A Perspective Towards Sustainable Global Nuclear Security and Safety

Obafemi O Olatunji, Felix A Ishola, Olayinka O Ayo, Olumide Towoju, Stephen A. Akinlabi

Abstract: The suppression of the high risks involved in the Nuclear energy venture tremendously depends on the safety culture of all stakeholders. Despite the commendable efforts that have been made towards nuclear security, there are still some significant loopholes which could retard this progress if not addressed. This paper reviews the global effort towards nuclear security and safety; focusing on the activities of International Atomic Energy Agency (IAEA) and of participating Nations as entangled factors to determine the sustainability of a secured and safe nuclear energy future. The authors presented the two possible global nuclear security scenarios in the nearest future; highlighting the nuclear security culture and action plans which could enhance the global nuclear security and prevent the world from the high-risk scenario were proffered. The recommended actions are expected to provide a breakdown insight to what is expected of individual Nuclear Energy countries as an entity to contribute to a strong safety climate in the world of Nuclear Energy.

Index Terms: Nuclear Safety, Safety Culture, Proliferation, Nuclear Security, Risk Management, IAEA, Nuclear Energy

1 INTRODUCTION

Countries with plans to embark on nuclear programs are continuously growing in numbers and these include different categories and kind of countries; large and small, advanced and developing, densely and sparsely populated, countries with a well-developed nuclear power plants' (NPP) and countries with none, countries with no indigenous energy resources and countries with various energy resources to mention few. Figures 1 and 2 shows the breakdown of new nuclear facilities under construction across the globe, as of the last report, fifty units of nuclear reactors are in this category; the highest number in China, while a lot more are underway [1]. The earlier mentioned diversities of the countries currently involved in Nuclear Energy (whether developed or planning stage) gives room for inter-development in the world's civilian nuclear industry but with lots of safety culture concerns [2]. Nuclear safety culture can be defined as cumulative attributes and attitudes of individuals, organizations and institutions which serve as a fulcrum to engender, energize, and sustain nuclear safety [3]. The uprising in nuclear energy exploration comes with a whole lot of implications as the international community is facing a critical challenge on how to set a functional and effective global nuclear security standard acceptable and practicable by all the stakeholders [4]. Despite the progress made so far, there are still pockets of identified significant flaws, and several measures need to be put in place to be able to predict and avoid any evolving threats [5].

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The sustainability of Nuclear Energy had been found to be explicitly dependent on the sustainability of its risk curtailment and some of these issues are related to the present nuclear security culture and policies which put the onus of security roadmap implementation on the participating states [6].

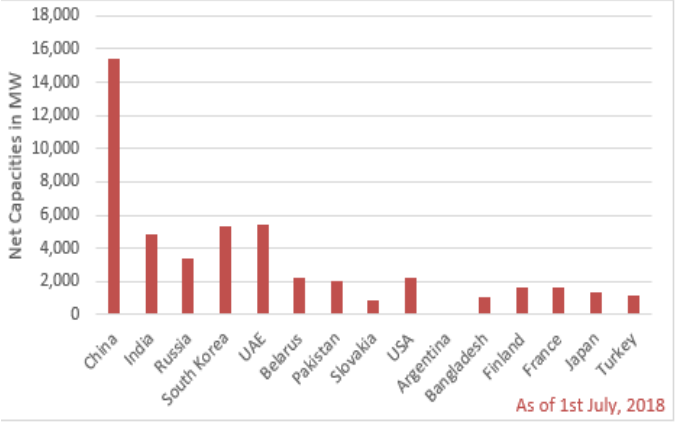

Fig. 1. *The net capacity of Global nuclear reactors under construction (IAEA-PRIS, 2018).*

2 GLOBAL NUCLEAR SECURITY AND SAFETY: THE JOURNEY SO FAR

Since the fall of the Soviet Union in the early 1990s, a lot of measures had been taken to address the difficulties involved in securing vulnerable nuclear materials from intruders [7]. A look into the depth of damage caused by the Fukushima incident in Japan shows the threats of nuclear materials on the environment [8]. Also since Chernobyl Accident, the concept of "safety culture" had been integrated into global nuclear safety, giving attention to phenomenon influencing human behaviours and values of people either directly or indirectly connected to the high-risk venture starting from the design stage to installation and operation of the NPP [9]. In recent times the concept of "nuclear security" has also become more closely linked with the war against terrorism. Specialists, analysts and researchers have been keeping tracks on the threat posed by nuclear terrorism, more so the dramatic emergence of Islamic State in 2014 is a clear pointer to the

