ten (10) years in operation from the date of establishment; plant technical audit checklist for refinery relocation purposes

It is also required that investors in modular refineries produce a CASHES (Community Affairs, Safety, Health, Environment and Security) Plan. This will state clearly how the investor intends to deal with each of the five components headlined in the Plan, as well as how change will be managed during and after the construction of the modular refinery. Investors are also mandated to maximize the use of local human and material resources in line with applicable laws and regulations on Nigerian content.

Details of the technical aspect of the modular refinery form the last part of the application process. Expected refined products, source of crude oil, marketing plan, and details of the technology to be applied must be provided, as highlighted in Table 2.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

Application fees for modular refineries in Nigeria

The fees charged on modular refineries differ according to the phase of work. Phases are identified by the licenses issued at the commencement of each phase. The Department of Petroleum Resources charges a flat fee of half a million Naira for each of the three phases. Phases 1 and 3 have additional statutory fees of fifty thousand dollars US and on thousand dollars US per each 1000 barrels refining capacity, respectively. These are detailed in Table 3.

Table 3: Fees applicable for modular refineries

ASPECT OF APPLICATION PROCESS	APPLICATION FEES ELEMENTS	DETAILS
Application Fees	License to Establish (LTE)	Statutory - USD 50,000.00 DPR Processing Fee - N500,000.00
	Authority to Construct (ATC)	DPR Processing Fee - N500,000.00
	License to Operate (LTO)	Statutory - USD 1,000/1000 BPD up to 30,000BPD; USD 100,000.00 for 30,000 BPD & Above DPR Processing Fee - N500,000.00

Incentives Associated with Modular Refineries in Nigeria.

In order to encourage the establishment of modular refineries, there are some incentives that have been designed to apply to investors. Table 4 provides details of these incentives in terms of support from government, qualification and description of incentives.

Government supports investors in modular refineries through facilitating the availability of crude from marginal fields and creation of joint venture vehicles involving host communities and state governments. Fiscal incentives include tax moratoriums, investment allowances, tax free dividends and tax-deductible loan repayments.

Table 4: Incentives associated with modular refineries

TYPES OF INCENTIVES PROVIDED	OVERVIEW OF INCENTIVE ELEMENTS
Government Support	Facilitation of crude commercial agreements from marginal and other oil fields Facilitation of Ownership-joint venture investment vehicles with organized host communities and State Governments
Legal Qualification	Modular Refineries being midstream oil and gas processing facilities shall qualify for all incentives enumerated under section 39 of the Companies Income Tax Act CAP. 60 LFN 1990
Fiscal Incentives	an initial tax free period of three years which may, subject to the satisfactory performance of the business, be renewed for an additional period of two years; OR an additional investment allowance of per 35 per cent accelerated capital allowances after the tax free period (annual allowance of 90 percent with 10 percent retention, for investment in plant and machinery; additional investment allowance of 15 percent) tax free dividend during the tax free period (if investment for the business was in foreign currency OR introduction of imported plant and machinery during the period was not less than 30 percent of the equity share capital of the company)

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

TYPES OF INCENTIVES PROVIDED	OVERVIEW OF INCENTIVE ELEMENTS
	interest payable on any loan obtained with the prior approval of Minister for a gas project, shall be deductible

Operational Characteristics of Licensed Modular Refineries in Nigeria.

This section of the Chapter addressed the second objective of the study; the operational characteristics of the modular refineries so far licensed by the DPR were examined and tabulated using frequency count and percentage analysis.

The States in which modular refineries (MRs) are located (or planned to be located), as well as the number of such MRs was examined in Table 5. Delta State hosts 29.55% of the total number of licensed MRs, followed by both Akwa Ibom and Rivers States with 6 MRs (13.64%) each. Lagos and Edo States shared 3rd place; each accounted for 4 MRs or 9.09% of the 44 MRs that were licensed.

