

INNOVATIVE POLICIES: AN ASSESSMENT OF THE NIGERIA ELECTRIC POWER SECTOR.

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Abstract— The study aimed to assess innovative policies in the Nigeria electric power sector. Nigeria electric power sector has gone through series of innovative policy and decision changes especially in the area of technological advancement since its inception in 1896. Using a mixed method research design in the forms of exploratory and secondary data research designs, the study found that the strategic innovative decision is to general decrease Nigeria government financial commitment to electrical power infrastructure, after the PPP agreement was implemented. This transferred the technology infrastructural development to the private investors while the management of the power sector divert its innovative effort to other process of developing the power sector. The study concluded that there was a reoccurring strategic innovation decision problem in the Nigeria power sector as each authority at points identified in this study, seems not to balance the capacity of the new innovation implementation to the ever-increasing demand as a result of population growth and the ability of the new installation to cope with the unforeseen circumstances like unexpected breakdown. Based on the observation, this study recommended that the fact that innovative power generation, transmission, distribution and financial facilities are available and accessed either through public or private funds, does not mean that the existing power facilities should be ignored as observed in the three-time period observed in this study.

Index Terms— Innovation, Policies, Electric Power Sector, Innovative Decision.

1 INTRODUCTION

Recently, there is an increase in government's and management of organisations' level of awareness on the influence of decision making on capital projects and the risks experienced on investment [8]. This is as a result of the problems or challenges encountered due to a combination of the ever-dynamic rate of change in the forces of technology, social, and economic processes that forces them to sometimes attempt what may be the impossible [24]. But [21] believed that though government developed what may be identified as innovative decisions, the quality of government-level innovative decision-making in Nigeria deserves scrutiny. To [21], there is a need to question what most of the authorised management of Nigeria policy referred to as an innovative decision, like "How much of it is idiosyncratic or how much of it is formally structured". Hence researchers like [26] are of the opinion that this challenge of erratic decision-making has been causing policy somersault and has not in any way beneficial to Nigeria and also has a detrimental effect on the achievement of socio-economic policy goals set by the various governments.

Like in the other sectors, the Nigeria electric power sector has gone through series of innovative policy and decision changes especially in the area of technological advancement since its inception in 1896. Nigeria been the fifth country in the world after USA, UK, Germany and Italy that electricity generating plants was installed.

Though [16] believed Nigeria is the third country in the world after USA and the UK. While other countries and many others have experience improved and stable electric power supply, there has been epileptic supply for major part of the years of its existence in Nigeria. This unstable power supply is

not peculiar to a particular part of the country, be it commercial states, urban or in the rural settlements and persists till date. While some parts of the country have been experiencing unstable power supply, some are experiencing power outages. Though, there are few exemptions. For example, the recent Federal Government announcement of a technological development that resulted in uninterrupted supply of electricity to two communities in Kaduna State for two straight years from the 90-kilowatt Solar PV off-grid system installed in the area [22]. Thus, this study assessed the historical development of the Nigeria electrical sector and the implication of few innovative policy in the sector to have a better understand of how this decision have shape the present state.

2 LITERATURE REVIEW

To have a clear understanding of the variable-innovative policy in this study, the two construct that made up the phrase-innovation and policy were first examined briefly.

According to [10], decision making - which is as old as man existence, [8] - entails identification and selection of alternative courses of actions based on the values and preferences of the decision makers. This mean for a decision point to occur, there are more than one alternative that have been identified and only one best fits with the goal(s), objective(s) or expected values of the system under consideration is chosen.

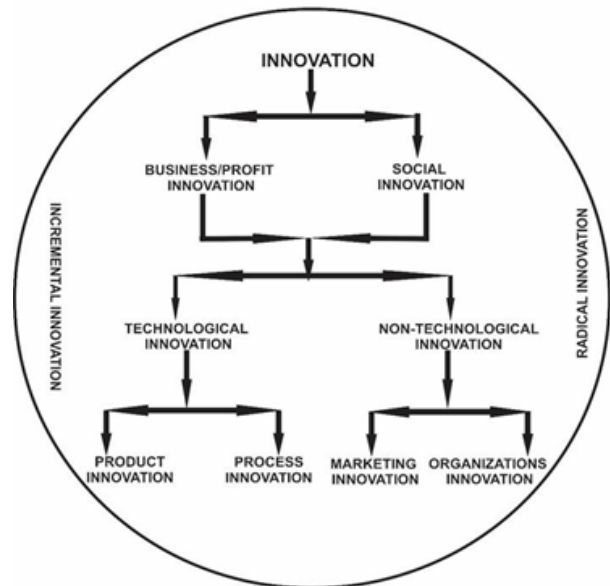
Researchers like [8] believe decision-making is a construct that is shrouded in the mystery of antiquity and is born out of the desire to make provision for the future. The desire to reduce the future uncertainty outcomes as a result of present actions

