

**WHAT'S THE NORTH-KOREAN NUCLEAR WEAPONS' FUTURE?
- COMPLEX-SYSTEMS APPROACH -**

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ABSTRACT

Two years before, North-Korean Government sentenced they have been had Nuclear Weapons. In correctly, October 9th, 2006, North Korean Government announced they had tested the Nuclear Weapons at the northern part of their territory. Also, they insisted their testing was successful with in triumph. They sentenced their country will be stronger than any other countries. It's means that they will have the hegemony of the Korean Peninsula.

By the way, South Korea, U.S. and Japan also China didn't want to accept the North Korean Nuclear Weapons. They worry about the break up with North-Eastern countries' weapon balance. Also, for South Korean people didn't want the existence of Nuclear Weapons in Korean Peninsula. They thought the Nuclear Weapons will not be a good environmental condition to unify the divided two Korea.

Anyway, the effort to remove the North Korean Nuclear Weapons is most important subject for Asia-Pacific countries. Therefore, they set up Six Party Talks to solve the North Korean Nuclear Weapons. Also, they made the promise to solve the North Korean Nuclear Weapons. On Feb.13, 2007 North Korea and Six Party Talks members agreed to shut down and disable its nuclear programs and weapons in return for incentives provided by other members of Six Party Talks-United States, Russia, China, Japan and South Korea. But, up the present North Korean Government didn't make a satisfactory response. I wonder if how the North Korean Nuclear Weapons be destined to future. I'd like to research 'What's the North Korean Nuclear Weapons' Future?' by Complex Systems Approach.

Keywords: complex systems, satisfactory response, nuclear weapons, weapon balance.

1. INTRODUCTION

Nowadays, the North Korean Nuclear Weapons is a big interesting issue for every country. It's because the North Korean Nuclear Weapons is a serious issue for Six-party countries. North Korean Authorities announced they have no doubts about their policy or action with their Nuclear Weapons. But, Six-party countries worry about the proliferation of Nuclear Weapons from North Korea to Syria. Also, someone worry about the proliferation of Nuclear Weapons from North Korea to so called terrorist groups.

On April.8, 2008, South Korea and the United States have agreed to focus on "monitoring" North Korea's potential uranium enrichment activities and nuclear proliferation with Syria, instead of "verifying" suspicions. The two sides agreed that

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plutonium-based programs, which pose substantial threats, should be verified immediately and completely. It's actualized 'Singapore Meeting' by U.S and North Korean chief nuclear negotiators. The deal was aimed at resolving differences over the North Korea's nuclear declaration, which was promised by the end of last year under the so called Feb. 13 nuclear pack signed by the two Koreas, U.S. China, Japan and Russia.

Also, U.S. and Six-party countries will close observation the suspected uranium enrichment program (UEP) and nuclear proliferation to Syria, however, a focal point would be a strengthening and monitoring system to prevent North Korea from engaging in such activities.

By the way, Washington would start the process of removing North Korea from its list of terrorism-sponsoring states in exchange for the North's full denuclearization. (By Jung Sung-ki, Staff Reporter of Korea Times, Apr.16, 2008). Any way, North Korean Nuclear Weapons Problem is a hot issue for us. Also, how it could be solved is a critical issue for South Korean people.

Of course, it will be a complicated quiz for us. Giving up the Nuclear Weapons for North Korean Government is not easy for their generic character. But, I think it's possible to explain by the Social Entropy Theory.

I'll quote Prigogine's theory and Yaneer Bar-Yam's explanation about the complex systems and Bailey's Social Entropy Theory.

In this paper, I'd like to research 'What's the North Korean Nuclear Weapons' Future?' by Complex Systems Approach.

2. COMPLEX-SYSTEMS APPROACH

2-1. Complex-systems Approach methodology

In general, studying complex systems approaches are two methods. The first method is a specific system is selected and each of the parts as well as their interactions are identified and described. The second method considers a class of systems, where the essential characteristics of the class described, and statistical analysis is used to obtain properties and behaviors of the systems. (Yaneer Bar-Yam. 1997). In this paper, I selected the first method to make a complex systems approach to research the North Korean Nuclear Weapons' future.

