



Technological Development in the Nigerian Oil Industry: Issues on Local Content

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Abstract

The Oil industry has been part of the main fabric of the Nigerian economy for over five decades. Despite the fact that the l industry has contributed enormously to the economy of Nigeria, local or indigenous participation in the acquisition or development of the industry and technology has been minimal. To address this, the government of Nigeria introduced the local content policy. This paper examines this policy and provides some recommendations.

Keywords: Technological Development; Local Content Policy; Oil Industry

Introduction

The oil industry has been part of the main fabric of the Nigerian economy for over five decades. Despite several decades of oil exploitation and exploration, it has been argued that Nigeria has been unable to grapple with the technological dimension of the industry. Less than 5 percent of goods and services used in the petroleum industry are sourced locally while about 95 percent of the yearly expenditure of about 8 billion US dollars flows out of the country through technical services and goods procured outside Nigeria¹. Part of the reason for this has been attributed firstly to the failure of the Multinational Corporations, who are the primary vehicle for the technical knowledge, to transfer this knowledge to Nigerian nationals and secondly, the inability of Nigeria to absorb and develop its own technological capabilities. The general situation in the industry is therefore one in which there is a low level of indigenous technological capabilities and the dominance of foreign Multinational Corporations in the operations of the industry. This appears to suggest that the oil sector cannot survive without foreign Multinational Corporations.

In its bid to address the above imbalance in technological development and optimise the benefits of this sector to the Nigerian economy, the Federal Government of Nigeria set up the National Committee on Local Content Development with the responsibility of developing a policy to promote increased utilisation of local manpower, goods and services. It is therefore not surprising to observe the upsurge in comments on the introduction of the local or Nigeria content in the oil and gas industry. However, to what extent would the Nigerian Content Initiative in the oil and gas industry help in assisting Nigeria towards having technological capabilities? That is the question this paper tries to answer.

Overview of the oil industry in Nigeria

The history of the oil industry in Nigeria dates back to the early 1900s, with the first major oil exploratory work conducted by a German Company, the Nigerian Bitumen Corporation². However, it was not until 1956 that crude oil was discovered in commercial quantities in the Oloibiri province of today's Bayelsa State. It was in 1958 that actual production started in the prolific Niger Delta Region. This region covers about 70,000 sq kilometres and it is an exotic fresh water swamp and mangrove forest which is claimed to be one of the largest in the world³. Based on the population census conducted by the Nigerian Population Commission in 2006, the region's population is about thirty two million (32,000,000) people. Politically, this region comprises nine states of the federation

¹ Oil Industry Report (2008), Research and Special Publications Unit of BusinessDay Media Limited

² Atsegbua, L. (1999) "The Development and acquisition of oil Licenses and Leases in Nigeria." (OPEC) March