made decision impeccable. However, the certainty of future outcomes had always been elusive consequent upon possible unpredictable changes in human behaviour, seasons, environmental factors, government regulations etc. which underline the concept of risk. However, policy and decision may look similar but are not conceptually the same based on the conceptual review of researches like [1]. [1] states that,

Policy making should not be confused with decision-making. Like the politics-administration dichotomy, policymaking - decision making dichotomy is blurring. However, there are some marked differences. While policy making can be characterized as a cluster of decision making, the converse is not the case. Moreover, policy making process can end into a codified document with binding force, decision-making can only culminate into an ultimate end with, at best, a precedent of discretionary reference. Despite these differences, policy-making and decision-making processes present some commonalities, like choice i.e. identifying and choosing the best alternative courses of actions towards realization of the optimum ultimate goal. Both also operate within the influences of environmental factors. However, the problem of choice and the influences of environmental factors are more crucial and severe in the policy making than in decision making. Similarly, while the decision maker is prone to making references to existing policies as defenses mechanism for airy shortcomings, the policy maker has no such opportunity.

Similarly, the word innovation has slightly different meaning to different discipline, but one unifying thing about it is the concept of new ideas, techniques and methods. While some even confused it with the concept of invention, others believed is the same thing as creativity. But what differentiates the concept of innovation from the other two concepts is the use of what the other two developed. While invention refers more directly to the creation of the idea or method [12] creativity essentially refers to the ability to produce new and interesting results through critical thinking associated with Ideas, Imagination, Inspiration, Intuition and Ingenuity [3], [13]. But innovation to researchers like [15] and [27] refers to an important force using these new ideas, techniques and methods to add value for sustaining the growth of the system under consideration. The level of values added to the system can be used as a performance indicator index to evaluate how innovation has improved the system depending on the type of innovation. The model shown in Figure 1.1 is a simple representation of the types of innovation as explained by Organisation for Economic Cooperation Development [28]. Though it should be of note that, not all changes can be considered innovations [28]

Figure 1.1: Types of Innovation



Source: Adopted from [28]

In Nigeria years of significant infrastructural deficit due to poor investment and maintenance in infrastructural facilities held back the Nation's development and economic growth [5]. Thus, Obasanjo in the year 2000 adapted a strategic innovative model of PPP in Nigeria out of the need to reduce the gap in infrastructural deficit. These infrastructures gap ranges from the port congestion to the epileptic power generation and supply etc. [25].

Obasanjo's policy gave birth to the first known Federal Government project executed under PPP by Bi-Courtney [7] and the launch of the first certain Independent Power Project (IPP) through the PPP initiatives under the umbrella of the offices of Bureau of Public Procurement (BPP) and the Infrastructure Concession Regulatory Commission (ICRC) [25].

[7] identifies lack of regulatory framework for PPP in Nigeria for quite a lengthy period of time but this gap was filled when Obasanjo signed into law the Act that brought ICRC into being in 2005 to strategically accelerate investment in national infrastructure through private investment. This was implemented by Late President Umar Yar'adua. in 2007 [29].

The Act enable the concession or contractual arrangements that encouraged entrepreneurs to participate in the financing, operations, development, construction, and/or maintenance of government infrastructural projects. This is based on the fact that, investment in Infrastructure offers significant investment opportunities for long-term investors, even in a time of global crisis, which is important, both for economic recovery and long-term development [11].

