A Roadmap for DPRK's Denuclearization Under the Consideration of Nuclear Latency

Junho Kwon, Man-Sung Yim *
Dept. of Nuclear and Quantum Engineering, Korea Advanced Institute of Science and Technology (KAIST), 291 Daehak-ro, Yuseong-gu, Daejeon 34141
**Corresponding author: msyim@kaist.ac.kr*

1. Introduction

The deadlock state of nuclear talks between the US and DPRK has been prolonged since the failure of the Hanoi Summit. Meanwhile, the new administration office in the US which is expected to pursue phase-by-phase approach to the issue has launched. In the meantime, North Korea is undergoing severe economic crisis due to continuing international sanctions amid the COVID-19 situation.

The aforementioned background requires a new approach toward the denuclearization of DPRK. Incremental steps for "mini-deals" in contrast to previous attempts needs to be prepared [1]. Therefore, viewing the roadmap in framework of nuclear latency, which focuses on the process of nuclear capabilities advancement, is expected to give possible scenario for conversion of North Korea's nuclear weapons capabilities into civilian nuclear power.

There have been a number of studies on nuclear latency. Based on the definition as the status of a nation which has nuclear technology capabilities without nuclear weapons [2], an empirical study showing the existence of "sweet spot" of nuclear deal at certain nuclear latency level range was conducted [3]. They give a room that nuclear deal with North Korea can be viewed under the considerations of nuclear latency.

Therefore, this study sees denuclearization of DPRK as transformation of the country from nuclear weapon possessor to nuclear latent nation and downgrading of its nuclear latency level. Figuring out the main factors determining the latency level, the priority of the roadmap to achieve the limitation of North Korea's nuclear latency advancement is suggested.

2. Methods and Results

The dataset of North Korea's nuclearization history from 1992 to 2018 in terms of technology and politics made by Hecker and Carlin was used. It includes sixteen parameters: US diplomacy, DPRK diplomacy, DPRK/ROK relations, DPRK/PRC relations, US/IAEA presence at Yongbyun nuclear center, plutonium, uranium enrichment, tritium/lithium-6, weaponization, nuclear weapons summary, missiles summary, imports (nuclear and missile-related), exports (nuclear and missile-related), sanctions (US and UN Security Council), North Korea economy, and US financial aid to North Korea [4].

For a quantitative analysis, the dataset originally colored based on each parameter's seriousness which was determined by the writers was coded into numbers. The notation "G(green)3" which means the most positive effect was coded into +2.5, while "R(red)3" which means the most negative effect was coded into -2.5. In a same manner, G2, G1, R1, and R2 were coded into +1.5, +0.5, -0.5, and -1.5, respectively. However, the data of US financial aid to North Korea was exceptional since it was not colored in the original dataset.

A multiple linear regression analysis was conducted using the coded data. The parameter "nuclear weapons summary", which includes the level of fissile materials production, weaponization, and nuclear tests was selected as the only dependent variable. The rest fifteen variables were all assumed as independent variables.

As the result, the one and only independent variable which had its p-value smaller than 0.05 was "US/IAEA presence at Yongbyon nuclear center", while p-values of other independent variables were bigger than 0.1.

Table I: Summary of the multiple linear regression analysis.

Independent variables	Coefficient	P-value
US diplomacy	-0.085	0.639
DPRK diplomacy	0.587	0.092
DPRK/ROK relations	-0.013	0.951
DPRK/PRC relations	-0.139	0.676
US/IAEA at Yongbyon	0.727	0.017
Plutonium	-0.046	0.882
Uranium enrichment	-1.035	0.170
Tritium/Li-6	1.168	0.146
Weaponization	-1.834	0.140
Missiles (summary)	0.722	0.191
Imports	-0.434	0.257
Exports	0.311	0.516
Sanctions	0.318	0.720
North Korea economy	-0.019	0.955
US Financial Aid	-0.003	0.385

From the statistics, the influence of inspections upon North Korean nuclear facilities by the US and IAEA was shown. Enhanced inspection will deter advancement of DPRK's nuclear capabilities, removing secrecy of its uranium enrichment capacity and weapon grade plutonium/uranium stockpiles [5]. Other than on-site inspections, strengthened remote monitoring methods such as satellite imagery and nuclear archaeology are also available [6].

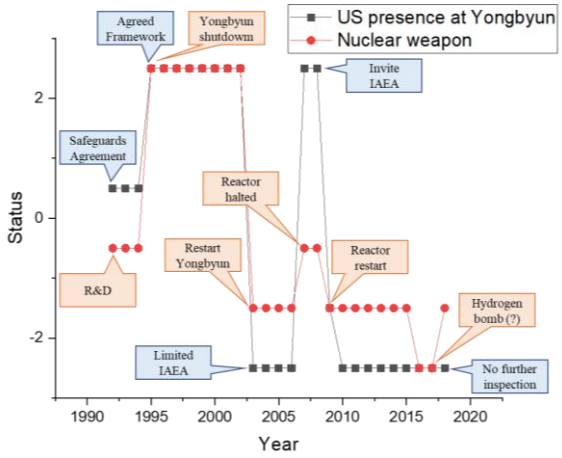

Fig. 1. Plotted status of the US/IAEA presence at Yongbyun nuclear center and North Korea's nuclear weapon development from 1992 to 2018. Text balloons includes main events contributed to change of the status.

In addition, the result of the analysis implies that technical capabilities are more related to the North Korea's nuclear arsenal development rather than the political situations. While p-values of the US diplomacy and DPRK-ROK, DPRK-PRC relations are above 0.5, the values of independent variables governed by technical capabilities – uranium enrichment, tritium/lithium-6, weaponization, missiles – are below 0.2.

Also, the p-values of "uranium enrichment" and "plutonium" give an insight that North Korean nuclear advancement more relies on uranium enrichment than plutonium extraction. In contrast to the independent variable "uranium enrichment", the p-value of the variable "plutonium" was relatively high, above 0.5. It corresponds to some expectations that the direction of the North Korea nuclear program may have shifted to uranium enrichment from plutonium extraction [6]. It implies deterrence of uranium enrichment technology development should be prior to plutonium technologies.

3. Conclusions

A multiple linear regression analysis using dataset of DPRK nuclearization history was studied to see main factors influencing advancement of the nuclear weapon capabilities. For effective deterrence of its nuclear weapon development, international inspections on its nuclear facilities including Yongbyun should be resumed as soon as possible. Also, technical capacity, especially uranium enrichment needs to be more focused and investigated, since it was turned out to be more influential to the progress of North Korea's nuclear program than other variables.

In addition, for transformation of North Korea into nuclear latent country, support for civilian nuclear power capabilities also can be suggested. Since the statistics implies the importance of presence of the US and IAEA at Yongbyun for inspections, enhanced monitoring and inspection system through civilian nuclear power plant project can be an option. However, it should be noted that it has to come after disabling of ENR technologies and nuclear arsenals.

For more specific and objective roadmap for North Korea's denuclearization, more quantitative analysis to see independency of the initially assumed independent variables is needed. Also, coding the qualitative nuclear history dataset into quantitative nuclear latency level data can be more sophisticated using various mathematical methodologies.

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