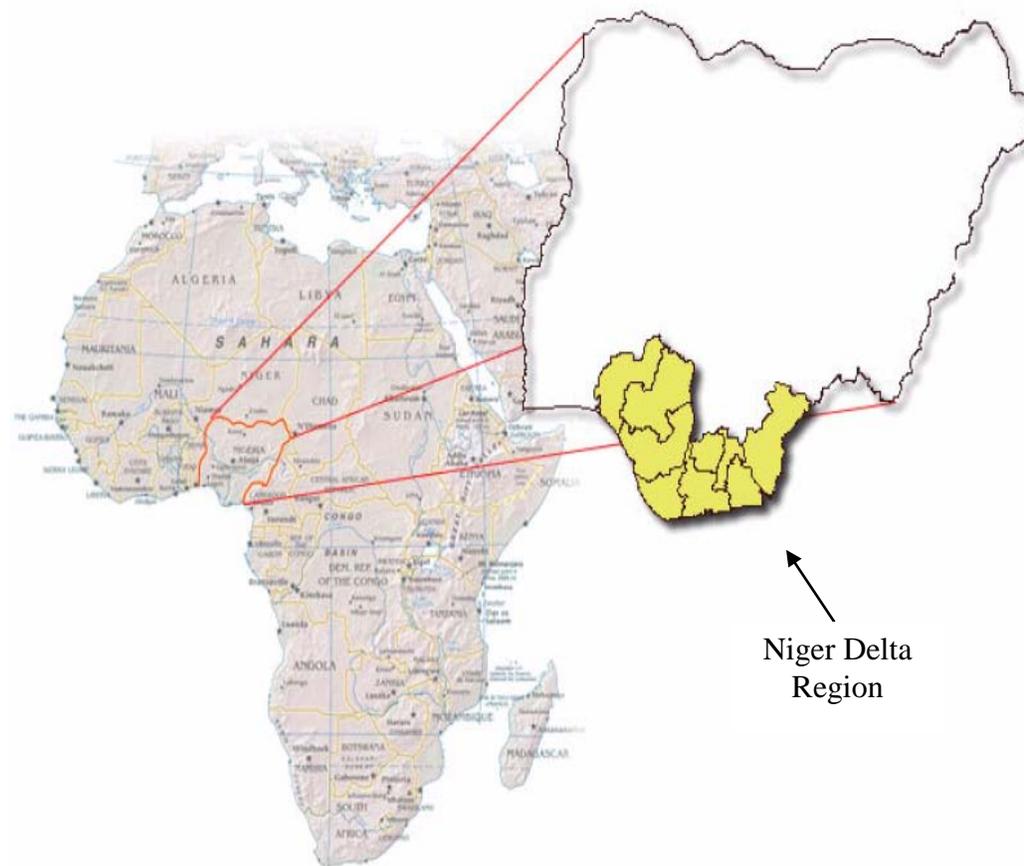
³ Onosode, G. (1997) Petroleum, Development and the Environment: NDES Perspective in Eromosele, V.E. (Eds) Nigerian Petroleum Business: A Handbook. Advent Communications Limited.

of Nigeria - Abia, Akwa Ibom, Bayelsa, Cross Rivers, Delta, Edo, Imo, Ondo and Rivers States. (See figure 1.1).

The oil industry in Nigeria can be split into two subsectors- the Upstream and the Downstream. While the Upstream subsector is concerned with geological prospects, drilling or oil extraction and production, the transformation of petroleum and its derivatives, transportation and the distribution of finished products to the ultimate consumer makes up the core business of Nigeria's downstream petroleum sector⁴. This paper however is interested in the developments of the upstream subsector, the main focus of government's Nigerian Content Development initiative.

Following the successful commercial discovery in 1956, and after independence from the United Kingdom of Great Britain in 1960, there was an influx of several foreign Multinational Oil Companies from the United States of America and the rest of the world. The sector became more important and strategic to the economic development of the country as the years rolled by. Based on the importance of this sector, Nigeria became a member of the Organization of Petroleum

Figure 1.1 Niger Delta Region of Nigeria



Source: Adapted from http://rrh.deakin.edu.au/publishedarticles/article_print_273.pdf

⁴ Eromosele, V.E. (1997), Nigerian Petroleum Business: A Handbook. Advent Communications Limited.

Exporting Countries (OPEC)⁵ in 1971. From a position of relative insignificance in the early 1960s, the petroleum sector became the fiscal basis of the Nigerian federation, effectively replacing the agricultural sector, which hitherto, was the dominant sector⁶. The resultant effect of this was the total neglect of the agricultural, manufacturing, and other sectors of the Nigerian economy.

Table 1.1, shows from a level of 75,000 b/d (barrels by day) in 1963, Nigeria's oil production is now above 2 m b/d. This however is often drastically affected by the frequent unrest and civil disturbances that occur in the Niger Delta Region of the country. These unrests are manifested through pipeline vandalism, kidnapping and blowing up of flow stations; all of which appear to be a direct response to the monumental problems of increasing poverty, underdevelopment, very poor or non-existent infrastructures and public utilities and the ever growing levels of unemployment⁷. Compared to the output level in 2007 (2,356,000 b/d), crude oil production was rather insignificant in 1963 with around 75,000 b/d being produced. However, this was to increase to over 140,000 b/d in 1968 just five years later. From then on, the increase in crude oil production has been unrelenting, peaking at over 2, 000,000 b/d in 1973, 1998, and again in 2001, 2003, 2005, and 2007. Part of the plans of the government of the federation of Nigeria is to raise this daily production to 4,000,000 by year 2010, thereby increasing the revenue that accrues to the government. Achieving this will be a great challenge, following the high level of insecurity of persons and assets and the communal struggles and crisis.