According to [4], the current state of electricity power supply in Nigeria is a major hindrance to general economic development and improvement. To address this gap, the Nigeria gov-

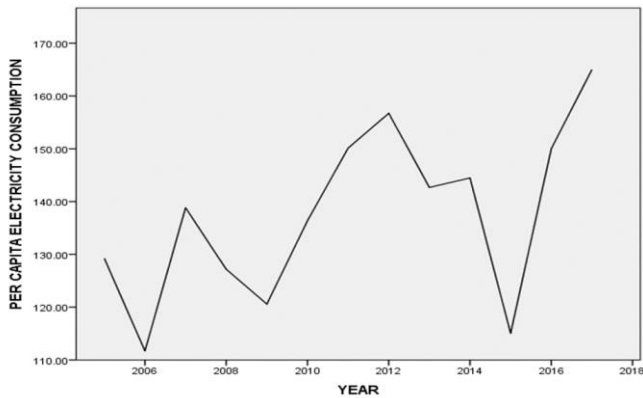
ernment through the PPP initiative focused more on the development of new infrastructural assets and enhancement of the existing capabilities across the value chain. However, an observation by this study of recent events shows that, eight years after the implementation of the PPP initiative has not improved the situation significantly with the present per capita consumption at 168kwh. This is one of the lowest amongst the peer-set (i.e. nations whose per capita GDP-at current rate-are within US\$2,000 and US\$4,000) range; depicted in the combination of Table 1. And figure 1. This is to compare Nigeria to nations whose population exceed 20 million and exhibit a relatively similar range of economic capacity.

Table 1: Change in annual per capita power consumption for key growth markets (non-exhaustive)

Country	Power consumption per capita in kWh (year in brackets)	Power consumption per capita in kWh (year in brackets)	Increase in power consumption per capita (multiple)	Time period (years)
Vietnam	159 (1995)	1035 (2010)	6.5	15 years
Egypt	199 (1972)	618 (1987)	3.1	15 years
Indonesia	163 (1990)	501 (2005)	3.1	15 years
Sri Lanka	169 (1992)	416 (2007)	2.5	15 years
Morocco	163 (1975)	357 (1990)	2.2	15 years
Philippines	236 (1971)	311 (1986)	1.3	15 years

[4] argue that, even if all power generation projects (from all the Discos and the power ministry) currently under construction in Nigeria are completed as schedule, the total projected installed capacity will be 32.8 GW. Also, if the efficiency rates and T&D losses in the Nigeria electric system is constant, then will the Nigeria’s power consumption per capita be able to reach 433 kWh in 2025. Despite this possibility of about 300% increase, an examination of table 2.5 shows that Nigeria will most probable remain one of the nations with the lowest per capita consumption amongst the peer-set.

Figure 1: Per capita electricity consumption



Source: [4]

This study, taken a clue from the study of [4], is of the opinion that the power sector of Nigeria with the PPP initiative can achieve a better result. That is to reach the average of the other peer nations depicted in Table 2. as 1,818 kWh per capita consumption. This can be achieved, if Nigeria through the PPP initiative can develop a Technologically Innovative (TI) strategy/policy like Vietnam. The result of Vietnam TI policy in the power sector is as shown in Table 2.5 above. This can also be

achieved within ten years instead of the 15years projected by the federal government, since Nigeria presently have a better economic position than Vietnam in 1995 (i.e. with a higher GDP per capita). Nigeria also has a substantial improvement in technology (i.e. as at 2015-when the present Nigeria government began its 10 years plan vs. 1995 when Vietnam government began its 15 years plan).

Table 2: Per capita power consumption (annual) for key growth markets (non-exhaustive)

Country	Electricity per capita consumption kWh (2015)	Population in millions (2015)	Electricity per capita consumption kWh (2025)	Population in millions (2025)	Increase in electricity consumption per capita
Ukraine	3,234	44.8	4157	42.7	1.3
Uzbekistan	1621	29.2	1805	33.3	1.1
Egypt	1877	91.5	2493	108.9	1.3
Vietnam	1465	93.4	2677	102.1	1.8
Indonesia	910	258.0	1393	285	1.8
Morocco	873	34.0	1240	37.7	1.4
Philippines	682	202.0	962	116.2	1.4
Sri Lanka	588	21.0	1009	21.4	1.7
Nigeria	151	182.0	453	230	2.8
	1213		1818		1.5

Source: [4]

