

Bridging the Gap Between Policy Practitioners and Technical Experts in Nuclear Nonproliferation and Security

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1. Background

In many areas, the decision-making process provokes conflicts between different stakeholders. For instance, the development of a forest, where environmentalists voice concerns over potential impact on the environment. At the same time, those who prioritize economic value will calculate the expected profit and cost efficiency of the investment. Meanwhile, local politicians will listen to the public opinion of the residents, but positions may vary even among those residents based on their own beliefs, inclinations, and convenience. While navigating all these different views may seem tedious and intricate, it is a method of rational decision-making, aimed at determining the options with the most substantial overall impact on stakeholders or avoiding unintended sacrifices. This approach aligns with the historical evolution of society, by making rational decisions that take into account as many points of view as possible. Similarly, nuclear nonproliferation and security activities often rely on this coordination process for decision-making and implementation, although unique aspects of the field affected to its increased complexity.

The genesis of nuclear science lies in the work of nuclear physicists and engineers, who remain pivotal actors the sector. However, given the profound destructive potential of nuclear weapons, the importance of interfacing science and socio-politics in this field extends beyond mere cooperation; it is imperative to consider ethical and socio-political perspectives, and nonproliferation and security are at the frontline of this notion.

Despite this fact, the interface between policy and technical dimensions of nuclear nonproliferation and security encounters challenges. The nuclear energy sector usually perceives itself as an engineering and promotional domain, exclusive to those possessing specific knowledge like nuclear engineering. Consequently, engineers who begin to work at nuclear nonproliferation and security often struggle with adjusting their perspective and acquiring the required skillsets. Similarly, policy practitioners, such as diplomats, may face challenges in negotiating nuclear nonproliferation and security practices due to a limited understanding of nuclear technology, constraining their

perspective within the realm of diplomatic theory on war and peace.

In light of this recognition of the problem, the paper will analyze the causes underlying this phenomenon and proposes a model capacity-building education and training program to address the identified challenges.

2. Causes and Impact of Low Awareness of Nuclear Nonproliferation and Security

Nuclear nonproliferation and security form a multidisciplinary sector that necessitates expertise in both nuclear science and socio-political dynamics. Despite this, there is a critical need to enhance awareness within expert communities of both sectors. This deficiency can be attributed to two interlinked factors: insufficient education and an exclusivity mindset.

2.1. Insufficient education at academic institutions

Primarily, the lack of education and training at academic institutions contributes significantly to this issue. In the Republic of Korea, there are 14 schools with nuclear engineering departments, of which approximately eight exclusively focus on nuclear engineering. The paper examined their undergraduate and graduate curricula, revealing a limited number of courses directly addressing nuclear nonproliferation and security, and which were often integrated with safety issues.

Table I: Nuclear Nonproliferation and Security Courses in Academic Institutions in the Republic of Korea

School	Level	Course
Chosun Univ. Nuclear Engineering	Undergraduate	♦ Nuclear Laws ♦ Nuclear Policy
	Graduate	N/A
Hanyang Univ. Nuclear Engineering	Undergraduate	♦ Nuclear Policy
	Graduate	♦ Nuclear Energy Policy
KAIST Nuclear and Quantum Engineering	Undergraduate	N/A
	Graduate	♦ Nuclear Energy Policy ♦ Nuclear Nonproliferation, Safeguards, and Security
Kyung Hee Univ. Nuclear Engineering	Undergraduate	♦ Nuclear Law and Safety Regulation
	Graduate	♦ Denuclearization of DPRK and Dismantling of Concerned Nuclear Facilities ♦ Special Topics on Nuclear Security Regulation

POSTECH Advanced Nuclear Engineering	Graduate	N/A
Sejong Univ. Quantum and Nuclear Engineering	Undergraduate	N/A
	Graduate	♦ Nuclear Safeguards and Nonproliferation
Seoul National Univ. Nuclear Engineering	Undergraduate	♦ Nuclear non-proliferation and nuclear security
	Graduate	♦ Societal Perspectives on Nuclear Energy ♦ Nuclear power control and international cooperation
UNIST Nuclear Engineering	Undergraduate	N/A
	Graduate	♦ Nuclear Material Safeguards and Non-Proliferation

Furthermore, since these courses are optional for graduation and occupy a small fraction of the whole curriculum, there is no guarantee that a nuclear engineering student will acquire sufficient awareness and knowledge of nuclear nonproliferation and security. Consequently, students may be inclined to view these topics as impediments to their engagement with the promotional aspects of the promotional aspects of the nuclear power generation industry or related research and development. This trend persists into their professional careers, resulting in relatively less respect toward regulatory expertise.

2.2. Low inclusiveness of nuclear sector

Insufficient awareness also creates an exclusive environment within the nuclear sector. Graduates in nuclear engineering, may perceive their colleagues with different backgrounds as outsiders who do not understand the 'hard science' of nuclear engineering. This perception persists, despite the significance of knowledge and skills in chemistry, law, international relations, pedagogy, and public relations in achieving the global objectives of nuclear nonproliferation and security [1].