However, Nigeria's oil export has risen significantly. Crude oil contributed around 11% to the total amount of export the years after independence from the United Kingdom in 1960. By the 1970s, oil exports had risen to over 80% of Nigeria's total exports. Its contribution to Nigeria's total exports was to increase even further in the 1990s and 2000s as indicated in Table 1.1. A significant feature of the Table is that for the periods between the 1970s and 2007, the minimum contribution of crude oil to the total exports of Nigeria was 90%.

The contribution of the oil sector to the revenue base of Nigeria has also been very high at over 70 percent⁸. From Table 1.1, the contribution of the oil sector to the revenue base of the country was lowest in 1963 with just 10 million naira⁹. This could be attributed to the dominance of the agricultural sector during that period. From the Table, this sector's contribution has consistently risen and in 2007 contributed over 6 trillion naira to the coffers of the government. This appears to suggest that the Nigerian government depends on this sector for its foreign exchange earnings and any adverse events in this sector nationally or in the industry globally (for example, fall or rise in the international oil prices) has adverse impact on the revenue base of the country.

⁵Other members include- Algeria, Angola, Ecuador, Indonesia, Iran, Iraq, Kuwait, Libya, Qatar, Saudi Arabia, United Arab Emirates and Venezuela (see <http://www.opec.org/library/FAQs/aboutOPEC/q3.htm>)

⁶Tebebah, E. (2005), "Technological Innovation in the Upstream Sector of the Petroleum Industry", PhD Thesis, University of Manchester, United Kingdom.

⁷Onuoha, F. (2007), "Poverty, Pipeline Vandalisation/Explosion and Human Security: Integrating Disaster Management into Poverty Reduction in Nigeria". African Security Review 16.2, Institute of Security Studies; Ojefia, I.A. (2004), "Nigeria and the Niger Delta Question", A paper for the 22nd Annual Conference for the Association of Third World Studies, Americus, Georgia, United States of America

⁸ Enabulele, S.E. (2007), 'Emergence of Local Content Drive and Procurement Services in the Oil and Gas Industry in Nigeria: Challenges and Prospects' Vol. 4 No. 1 PTJ, Pg. 30-35; Oil Industry Report (2008), Research and Special Publications Unit of BusinessDay Media Limited.

⁹ Naira is the official currency of Nigeria

Driven by this dependency, the government of Nigeria, which previously was only interested in royalties and provision of regulatory frameworks, sought to become more active in the operations of this sector by the acquisition of equity shares from various foreign Multinational

Table 1.1 Growth of Nigeria's Oil Export, Crude Oil Production and Revenue 1963-2007 (selected years)

Year	Crude Oil Production (000 barrels per day)	Crude Oil Revenue (=N= million)	Oil Exports as % of Total Exports
1963	75.0	10	10.8
1970	1084	167	57.6
1973	2,055	1,016	83.1
1978	1,895	4,556	89.4
1983	1,235	7,253	96.0
1988	1,445	20,934	91.2
1993	1,985	106,192	97.5
1998	2,167	289,532	95.4
2001	2,274	1,340,000	97.1
2003	2,263	2,074,300	
2005	2,580	4,762,400	96.0
2007	2,356	6,700,000	95.0

Sources: Computed from IMF International Financial Statistics Yearbook; BP Statistical Review of World Energy (various years); Petroleum Inspectorate, Nigeria National Petroleum Corporation (NNPC)

Corporations and issuing of oil licenses to indigenous oil companies. Through its state owned petroleum corporation, established in 1971, the Nigerian National Oil Corporation (NNOC), which later became the Nigerian National Petroleum Corporation, (NNPC) in 1977¹⁰, acquired equity shares from the respective joint ventures which are still prevalent at this time. In these equity participation, the government of Nigeria through the NNPC is considered to be an important 'stakeholder' in the oil sector, but does its interest extend to technological development in the industry? Table 1.2 contrasts the technological fortunes of the NNPC with two other state owned companies, one from another developing country, Brazil and the other from a developed country, Norway.