2.1 Theoretical Review

Transaction costs perspective

[14] model examines the circumstances under which cooperation agreements are the most efficient form of organisation. In this theoretical approach, industrial innovative linkages can be explained by the increasing vertical disintegration (as adopted in Nigeria power sector to reduce the bureaucracy that has hindered private participation), the necessity of exchange processes increase and the number of required transactions. This is because differentiation, technological complexity and interdependence led to the increase in costs of activity coordination within organisation especially public entity, so that the pressure to search for external arrangements (private participation) rises as well. Hence the most cost-effective variant should be sought. In this interpretation, transaction cost efficiency can be regarded as a motivation for public private partnerships. For example, the level of efficiency expected by the Nigeria government can be determined by the investment in collaborative and R&D efforts between the Nigeria power sector MDAs and its environment.

Innovation Economics

[2] opine that innovation creates novelties. These novelties (inventions) become an innovation via its commercialisation as a result of value added which can be technological or non-technological. A major difference to traditional interpretations of the innovation concept (e.g. as identified by the push and pull model) is that nowadays innovation is regarded as a non-linear and cumulative process which is influenced by socio-cultural factors and which is characterised by interactivity between many stages and many agents contributing to the realisation of an innovation. As a matter of fact, innovation can also be interpreted as a distributed knowledge sourcing and combining process between different agents. Both tangible and intangible (social) interactions with firms, research institutes, intermediaries, clusters, linkages, networks and others play a prominent role in the transfer of information, implicit and explicit knowledge to new technological, social

and organisational solutions to add value to the system [23]. Hence, taking a clue from the concept of performance identified earlier, innovation economies provide the bases necessary to believe technological linkage capabilities will provide necessary resource for performing operations at the minimum cost and invariably improving the per capita electricity consumption.

2.2 History of the Electricity Power Industry in Nigeria

Electricity generation started in Nigeria by the Public Works Department (PWD), at the cost of £6 thousand in Lagos Marina in 1896 [6], [19]. This made the marina plant the 22nd electric plant to be built in the world as shown in Appendix 1. And also made Nigeria is the fifth country in the world after USA, UK, Germany and Italy that electricity generating plants was installed as identified earlier. Though [16] believed Nigeria is the third country in the world after USA and UK.

As a result of increased load and demand for electricity, by the beginning of June 1923 the first coal powered plant in the country, was constructed and commissioned in Ijora Lagos. This led to the shutting down of the Marina power station towards the end of November 1923. The Ijora coal powered plant, depict the first vital breakthrough towards developing electrical infrastructures in the country. It had an initial total installed capacity of 3.6 MW, which later increased to 13.75 MW in 1924.

In 1901, Lugard, constructed a power plant in Zungeru, through the Niger Company-a project that enable the government to lighting up its environment and subsequent governments undertook another in Plateau-a hydro-electric power installation to be able to service the coal mining activities and the Nigerian Eastern Railway (NER) workplace in Enugu. The Plateau plant was-as at the time-a low-cost maintenance water turbines. However, inaccessibility constraints due to the remote location of the site; high cost of transmission; and reduction in the speed of the river flow during harmattan season are major constraints experienced. Thus, by 24 June 1924 another coal-fired power plant that was built and commissioned in Enugu.

The Nigerian Electricity Supply Company (NESCO), was set-up in 1929 as the first Nigeria electricity utility company, [18]. NESCO built a 2MW hydro-electric power plant close to Jos.to its commenced operation

The zeal to able to match supply with the consistently increasing demand for electric power, results in the establishment of the Electricity Corporation of Nigeria (ECN) 1951. ECN built the first 132KV line in 1962 to link Ibadan power plant to Ijora Power plant, while the Niger Dam Authority (NDA) (a state-owned enterprise was inaugurated with the aim of identifying and developing the nations' hydropower potentials in 1962. But by 1972, the federal government merged ECN and DNA into the National Electric Power Authority (NEPA) with the decree No 24 of that year. NEPA was given the mandate of generating and maintaining a cost effective and economic system of electricity that is efficient to supply electric power to every parts of the Nigeria for developing the technological and industrial growth of the country [16].