Yaneer Bar-Yam's explanation about the complex systems in a unified framework has become recognized in recent years as a new scientific discipline, the ultimate of interdisciplinary fields. (Yaneer Bar-Yam, 1997)

I think we need considering the complex systems property for explaining the change of system. The properties of complex systems are change, growth, and death, possibly from life cycle. For complexity to emerge, two ingredients are necessary. The first essential ingredient is an irreversible medium in which things can happen: this medium is time, flowing from the past that lies closed behind us toward a future that is open. The second essential ingredient is nonlinearity. (Hyuk Kihl, Kwon's paper. 2007, 51st ISSS Annual Conference)

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We are all familiar with linear systems that have been the mainstay of science for a long time. But, the nonlinear systems do not obey the simple rules of addition. Nonlinearity causes small changes on one level of organization to produce large effects at the same or different levels. In general, nonlinearity produces complex and frequently unexpected results. Irreversibility and nonlinearity characterize phenomena in every field of science (Peter Coveny & Roger Highfield, 1995). The two properties are the main ingredients of complex systems.

By the way, Social Entropy is a measure of the natural decay within a social system. It can refer to the decomposition of social structure or of the disappearance of social distinctions. (Bailey, 1995)

Modern Western complex societies remain organized by large inputs of energy to mitigate the natural progression of increasing entropy (disorder), according to the Second Law of Thermodynamics, a fundamental law of physics. This effectively states that entropy (disorder) increases with time. As the system becomes more complex, through access to energy, it becomes more susceptible to changes that may occur if one were to remove this source of energy.

Also, I'd like to quote the Prigogine's an entropy equation.

$$dS = deS + diS$$

dS means total of the entropy in the system and deS means the entropy from the outside. On the other hand, diS means the entropy from inside because of irreversible processes. (Bailey, 1995)

It'll be a more useful explanation tools for my topics.

2-2. Complex-systems Approach to explain the North Korean Nuclear Weapons' future.

David Easton's political system theory is full of suggestions for political analysis. And, it suggests that we could analyze North Korean political system's reaction about the North Korean Nuclear Weapons. In Easton's assumption, a political system that is self-regulation can respond and can adapt itself to environmental changes. Meanwhile, thermodynamics is that part of physical science that is concerned with the conditions that material systems may assume and the changes in conditions that may occur either spontaneously or as a result of interactive between systems, including interactions such as heat, which cannot be described in terms of mechanics. More recently thermodynamics has been extended to include physical system in non-equilibrium states. This theory of thermodynamics, as Prigogine and Jantsch explicitly or implicitly suggested, can be properly applied to the study of social phenomena. In non-equilibrium thermodynamics there are the reciprocity relations. Reciprocity relations have been the most important dynamics in the thermodynamics of irreversible process (Yong-pil, Rhee.1999). I think to explain the North Korean Nuclear Weapons' future is possible by complex systems approach.

At the present time, North Korean Nuclear Weapons didn't remove from North Korea. Also, the negotiation is going with U.S. and North Korean negotiator. It's actualized 'Singapore Meeting' by U.S. and North Korean chief nuclear negotiators. The deal was aimed at resolving differences over the North Korea's nuclear declaration, which was

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promised by the end of last year under the so called Feb. 13 nuclear pack signed by the two Koreas, U.S. China, Japan and Russia. By the way, Washington would start the process of removing North Korea from its list of terrorism-sponsoring states in exchange for the North's full denuclearization. (By Jung Sung-ki, Staff Reporter of Korea Times, Apr.16, 2008). I think such a process is one of the states of complex system's pertinent. Several systems are inter-connected each other. Also, each system affects the other systems.

Of course, it will be a complicated quiz for us. Giving up the Nuclear Weapons for North Korean Government is not easy for their generic character. But, I think it's possible to explain by Social Entropy Theory.