Table 1.2 contrasts the NNPC with Statoil and Petrobras. While NNPC was established in 1977, Statoil (Norway) was formed in 1972 and Petrobras (Brazil) in 1954. Statoil is the assignee of twenty three patents at the US Patent and Trademark Office, it is a market leader in such areas as reservoir management, floating and sub-sea oil and gas production technologies, and its operations have expanded to twenty nine countries with Norway as its headquarters. Petrobras

¹⁰ Efforts are being made by the federal government to restructure the NNPC to be a truly integrated oil and gas company which is expected to compete favourably with other Multinational Corporations (see the Oil and Gas Sector Reform Implementation Committee, (OGIC report)). However, it is important to note that the National Assembly has to ratify such recommendations.

Table 1.2 Comparisons of the NNPC, STAOIL and PETROBRAS

Companies	NNPC (Nigeria)	STATOIL (Norway)	PETROBRAS (Brazil)
Nature of Companies	National Oil Company	National Oil Company	National Oil Company
Achievements in terms of technological development	No evidence of patents with US Patent and Trademark Office	It has 23 assignee names in the US Patent and Trademark Office; Market Leader in reservoir management, floating and sub-sea oil and gas production technologies	It has 145 assignee names in the US Patent and Trademark Office; Special expertise in offshore exploration, with established leadership in deep water prospecting, exploration and production technology; Formation of strategic alliances Repsol-YPF, ExxonMobil, Royal Dutch Shell, BP, Chevron, Total to develop cutting edge technologies
Operations around the world	Within Nigeria	Twenty nine different locations	Presence in Angola, Argentina, Bolivia, Brazil, Columbia, Nigeria and the Gulf of Mexico.

Source: Adapted from Tebepah (2005)

has one hundred and forty five assignee names in the US Patent and Trademark Office, and appears to have assumed a leadership role in deep water prospecting, exploration and production technology. This is particularly so as most of its operations are located in the deep offshore waters. It has also succeeded in forming strategic alliances with other foreign Multinational Oil Companies such as ExxonMobil, Royal Dutch Shell, BP, Chevron, Total and Repsol-YPE in developing cutting edge technologies. Its operational presence includes Angola, Argentina, Bolivia, Colombia, Nigeria, and the Gulf of Mexico, United States of America. The NNPC, on the other hand, has no confirmed evidence of patented invention, and its operational presence is confined to Nigeria.

The lack of sufficient indigenous technological capability can also be buttressed in the daily production of crude oil in Nigeria as it depends heavily on foreign multinational corporations for

technological expertise, production and capital outlay ¹¹ (see Table 1.3 for crude oil produced by companies in Nigeria in 2005). As indicated in Table 1.1. Nigeria's daily crude oil production has continued to increase steadily, from 75,000 b/d in 1963 to over 2,000,000 b/d in recent years. An analysis of the daily production of crude shows the dominance of foreign multinational corporations.

Table 1.3 Crude Oil Productions by Companies Operating in Nigeria 2005

Company	Average Daily Production (b/d)	Percentage (%) Share of Total Production
Joint Venture Contract (JVC)		
Shell	924,481	36.71
Mobil	574,907	22.83
Chevron	349,022	13.86
Elf	218,074	8.66
NAOC/Philips	170,584	6.78
Texaco	14,986	0.60
Pan Ocean	23,649	0.95
Production Sharing Contract (PSC)		
Addax	65,244	2.59
SNEPCO	4,292	0.17
Service Contract		
AENR	42,871	0.47
NAE	11,828	1.23
Independent/Sole Risk		
Monipulo	5,794,198	0.63
NPDC	2,025,562	0.22
Continental Oil	13,241,057	1.44
Cavendish	1,408,276	0.15
NPDC/AENR	1,408,276	2.17
EPGA/CONOCO	2,918,957	0.32
AMNI	839,956	0.09
Conoil	726,530	0.08
Atlas	163,979	0.02
Dubri	152,701	0.02
Niger Delta	141,028	0.02
Petroleum Resources		