Though, Egbin gas powered plant commenced operation in

the mid-eighties in Nigeria, the nations electric power sector however, suffered a considerable setback in the 80s and 90s. this occurred during the military rules as considerable percentage of the hydro-electric dams and equipment were rot due to lack of investment on maintenance. The transmission and distribution equipment and lines were also not upgrade and thus become obsolete with time. This continued till 1998 when the Federal Authorities ended the monopoly of NEPA in generating, transmitting, and distributing electric power [9], [17], [18], [20].

A further reformation process embarked in 2001 resulted in the Electric Power Sector Reform Act to;

- Unbundle NEPA as an entity into generation, transmission and distribution companies;
- Arrange for the transfer of both human and physical assets and liabilities of NEPA to PHCN and subsequently to successor generation, transmission and distribution companies;
- Develop a market that allowed competition among the operators of electricity services in Nigeria;
- Inaugurate an independent regulatory system in PHCN

Around the end of the third quarter of 2013, the implementation of the privatisation initiative of the power sector reform act of 2005 by the Jonathan administration, resulted in the unbundling of the PHCN. The Nigerian Electricity Regulatory Commission (NERC) was established as an agency of the power ministry with the responsibility of regulating and monitoring the electric power sector as provided in the Electric Power Sector Reform Act of 2005. NERC is also given the responsibility to issuance licenses to market operators, and enforcing compliance with established operating guidelines within the acceptable market framework. Hence due to the federal government divestment from PHCN, the organisation was split into different entities called Local Distribution Companies (LDC), each of the resulting entities is responsible for handling electricity distribution in each region [19].

Observations and Implication of Management Decisions from the history of Nigeria's Electric System.

One major management decision that causes the power fluctuations as identified from the historical observation is that, the nation decision makers tend to quickly abandon a power plant once an improved power plant is either established or ongoing. This is not peculiar to the setback experienced during the military rule between 1983-1998 on the available hydro-electric power infrastructures, as a result of investment on the Egbin gas powered plant. But also, the closing down of the Marina plant in 1923 once the Ijora plant commenced operation. These management decisions were taken without due consideration to the possibility of the new installations meeting the electric power demand at those point in time, the possibility of the new installation meting this ever-increasing demand as a result of population growth and the ability of the new installation to cope with the unforeseen circumstances like unexpected breakdown. These are radical strategic innovative decision taken at those point in time. Hence the study observed that, the authorised body could not differentiate be-

tween when to apply radical or incremental innovative policies and when to apply both in the power sector.

Another management decision is that it took too long for Nigeria government to realise and take proactive steps towards private investment in the power sector. This is more obvious in all management decisions on the power sector before 1999.

Finally, the inability of the various government over years to create a persistent conducive investment climate despite the overwhelming evidences of market availability for private investment into the electric power sector and has caused the response from investors to be lower than expectation in Nigeria. [16].

As of July 2017, the structure of the companies is as shown in Table 1.1 below [19]. It shows that the PHCN was unbundled into, eleven (11) Distribution companies, six (6) Generation companies and one (1) Transmission company

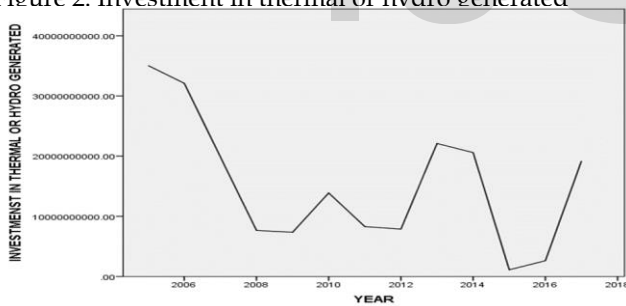
Table 3: Structure of the electric companies in Nigeria-2017

S/N	Distribution Companies	Generation Companies	Transmission Company
1	Abuja Electricity Distribution Company Plc	Afam Power Plc	Transmission Company of Nigeria
2	Benin Electricity Distribution Company Plc	Egbin Power Plc	
3	Eko Electricity Distribution Company Plc	Kainji Hydro-Electric Plc	
4	Enugu Electricity Distribution Company Plc	Sapele Power Plc	
5	Ibadan Electricity Distribution Company Plc	Shiroro Hydro-Electric Plc	
6	Ikeja Electricity Distribution Company Plc	Ughelli Power Plc	
7	Jos Electricity Distribution Company Plc		
8	Kano Electricity Distribution Company Plc		
9	Kaduna Electricity Distribution Company Plc		
10	Port Harcourt Electricity Distribution Company Plc		
11	Yola Electricity Distribution Company Plc		

