



CHALLENGES FACING THE NIGERIAN NUCLEAR REGULATORY AUTHORITY AND THE DRIVE FOR NUCLEAR TECHNOLOGY 2020 – 2024

BY

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Abstract

The Nigerian Nuclear Regulatory Authority (NNRA) was established by the Nuclear Safety and Radiation Protection Act 1995 with the overall responsibility for nuclear safety and radiological protection regulation in the country. It regulates the possession and application of radioactive substances and devices emitting ionising radiation; ensures protection of life, health, property and the environment from the harmful effects of ionising radiation, while allowing beneficial practices involving exposure to ionising radiation. The practices involving the use of radioactive sources predates the establishment of the NNRA by several decades with the petroleum industry making the most extensive use of radioactive sources for non-destructive testing, well logging and in control gauges. Nigeria is facing the problem of constructing and maintenance of nuclear power plant and its inclusion into the national economy. This paper assesses the Nigerian nuclear regulatory authority and the drive for nuclear technology (2020-2024), qualitative data was used for the study and the study revealed that the NNRA faces a lot of challenges which include regulatory hurdles, human capacity constraints, funding limitations, and the need for international cooperation. The study also recommends that the Nigerian government need to enhance the country's regulatory legal framework in line with the International Atomic Energy Agency (IAEA) safety standards; the Nigerian Nuclear Regulatory Authority (NNRA) should also carry out analysis of all competencies needed to cover its responsibilities.

Keywords: Authority, Challenges, Nuclear, Regulatory, Technology.

Introduction

Nigeria's nuclear technology history started after her independence when the Federal Radiation Protection Service was established in 1964 and at the same time the country joined the International Atomic Energy Agency (IAEA) (Mundu and Umar, 2004). Again, the government of Nigeria re-explored the possibility of developing nuclear energy in the 1970s. Ultimately, there has been a renewed interest in nuclear power over the past years. The Nuclear Safety and Radiation Protection Act 1995, established the Nigerian Nuclear Regulatory Authority (NNRA) with the responsibilities for nuclear safety and radiological protection regulation in Nigeria. This Act was put into effect by the commencement of operations in May, 2001. The NNRA registers, licenses, inspects and enforces nuclear safety and radiological protection in all



practices and industries involved in the use of Ionizing radiation in Nigeria. In line with her mandate to protect lives, the NNRA has come up with this application to ensure the general public is adequately informed and only patronize medical diagnostic facilities designed and operated according to the prescribed health and safety requirements which form the bases for an NNRA certification. Facilities authorized by NNRA are considered safe and ensure best practice radiation protection measures is the norm. Nigeria has for decades been involved in many peaceful applications of nuclear science and technology to improve the energy generation in the country which necessitated the inauguration of an Inter-Ministerial Committee on Energy Resources in 2004. In the report of the committee, nuclear power was recommended as a major potential source for consideration in the country. Consequently, in June 2005, another Inter-Ministerial Committee was inaugurated to evaluate the feasibility of launching a national programme to deploy nuclear energy for electricity generation in the country.

The committee's report was favourable.

According to Bennett (2013), based on keeping with the provisions in the national energy policy to deploy nuclear energy for electricity generation, the Nigeria Atomic Energy Commission (NAEC) was activated by Act 46 of July 1976. As provided for in the Act, NAEC is mandated, as the focal national agency, to develop the framework and technical pathway to explore, exploit and harness atomic energy for peaceful applications in all its ramifications for the socio-economic development of Nigeria in conformity with the policies of the Federal Government. Nigeria Atomic Energy Commission (NAEC) Act, and the Federal Government's decision as contained in Council decisions EC38(06)12, and EC5(07)9, and Presidential directive (PRES/101) of February 27, 2007, the Nigeria Atomic Energy Commission was empowered and designated as the national agency vested with the responsibility for the implementation of the national nuclear power programme. In this regard, NAEC is the focal agency for liaison and partnership with the IAEA and other development partners for the programme planning and implementation (NAEC, 2009). Nigerian government effort at the international level was characterized by an imminent desire to benefits and tap from its relations with other countries to boost its energy capacity and make use of nuclear technology in many ramifications for national development. Nigeria since 2007 through the various reforms embarked upon actually brought the country to the realization of achieving Nuclear energy target. However, the fact that Nigeria made progress over the years towards its stated policy goal of bringing 1,000 Mw of nuclear power online by 2017.