Source: NNPC; modified by the author

From the Table above, Shell has the highest about production with an average of 924,481 b/d, which translates into about 37% of the total crude oil production. Next is ExxonMobil, with a production figure of 574,907 b/d or 22.83%. Chevron comes third with 349,022 b/d, which about 14% of the total crude oil production. Another multinational, Elf comes fourth with 218,074 or about 9% of the total crude oil production. The contribution to the total production of crude oil in Nigeria by any indigenous company is still under 2%. Foreign multinational corporations as indicated by the Table above contribute over 90% of the total crude oil production. This is not different from what has been

¹¹Tebepah, E. (2005), "Technological Innovation in the Upstream Sector of the Petroleum Industry", PhD Thesis, University of Manchester, United Kingdom

happening in previous years. For example in 1997 the two largest indigenous producing companies, Amni International and Consolidated Oil, accounted for only 0.7% of Nigeria's total oil production each, while the six established companies - Shell, Mobil, Chevron, Elf, Agip and Texaco- together accounted for over 97% of Nigeria's oil production¹².

Local Content Policy Development

Faced with the low level of local participation by indigenous companies in the oil industry, the government of Nigeria introduced the Nigeria (Local) Content policy of the petroleum industry as earlier stated in this paper. The local content of the petroleum industry is considered as the quantum of composite value added or created in the Nigerian economy through conscious utilisation of Nigerian human and material resources in the exploration, development, transportation and sales of Nigerian crude and gas resources within acceptable quality, health, safety and environmental standards in order to stimulate the development of indigenous capabilities¹³¹⁴. This policy is aimed at transforming the petroleum industry into an economic engine for the creation of jobs and national growth through the development of in-country capacity and indigenous capabilities. Through this, it is expected that greater proportion of work activities in the petroleum sector is done within the shores of Nigeria, with active support or participation from other sectors of the economy.

In line with the local content policy, the federal government of Nigeria ordered that local content in the petroleum industry should increase to 45 percent by 2006 and 70 percent by 2010. These targets appears to very ambitious particularly when the current level of local content is relatively small. Indicated below are some of the task specific directives from the Nigerian government to all companies operating in the petroleum industry, showing their scope of work in all exploration and production projects that must be executed in Nigeria¹⁵:

- Front End Engineering Development and detailed engineering design for all projects for all projects are to be carried out in Nigeria by the end of 2005;
- Project management teams and procurement centres for all projects in the Nigeria industry must be located in Nigeria from the first quarter of 2006;
- All operators and project promoters must forecast procurement items required for operations and projects from inclusion in a Master Procurement Plan (MPP) to be submitted to the Nigerian Content Division on or before January 31st of every year;
- From January 2006, all topsides of fixed (Offshore and Onshore) platforms weighing up to 5,000 tons are to be fabricated in Nigeria;
- Fabrication of all piles, anchors, buoys, jackets, bridges, flare booms and storage tanks are to be done in Nigeria;
- All fabrication of subsea systems including riser and flow-lines, subsea assemblies and ancillary tests are to be performed in Nigeria;
- Starting from January 2006, a minimum of 50 percent of the total tonnage of Floating Production Storage and Offloading (FPSO) topside modules should be fabricated in Nigeria;
- Starting from mid 2006, all FPSO contract packages are to be bid for on the basis of carrying out topside integration in Nigeria;

¹² Weekly Petroleum Argus, 21, April 1997

¹³ Enabulele, S.E. (2007), 'Emergence of Local Content Drive and Procurement Services in the Oil and Gas Industry in Nigeria: Challenges and Prospects' Vol. 4 No. 1 PTJ, Pg. 30-35