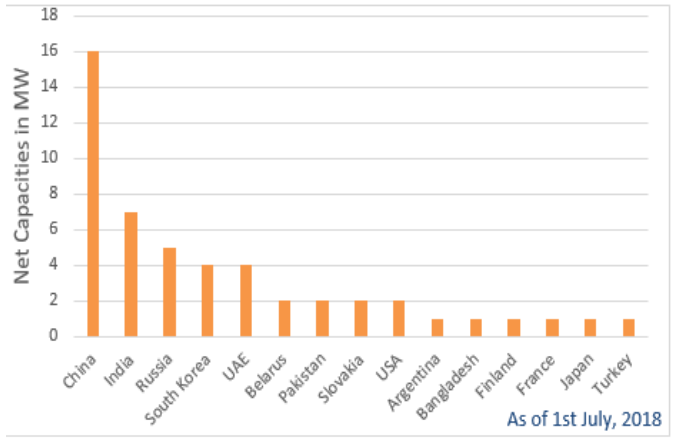

Fig. 2. *Number of Nuclear reactors under construction in each country (IAEA-PRIS, 2018).*

evolving nuclear security threat [10]. It is instructive to recall the statement made by Yukiya Amano, the Director General of the International Atomic Energy Agency (IAEA), which succinctly captured the present nuclear security peril, saying, "the threat of nuclear terrorism is real, and the global nuclear security system needs to be strengthened in order to counter that threat" [11]. The application of nuclear resources will continue to grow just as many countries are seeing this as a viable way out of their energy challenges, therefore, there must be adequate security plans to prevent the access by the terrorists who are equally interested in these resources to wreck maximum havoc. The efforts of IAEA and other related institutions toward global nuclear security are highly commendable because much progress has been made. The earlier nuclear security regime was defined by some vital multilateral agreements as stated by UN Security Council Resolution in 1373, UN Security Council Resolution in 1540; the Convention for the Suppression of Acts of Nuclear Terrorism (also known as the Nuclear Terrorism Convention); the Convention on the Physical Protection of Nuclear Material (CPPNM) and its amendment; the Physical Protection of Nuclear Materials and Nuclear Facilities INFCIRC/225/Rev.4 (INFCIRC/225); and the IAEA Code of Conduct on the Safety and Security of Radioactive Sources (known as the Code of Conduct). However, all these legal instruments are concisely pointing to three flaws: unclear obligations; inadequate monitoring of project implementation and inappropriate use of multilateral tools [5]. The UN Resolution of 1540, the Nuclear Security Summits and informal collaborations with the Global Initiative to Combat Nuclear Terrorism (ICSANT) have raised awareness worldwide on the threats to nuclear security. Also, IAEA has provided different kinds of platforms to states in order to improve their nuclear security regime.

3 The Future Path of Global Nuclear Security

The strength of global nuclear security in the next few years depends on the commitments and actions of all the stakeholders. If the global effort is properly channelled, the present momentum will lead to achieving more sustainable security of nuclear materials and facilities [12]. Usually, Safety activities of a system are developed over time as a result of a response to incidents and accidents but in the case of nuclear projects, the occurrence of incidence and accident are not desirable at all. This suggests the approach of risk analysis must be on a local level as well as on a global level with a modality for maximum interactions such that there is a consensus global nuclear safety management to audit, inspect and review safety activities most constantly in order to facilitate exchange of practices on a global level [13]. It is not a gainsaying that any Luke-warmness or laxity will pose a real-time danger as the recent gains will be eroded and expose the world to a tremendously high nuclear terrorism amongst all other nuclear risks. Based on the emerging trends, there are two possible future scenarios for nuclear security regime; 1. Low-risk Scenario; 2. High-risk Scenario.