The Nigerian Nuclear Regulatory Authority has a very important role in the communication of nuclear safety to the population. It is the regulatory authority that establishes, controls, inspects and enforces the nuclear regulations. It is often the first to be contacted when there is an abnormal situation. The regulatory authority, as a body with independent functions to control the use of radiation, is the appropriate organization for providing independent, neutral, balanced and factual information about any issue related to nuclear safety in the country. This position gives the necessary credibility to the regulatory authority. Despite the significant improvement in nuclear technology, Nigeria need to address in areas of constructing and maintenance of nuclear power plant and its inclusion into the national economy and also government policy on nuclear technology, efficient regulatory on users of nuclear technology and relationship between Nigeria Nuclear Regulatory Authority and her foreign partners such as International Atomic Energy Agency. This paper is aimed at examining the challenges facing Nigerian Nuclear Regulatory Authority and drive for Nuclear Technology from 2020 – 2024.

Literature Review

Historical Foundation of Nigerian Nuclear Program

The Nigerian nuclear program emerged tentatively in the 1976 with the establishment of the NAEC, primarily as a response to South Africa's acquisition of nuclear weapons and India's test of a nuclear device. Negotiations were undertaken with West Germany and Canada to explore the purchase of a nuclear

power plant. The development of nuclear weapons was also briefly considered. With a view to achieving nuclear autarky, the Nigerian Uranium Mining Company (NUMCO) was founded in 1978, a partnership between the Nigerian federal government and the French mining company Minatom (Quaker-Dokubo, 2000). According to Mundu and Umar (2004), the results of this partnership were aerial radiometric surveys of about 617,000 km² of land surrounding the Jos Plateau, which is thought to contain uranium reserves (National Energy Commission, 2003). Two nuclear research centres were founded under the auspices of the NAEC: The Centre for Energy research and Development (CERD) at Obafemi Awolowo University (formerly the University of Ife) and the Centre for Energy Research and Training (CERT) at Ahmadu Bello University in Zaria. These centres have mandates to conduct research and build a critical mass of indigenous nuclear expertise (NAEC, 2009). In order to build human capital, the NAEC has sent 60 graduate students to Europe and North America for training in nuclear-related disciplines since the 1970s. In 1995, the Nigerian Nuclear regulatory authority (NNRA) was established by the Nuclear safety and radiation Protection act. The NNRA began operation in 2001 and has subsequently begun implementing regulations. Nigeria's first research reactor was commissioned at Ahmadu Bello University in 2004. It is a 31.1 kw Chinese tank-in-pool Miniature Neutron source reactor, which uses 90 percent enriched uranium as fuel, light water as a moderator and coolant, and metallic beryllium as a reflector (Jonah and Balogun, 2005: 1). It is similar to other Chinese units operating in Ghana, Iran, Syria and China (World Nuclear Association, 2008).

Nuclear energy has received support, albeit primarily rhetorical, from the Yar'adua administration. The National Energy Policy of 2003 explicitly calls for the development of nuclear power and exploitation of uranium resources in Nigeria (National Energy Commission, 2003). The Draft National Energy Master Plan of June 2007 reaffirms the government's support for nuclear energy (National Energy Commission, 2007). However, substantive action on policy objectives has been less advanced.