¹⁴ Oil Industry Report (2008), Research and Special Publications Unit of BusinessDay Media Limited

¹⁵ For a comprehensive specific task directives by the Feral government of Nigeria to companies active in industry in the petroleum industry, see Nigeria Energy (2007/2008), a publication of African Oil and Gas; http://www.nigeria-oil-gas.com/nigerian_local_content-26-10-2-art.html

- Starting from mid 2006, all third party services (mechanical tests), certification of welding procedures and welders must be carried out in Nigeria. The Nigeria Institute of Welding must certify all such tests in collaboration with International accreditation bodies;
- All operators and project promoters must ensure that recommendations for contract awards in respect of all major projects be forwarded to the NNPC/ constituted boards of such oil and gas companies for approval must include evidence of a binding agreement by the main contractor with the Nigerian content subcontractor. Such agreements shall indicate the cost and detailed scope including total man hours for engineering tonnage and relevant defining parameters for materials to be procured locally as well as other services;
- Domestication of all seismic data processing projects and all reservoir management studies effective end 2005;
All low voltage earthing cables of 450/750 V grade and control, power, lighting cables of 600/1000 V grade must be purchased from Nigerian cable manufacturers.

Level of Implementation of Local Content Policy

As explained earlier, the main thrust of the local content policy of Nigeria is to promote a framework that guarantees active participation of Nigerians in the activities of the petroleum industry without the compromise of standards. Whilst it is commendable to have directives (as noted earlier) issued out to companies operating in the petroleum industry in Nigeria, the implementation and monitoring of these directives appear to be very crucial for the success of the local content policy. Already, available evidence from the industry shows that stakeholders doubt about the Nigeria's capacity to attain the 70 percent local content in 2010, even as it has been unable to attain the 45 percent local content target for 2006¹⁶.

An example of this was given in one of the National Daily Newspaper of Nigeria. According to the paper,

*"... It was reported that Total has received approval to commence the development of Usan Field which is expected to begin production in 2011. Usan is believed to have more than 500 million barrels of oil. Being an offshore field, Usan comes with its own peculiar technical challenge. What is of interest is who is getting the major chunk of work to be executed in bringing Usan into production. Cameron, a foreign company is claimed to be getting \$650 million to provide subsea engineering systems for initial phase of the Usan development. \$1.6 billion goes to the Korean company [another foreign company], Hyundai Heavy Industry to build a super-large floating production, storage and offloading vessel and this is capable of yielding 160,000 barrels of crude and five million cubic metres of gas daily"*¹⁷

A similar complaint is made by a Chief Executive Officer of one of the indigenous companies that-

*"... Products such as threaded pipes and other oil industry tubular goods [OCTG] are still being imported into the country despite the fact that its fabrication yard located in Port Harcourt, Rivers State, has been completed and ready to receive orders..."*¹⁸

Another issue worth mentioning is the delay by the National Assembly in passing the local content bill into law. It is disheartening to observe that over four years after the bill was forwarded to the National Assembly, Nigerian Content Policy is yet to be law. For a country that is heavily dependent

¹⁶ Balogun, F. (2008) see <http://thenewsng.com/article/616>

¹⁷ Thisday Newspaper, Vol.13, No. 4841

¹⁸ The Nigerian Guardian Newspaper, July 16, 2008

on the petroleum sector for its revenue, it would have been expected that the bill would have been given utmost priority.

However, it will be in-appropriate to say that nothing has been achieved since the local content policy was introduced. For example, the General Manager, Nigerian Content Division states that both the engineering man-hours and fabrication tonnage performed in Nigeria has increased from 250,000 in 2004 to about 2 million in 2007, and from 12,000 in 2004 to between 80,000-100,000 in 2007 respectively. The danger is that if nothing drastic is done to achieve a sustained national effort towards progressing appreciably to the 70 percent local content and above as in the case of Brazil, which has over 80% local content¹⁹, the nation's economy stands the risk of losing out considerably in terms of value adding, technology acquisition and job Creation.

