

Full Length Research Paper

Pharmaceutical industry capacity utilization in Nigeria

Joshua Ikoni Ogaji^{1*}, Anthony Olaniyi Alawode² and Titus Afolabi Iranloye³

¹Department of Pharmaceutics and Pharmaceutical Technology, University of Jos, PMB 2084-93001, Jos, Plateau State, Nigeria.

²GlaxoSmithKline (Nigeria) PLC, Km32, Igbesa Road, Agbara, Ogun State, Nigeria.

³Department of Pharmaceutics, Faculty of Pharmaceutical Sciences, University of Ilorin, PMB 1515, Ilorin, Kwara State, Nigeria.

Received 29 January, 2014; Accepted 24 March, 2014

The performance of any enterprise is influenced by the environment in which it is located. The last two decades has witnessed the pre and post democratic governance in Nigeria as well as a number of government initiatives aimed at addressing some challenges facing the health delivery system of the country. The purpose of this paper was to study the capacity utilization of the pharmaceutical industry within the period to understand whether there was or no association in the performance with these changes. A survey of the capacity utilization in the production of solid and liquid dosage forms was carried out. A study of the availability and distribution of scientific workforce in the industry was also undertaken. Interviews were held with some individuals to gain more insight in the activities of the pharmaceutical industry. The scientific workforce within and among organizations varied considerably and the variation was influenced by perceived benefits and opportunities. The study showed that the capacity utilization of the pharmaceutical industry increased steadily but marginally over the period. There was reason to believe that the marginal increments were influence by the government policies and initiatives during this period, but could be better if some economic investments such as steady electricity were made. It was concluded that a sustained support and provision of infrastructures by the government together with trained and motivated scientific workforce are important in improving the capacity utilization in the pharmaceutical industry.

Key words: Government initiatives, infrastructures, scientific workforce, capacity utilization, pharmaceutical industry.

INTRODUCTION

Nigeria is a relatively large country with an estimated population of 169 million and it is endowed with natural resources, high levels of human and social capital. However, it is plagued with a very high incidence of disease, poverty and malnutrition and has lower life expectancy than some other African countries of comparable economy (WHO, 2013).

The role of the pharmaceutical industry in a country such as Nigeria in the provision of safe, pure, quality and efficacious products to meet the healthcare need of the populace cannot be over-emphasized. Provision of essential medicines by this sector would curb infiltration of the market with spurious and substandard products and would also enhance the economy.

*Corresponding author. E-mail: Ikoni.ogaji@fulbrightmail.org. Tel: +234 802 363 4482.

Author(s) agree that this article remain permanently open access under the terms of the [Creative Commons Attribution License 4.0 International License](http://creativecommons.org/licenses/by/4.0/)

In realization of key role the availability of essential drug plays in health system, the government of Nigeria has made more efforts in empowering the pharmaceutical industry in the last two decades than was ever made in the history of the country. Specifically, the Petroleum Trust Fund (PTF) was established by the Federal Government in 1990s to provide infrastructural incentives to all sectors of the economy, as a palliative to the increased pump price of petroleum and the pharmaceutical industry was a key beneficiary (LFN, 1994). The year 1990 witnessed the adoption and launch of the maiden National Drug Policy (NDP) for Nigeria to address the inadequacies in drug availability, supply and distribution. The establishment of National Agency for Food and Drugs Administration and Control (NAFDAC), the publication of Essential Drug List (EDL) and a National Drug Formulary (NDF) resulted from the policy. In the first revised National Drug Policy (NDP, 2005), it was anticipated that by 2008, the local pharmaceutical industry would have realized a production capacity of 70% to satisfy at least 60% of national drug requirements of essential drugs, while the balance was to be exported (NDP, 2005). Consequently, a number of essential drugs that the local manufacturing industry has the capacity to produce have been put on import prohibition list to encourage the local manufacture and improve on the capacity utilization of sector (NCS, 2014).