Table 5: Geographical spread of licensed modular refineries

Location	Nr of MR licensed	% of MR licensed
Abia	1	2.27
Akwa Ibom	6	13.64
Bayelsa	3	6.82
Cross Rivers	2	4.55
Delta	13	29.55
Edo	4	9.09
Imo	3	6.82
Lagos	4	9.09
Ogun	1	2.27
Ondo	1	2.27
Rivers	6	13.64
	44	

In Table 6, the type of refinery plant proposed to be used was examined. There are three main types; most of the licensed MRs intended using a 'hydro-skimming' approach (59.09%), while 25% of MRs would be built on a 'topping' plant approach. Only 15.91% of MRs was following a 'conversion (cracking)' approach.

Table 6: Proposed refinery plant types for licensed modular refineries

Type of refinery plant proposed	Nr of MR using proposed plant	% of total MR licensed
Conversion (cracking) plant	7	15.91
Hydro-skimming plant	26	59.09
Topping plant	11	25.00
	44	

It was interesting to note that not all of the MRs was actually designed as modular refineries. Although 38 out of 44 MRs adhered to modular refinery design, some 6 refineries (13.64%) were designed as conventional refineries, as presented in Table 7. This probably meant their refining capacities were planned to be higher than the 30,000 barrels per day ceiling for MRs.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

Table 7: Proposed refinery designs for licensed modular refineries

Type of refinery design proposed	Nr of MR using proposed design	% of total MR licensed
Conventional	6	13.64
Modular	38	86.36
	44	

The most common size of MR was the 10,000 barrels per day capacity, which was planned for 9 MRs (20.45%) of the total refining capacity of all licensed MRs. Small refineries (less than 30,000 barrels per day refining capacity) constituted 75% of all licensed MRs by number; in terms of total refining capacity however, such small refineries contributed only 22.04%. This meant that the single largest refinery located in Lagos State (with a refining capacity of 500,000 barrels per day) would contribute more refining capacity than all of the smaller MRs. There are only eleven refineries that are larger than the 30,000 barrels per day ceiling for MRs (see Table 8).

Modular refineries were also examined in terms of the year they were established. Very few MRs were licensed before 2015; in fact there were only two (1 in 2004 and 1 in 2007). By contrast, from the data presented in Table 4.9, 17 MRs were licensed in 2015, with a further 7 being licensed the following year, 2016. There were 12 and 6 MRs licensed in 2017 and 2018 respectively. This meant that the MR Policy appeared to have picked up steam only when the present political dispensation came to power.

Table 8: Proposed refining capacities for licensed modular refineries

Capacity of refinery plant proposed (in Bpsd)	Nr of MR of stated capacity	% of total MR licensed
5000	5	11.36
6000	1	2.27
7000	1	2.27
10000	9	20.45
12000	4	9.09
20000	8	18.18
24000	2	4.55
30000	3	6.82
50000	1	2.27
100000	5	11.36
107000	1	2.27
120000	1	2.27
150000	1	2.27
250000	1	2.27
500000	1	2.27
	44	

Table 9: Year of establishment of proposed licensed modular refineries

Year of establishment of MR	Nr of MR established	% of total MR established
2004	1	2.27
2005	0	0.00
2006	0	0.00
2007	1	2.27
2008	0	0.00
2009	0	0.00

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

2010	0	0.00
2011	0	0.00
2012	0	0.00
2013	0	0.00
2014	0	0.00
2015	17	38.64
2016	7	15.91
2017	12	27.27
2018	6	13.64
	44	

Table 10 presented information on the different types of licenses issued for MRs. About 70.45% of all licenses were issued for establishing MRs, while some 13 licenses (29.55%) were for construction of MRs. No investor, as at 2018, had been issued with a license to operate a modular refinery. All licenses were generally valid for a period of two years.

Table 10: Types of licenses issued for proposed licensed modular refineries

Types of licenses issued for setting up MR	**Nr of licenses issued**	**% of total licenses issued**
License to establish (LTE)	31	70.45
Authority to construct (ATC)	13	29.55
License to operate (LTO)	0	0.00
	44	

An overwhelming 81.82% of all licenses issued for MRs had expired as at the time of preparing this study. Only 13.64% of the licenses were still valid (see Table 4.11). This appeared to show that the pace of setting up MRs has been very slow. While there are probably good reasons for the slow pace, it places additional strain on investors who have to renew their licenses. Such renewal would obviously entail some financial expense and bureaucratic delay.