Source: [19]

3 ANALYSIS AND DISCUSSION OF FINDINGS

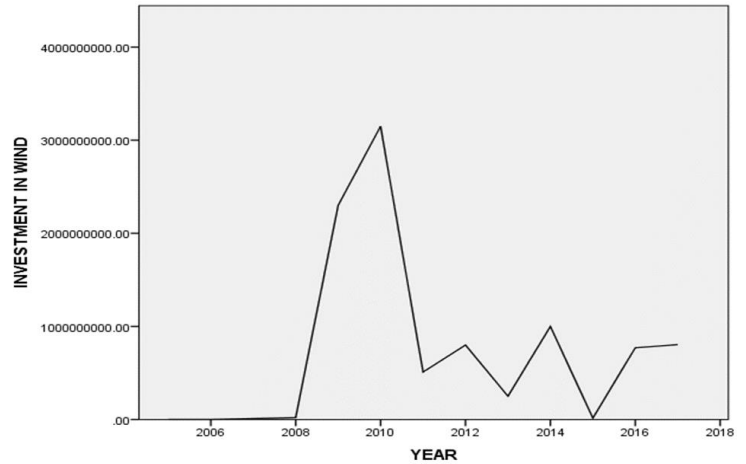
Figure 2: Investment in thermal or hvdro generated



Source: Budget Office of the Federation (2005 - 2017)

Figure 2 depicts the investment the power sector made over a study period of twelve years between 2005 and 2017 on Thermal or Hydro Generated Capital Projects. The trend shows that the intensity of investment by the ministry of power on Thermal or Hydro Generated Capital Projects was steadily decreasing immediately after the full implementation of the innovative power sector reform of 2005 till 2016. This is may be expected to so many Nigerian power sector analyst because the Nigeria power sector implementation of the PPP initiative is expected to reduced public spending in power generation considerably. But the sharp increase in budget allocation in 2016 gives a contrary opinion.

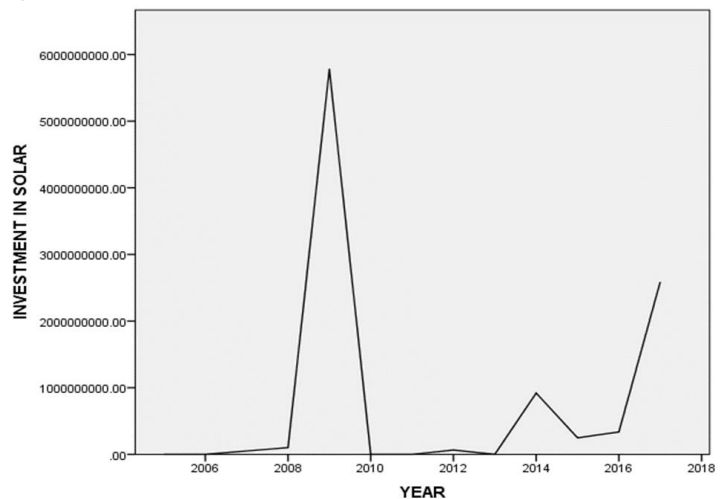
Figure 3: Investment in Wind Power Plant



Source: Budget Office of the Federation (2005 - 2017)

Figure 3, depicts the intensity of investment in the wind power energy between 2005 and 2017. The trend shows that this product innovation had a major investment by the ministry of power on renewable energy through Wind Power Plant in 2010 and the level of investment dropped to approximately the same level in the pre and post PPP implementation period.