3. THE HISTORY OF THE NUCLEAR WEAPONS ON THE KOREAN PENINSULAR

3-1. Withdraw the NPT, and Break the Geneva Agreement

In September 1990, prime minister-level meetings between North Korean and South Korean officials took place in Seoul. The talks resulted in two major agreements: the Agreement on Reconciliation, Nonaggression, Exchanges, and Cooperation (the "basic agreement") and the Declaration on the Denuclearization of the Korean Peninsula (the "Joint Declaration"). The Joint Declaration called for a bilateral nuclear inspection regime to verify the denuclearization of the peninsula. The Declaration, which came into force on 19, February.1992, states that the two sides "shall not test, manufacture, produce, receive, possess, store, deploy use nuclear weapons," and that they "shall not possess nuclear reprocessing and uranium enrichment facilities." (Hyuk Kihl, Kwon, ISSS 2007 Annual Conference) This safeguards agreement allowed IAEA inspections to begin in June 1992. This promising development was halted by the North's refusal in January 1993 to allow special inspections of two unreported facilities suspected of holding nuclear waste. Ignoring the South-North Joint Declaration of the Denuclearization of the Korean Peninsula, North Korea refused IAEA inspections and operated nuclear reprocessing facilities, making the world suspicious of its nuclear intentions. The North's threat to withdraw from the Nuclear Non-Proliferation Treaty (NPT) brought North-South progress to an abrupt halt. Tensions ran high on the Korean Peninsula as the confrontation between North Korea and the United States.

Meanwhile, official negotiations between the two sides opened on July 8, 1994 in Geneva, and led to the signing of the Agreed Framework on October 21. The Agreed Framework signed by the United States and North Korea. North Korea would freeze its existing nuclear program and agree to enhance International Atomic Energy Agency (IAEA) safeguards. The objective of the agreement was the freezing and replacement of North Korea's indigenous nuclear power plant program with more nuclear proliferation resistant light water reactor power plants, and the step-by-step normalization of relations between the U.S. and the DPRK.

Both sides would cooperate to replace the North Korea's graphite-moderated reactors for related facilities with light-water (LWR) power plants. Under terms of the agreement, North Korea was obligated to freeze its graphite-moderated reactor at Yongbyon and halt construction of two more reactors. In return, the United States agreed to undertake to make arrangements for the provision to North Korea of a light water reactor (LWR) project with a total generating capacity of approximately 2,000

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MW(e) by a target date of 2003. An international consortium would be organized under the leadership of the U.S. to finance and supply the project. As a result, South Korean regime will burden 75% of the financial support. Light Water Reactor(LWR) do not hold the same potential as graphite-moderated reactors for the production of plutonium that can be reprocessed for use in the development of nuclear weapons. As an interim measure, while the light water reactors were under construction the United States was obligated to supply North Korea annually with 500,000 tons of heavy fuel oil for heating and electricity production.

Also, KEDO(Korean Peninsular Energy Development Organization) was going to make a LWR at the North Korean Shinpo area by South Korean Electronic Company. LWR model was unique Korean model devised by Korean Electronic Company. Actually, constructing LWR was big event for South Korean regime. South Korean regime would be a big sponsor of the LWR. (Hyuk Kihl, Kwon, ISSS 2007 Annual Conference)

But, the Agreement broke-down by 2003. On January 10, 2003, North Korea again announced its withdrawal from the Nuclear Non-Proliferation Treaty. On February 10, 2005, North Korea finally declared that it had manufactured nuclear weapons as "nuclear deterrent for self-defense" On October 9, 2006. North Korea conducted a nuclear test. US intelligence agencies believe that North Korea has manufactured a handful of simple nuclear weapons. (Wikimedia Foundation, Inc., free encyclopedia)

3-2. North Korean Nuclear Explosion Test

Two years before, Oct 9th, 2006. North Korean Nuclear Explosion Test was terrible memory to South Korean people. North Korean Kim Jong-II tested the Nuclear Weapons. At that time, South Korean felt the fear and anger to North Korean Kim Jong-II regime. It's because that South Korean didn't want to exist Nuclear Weapons in Korean Peninsular. Also, U.S. Japan and China didn't want to accept to have Nuclear Weapons of North Korea.