Table 11: Status of licenses issued for proposed licensed modular refineries

Status of licenses issued for setting up MR	**Nr of licenses of stated status**	**% of total licenses issued**
Expired	36	81.82
Valid	6	13.64
No status indicated	2	4.55
	44	

Progress Achieved in the Establishment of Modular Refineries in Nigeria

This section of the Chapter addressed the third objective of the study; the progress achieved in the establishment of modular refineries so far licensed by the DPR was examined and tabulated using frequency count and percentage analysis.

Table12 reports an idealized situation, where all of the MRs already started are completed and put into operation. The information in the table shows where such MRs are located as well as the amount of refining capacity that will be provided in each location. However, as data presented in subsequent data shows, not all of the MRs are on course for completion.

In terms of number of MRs, Delta (13 MRs), Akwa Ibom (6 MRs) and Rivers (6 MRs) stand out. However, in terms of refining capacity, Lagos (740,000 bpd), Akwa Ibom (337,000 bpd) and Delta (296,000 bpd) stand out as the States with the highest proposed refining capacities.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

Table 12: Numbers, refining capacities and geographical location of refineries

Location	Nr of MR	% of total Nr of MR	Capacity of MR	% of total Capacity of MR
Abia	1	2.27	10000	0.46
Akwa Ibom	6	13.64	337000	15.67
Bayelsa	3	6.82	129000	6.00
Cross Rivers	2	4.55	16000	0.74
Delta	13	29.55	296000	13.76
Edo	4	9.09	64000	2.98
Imo	3	6.82	49000	2.28
Lagos	4	9.09	740000	34.40
Ogun	1	2.27	250000	11.62
Ondo	1	2.27	10000	0.46
Rivers	6	13.64	250000	11.62
	44		2151000	

Although the narrative for MRs appeared to be mostly negative, there are some positive spots. While licenses for the establishment of MRs have largely expired, there were three refineries in Cross Rivers, Delta and Edo States that still held valid LTEs. In addition, two (out of 11) Authority to Construct (ATC) was still valid in Delta and Lagos States (see Table 13). This meant that not all of the MR projects have ground to a halt. It also provides evidence that unless some remedial actions are taken, it is unlikely that the larger proportion of MRs will be completed and put into operation.

Table 13: License status and geographical spread of licensed modular refineries

Location	Nr of MR with Expired LTE	Nr of MR with Valid LTE	Nr of MR with Expired ATC	Nr of MR with Valid ATC
Abia	1	0	0	0
Akwa Ibom	3	0	2	-
Bayelsa	2	0	1	0
Cross Rivers	0	1	1	0
Delta	9	1	2	1
Edo	3	1	0	0
Imo	2	0	1	0
Lagos	3	0	0	1
Ogun	1	0	0	0
Ondo	1	0	0	0
Rivers	3	0	2	-
	28	3	9	2
	66.67	7.14	21.43	4.76

Table 14 reports the status of MR licenses in terms of the refining capacities affected. It is now possible to see that only a paltry 64,000 barrels per day refining capacity is still covered by valid LTEs. The LTEs covering a refining capacity of 1,155,000 barrels per day have expired. So also have the ATCs covering 313,000 barrels per day refining capacity. Only a refining capacity of 507,000 barrels per day is still covered by valid ATCs.

Table 14: Refining capacities affected by license status of modular refineries

Location	Capacity of MR with Expired LTE	Capacity of MR with Valid LTE	Capacity of MR with Expired ATC	Capacity of MR with Valid ATC
Abia	10000	0	0	0
Akwa Ibom	175000	0	150000	-
Bayelsa	117000	0	12000	0
Cross Rivers	0	10000	6000	0
Delta	229000	30000	30000	7000

International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 8 Aug 2021, pp: 94-108 www.ijaem.net ISSN: 2395-5252

Edo	40000	24000	0	0
Imo	44000	0	5000	0
Lagos	240000	0	0	500000
Ogun	250000	0	0	0
Ondo	10000	0	0	0
Rivers	40000	0	110000	-
	1,155,000	64,000	313,000	507,000
	53.70	2.98	14.55	23.57

The implication is that policy makers cannot plan for self-sufficiency in domestic petroleum products refining based on the total proposed capacity of the licensed MRs. In the near future, it is probable that local refining capacity will be boosted by not more than 507,000 barrels per day.