A number of articles are available in the literatures addressing the effect of the various initiatives of the government on the manufacturing sector (Akinlo, 1996; Essien, 2005; Inegbenebor, 1995; Kayode, 1987; Anyawu, 2000), but none regarding the pharmaceutical subsector is currently available. Additionally, a typical pharmaceutical industry is home to interdisciplinary professional workforce, whose qualifications, motivation and competencies have impact on the quality of products and services rendered by the pharmaceutical industry. The present study was an investigation on the profile of the scientific workforce and the effects of some government initiatives in the last two decades on the capacity utilization of the pharmaceutical industry.

MATERIALS AND METHODS

The study instruments used were questionnaires and interviews, which contained both closed and open ended questions.

Capacity utilization study

Seventy (70) copies of questionnaires were administered to representatives of the pharmaceutical manufacturing companies. The survey covered public liability companies (PLC), limited liability companies (LTD) and non-for profit or non-governmental (NGO), which may be a multinational, international or indigenous company. Convenience method of sampling was employed to optimize the results of the survey. The questionnaire was filled by officers who had the relevant information on the following areas: the nature of pharmaceutical business, age of the organization, line of products,

annual installed and used equipment capacities, staffing and their productivity, number of shifts per day, sources of raw and packaging materials, research and development activities by Nigerian pharmaceutical industry and the use or otherwise of locally fabricated machinery.

Survey on workforce

Two hundred and fifty (250) copies of the questionnaires were administered to individual employees of the pharmaceutical industry. Self-report questionnaires method of Michigan Organization Assessment Package was adapted for the individual questionnaires (Michigan, 1975). The questionnaire sought information from individual employees working in the pharmaceutical industry in the following areas: age and sex, work experience, job related challenges, meaningfulness of the job, responsibility, variety and skill task identity and feedback, autonomy, work influence, pace control, role conflict and clarity, task uncertainty and interdependence, resource and skill adequacy and competencies. Closed questions were predominantly used, as appropriate, for greater precision and ease of analysis. Various persons including pharmacists, chemists and microbiologists working in sampled pharmaceutical industry received the questionnaires. Engineers and other scientists not directly involved in manufacturing and distribution of the pharmaceutical products were excluded from the study. Pre-tested questionnaires were modified to keep the questionnaires short and simple.

Interviews

Interviews were also held with selected individuals who have spent over fifteen years in the industry in strategic positions and understood the dynamics of pharmaceutical business in Nigeria.

RESULTS

Twenty eight organizations comprising nine (9) multinational/ international and nineteen (19) indigenous companies responded to the questionnaire. Fourteen (50.0%) and 24 (85.7%) of the organizations manufacture tablets and liquid preparations, respectively. Capsules and sterile products, respectively were manufactured in 4 and 3 of the facilities surveyed. Twenty two organizations use own facilities for the manufacture of their products while the remaining ones utilized third party facilities.

Installed capacity and capacity utilization

Tables 1 and 2 show the one factor analysis of variance (ANOVA) of installed capacity utilization of machinery in liquid and tablet production in the sector over the last twenty years. The capacity utilization in the production of liquid preparations was between 33.08 ± 0.9 to $55.6 \pm 1.14\%$, while the corresponding value for the tablets was 35.71 ± 1.8 to $49.93 \pm 2.4\%$. The F (19, 460) was 51.14 at P-value of 0.00 compared to the F critical of 1.61 for the liquid production line, while in the tablet production line, the F (19, 260) value was 4.37 compared to F critical of 1.63. Figure 1 shows the capacity utilization in the

Table 1. ANOVA of capacity utilization in the production of liquids single factor ANOVA of capacity utilization liquid production line in Nigeria Pharmaceutical Industry from 1993-2012.