Suggestions on key considerations in the Local Content Policy

As can be observed in this paper the oil industry is very important to the Nigerian economy. It is therefore crucial that any local content policy being introduced must be properly integrated into the industrial and economic growth strategy of the Nigeria. In other words, such a strategy must have plans for indigenous capacity growth and infrastructure development to increase the national industrial base²⁰. It is very disheartening to observe the low level of indigenous capability in the country. When Research and Development indicators are considered as indicated in Table 1.4, it is quite evident that a considerable gap exists between Nigeria and other petroleum producing countries such the Netherlands, United States of America, United Kingdom, Norway, Canada, Brazil, Venezuela and Malaysia.

Table 1.4 Research and Development Indicators

Countries	Scientists and engineers in R&D per million people (1985-95)	Technicians in R&D per million people (1985-95)	Expenditures for R&D % of GNP (1985-1995)	High-technology exports \$ millions 1997	High-technology % of manufactured exports 1997	GDP/Per Capita \$ (2007)
Netherlands	2,656	1,357	2.1	57,082	44	46,261
United States	3,732	-	2.5	197,657	44	45,845
United Kingdom	2,417	1,019	2.2	95,755	41	45,575
Norway	3,678	1,819	1.8	2,703	24	83,922
Canada	2,656	1,073	1.6	33,068	25	43,485
Brazil	168	59	0.6	5,175	18	6,938
Venezuela	208	32	0.5	249	0	8,596
Malaysia	87	88	0.4	39,490	67	6,948
Nigeria	15	69	0.1	NA	NA	1,159

Source: Adapted from World Development Indicators (1999), World Economic Outlook Database-April 2008, International Monetary Fund

¹⁹ Neff, S. (2005), "Memorandum on International Best Practice in Development Local Content in the Energy Sector", National Stakeholders Working Group

²⁰ Neff, S. (2005), "Memorandum on International Best Practice in Development Local Content in the Energy Sector", National Stakeholders Working Group

While Nigeria has 15 scientists and engineers in R&D per million people, other countries according to table 1.4 above boasts of far greater number of scientists and engineers in R&D per million people. When the expenditures for R&D as a percentage of Gross National Product are considered, Nigeria has 0.1% for R&D as percentage of GNP. This, as shown in Table 1.4 is the lowest when compared to other countries.

Table 1.4 also indicates the GDP Per Capita of the various countries. Nigeria is the lowest when compared with other countries with just \$1,169.

Table 1.5 Upstream R&D location of some Multinational Corporation

Companies	Location of main R&D department
Royal Dutch Shell	Rijswijk, The Netherlands Bellaire, Wood Creek, Westhollow, New Orleans (all in the United States)
ExxonMobil	Houston, Texas, United States
Chevron	Richmond, San Ramon, and Bellaire, United States
ENI (AGIP)	Milan, Rome, Messina (Italy)

Source: Adapted from companies websites.

Both Tables 1.4 and 1.5 appear not to provide good reading for the government of Nigeria because of the apparent differences between it (Nigeria) and other countries. It will, therefore appear to be very difficult for Nigeria to attract the location of cutting-edge technological research by foreign Multinational Companies. It is no wonder that the largest oil operators in Nigeria’s upstream sub-sector have their main R&D departments outside the country (see Table 1.5). Given that Nigeria’s energy resource endowment appears to be enormous, the government of Nigeria might want to consider if the tax system can be used in such a manner to provide incentives for the location of Research and Development facilities of foreign Multinational Oil Corporations in the country. This should be included in the local content policy.

Because of the apparent differences between Nigeria and some other developed oil producing countries in terms of the level of indigenous technological capability, a local content policy that seeks to expand the technological infrastructure with particular reference to the human capital development is suggested. There is no doubt that certain highly qualified Nigerians are currently in the industry or retired at the moment. The challenge however is to expand the opportunities in the educational sector to allow for more work to be carried out by Nigerians either directly or indirectly. The traditional educational programme should be fine tuned in such a way that it has direct relevance to the industry and expands the national industrial base of the country. Also, in addition to the expanded support to the traditional educational programmes, a key focus on technical training and ongoing continuing education would provide a flexible means to meet evolving needs of the industry²¹. The government, foreign multinational corporations and other relevant development agencies are encouraged to support such local content policy initiatives.