Challenges Hindering the Completion of Modular Refineries and Ways of Overcoming such Challenges

This section of the Chapter addressed the fourth objective of the study, which were the challenges hindering the completion of modular refineriesso far licensed by the DPR. Challenges were identified and examined using frequency count and percentage analysis.

Data reported by the Department of Petroleum Resources (DPR) revealed that 59.09% of licensed MRs have funding as the major challenge impeding their completion. This is presented in Table 15. While this is a significant proportion, the data reported in Table 16 is more thought provoking. Out of 28 MRs whose LTEs had expired, 23 admitted to having problems with securing necessary funding that will enable timely completion. However, of the 9 MRs whose ATCs had expired, only 2 reported that securing necessary funding was a major hindrance to timely completion.

Table 15: Major challenges affecting modular refineries

Type of challenges facing MR	Nr of MR involved	% of MR involved
Funding challenges	26	59.09
No challenge stated	18	40.91
	44	

It thus appeared that lack of sufficient funds to complete MR projects is a major threat that must be addressed, if the MR Policy is to attain some measure of success. This might perhaps be best achieved by linking up MR investors with venture capitalists, rather than through direct funding by government. In extreme cases, government might provide some form of guarantees.

Table 16: Problems with funding and license status of modular refineries

Location	Nr of MR with Expired LTE	Nr of MR with Expired LTE that have Funding problems	Nr of MR with Expired ATC	Nr of MR with Expired ATC that have Funding problems
Abia	1	1	0	0
Akwa Ibom	3	3	2	0
Bayelsa	2	2	1	0
Cross Rivers	0	0	1	0
Delta	9	8	2	0
Edo	3	1	0	0
Imo	2	1	1	1
Lagos	3	2	0	0
Ogun	1	1	0	0
Ondo	1	1	0	0
Rivers	3	3	2	1
	28	23	9	2
	66.67	54.76	21.43	4.76

IV. CONCLUSION.

This work set out to identify the contributing factorshindering the completion of modular refinery projects in Nigeria. As earlier stated, some investorswho were awarded licenses to build refineries, had, over the years, cited the non-deregulation of the downstream sector as the major reason for their inability to invest in the building of refineries in Nigeria(Michael, 2017). However from the analysis of data collected for the study, a total of forty-four (44) refinery were licensed, thirty-six (36) have their licenses expired, six (6) are valid and two (2) have their status not indicated. Also 66.67% have expired LTE, where 54.76% have their LTE expired due to funding problems. Thus it could be concluded that funding problem is a hindrance to completion of refinery project in Nigeria.

V. RECOMMENDATIONS.

It thus appeared that lack of sufficient funds to complete MR projects is a major threat that must be addressed, if the MR Policy is to attain some measure of success. This might perhaps be best achieved by linking up MR investors with venture capitalists, rather than through direct funding by government. In extreme cases, government might provide some form of guarantees.

Investor can also make use of the costly machines and equipment procured in the process in other related investments to leverage the cost incurred and raise more fund for continuity and completion.

REFERENCES

[1]. Adewuyi, D. O. (2017). Flow Station Location As a Critical Factor in the Siting of a Modular Crude Oil Refinery – A Case Study of a Modular Refinery in Delta State, Nigeria . SPE Nigeria Annual International Conference and Exhibition. Lagos.

[2]. Agaptus, N., John, O., Ake, M., Onjefu, O., aert, r. y., etryui, y. t., & etrytj, e. (2020). Oil and its Discontents: The Political Economy of Artisanal Refining in Nigeria. Review of African Political Economy, 662-675.

[3]. Akpomera , E. (2019). Nigeria's Foreign Investment Policy and Artisans' Underground Oil Economy: Who Wins in the Niger Delta Region. Indian Journals Dynamics of public Administration, 1-11.

[4]. Anozie , J. A., & Ojiabo , U. (2020). DEVELOPING ORGANIZATIONAL INNOVATION CAPABILITIES THROUGH KNOWLEDGE MANAGEMENT: EVIDENCE FROM REFINING COMPANIES IN NIGERIA. International Journal of Advanced Academic Research.