Figure 4: Investment in Solar

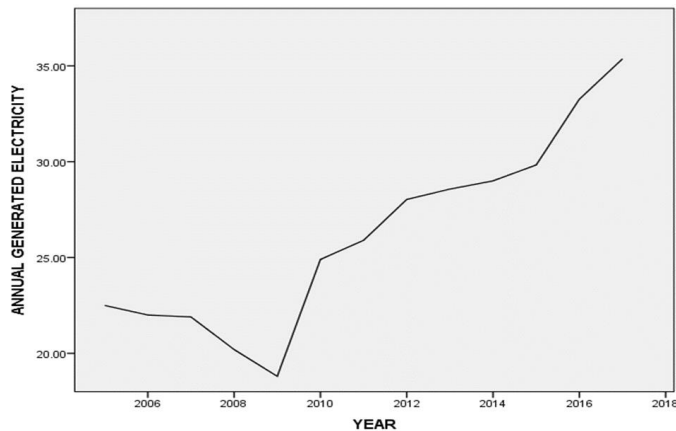


Source: Budget Office of the Federation (2005 - 2017)

Figure 4 depicts the intensity of investment on product innovation in the power sector between 2005 and 2017. via Invest-

ment in renewable energy through solar Power Plant. The trend shows that innovation had a major investment by the ministry of power on renewable energy through solar Power Plant in 2009 and the level of investment dropped to approximately the same level in the pre but gradually increased in the post PPP implementation

Figure 5: Annual Generated Electricity



Source: Federal Ministry of Power, Works & Housing (2016; 2017); United Nation Energy (2016)

Figure 5 as shown below, depicts the trend observed with the Nigeria Annual Generated Electricity between 2005 and 2017. This shows that there has been a lightly gradual decrease in Annual Generated Electricity before 2009 and a steady increase. There is a reduction in the gradient (level of steepness) between 2012 and 2016, and then a steady rise again.

4 DISCUSSION OF FINDINGS

The charts in Figure 2 to Figure 4 show that the strategic innovative decision is to general decrease Nigeria government financial commitment to electrical power infrastructure, after the PPP agreement was implemented. This transferred the technology infrastructural development to the private investors while the management of the power sector divert its innovative effort to other process of developing the power sector. This form of agreement is based on the Transaction cost economics theory identified by [14], as the management of the Nigeria power sector took advantage of the cooperate agreements with the private investors in the PPP initiative as the most efficient process of reorganising the organisation for effective service delivery

The trend in Figure 2 to 4 also identified a sharp increase in budget allocation to power generation in 2016 giving a contrary opinion to the expected reduction in government spending. This study believes this is a strategic and innovative policy decision. This is because an observation of figure 5 shows that there was a corresponding reduction in power generated as government financial commitment reduces and vice versa. Similar decision points of financial reduction from historical perspective set the Nigeria power sector aback as identified

earlier in this study.

These decision points setbacks were experienced during the military rule between 1983-1998 when investment in the hydro-electric power infrastructures was stopped as a result of investment in the Egbin gas powered plant. And also, the closing down of the Marina plant in 1923 once the Ijora plant commenced operation as identified earlier. These management decisions were taken without due consideration to the possibility of the new installations not meeting the electric power demand at those point in time. This became a recurring decision problem in the Nigeria power sector as each time a new decision point occur. The authority seems not to balance the capacity of the new innovation to the ever-increasing demand as a result of population growth and the ability of the new installation to cope with the unforeseen circumstances like unexpected breakdown. Hence, this study established that, the authorised body could not differentiate between when to apply radical or incremental innovative policies decisions and when to apply both in the power sector as earlier identified. The decision to increase the government financial commitment from 2016 rather than decrease as observed in Figure 2 to 4 is a major breakthrough in strategic innovative decisions taken by the management.

5 CONCLUSIONS

This study made the following observations;

1. There was a reoccurring strategic innovation decision problem in the Nigeria power sector as each authority at points identified in this study, seems not to balance the capacity of the new innovation implementation to the ever-increasing demand as a result of population growth and the ability of the new installation to cope with the unforeseen circumstances like unexpected breakdown.
2. For a long time since the inception of electrical power sector in Nigeria, the authorised body could not differentiate between when to apply radical or incremental innovative policies decisions and when to apply both.
3. The decision to increase the government financial commitment from 2016 rather than decrease is a major breakthrough in strategic innovative decisions taken by the management of the Nigeria power sector.
4. The result of the decision to increase government financial commitment also shows that what the system required was an incremental innovation policy system rather than the radical approach that do set the power sector backward or create shortfall in supply.

Based on the above observation this study recommended that, the fact that innovative power generation, transmission. distribution and financial facilities are available and accessed either through public or private funds, does not mean that the existing power facilities should be ignored as observed in the three-time period observed in this study.

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