Summary (Group)	Count	Sum	Average		Variance	
1993	24	857	35.70833		19.08514	
1994	24	837	34.875		22.9837	
1995	24	794	33.08333		19.9058	
1996	24	827	34.45833		26.51993	
1997	24	857	35.70833		19.08514	
1998	24	857	35.70833		19.08514	
1999	24	928	38.66667		32.49275	
2000	24	997	41.54167		50.1721	
2001	24	1082	45.08333		65.38406	
2002	24	1204	50.16667		49.88406	
2003	24	1285	53.54167		64.25906	
2004	24	1318	54.91667		38.42754	
2005	24	1335	55.625		31.54891	
2006	24	1330	55.41667		43.73188	
2007	24	1288	53.66667		28.84058	
2008	24	1297	54.04167		25.60688	
2009	24	1295	53.95833		39.51993	
2010	24	1290	53.75		48.80435	
2011	24	1252	52.16667		44.05797	
2012	24	1191	49.625		26.7663	
ANOVA (Source of variation)	SS	df	MS	F	P-value	F crit
Between Groups	34775.79	19	1830.305	51.11432	1.9E-100	1.609196
Within Groups	16471.71	460	35.80806	-	-	-
Total	51247.5	479	-	-	-	-

production of tablets and liquid products. The average capacity utilization decreased in 1995 and 1996. In liquid manufacture, the capacity utilization witnessed marginal increase from 1997 to 2012, and then declined of the capacity utilization in tablets decreased in 2002. Figure 2 shows the combined average capacity utilization of the tablets and liquid preparations. The Figure showed a generally slow but steady rise in the capacity utilization of the period, declining only in 2012.

Infrastructural facilities

Source of energies

Pharmaceutical manufacturers in Nigeria use public and own energy sources. Three (12%) of the respondents use the electricity supply from the Power Holding Company of Nigeria (PHCN), formerly known as National Electric Power Authority (NEPA), while an organization (4%) used own generating plant. Twenty four respondents (96%) depended on PHCN and own plant for energy supply. PHCN electricity supply met 4 to 64% of the annual energy requirements of the respondent organizations and was considered cheaper than own source of energy.

Water supply

Ninety percent of the respondents have their own water source and do not rely on supply from the public main.

Access road

The pharmaceutical companies have access roads that are not maintained in most of the cases.

Information and telecommunication technology (ICT)

A 70% of the respondents were not satisfied with telecommunication services when Nigeria Telecommunication Limited (NITEL) was the sole provider of telecommunication services in the 1990s. The respondents claimed that the global system of communication (gsm) has made information and telecommunication technology more accessible. All the 28 companies that responded have at least desktop and or personal computers as well as other electronic devices for ICT management in the organizations.

Table 2. ANOVA of capacity utilization in the production of tablets single factor ANOVA of capacity utilization tablet production line in Nigeria Pharmaceutical Industry from 1993-2012.

Summary (Group)	Count	Sum	Average	Variance		
1993	14	520	37.14286	9.362637		
1994	14	536	38.28571	18.98901		
1995	14	500	35.71429	47.45055		
1996	14	502	35.85714	64.13187		
1997	14	688	49.14286	189.3626		
1998	14	684	48.85714	119.0549		
1999	14	677	48.35714	36.24725		
2000	14	655	46.78571	37.1044		
2001	14	648	46.28571	48.68132		
2002	14	624	44.57143	27.64835		
2003	14	631	45.07143	30.07143		
2004	14	635	45.35714	51.78571		
2005	14	645	46.07143	50.68681		
2006	14	659	47.07143	93.91758		
2007	14	674	48.14286	89.82418		
2008	14	679	48.5	116.1154		
2009	14	699	49.92857	80.07143		
2010	14	688	49.14286	109.3626		
2011	14	694	49.57143	112.5714		
2012	14	620	44.28571	64.83516		
ANOVA (Source of variation)	SS	df	MS	F	P-value	F crit
Between groups	5805.414	19	305.5481	4.373487	1.69E-08	1.626697
Within groups	18164.57	260	69.86374	-	-	-
Total	23969.99	279	-	-	-	-

Some specific interventions

The establishment of the National Agency for Food and Drug Administration and Control (NAFDAC) in the early 1990s was the most significant decision of the government against the proliferation of fake and substandard pharmaceuticals in the country. All the respondents acknowledged the positive impact of the agency on drug business in Nigeria as it sanitized the drug manufacturing and advertisement to a great extent.