They should not reprocess the used fuel to produce the plutonium. I think North Korean Authorities have been had the fear of U.S. Also, they thought the nuclear weapon was the last shield for their lives. But, their selection was not so good. Especially, South Korean was frustrated by North Korean regime's acts. The tension of Korean Peninsular is so high that world countries watch intently the North Korean regime.

President Bush said "The United States of America will not permit the world's most dangerous regimes to threaten us with the world's most destructive weapons."

Perhaps, Kim Jong-II may believe that a successful nuclear test provides him with a safety blanket from under which he may lash out at the region and cause greater instability. Actually, the possibility of a devastating North Korean attack on South Korea and Japan with the conventional rockets and missiles or from the useful weapons of mass destruction like Nuclear Weapons are terrible scenario for us.

4. COMPLEX SYSTEMS APPROACH THE NORTH KOREAN NUCLEAR WEAPONS' FUTURE

In Easton's assumption, a political system that is self-regulation can respond and can adapt itself to environmental changes. Also, we can imagine the North Korean Nuclear

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Weapons' future is a complicated situation as a complex system. Therefore, we can imagine various irreversible conditions to change North Korean Nuclear Weapons' future.

4-1 'Singapore Meeting' by U.S. and North Korean chief nuclear negotiators

On April.8, 2008, South Korea and the United States have agreed to focus on "monitoring" North Korea's potential uranium enrichment activities and nuclear proliferation with Syria, instead of "verifying" suspicions. The two sides agreed that plutonium-based programs, which pose substantial threats, should be verified immediately and completely. It's actualized 'Singapore Meeting' by U.S and North Korean chief nuclear negotiators. (By Jung Sung-ki, Staff Reporter of Korea Times, Apr.16, 2008) Also, U.S and Six-party countries will close observation the suspected uranium enrichment program (UEP) and nuclear proliferation to Syria, however, a focal point would be a strengthening and monitoring system to prevent North Korea from engaging in such activities.

By the way, Washington would start the process of removing North Korea from its list of terrorism-sponsoring states in exchange for the North's full denuclearization. Anyway, North Korean Nuclear Weapons Problem is a hot issue for us.

The key issue in the Singapore deal is to what extent North Korea will report its nuclear assistance to Syria and alleged uranium enrichment program, neither of which it is willing to admit point blank. Under the compromise plan, the U.S. would make a report on these two issues "on North Korea's behalf" and North Korea would "acknowledge" U.S. concerns about the issues. (englishnews@chosun.com)

The declaration list will be the last part of the second phase of the denuclearization steps endorsed at the six-party talks. In Washington, the State Department underscored once again that verifying the North's production of plutonium will be a key part of the denuclearization process. Yongbyon facilities are currently being disabled as part of the second phase. The first phase was shutting down of the facilities. The next phase will involve verifying the past activities and dismantling them. (Lee Joo-hee ; Wednesday, April 23, 2008. Korea Herald, angiely@heraldm.com)

I think North Korean Leader Kim Jong-Il have to make a trust sincerely with six party talk countries. Not only making good promises, but also doing sincerely. And, recovery of NPT will be more trust from Six Party talk countries.

4-2 Invisible Pressure of the recovery of the relation with South Korean New Government

February, 25 inauguration of conservative Lee Myung-bak as South Korea's president will do much to repair the damage wrought by five years of the progressive Roh Moo-Hyun administration. Under Roh, Seoul's relations with the U.S. and Japan deteriorated, its outreach to North Korea was counterproductive, and domestic and foreign investors were driven overseas by vacillating economic policies and South Korea's declining competitiveness.