3.1 Low-risk scenario

On a Low nuclear security risk scenario, locations, where nuclear-related weapons and materials are stocked, would be points of attention against different dimensions of threats. Such locations would globally be effectively secured as the nations will be committed to building further understanding of the threat and the present process of dialogue will be strengthened. In a growing quest for attaining excellence in nuclear security and a reduced risk of experiencing nuclear-related attacks, this pathway would definitely lead to a forestalled improvement towards nuclear security on a continuous basis. Low nuclear security risk pathway will be characterized by the following; strong commitment to nuclear security globally agreed principles, an effectively sustainable nuclear security regime, Progressive consolidation of nuclear weapons and materials used to create them, more trusted nuclear security, less stringent bureaucracy and emphasis on sovereignty and continuous nuclear security dialogue [14].

3.2 High-risk scenario.

In this scenario, lesser attention would be in such locations of nuclear-related weapons and their essential materials exist; complacency towards weak security cultures and any other appearances of threat would increasingly be the order of the day; and whatever gain from international discussion on nuclear security would be soiled in diplomatic disputes and excessive concern for secrecy [8]. This will eventually lead to; shrinking nuclear security dialogue, waning confidence in nuclear security strategies among the states, frail commitment to nuclear security policies, growing cyber insecurity, among so many other consequences that would make many states to remain dangerously vulnerable and exposed to nuclear insecurities. In this situation, the global community would become so vulnerable to nuclear terrorism as measures to control access and reduce the size of nuclear stockpiles would not be in place. It is highly advised that the global community should strive hard to stay away from possible high nuclear security risk scenario.

4 Foci on Safety Culture Perspectives

In setting the agenda for nuclear security both for the present and the future, the following key objectives which should form the scope of commitments must be pursued spiritedly and vigorously;

- An improved nuclear security culture.
- Regional coalition on nuclear security.

The described interconnectivity between the subject matters is as summarized in figure 3 below.

Fig. 3. *Sustainable Global Nuclear Safety as a function of Safety Cultures.*

4.1 A Call for An Improved Nuclear Security Culture

A United States nuclear security official once said that "good security is 20 percent equipment and 80 percent culture." Therefore, culture can be seen as very critical in achieving sustainable nuclear security. Some of the nuclear security cultures which need to be addressed include: Culture of transparency and mutual trust as well as a culture of ensuring efficiency and enhanced performance, these are further explained as below.

4.1.1 Culture of Transparency and mutual trust

Nuclear security strategies in most states are cocooned in secrecy and almost lacking in transparency. As rightly suggested by Bunn (2013), states that have information about the activities of nuclear terrorism should be ready to share their insights with the other natures for timely deliberations and interventions. This is in tandem with the view of Richardson et al (2012) who suggested that universal transparency is an important factor. Transparency should be aimed at enhancing the commitment of states to global security. These can be achieved by jettison bottlenecks around nuclear weapon program which have to do with safety and security, though not to the detriment of weapon design strategies [15]. Carlson (2012) opined that nuclear security comprises of a comprehensive duty of the provision of a means of tracking, protecting and managing nuclear equipment in a manner that will not jeopardise the security responsibilities of the countries involved. It is the view of this author that the vicious cycle of nuclear security secrecy should be discarded because it is more detrimental to global security. The sparse information exchange mechanism which hampers countries from exchanging ideas without any fear of sabotage may worsen the prospect of the threat-free world. This will further jeopardize global cooperation as the weak links will perpetually exist to the detriment of the security of all [16].