Petroleum (special) trust fund

Opinion was divided on the impact of the Petroleum Trust Fund (PTF) on the manufacturing sector. Seventy eight percent (78%) of the respondent organizations had marginal improvement in the capacity utilization of their facilities that was traced to the intervention.

Other interventions

Personal interview with some key players in the industry

revealed that the pharmaceutical industry believes in the ability of the intervention fund to the industry by the federal government in the form of NAFDAC-Central Bank of Nigeria (NAFDAC-CBN) fund to turn things around for better. It was generally agreed that the import prohibition of some essential drug impact positively on the industry. The President's Emergency Plans for AIDS Relief (PEPFAR) funds and the current World Health Certification drive by some pharmaceutical companies are areas capable of significantly improving the capacity utilization in the pharmaceutical industry subsector of the economy.

Research and development profile of the pharmaceutical industry in Nigeria

Twenty respondent organizations (71.43%) carry out marketing related research with 1 to 5% of their profit after tax annually. Research on drug discovery was not carried out in any of the respondent organizations, but limited formulation studies happened occasionally when an excipient is substituted. Ten (35.7%) of the respondents use locally fabricated equipment such as

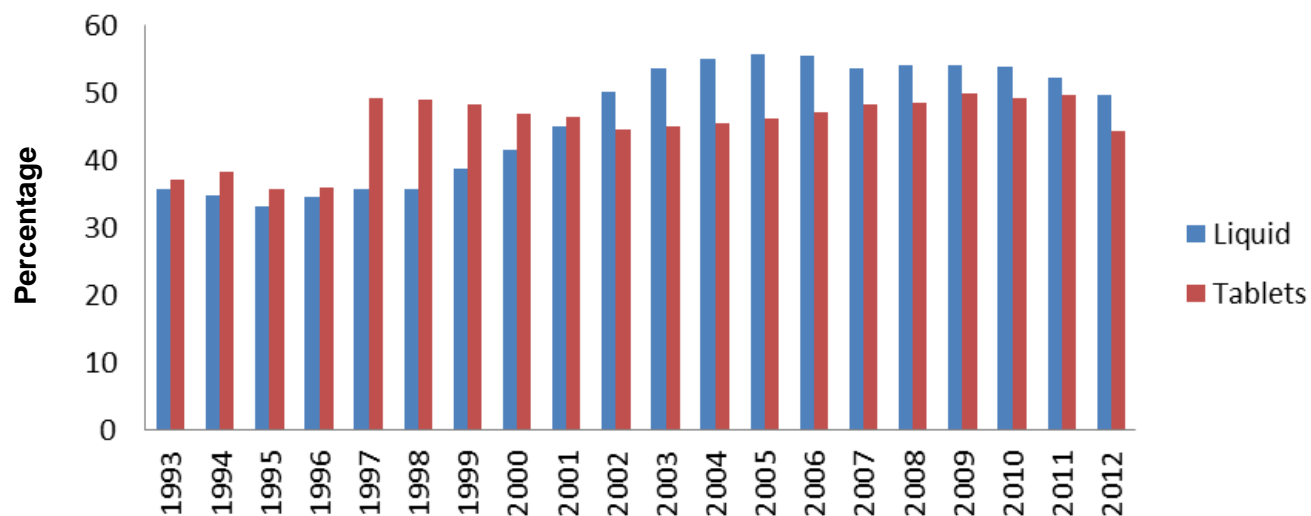


Figure 1. Average capacity utilization for tablets and liquid preparations from 1993-2012.