The Current Challenges Facing Nigerian Nuclear Industry

Nuclear energy can be used for various industrial applications, including: seawater desalination; hydrogen production; district heating and cooling; process heat for industries; the extraction of tertiary oil resources; process heat applications such as cogeneration; coal to liquids conversion; and assistance in the synthesis of chemical feedstock. Owing to steadily increasing global energy consumption, the finite availability of fossil fuels and an increased sensitivity to the environmental impacts of fossil fuel combustion, the demand for nuclear energy for industrial applications is expected to grow rapidly (International Atomic Energy Agency, 2017). Oludare, Agu, Akusu, Umar, and Omolara (2018) postulated that the Nigerian Nuclear Regulatory Authority (NNRA) faces numerous challenges in its quest to ensure nuclear safety and radiation protection in Nigeria. One of the major challenges is the limited financial resources. The NNRA requires sufficient funding to effectively regulate and monitor nuclear activities, but inadequate budget allocation hampers its efforts.

This limitation affects the authority's ability to invest in modern technology, training, and manpower development. Bala (2019) on his part stated another challenge facing the NNRA is the lack of public awareness. Many Nigerians are not aware of the risks associated with nuclear radiation and the importance of nuclear safety. This lack of awareness makes it difficult for the NNRA to effectively communicate its mission and objectives to the public. The authority must educate the public on the dangers of nuclear radiation and the measures in place to protect them. Mohammad (2019) further agreed, that insufficient infrastructure is also a significant challenge facing the NNRA. Nigeria's nuclear facilities require modernization and upgrading to meet international safety standards. The authority must ensure that nuclear facilities are designed, constructed, and operated with safety in mind. This requires significant investment in infrastructure development. The NNRA faces the challenge of international cooperation and compliance. Nigeria is a signatory to several international nuclear safety agreements, and the NNRA must

ensure compliance with these agreements. The authority must work closely with international organizations, such as the International Atomic Energy Agency (IAEA), to ensure that Nigeria's nuclear activities meet global safety standards. By addressing these challenges, the NNRA can effectively regulate Nigeria's nuclear industry and protect the public from nuclear radiation hazards. Nnaji (2012) further affirmed that, the Nigeria peaceful application of nuclear energy revolved around industrial radiography in oil and gas operators commonly employ service companies to carry NDT to ensure that all constructions and fabrications are completed to the required standard and to check the integrity of petroleum pipes by identifying flaws in welds to prevent leakages. Ionizing radiation is used in plant breeding to produce new genetic lines such as sorghum, garlic, wheat, bananas, beans, avocado and peppers. The new lines are more resistant to pests and more adaptable to harsh climatic conditions. Also, radiation at appropriate doses can kill harmful pests, bacteria, or parasites, and extend shelf-life of foods.

According to Hassan (2010) who stressed that the development of nuclear technology in Nigeria led to the agreement in 1994 by the International Atomic Energy Agency (IAEA) to donate a Miniature Neutron Source Reactor (MNSR) to Nigeria under a Technical Cooperation project. This put pressure on Nigeria to enact a framework for nuclear safety, security and regulatory control. This led to the enactment of the Nuclear Safety and Radiation Protection Act in 1995. This Act set up the Nigerian Nuclear Regulatory Authority (NNRA) and mandated it to regulate all nuclear activities in the country, including the enforcement of all nuclear laws and regulations. However, it was not activated until January, 2001 (Hassan, 2010).

Theoretical framework

This paper adopts National Interest Theory to assess the challenges facing the Nigerian Nuclear Regulatory Authority and the derive for Nuclear Technology 2020 – 2024. The National interest theory as an analytic tool is employed to describe, explain, or evaluate the sources or the adequacy of a nation's foreign policy. Additionally, national interest theory can be used as an instrument of political action because it serves as a means of justifying, denouncing, or proposing policies. Both usages of the theory, in other words refer to what is best for a national society. It also shares a tendency to confine the intended meaning to what is best for a nation in foreign affairs. Among the proponents of national interest theory were Joseph Frankel, James N. Rosenau, Charles Beard and Hans Morgenthau among others. In 1930 Charles Beard wrote "The Idea of National Interest". His write-up was one of the first to develop the purpose of the national interest theory and to distinguish it from the public interest that refers to domestic policies of nations. The great increased attention to national interest theory, however, came after the World War II, with the Realist school led by the truly powerful mind of Realism, Hans J. Morgenthau. His works advanced "a realist theory of international politics" founded on the concept of national interest. Morgenthau recognised that the interest of a nation, "the kind of interest determining political action in a particular period of history depends upon the political and cultural context within which foreign policy is formulated." He envisioned accounting for these contextual factors by defining interest in terms of power. For Morgenthau "interest defined as power is an objective category which is universally valid," and, as such, power serves to determine what true interest is and should be (Morgenthau, 1963).