Lee Myung-bak is expected to improve strained relations with Washington, implement a more pragmatic policy toward North Korea, and establish a business-friendly environment. President Roh's departure also sets the stage for greater integration with the U.S. on security policy and more effective multilateral efforts to denuclearize North Korea. The result should be a firm foundation for realizing the full potential of the bilat-

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eral relationship. But, the result was not to be seen for Korean people. Passing about 10 years, South Korean Government was to be seen like a progressive regime. Also, South and North relation was to be seen smoothly. Of course, pull and push policy was lasted all around. Kim Dae-Jung and Rho Moo-Hyun government tried to 'Sunshine Policy' to North Korea. Its' main stream is to pouring of material assistance to North Korea because of humanity. Also, South Korean government tried to make package tours to Mt. Kungang and the Kaesong Industrial Complex. But, South Korean thoroughly betrayed by North Korean Kim Jong-il regime. It's because they attack back part of South Korea. They made the Nuclear Weapons instead of the peace.

President-elected Lee will enjoy a honeymoon period of positive U.S. opinion, especially during an early summit meeting with President George W. Bush. However, to maintain U.S. support, Lee will have to avoid political landmines. He must describe his North Korean policy more fully, continue a vigorous outreach to the foreign business community, and deliver on his economic promises.

Lee Myung-bak's pragmatic demand for conditionality in Seoul's engagement with North Korea will increase allied leverage in the six-party talks and reduce Pyongyang's ability to play the U.S. and South Korea against each other. A realistic policy that requires reciprocity and transparency from North Korea will also be more consistent with the six-party talks' goal of using coordinated multilateral diplomatic efforts to leverage Pyongyang's implementation of its nuclear commitments. ('New South Korean President Brings Conservative Policy Change' by Bruce Klingner, April 01, 2008)

Under President Roh, South Korea pursued a unilateral, uncoordinated policy that undermined the multilateral and conditional approach of the six-party talks. By providing billions of dollars in unconditional aid and promises of yet more largesse, Seoul minimized its influence over Pyongyang and marginalized its effectiveness in the talks. With a guaranteed pipeline of benefits from South Korea, North Korean leader Kim Jong-il had less need to comply with the "action for action" requirements of the talks.

Lee will maintain South Korea's engagement policy but will condition economic, humanitarian, and political benefits on the pace of North Korean denuclearization. This is a significant departure from Roh's approach of unconditional, asymmetric provision of benefits without demanding any reciprocal economic or diplomatic concessions from North Korea. (Bruce Klingner, April 01, 2008)

Therefore, North Korean regime criticizes Lee Myung-bak Government will be a compliant regime. Also, they tested launch-missiles near the northern Yellow Sea area. Sometimes they agitate South Korean leaders. North Korea test-fired a barrage of short-range missiles on March 28, the communist nation's latest apparent angry response to the new South Korean government's tougher stance on Pyongyang. (The Seoul Times, Tuesday, April 22, 2008)

Anyway, North Korean Kim Jong-Il regime didn't like new president, because of different from Kim Dae-Jung and Roh Moo-Hyun past president. In these days, South and North dialogue is stopped. Nobody knows when is the real time with the South and North confrontation is resolved. In fact, North Korean food shortage is serious all the country. They need more fertilizer and foods urgently. It's means that Social Entropy increased so high. I think the best policy for North Korean Crisis is giving up their Nuclear Weapons and their rigid confrontation policy. In fact, recovery of the South and North Korean relationships is one of the best select for North Korean people. The first

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step is giving up their Nuclear Weapons permanently. The second step is making good relation with South Korea. Also, opening their country is the best way reducing social entropy.

4-3 Reducing Social Entropy by fulfilling Peoples' demand

North Korea's internal demands will work to increase the social entropy. In this year, food shortage is reported seriously. Past 1990s, millions of North Korean people died of food shortages. I think the North Korean Authorities will know about the Nuclear weapon will be a barrier to reach South and North Korean relationships. For a long time, North Korean people had been lived without sufficient materials. They were accustomed to endure the difficulty from hunger and difficult. I think all of North Korean want to be a plenty lives without hunger and difficult. They are exhausted with through the hard living life for a long time. Also, divided people will want to be a free travel with no threat at all. It means that North Korean regime have to abandon the Nuclear Weapons. But, there were bad news about the disappeared officials because of to try to start the incentive system. Hwang Jang-Yeup, 10 years before escaped from North Korea, said North Korea would be disappeared without South Korean regime's support like 'Sun-shine policy'. (Hyuk Kihl, Kwon's paper. 2007, 51st ISSS Annual Conference) Anyway, I think internal demand of North Korea people will be one of the factors to remove the North Korean Nuclear Weapons.