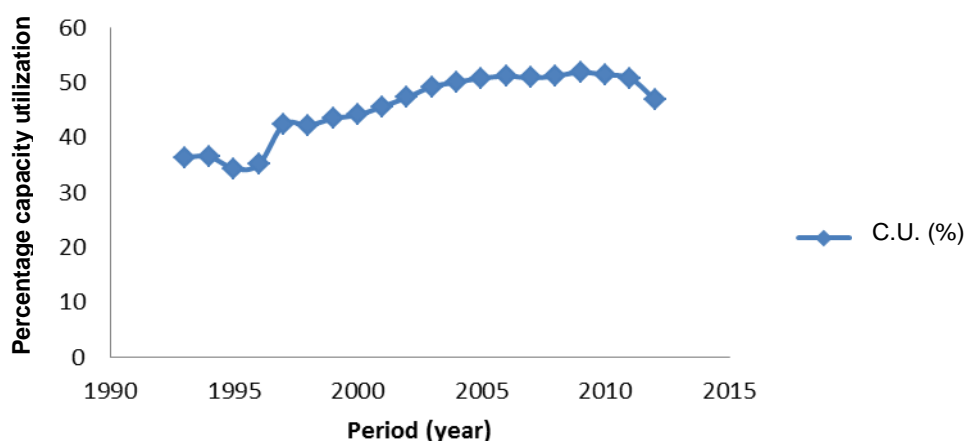


Figure 2. Combined average capacity utilization for tablets and liquid preparation.

mixing tanks, mixers, scoops, stainless steel containers and simple liquid filling equipment for their production. The survey showed that over 60% of the equipment used in the manufacture of liquid preparations was imported, while tablets and capsules are manufactured using imported equipment.

Scientific workforce in the pharmaceutical industry

One hundred and forty four (144) of the 250 questionnaires were returned from the scientists working in the pharmaceutical manufacturing establishments. Thirty percent of the respondents were 23 to 33 years old, while the remaining respondents were older but less than 55 years. Two of the respondents had PhD, one had Fellowship of the Postgraduate College of Pharmacists and 103 have other postgraduate qualifications. The

survey revealed that 28 (19.4%), 17 (11.81%), 72 (50.0%) and 27 (18.75%) of the respondents had worked in the industry for 1 to 4, 5 to 10, 11 to 20 and over 20 years, respectively. The workforce distribution of the respondents was 11, 39 and 50% in production, quality control and marketing comprising pharmacists (51%), chemists and biochemists (39%), microbiologists (8%) and other scientists (2%). Job satisfaction among the scientific workforce ranged from 40 to 100%. The study showed that the employee in marketing were more satisfied with their jobs than their counterparts in either production or quality control.

Job security

Over 80% of the respondents felt secured in their current jobs and do not anticipate being fired or laid off by their

organizations, while 20% were not sure. About 75% of the workforce in marketing was likely to look for a higher pay opportunity in the next one year. The respondents claimed to have achieved 75 to 100% of the annual target rated on options of less than 50, 50, 75, and 100% or above 100% achievement of annual target. Production and quality control workers met their targets more than their counterpart in marketing and sales.

Mental acuity utilization

The survey showed that mental acuity utilization in the area of competencies was less than 50%. Managerial capabilities of the respondents were rated as adequate by 33.3% (48), while the remaining 67.7% (96) claimed that management skills were inadequate for their current responsibilities. The respondents were evenly split in the rating of the on-the-job training as either adequate or inadequate.

Determinants of career choice

The determinants of choice of area of practice within the industry were monetary reward (40%), opportunity for promotion (18%), job security (16%), public perception (15%), job contents and challenges (11%).

Generally, benefits such as incentives bonuses, company automobile, stock options and potentials for and advancement more often than not account for how opportunities within the sections of the industry are rated and are the driving forces for seeking employment opportunities by scientists.

DISCUSSION

Both indigenous and multinational establishments are involved in the manufacture of pharmaceuticals in Nigeria and over 90% of them are concentrated in Lagos, the commercial nerve of the country, and the contiguous states. The industry engages in the secondary manufacture of solid and liquid dosage forms. There are more manufacturers of liquid preparations than of solid probably, because of the few unit operations involved in liquid manufacture and hence relatively lower manufacturing cost. Liquid preparation equipment have more flexibility in usage to make different products than either tablet or capsule and this might explain why the capacity utilization of liquid producing equipment was relatively higher than those of the tablets. While the same mixing tank and a filling and capping line can be used for a number of products, the use of a tableting machine for tablets of different sizes and shapes will require change parts. The results showed that there was a general marginal increase in the capacity utilization over the period.