However, whereas advancing of state interests is the statesman's prime responsibility, this role must also remind him that, as Carr (1964) warned, "to make the harmonisation of interests the goal of political action is not the same thing as to postulate that a natural harmony of interests exists." Rather, international society is, "an association of independent and diverse political communities, each devoted to its own ends and its own conceptions of the good, often related to one another by nothing more than the fragile ties of a common tradition of diplomacy" (Carr, 1964). Thus, the two meanings of national interest theory work to balance each other in a "world of power." Interplay between the domestic debate over the requirements of the national interest, on one hand, and the international debate over any state's asserted national interests,



on the other hand, influence the national interest thinking. If the state is to assert 'moderate' claims in the international realm or to restrain those excessive claims made by other states, then restraints may also be placed on personal or other private interests. For instance, the state increases taxes or imposes "wartime censorship of speech and the press or other controls on individual liberties" (Rosenau, 1968). Likewise, world opinion on a particular state's interests and duties becomes a source of authority for participants in the internal debate who seek to move their state's national interest in the same direction. Also, international actors may at times undertake to influence the internal debate in other states. On the other hand, the internal political debate may influence the external: the international consensus on a state's proper national interests may be altered when the outside world 'overhears' that state's internal debate and becomes aware of its justifiable claims (Clinton, 1994).

National interest theory applies to the challenges facing the Nigerian Nuclear Regulatory Authority (NNRA) because Nigeria's pursuit of key interests such as energy security, economic growth, political stability, international prestige, and technological advancement directly influences nuclear regulation. These priorities can create pressures like underfunding, political interference, fast tracked project approvals, over commitment to international obligations, and shortages of skilled personnel, all of which make it harder for the NNRA to maintain strict, independent nuclear safety and security oversight.

Methodology

The used of a qualitative approach in nuclear activities is not a new phenomenon and the approach is gaining wider acceptance in research (Dvora, 2007; Sadovnik, 2007; Berg, 2001 cited by Ibrahim, Halim, Adnan, and Jawan, 2023). The approach according to Maxwell (2005) "is an important tool for policy researchers". Considering the nature of the study, the authors upheld the advice of Strauss and Cobin (1998), Denzil & Lincoln, (2000) who explained that "qualitative study allow an in-depth understanding of phenomena under investigation from the perspectives of people that have in depth knowledge on the issues" In this regard exploring the challenges and opportunity for Nigerian Nuclear Regulatory Authority, can best achieved using the qualitative approach (Creswell, 2003).

The paper adopts purposive sampling procedure to identify participants who provided an in-depth data relevant to the study. Patton (2002) states that purposive sampling is based on selection criteria that would lead to valuable information, therefore, criteria for inclusion in this study are: five Senior official from Nigeria Nuclear Regulatory Authority in federal capital territory Abuja who have vast knowledge on the activities of NNRA, five senior official from Nigerian Atomic Energy Commission with more experience in NAEC, five senior official from Centre for Energy Research and Training, (CERT) ABU Zaria with vast knowledge on energy and training and five senior scholars with relevant research on issues and topics in international relations totaling 20 respondents. The 20 participants in this study was determined by the point of saturation, Lincoln and Guba (1985) stated that sampling stopped once it reached a saturation point. Thus, the authors interviewed the 20 participants when they realized the sampling had reached saturation point, the authors stopped further selection because it was no longer needed to increase the sample size beyond the saturated level when no new information and substantial contribution is forthcoming. Primary and secondary data were used in this study, the primary data consist of semi-structured with open-ended questions in English language were conducted with participants. The interviews were conducted in a quiet, safe, conducive and at the time convenient to each participant (Denzin & Lincoln, 2000). The date of the interviewed were fixed by the participants at their appropriate and convenient time, All the interviews were conducted at the time range between 45 to 90 minutes, this is in line with the position of Guest et al (2013) that true in-depth interview needs 45 to 90 minutes. The authors followed the analytical procedures proposed by (Creswell, 2007). Firstly, the authors transcribed all the interviews. Secondly, each of the transcribed interviews was read, re-read and re-read in its entirety for the purpose of familiarization and preparation for coding. Thirdly, the authors reduced the collected