[5]. Asawo, P. S. (2016). Management of Entrepreneurial Orientation Tendencies in Artisanal Oil Refineries and Nigeria's National Growth. European Scientific Journal.

[6]. Chigioke, K. M. (2015). Analysis: Mini-refining investment Oppourtunities in Nigeria. A F R I C A' S B A R R E L E Q UAT I O N S.

[7]. Chikwem. (2014). Political Economy of Fuel Importation and Development of Refineries in Nigeria. International Journal of Management Science.

[8]. Chikwem, F. C. (2016). The Political Economy of Fuel Importation Probes and Development of Refineries in Nigeria. Sages Journals.

[9]. Dayo, s. I., Dotun, O. J., Segun, L. B., strdy, s. r., ertdy, e. t., & trdyf, y. r. (2007). Effect of Water on Concrete Mixture. International Jounal of project management, 16-17.

[10]. Eboh, M. (2017). Appropriate Price for Petrol, Modular Refineries in N-Delta and Illegal Refiners. Lagos: Vanguard News Nigeria.

[11]. EROMOSELE, P., SULEIMAN, R., & LYZHINA , N. V. (2019). THE ROLE OF OIL COMPANIES IN THE DEVELOPMENT OF THE NIGERIAN ECONOMY. HORIZON RUSSIA, (pp. 401-403). Kazan.

[12]. Iheukwumere, O. E., Moore, D., & Omotayo, T. (2020). Investigating the Challenges of Refinery Construction in Nigeria: A snapshot across two-timeframes over the past 55 years. International Journal of Construction Supply Chain Management, 46-72.

[13]. Lawal, Y. O. (2014). Subsidy Removal or Deregulation: Investment Challenge in Nigeria's Petroleum Industry. America Jounal of Social and Management Sciences.

[14]. Maclean, M. G., & Wordu, S. A. (2019). Analysis of Trend and Emergent Factors of Artisanal Refining in Niger Delta Region of Nigeria. International Journal of Innovative Human Ecology & Nature Studies, 43-55.

[15]. Mamudu, A. (2017). The Comparative Analysis of Bonny Light& Bonny Medum Crude Oil Using Simple Distillation and Preflash Model For Maxi. International Journal of Applied Engineering Research.

[16]. Mamudu, A., Okoro, E., Igwilo, K., Olabode, O., ade, olu, & segum. (2018). Challenges and Prospects of Converting Nigeria Illegal Refineries to Modular Refineries. The Open Chemical Engineering Journal.

[17]. Mamudu, O. A., Igwe, G. J., & Okonkwo, E. (2016). Process Design Evaluation of an Optimum Modular Topping Refinery for Nigeria Crude Oil Using HYSYS Software. SPE Nigeria Annual International Conference and Exhibition. Lagos.

[18]. Ogbon, N. O., Otanocha, O. B., & Rim-Rukeh, A. (2018). Assessment of the Economic Viability and Competiveness of Modular Refinery In Nigeria. Nigerian Journal of Technology, 1015-1025.

[19]. Ogbuigwe, T. (2017). Modular Refineries-Prospects and Challenges. Lagos: The Guardian .

[20]. Ogele, P. E., & Egobueze, A. (2020). The Artisanal Refining and Socioeconomic Development in Rivers State, Nigeria, 2007-2017. International Journal of Research and Innovation in Social Science (IJRISS).

[21]. OLUJOBI, O. J., OLUJOBI, M. O., & Daniel, E. U. (2020). A CRITICAL APPRAISAL OF LEGAL FRAMEWORK ON DEREGULATION OF THE DOWNSTREAM SECTOR OF THE NIGERIAN PETROLEUM INDUSTRY. International Journal of Management, 252-268.

[22]. Onigbinde, I. O. (2014). EVALUATION OF PETROLEUM PRODUCTS MARKETING IN A GLOBALIZING ECONOMY: A CONCEPTUAL EVIDENCE FROM NIGERIA. British Journal of Marketing Studies, 71-81.

[23]. Tijani, O. E., Barivole, N. B., Odike, B. E., & Dagde, K. K. (2020). Software Development for the Design of Atmospheric Distillation Column for Proposed Mini-Refineries in Nigeria. International Research Journal of Advanced Engineering and Science.