This was probably due to several measures by the government aimed at improving the productivity of the industry. The year 1995 was a very challenging time in Nigeria due to political instability and power struggle, which impacted on many sectors of the economy; and this might explain why the capacity utilization declined in 1995 (Anon, 1998; Olowe, 1995). It was also probable that the new requirements for manufacture and advertisements of drugs, introduced by NAFDAC, were yet to be understood and complied with by the manufacturers.

Manufacturing productivity growth and capacity utilization are two major phenomena that are intertwined such that the higher the capacity utilized, the larger the outputs that are produced and the faster the growth of manufacturing productivity (Bamikole, 2012).

Generally, capacity utilization of 70 to 75% is required for a sector to experience productivity growth (Bamikole, 2012). Manufacturing productivity growth is the increase in the efficiency and productive capacity of the manufacturing sector.

Slackening domestic demand and lack of foreign exchange to import raw materials or imported inputs can negatively affect capacity utilization (Essien, 1990) and this seems to be the case with the pharmaceutical industry. The exchange rate and foreign reserves may influence manufacturing productivity growth and capacity utilization, if the naira depreciates against the dollar, imports become exorbitant and production at home may be halted. This may be the case with the low capacity utilization in the pharmaceutical industry in spite of the fact that some products have been placed under import prohibition list, to encourage their local manufacture. Investment in infrastructure has a positive impact on manufacturing productivity, while inefficient investment in economic infrastructure (electricity and transport) has a negative effect on manufacturing productivity (Adenikinju and Olofin, 2000; Ukoha, 2000; Mojekwu and Iwuji, 2012). This indicates that government interventions must be all inclusive to realize high manufacturing activity in the pharmaceutical subsector. The current wave of huge investments by some local manufacturers to upgrade their facilities to internationally accepted standard is a good development and government can do well to patronize them and also encourage donor agencies involved in procurement of pharmaceuticals to turn to local manufacturers of such articles. In this regard, establishment of good channels of communication between the government and the stake holders in the industry would be very crucial. It has been reported that the current local manufacture of essential drugs meets only 30% of the country's essential drug needs (thepahrmaletter.com) which means that reasons other than lack of patronage by the government are responsible for the sector not meeting her target of producing 60% of the country's need of essential drug (PMG-MAN). Interestingly, two third of the over 34 million world population of people living with HIV/AIDS are in the

Sub-Saharan Africa (www.theglobalfund.org). Moreover, there is substantial allocation of funds for malaria and tuberculosis that the local industry can provide marching drug component requirements and thereby increase capacity. There would be sense in developing requisite expertise that would effectively manage the scarce resources at the disposal of pharmaceutical industry and for the government to take a holistic approach in re-vamping the ailing industry. Optimum local production of the essential medicines will not only enhance access to good quality medicines, but will also create employment opportunities. Worthy of mention is the need for collaboration between the industry and the academia in the area of research and development so as to take advantage of the locally available abundant resources that could serve as excipients and packaging materials.

Scientific workforce in the pharmaceutical industry

Company size and product lines are different and there exists considerable variability in the utilization of pharmacists and other scientists within industry. Disparity in benefits within and among organizations can be a challenge to workforce availability, which can impart negatively on the quality of goods and services delivered by the industry. The manufacture of safe and efficacious medicines cannot take place without the input of skilled and motivated scientific workforce. One of the critical aspects of the long term sustainability of the pharmaceutical industry is enlargement of human capitals that can satisfy the diverse undertakings in the pharmaceutical manufacturing system. There must also be a continuous linkage between the industry and the academia to be able to focus on training manpower that will meet the manufacturing and research skill needed in the industry.