data into various themes through the process of coding (Saldana, 2015 cited by Ibrahim, Halim, Adnan, and Jawan, 2023).

The secondary data includes written content such as journals, articles, office records, past research, journal publications, newspapers, textbooks among others. Some limitations of qualitative methods can be time consuming, oversimplify complex issues, prone to researcher bias, and harder to replicate. Findings may lack generalizability due to small, non-representative samples and are often more subjective in interpretation.

Result and discussion of findings

The result of the study revealed that, the NNRA faces numerous challenges that hinder its ability to effectively regulate nuclear activities in Nigeria. These challenges include institutional weaknesses, lack of autonomy, inadequate laws and policies, limited financial and human resources, and technological complexity. Additionally, the NNRA faces challenges related to public trust and confidence, risk management and communication, and governance and accountability. These challenges affect the NNRA's ability to ensure nuclear safety and security, and ultimately, its ability to promote national development through the safe and secure use of nuclear technology. Informant are coded as NN: Nigerian Nuclear Regulatory Authority, NA: Nigerian Atomic Energy Commission, CE: Centre for Energy Research and Training and SC: Scholars while numeric numbers represent number of informant.

Informant SC4, CE4, NN2 and NA4 argued

“The Nigeria Nuclear Regulatory Authority (NNRA) faces significant challenges in performing its regulatory functions due to insufficient funding and resources. The authority relies heavily on government funding, which is often inadequate and unpredictable. This affects the NNRA's ability to recruit and retain qualified staff, purchase necessary equipment, and conduct regular inspections and audits”.

Informant SC2, CE4, NN4 and NA3 argued

“The NNRA faces a significant challenge in terms of limited human capacity and expertise. The authority requires specialized staff with expertise in nuclear safety, security, and regulation. However, the NNRA faces difficulties in recruiting and retaining qualified staff due to limited funding and competition from other organizations”.

Informant SC1, CE5, NN2 and NA4 states that:

“The NNRA faces significant challenges in terms of inadequate infrastructure and equipment. The authority requires specialized equipment and facilities to conduct inspections, audits, and testing. However, the NNRA often lacks access to these resources, affecting its ability to perform its regulatory functions effectively”.

Informant SC5, CE3, NN1 and NA2 argued that:

“The NNRA faces a significant challenge in terms of limited public awareness and education on nuclear safety and security. The authority requires public support and cooperation to perform its regulatory functions effectively. However, limited public awareness and education on nuclear issues affect the NNRA's ability to engage with stakeholders and promote nuclear safety and security”.

Informant SC1, CE5, NN3 and NA1 stated that:

“The NNRA faces significant challenges in terms of corruption and lack of transparency. Corruption can affect the authority's decision-making processes, while lack of transparency can erode public trust and confidence. The NNRA requires a strong governance framework and effective anti-corruption measures to address these challenges”.

Informant SC5, CE1, NN2 and NA5 believed that:

“The NNRA faces significant challenges in terms of an inadequate legal and regulatory framework. The authority requires a robust and effective legal and regulatory framework to perform its regulatory functions. However, the existing framework is often inadequate, affecting the NNRA's ability to enforce compliance and regulate nuclear-related activities effectively”.

Informant SC3, CE2, NN1 and NA5 argued that:

“The NNRA faces significant challenges in terms of dependence on international cooperation and assistance. The authority requires technical assistance, training, and capacity-building programs to perform its regulatory functions effectively. However, dependence on international cooperation and assistance can affect the NNRA's autonomy and decision-making processes, while also creating sustainability challenges”.