2.3. Impact of the weak interface between socio-political and technical activities

The weak interface between socio-political and technical activities compounds the issue. Along with the technical development, its benefits and threats are posing a global impact on the security and welfare of humankind, proving that traditional and theoretical activities of diplomacy and politics are insufficient. Therefore, intersectional concepts such as 'Tech Diplomacy' were introduced to incorporate technical aspects [2]. However, the deep disparateness between policy practitioners and technical experts within nuclear nonproliferation and security hinders effective communication and collaboration. Such issue can crucially sabotage the integrity of the beneficiaries of political decisions because it may lead to irrational decision-making, neglecting either scientific evidence or geopolitical considerations [3].

3. Building Confidence Through Education and Training

An optimal strategy for the comprehensive implementation of nuclear nonproliferation and security involves acquiring talents who possess both policy and technology knowledge and skills. However, recognizing the rarity of finding such individuals with proficiency in both areas, organizations engaged in nuclear nonproliferation and security activities should focus on building confidence within a cross-functional teams, maximizing the utilization of diverse talents.

One of the ways to nurture such an institutional culture is by providing enough opportunities to raise awareness of the sector and communicate with experts with different backgrounds to understand each other's strengths. Therefore, a model training course is designed as below.

Table II: A Model Training Course

Title	Training Course for Policy and Technical Support Interface in Nuclear Nonproliferation and Security		
Purpose	This course is designed to raise awareness of nuclear nonproliferation and security among policy practitioners and technical support experts and enhance mutual understanding of roles and expertise to facilitate cooperation.		
No. of trainees	20 trainees in total, 10 policy practitioners, and 10 technical support experts.		
Agenda			
	Policy Practitioners (PP)	Technical Supporters (TS)	Together (PP+TS)
Day 1	[Lecture] Introduction to nuclear nonproliferation and security – focusing on the scientific development of the discipline	[Lecture] Introduction to nuclear nonproliferation and security – focusing on the legitimacy of international and domestic regulatory activities	[Discussion] Role of PP and TS in nuclear nonproliferation and security
Day 2	[Lecture] Implementing nuclear nonproliferation and security – focusing on the ways to executive regulatory activities for safeguards, export control, physical protection and cyber security	[Lecture] Implementing nuclear nonproliferation and security – focusing on the ways to implement institutional/national position based on technical analysis and political considerations	[Tabletop Exercise (TTX)] Understanding and analyzing physical protection of a nuclear facility model, analyzing possible weaknesses, designing possible incident–counteract scenarios
Day 3	[Visit] Visit nuclear facilities – such as nuclear power plants, fuel fabrication factories, or laboratories	[Visit] Visit administrative/political organizations – such as a national assembly, administrative government bodies, or an international organization	N/A
Day 4	N/A	N/A	[TTX] Produce a policy brief to explain the scenario from the previous TTX, and write a national statement to be presented at an international meeting [Hands-on training] Study and experiment with the devices for regulatory activities
Day 5	N/A	N/A	[TTX] Run a model international conference [Discussion] Self-assessment of the model international conference and a way forward for policy-technical support interface

The primary strategy of the course is to run the program using the 'Two-track and Together' method. The course, however, remains adaptable to the specific purpose and audience it targets.

The model course is designed under the following assumptions and conditions: a) the number of trainees should be range from 20 to 30, with a balanced composition of 50 % policy practitioners and 50 % technical support experts; b) the lectures and visits can be conducted separately for each track to address the distinct demands of the course. This approach allows policy practitioners to comprehend the technical

background of the sector and implementation methodologies of regulatory activities. Concurrently, technical support experts are educated on the legitimacy of regulatory activities and the required skillsets for international and domestic administration; c) discussions and tabletop exercises are conducted collaboratively to facilitate shared understanding of the necessity and methods of cooperation. The objective is to demonstrate how diverse experts synergize in a professional setting.

4. Conclusion

The interdisciplinary nature of nuclear nonproliferation and security presents an intriguing avenue for attracting and cultivating skilled experts. This field offers a distinctive career path and a dynamic work environment that inevitably engages professionals in both technical and socio-political spheres, providing them with collaboration and constant learning opportunities.

However, while scientists are interested in new technologies and diplomats in building confidence among states, there is notable underinvestment in rectifying the internal institutional culture, which is crucial for the sector's longevity.

The process of nurturing an institutional culture is extremely slow and challenging, particularly within a conservative and closed environment. Therefore, the timely implementation of a well-designed program become imperative to bridge the existing gap between policy practitioners and technical experts in nuclear nonproliferation and security. The program aims to build a solid foundation of mutual understanding and confidence facilitating collaborative efforts toward share objectives. By doing so, it is expected to fortify the sector's internal dynamics, ensuring its resilience and adaptability for the challenges that lie ahead.

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