Conclusion

A study of the capacity utilization in the last two decades in the pharmaceutical industry in Nigeria was carried out. There was association between the performance of the pharmaceutical industry in Nigeria and interventions of the government over the last two decades, but the influence was marginal on the capacity utilization of the pharmaceutical industry over the period. Full benefit of any intervention by the government can be realized if there is corresponding economic investment in infrastructures particularly electricity and the stabilization of naira. A focused search for and development of excipients from local sources can boost capacity utilization of the pharmaceutical industry.

Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

REFERENCES

- Adenikinju A, Olofin SO (2000). "Economic Policy and Manufacturing Sector Growth Performance in Africa". *Nig. J. Econ. Soc. Stud.* 42(1):1-2.
- Akinlo E (1996). Improving the Performance of the Nigerian Manufacturing Sub-Sector after Adjustment: Selected Issues and Social Proposals. *Nig. J. Econ. Soc. Stud.* 38:91-111
- Anon (1998). The end of Nigeria? *Socialism Today*. www.socialismtoday.org/31/nigeria_end31.htm Accessed on February 18, 2014.
- Anyawu CW (2000). Productivity in the Manufacturing Industry. Central Bank of Nigeria <http://www.centralbank.org/out/annual/ACKZU/2000/abe-00-7.pdf>.
- Bamikole OO (2012). The Impact of Capacity Utilization on Manufacturing Productivity Growth in Nigeria Using Co-integration Analysis (1975-2007). The University of the West Indies, Mona Campus, Jamaica. Accessed online on October 7, 2013 from <http://ssrn.com/abstract=2066174>
- Essien E (1990). Nigeria under Structural Adjustment. Agodi, Ibadan, Nigeria: Fountain Publishers. P 261.
- Essien AE (2005). A Consistent Macroeconomic Framework for the Agriculture Sector under the Natural Economic Empowerment and Development Strategy (NEEDS). Central Bank of Nigeria (CBN) Bulletin
- Inegbenebor (1995). Size: Structure and Performance of Private Nigerian Manufacturing Enterprises: *Nig. J. Econ. Soc. Stud.* 37:13-27
- Kayode MO (1987): The Structural Adjustment Programme (SAP) and the Industrial Sector: NISER, Ibadan, Nigerian 1987
- Michigan Organization Assessment Package (1975). Progress Report II. Institute for Social Research. The University of Michigan, Ann Harbor, Michigan 48106, USA.
- Mojekwu JN, Iwuji I (2012). Factors Affecting Capacity Utilization Decisions in Nigeria: A Time Series Analysis. *Int. Bus. Res.* 5(1):157. Doi.10.5539/ibr.v5n1p157
- National Drug Policy. Federal Ministry of Health Abuja in collaboration with World Health Organization, Department for International Development and European Union. April, 2005
- Nigeria Custom Services. Import Prohibition List. <https://www.customs.gov.ng/ProhibitionList/import.php>. Accessed on February 17, 2014. Last updated 2014
- Olowe RA (1995). Risk and Return: Empirical Evidence on Market Factors in the Behavior of Nigerian Stock Exchange Common stock prices." *Nig. J. Mgt Stud.* 7(1):104-121.
- Olowe RA (2008). The impact of the Annulment of the June 12 1993 Election and the Nigerian Stock market.,12. *ASUU-Unilag J. Contemp. Issues* 3(1):25-44.
- The 1994 Petroleum (Special) Trust Fund Act, CAP P 14 Law of the Federation of Nigeria 2004
- Ukoha OO (2000). "Determinant of Manufacturing Capacity Utilization in Nigeria 1970-1988. *Nig. J. Econ. Soc. Stud.* 42(2):121-130
- WHO. www.who.int/countries/nga/en. Accessed on September 15, 2013, last update in May 2013.
- WHO Africa Region: Kenya. www.who.int/countries/en. Accessed on September 15, 2013, last update in May 2013
- www.theglobalfund.org/en/about/diseases/. Accessed on October 13, 2013
- www.thepharmacist.com/articles/less-than-30-of-drugs-in-nigeria-made-locally. July 15,2013. Accessed on October 12, 2013