Nuclear Rollback Case-based Qualitative Criteria on Non-proliferation Credibility of Individual Countries

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1. Introduction

The advent of nuclear renaissance is expected to rapidly increase the demand of nuclear fuel cycle service in both the front-end and back-end systems, which may disturb nuclear non-proliferation regime. To allow nuclear renaissance to satisfy non-proliferation as well as peaceful uses of nuclear energy, global leaders are endeavoring to limit the accessibility of technologies in certain countries as a multinational option. Despite of its imperatives, this alternative has been controversy due to no consensus over assessment criteria for qualifying authorized countries. Hence, it is significance to develop evaluation methodology for non-proliferation credibility of individual countries. As an embarkation activity, qualitative criteria based on experience of nuclear rollback will be drawn and presented.

2. Determining Factors of Nuclear Rollback Experiences

Since the nuclear holocaust in Hiroshima and Nagasaki, many countries have tried to develop nuclear weapons as a national defense mechanism or a bargaining chip. More than 20 countries decided to abandon their nuclear weapon development program because of the domestic politics and international pressure, whereas 4 countries currently illegally hold nuclear weapons (or a nuclear explosive device). In this context, investigating causes of nuclear rollback would provide determining factors for proliferation resistance of individual countries.

Each discontinuance case of nuclear weapon development has complex reasons in multiple dimensions such as internal resistance, external pressure and their interaction. Although a certain factor would be difficult to completely explain the causes of nuclear rollback, there is a pivotal factor that plays more significant role in each case. Even, it would be possible to discern commonalities and categorize reasons into several groups.

Internal dynamics is a principal cause of nuclear rollback in Romania [1]. As soon as a dictator, Nicolae Ceausescu who began nuclear program, was executed during the middle of a revolution into democratization, Romania's nuclear program is stopped with disappearance of his ambition. Moreover, Romania seemed to have the lack of technological breakthrough. Sweden once considered the acquisition of nuclear weapon, but they decided that nuclear activities in military purpose have no benefits. Instead, they are maintaining conventional military force. Public dissent is a significant reason in Canada and Australia.

Internal political decision pressured by international sanctions is particularly important in Libya which has been governed by Libyan leader Muammar Qadhafi since 1969 [1]. Despite of his initiation of nuclear weapon program, Libya facing economic and domestic political imperatives decided to relinquish the military project for economic improvement as well as his political survival. Kazakhstan abandoned its nuclear arsenal after the collapse of the Soviet Union due to the internal evaluation of politically, physically and psychologically high costs of holding nuclear weapon in exchange of the US's economic assistance.

In contrast, the nuclear relinquishment of Belarus and Ukraine is slightly influenced by external factors rather than internal reasons [2]. The countries became nuclear weapon holders because of the collapse of the Soviet Union in 1989. Belarus that would be the first strike target when a dispute occurred between NATO and Russia gave up its weapon for practical and strategic reasons. They moved their position in return for technical assistance and financial incentives from the US. Moreover, unfavorable attitude toward nuclear program caused by Chernobyl disaster in 1986 was one of most compelling reasons for Belarus's disarmament. Similarly, Ukraine knew that possession of nuclear weapon could endanger Ukraine's national security and secured that they received considerable financial compensation from both US and Russia in exchange for its nuclear disarmament. Brazil and Argentina, two rivals in Latin America, have a unique approach that reached bilateral rapprochement by mutual monitoring safeguards system like ABACC (Argentinean-Brazilian Agency for the Control of Nuclear Material) [2].

3. Qualitative Criteria on Nonproliferation Credibility of Individual Countries

Based on nuclear rollback experience, five qualitative categories for evaluation on non-proliferation are suggested. These five categories would be divided into largely two parts, benefits of nuclear weapon and resistances of weapon development program. In other words, benefits of nuclear weapon would be motivations that states launch nuclear arsenal development program. If state was protected by enough nuclear umbrellas, there is no reason for developing or holding nuclear weapons. Moreover, there are some countries trying to

use nuclear capabilities or intentions as bargaining chips in negotiating table with the world powers or neighboring countries.

Consequences of nuclear weapon are political, physical and economical costs that states should compensate for developing nuclear weapon even though international opposition. Stronger international bonds would lead higher costs and influential impact due to vigorous collective sanction from global community, which increases external resistance against illegal nuclear activities on military purpose.

Internal dynamics is a political and social barriers that nuclear power program should overcome to increase its goals. In many cases, political shift of a certain country from dictatorship to democracy was the main reason for relinquishing nuclear weapon or terminating development program. In addition, high quality of life, freedom of speech and high level of education may be internal resistances because these factors allow people to prevent extreme decision of small leading groups.

Nonproliferation efforts are evaluation criteria that how much state shows their endeavor and contribution to nuclear non-proliferation regime. This category also tracks the past activities related with nuclear proliferation for at least the last decade that may be appropriate time to change political position except some rough countries.

Technological availability could be measurement for time required for the development of nuclear weapon. In civilian purpose, there are little reasons to store Pu or highly enriched uranium without shortly removal and peacefully usable plan.

Fig. 1 shows the concept of qualitative criteria for non-proliferation credibility based on nuclear motivation and resistance from internal and external dimensions. This figure expresses benefits of nuclear weapon development in event diagram and resistances in fault diagram. Detailed metrics for five qualitative categories are listed in Table I.

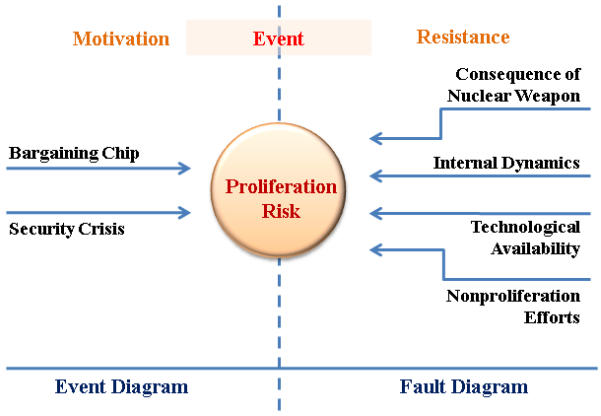

Fig. 1. Concept of Qualitative Criteria for Non-proliferation Credibility based on Motivation and Resistance

Table I: Categories and Metrics of Qualitative Criteria for Non-proliferation Credibility

Benefit of Nuclear Weapon	Guarantee of Nuclear Umbrella
	Dependence of national defense capabilities
	Nonaggression treat
	Self-reliant defense potential
Consequence of Nuclear Weapon	Trade dependence
	Foreign assistance dependence
	Energy dependence
	Number of nuclear power plants and its electricity share
Internal Dynamics	Political stability
	Living standards
	Freedom of speech
	Level of education
Nonproliferation Efforts	History of nuclear weapon program in the last 10 years
	Violation of safeguards requirements in the last 10 years
	Degree of contribution for international non-proliferation
	Possession of nuclear weapon
Technological Availability	Amount of unnecessary Pu without removal plan
	Amount of unnecessary HEU without removal plan
	Technological advancement of nuclear weapon launchers
	Availability of nuclear weapon experts

4. Conclusion and Future Work

Determining factors of nuclear rollback are analyzed from specific cases of several countries in internal and external structures. The experience could be basic information for developing qualitative criteria for non-proliferation security (or proliferation risk) of individual countries. Based on these preliminary standards, further strategic study and quantitative evaluation methodology will be developed to provide self or mutual evaluation tools for national non-proliferation credibility.

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