²¹Neff, S. (2005), “Memorandum on International Best Practice in Development Local Content in the Energy Sector”, National Stakeholders Working Group

A further Policy recommendation for the government in terms of its local content policy is understanding the role technological collaborations play in technological developments. The government, through its state owned company, the NNPC, can enter into collaborative arrangements in its quest for technological development²². A strategy similar to that adopted by Petrobras as can be seen in Table 1.2. The following arrangements are recommended:

- Collaborative arrangements with other state owned petroleum companies, for example, Statoil of Norway, Petrobras of Brazil, Petronas of Malaysia, PDVSA of Venezuela, and Pertamina of Indonesia, to improve their operational efficiencies and to develop new technological innovations;
- Collaborative arrangements with Foreign Multinational Corporations such as Royal Dutch Shell, ExxonMobil, Chevron, BP, Total, ENI, and ConocoPhillips, to develop cutting-edge technologies;
- Collaborative arrangements with Oil Service Companies such as Halliburton, Baker Hughes, Schlumberger, and Weatherford, to develop leading-edge innovations;
- Collaborative arrangements with other indigenous companies to develop technologies that may be peculiar or specific to the context of the industry in Nigeria.

Although the collaborative arrangements between the NNPC and these four groups have been listed, nothing stops the NNPC from participating in an innovation that combines all the groups. There appears to be no evidence that it has done that before.

Several good policies in Nigeria will go unfulfilled because of apparent lack of proper monitoring and implementation framework. Nigeria has consistently been shifting the dates given to foreign Multinational Corporation to end gas flare in the country. As earlier indicated in this paper, the local content policy by the government of Nigeria, which had earlier contemplated in increasing the local content in the oil industry to 45 percent in 2006, appears not to have been met. The target of 70 percent local content by 2010 would appear to be a mirage *if a proper monitoring and implementation framework is not developed*. The Nigerian government is therefore encouraged to set up an agency responsible for the monitoring and implementation of the local content policy. This agency should also be saddled with the following responsibilities: it is important to note that the responsibilities of the agency below are not exhaustive:

- Ensuring that the targets set by the government of Nigeria for local content be met by all stakeholders in the industry with consequences or penalties clearly stated should there be default by any stakeholder;
- This agency should liaise with the operators in the industry on the various skills that are required;
- Liaising with higher educational institutions on skills relevant in the industry and ways of meeting skill shortages; and
- Creating a database on the skills/ competences in the industry

The Federal government of Nigeria is also encouraged to work with the National Assembly in order to pass the local content bill into law. An industry which is worth 67.1 billion US dollars in the next five years (2008-2012) in its total expenditure²³ should be given utmost priority in the National Assembly.

²²Okubote, J.T. (2001) "Repositioning the Oil and Gas Industry for Economic Development" May, CPDD, NNPC

²³ Balogun, F (2008), <http://www.thenewsng.com/article/616>

Conclusion

The petroleum industry has been one of the bedrocks of the Nigerian economy. For over 50 years since crude oil was first discovered in commercial quantity, the country has benefit enormously from this rich resource as its contribution to the revenue base of the country has risen considerably. However, despite these several decades of oil exploitation and exploration, it has been argued that Nigeria has been unable to grapple with the technological dimension of the industry. With a view to address this, the federal government of Nigeria introduced the local content policy in the petroleum industry. It is no longer news that Nigeria loses considerable amount of money to capital flight as its indigenous technological capacity is very low. Whilst this policy is laudable and should be encouraged, the government of Nigeria might want to consider some key areas such as, location of foreign Multinational Companies R&D facilities in the country, development of human capital, role of technological collaboration in technological development, an appropriate agency saddled with the responsibility of monitoring and implementation of the local content policy and passing of the local content bill into law. It is hoped the inclusion of the above will greatly assist the government in improving the level of indigenous capacity in the industry.