4.1.2 Culture of Safety Check-ups on efficiency and enhanced performance

In order to strengthen the weak linkages in global nuclear security effort, nuclear security exercise and objective testing of security strategies should be explored. An independent peer review is an approach which can stimulate the global efficiency and effectiveness of nuclear security measures. Integrated Nuclear Security Advisory Service (INSServ) and the International Physical Protection Advisory Service (IPPAS) established by IAEA is making commendable efforts in these directions. The former provides a detailed review of a country's nuclear security prowess while the latter has the expert team which reviews a country's infrastructure for security activities and their implementation strategy at each site. Again the contribution of these bodies is limited by the willingness of the states [17]. To engender participation, the membership of such team should cut across continents. Though the dynamics of nuclear threat varies for different regions, every state is measured against the global baseline in this age of global terrorism. For instance, the US nuclear expert visited Israel to review the level of security at the Soreq nuclear facility. The recent progress in nuclear safety is because of emphasis on performance, therefore nuclear security effort should be geared in the same direction instead of some sets of rules which are a stereotype and not amenable to the dictate of the incidences. Consequentially, continuous performance evaluation and constant Risk Analysis are important both internally and globally [13]. There is a limited emphasis on regional nuclear security. The policy framework of IAEA and other nuclear security organizations have only passively supported a regional approach to nuclear security. Indeed, this was succinctly captured as follows; 'The responsibility for nuclear security within a state rests entirely with the state, which has to ensure the security of nuclear materials, other radioactive materials, associated facilities, and their activities under its jurisdiction. Each state aims to achieve nuclear security by creating its own nuclear security regime which is appropriate to that State' [17]. Francesca (2016) eloquently submitted that most states continue to pursue cooperation with the IAEA at the national level and disparities in technological advancements and nuclear security goals make a collective solution more cumbersome and lengthy [18]. The current approach leaves the onus for the establishment, maintenance, and strengthening of border and export control policies solely with the individual nations and their domestic jurisdictions. However, it must be submitted that national policy alone may not be sufficient to combat nuclear security threat. Bilateral and multilateral cooperation, especially among the neighbouring countries, would be vital to extracting commitment and political will for nuclear security policies. If a regional coalition is efficient, both from a security and an economic point of views, participating countries will begin to develop confidence in the collaborative control policies and will be encouraged for further involvement. It is the view of the authors that nuclear threat is an international concern which should be harmonized among the neighbouring countries. As an instance, the bilateral cooperation between Brazil and Argentina came into existence after several years of suspicion and uncertainties. A body named the Agencia Brasileira-Argentina de Contabilidady Control de Materiales Nuclear (ABACC) was established in 1991 [19]. This agency was responsible for the verification of nuclear materials usage pattern between these two countries. Their three prong focuses are; to safeguard the nuclear facilities and materials; train the technical staff and; ensure technical cooperation with other related organizations. Also, Argentina and Brazil have integrated their nuclear resources for the technological and socio-economic development of their people. ABACC is an accomplished model of transparency, mutual confidence and

political determination in the peaceful use of nuclear resources [20]. In view of this, the nuclear security policies and strategies should tilt towards binding international and regional conventions which underline the responsibility of the nations and region towards effective nuclear security.

4.2 A Scope of Regional Coalition on Nuclear Security

If regional cooperation is strong both from a security and an economic standpoint, countries might be more inclined to cooperate further on border control and export control policies. It is the view of the authors that nuclear threat is an international concern which should be harmonized among the neighbouring countries. As an instance, the bilateral cooperation between Brazil and Argentina came into existence after several years of suspicion and uncertainties. A body named the Agencia Brasileira-Argentina de Contabilidady Control de Materiales Nuclear (ABACC) was established in 1991 [19]. This agency was responsible for the verification of nuclear materials usage pattern between these two countries. Their three prong focuses are; to safeguard the nuclear facilities and materials; train the technical staff and; ensure technical cooperation with other related organizations. Also, Argentina and Brazil have integrated their nuclear resources for the technological and socio-economic development of their people. ABACC is an accomplished model of transparency, mutual confidence and political determination in the peaceful use of nuclear resources [20]. In view of this, the nuclear security policies and strategies should tilt towards binding international and regional conventions which underline the responsibility of the nations and region towards effective nuclear safety and security.

5. Conclusions

The failure or success of a global nuclear venture tremendously depends on the aggregate function of the safety culture of all the participating countries. The authors proposed the possible safety culture to forestall high-risk security scenario which would definitely reduce the overall risk factor. There is a need for improvement on the reportage of nuclear energy plants' safety and security incidences at every unit as a commitment to performance evaluation of nuclear energy facilities on a global level. States in a particular region can agree on a number of nuclear security projects which can include border monitoring and related feedbacks. IAEA can develop nuclear security incentives to motivate information sharing and transparency among the nations. Strong nuclear security regulations must be implemented and holistically enforced to avoid high nuclear security risk and any associated socioeconomic loss.

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