Lee Myung-bak, South Korean New president announced if North Korean Authorities give up the Nuclear Weapons, and open the society will help North Korean brothers with heartily. His new policy is North gives up its nuclear programs and opens their society the South will help the North so that their per capita income will rise to \$3,000 within a decade. This is the basis for the framework of Lee's so-called Vision 3000, which aims to achieve a nuclear-free North Korea.

I think if North Korean Leader Kim Jong-Il admits the South Korean President's suggestion, North Korean social entropy will reduce. Also, North Korean people's hard living will improve.

4-4 Time and Nonlinearity as special pertinent

I think 'What's the North Korean Nuclear Weapons' future' is more complex-systems problems. Actually, several systems are related each other. So many systems and factors inter-related each other. Also, time and nonlinearity is the property of the complex systems. We can imagine the North Korean Nuclear Weapons situation is one of the complex systems.

Also, 'Time and Nonlinearity' will be affected as special pertinent. 'Time' is will be a big pertinent for the North Korean Nuclear Weapons system. Actually, the North Korean leader will be changed as like human history. Also, the North Korean Nuclear Weapons system will be changed more rational situation. Also, Nonlinearity means that the future is unpredictable and flexible society.

Past 10 years, North Korean Authorities learned about South Korean Society is more abundant than North Korea. As a result, the North Korean Nuclear Weapons system will be change carefully. At last, North Korean regime will select to give up the Nuclear Weapons step-by-step. 'Singapore Meeting' by U.S and North Korean chief nuclear negotiators is the progressive example step-by-step. I think we need a time for the one

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step forwards. Of course, North Korean Leader Kim Jong-Il is not accustomed to South Korean New Government. But, time is the key which open the dialogue with two Korea.

It's because North turns their face away from South is means losing big chance for their future. Also, their losing chance means their society will meet the more increased entropy in their country. Disorder and discontent will make the disturbance their society.

5. CONCLUSION

I think to Remove the North Korean Nuclear Weapon is one of the most difficult problems. But, it was inevitable problem for us Korean. All of the East Asian countries and U.S. concerned with North Korean Nuclear Weapons. I think 'to remove the North Korean nuclear weapons' is more complex-systems problems. So many systems and factors inter-related each other. Also, all of the factors are affected each other. Actually, several systems are related each other.

At chapter 4, I introduced several systems to explain for the removal of the North Korean Nuclear program. In a word, 'to remove the North Korean Nuclear Weapons' is not a single problem. As we noticed, we need to think about two pertinent. One is time, and the other is nonlinearity.

We can imagine the North Korean Nuclear Weapons situation is one of the complex systems. Also, we can imagine it have several factors like as the rising of South Korean Lee Myung-bak new president's reciprocal directions. And, the sanctions and international pressure by the six-party talks, the pressure of recovery of the relation with South and North Korea, the North Korea's internal needs for upgraded lives. Also, the social entropy will increase because of internal and external factors.

I think the best choice is to give up the Nuclear Weapons and appear to as an international real member.

We can conclude as bellows.

- North Korea will come back NPT and will be inspected thoroughly by IAEA as like other countries.
- Dialogue with South and North will open in the near future.
- 'Singapore Meeting' by U.S and North Korean chief nuclear negotiators will make a good conclusion.
- The pressure by six party talks will make a conclusion like a 'Singapore Meeting'.
- The best choice to reducing social entropy is opening North Korean Society and making good relation with South and North Korea.
- In a word, North Korean Nuclear Weapons will dismantle step-by-step.
- North Korean Nuclear Weapons to be given up because of the survival of North Korean Political Systems itself.

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