From the submission of the respondents, the Nigeria Nuclear Regulatory Authority (NNRA) faces significant challenges that affect its performance in regulating nuclear-related activities. Despite its efforts to ensure nuclear safety and security, the NNRA is confronted with inadequate funding and resources, limited human capacity and expertise, and inadequate infrastructure and equipment. Additionally, the authority faces challenges related to limited public awareness and education, corruption and lack of transparency, and an inadequate legal and regulatory framework. Furthermore, the NNRA's dependence on international cooperation and assistance raises concerns about its autonomy and sustainability. Addressing these challenges is crucial to ensuring the effective performance of the NNRA and promoting nuclear safety and security in Nigeria.

The above views are in connection with the assertion of Oludare, Agu, Akusu, Umar, and Omolara (2018) who postulated that the Nigerian Nuclear Regulatory Authority (NNRA) faces numerous challenges in its quest to ensure nuclear safety and radiation protection in Nigeria. One of the major challenges is the limited financial resources. The NNRA requires sufficient funding to effectively regulate and monitor nuclear activities, but inadequate budget allocation hampers its efforts. This limitation affects the authority's ability to invest in modern technology, training, and manpower development. Bala (2019) on his part stated another challenge facing the NNRA is the lack of public awareness. Many Nigerians are not aware of the risks associated with nuclear radiation and the importance of nuclear safety. This lack of awareness makes it difficult for the NNRA to effectively communicate its mission and objectives to the public. The authority must educate the public on the dangers of nuclear radiation and the measures in place to protect them.

Similarly, Mohammad (2019) further agreed, that insufficient infrastructure is also a significant challenge facing the NNRA. Nigeria's nuclear facilities require modernization and upgrading to meet international safety standards. The authority must ensure that nuclear facilities are designed, constructed, and operated with safety in mind. This requires significant investment in infrastructure development. The NNRA faces the challenge of international cooperation and compliance. Nigeria is a signatory to several international nuclear safety agreements, and the NNRA must ensure compliance with these agreements. The authority must work closely with international organizations, such as the International Atomic Energy Agency (IAEA), to ensure that Nigeria's nuclear activities meet global safety standards. By addressing these challenges, the NNRA can effectively regulate Nigeria's nuclear industry and protect the public from nuclear radiation hazards.

Conclusion

In conclusion, the Nigerian Nuclear Regulatory Authority (NNRA) faces significant challenges in its quest to ensure the safe and secure development of nuclear technology in Nigeria. These challenges



encompass regulatory, human capacity, funding, public perception, and international cooperation issues. These challenges can be tackled by updating existing laws to align with International Atomic Energy Agency (IAEA) standards, strengthening enforcement mechanisms, and streamlining licensing processes to improve compliance and efficiency. Human capacity gaps can be mitigated through targeted training programs, academic scholarships in nuclear related fields, and strategic partnerships with international regulatory bodies for knowledge transfer and mentorship. Ensuring consistent and adequate funding through dedicated government allocations, cost-recovery mechanisms, and donor-supported projects will also help sustain the NNRA's operations and enhance its effectiveness.

Recommendations

Based on the findings of this study, the following recommendations are made: The NNRA should be granted full independence in decision-making and regulatory activities to ensure effective nuclear regulation. This can be achieved by establishing a clear separation from entities with conflicting interests. The NNRA should prioritize training and capacity building for its staff to develop the necessary expertise in nuclear regulation and safety. The NNRA should ensure that it has sufficient funding to carry out its regulatory activities effectively. The Nigerian government needs to enhance the country's regulatory legal framework in line with the International Atomic Energy Agency (IAEA) safety standards.

The Nigerian Nuclear Regulatory Authority should ensure promote transparency by sharing safety reports and regulatory actions publicly to build trust and accountability. By addressing these challenges, the NNRA can effectively regulate Nigeria's nuclear industry, ensuring the safe and secure development of nuclear technology for the benefit of the country and its people.

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