INTERNATIONAL RELATIONS & COMPLEX SYSTEMS THEORY

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In this paper, we would like to raise the importance of complex systems theory in analyzing the phenomena of international politics while considering the characteristics of the international system that is getting more complex day by day. First, let us examine the meaning that the complex systems theory is held as a new recognition method of a social phenomenon while reviewing the characteristics of complex systems theory and the complex systematic characteristics held by today's new international system. Next, we explain about the meaning of the nonlinear non-equilibrium thermo-dynamics used in the static analysis of complex system and the major construction concepts and then, we briefly apply this complex systems theory to the actual phenomenon of international politics.

Key words: international politics,complex system, international system, political phenomena, international relations

INTRODUCTION

The international politics after the cold war age shows quite a complicated appearance. While the political phenomena occurring from the international system during the cold war age could be analyzed in a quite regular and patterned perspective, the components of international system after the cold war age are interacting in a more open and complicated manner. Among the political phenomena occurred in this complicated mutual relationship, more phenomena that can not be explained by the deterministic rule of Newton are increasing.

A direct example of this could be the crisis of East Asia so-called as the "IMF economic crisis." The act that one investor pushes the 'Enter'key from the Wall Street of New York may stimulate the world financial market and a crisis may appear from the weakest point in the world economy. Just like the fluctuations of a butterfly from one side of the earth can bring a storm in the area completely different from the region. The entire world is constructed by one large network and its degree of integration is getting complicated. Therefore, the world intricately integrated may show an emergent phenomenon different from the existing phenomenon. Accordingly, we would observe the phenomena integrated more intricately and organically than that in the past.

And, international system is traditionally described as an anarchical state and this can be seen as one complex system that lies under a chaotic static more than the international politics. In order to conduct an international politics research, it is necessary to analyze this complex system lying under such a chaotic state and to consider the greatest number of variables since unpredicted problems can occur in analyzing the result. Under the international system of chaos and sudden change, it is

impossible to explain about the past as well as the prospect for the future only by the existing unilinear, short-term and static analysis. For example, Bertrand Schneider the Secretary General of Rome Club has told that the interactions of 1,000 variables should be made to understand a problem on the earth. Accordingly, we have to review the interactions between many variables in order to analyze the phenomenon of international politics.

Likewise in this paper, we would like to raise the importance of complex systems theory (a new science theory) in analyzing the phenomena of international politics while considering the characteristics of the international system that is getting more complex day by day. First, let us examine the meaning that the complex systems theory is held as a new recognition method of a social phenomenon while reviewing the characteristics of complex systems theory and the complex systematic characteristics held by today's new international system. Next, we explain about the meaning of the nonlinear non-equilibrium thermo-dynamics used in the static analysis of complex system and the major construction concepts and then, we briefly apply this complex systems theory to the actual phenomenon of international politics.

CHARACTERISTICS OF COMPLEX SYSTEMS THEORY

1. Concept of Complex Systems Theory

Modern social phenomena have become quite complex and so it is difficult to describe them in a traditional method and to control them by using a traditional method. The fundamental reasons that it is getting difficult to explain and describe the phenomenon of international politics are because ① the system components that constructs the international system are varied; ② the nonlinear interactions between system components are increasing.

A numerous number of system components that are interacting in various ways can bring an unpredictable behavior. Likewise, the system of holding nonlinearity is generally referred to as a complex system. John L. Casti explains the characteristics of complex system with simplicity and complexity, continuity and collapse, chaotic attribute, impossibility of reduction, and emergence. The complex systems theory can be referred to as a logic system that ① interprets a phenomenon nonlinearly rather than linearly, ② the constituents of the system are interacting with each other rather than making an absolute reaction, ③ studies a phenomenon from a perspective of non-continuity rather than continuity, and ④ takes generality as its basic rule rather than reduction.

The complexity and uncertainty due to the rapid change of international system have required us reviewing the relationships between many variables in analyzing the phenomenon of international politics. Right here, we have recognized the need of complex systems theory.

2. Difference between Complex System and Simple System

Ilya Prigozine a winner of the Nobel Prize views a system into the simple system and complex system and the international system is also a system of holding both attributes. He sees that there is a big difference between the movement taken in a state close to the equilibrium state and the movement taken in a state deviating far from the

equilibrium state.

Unlike the simple system, the method of traditional dynamics could not be applied in the complex system that the evolution process itself is engaged with the early conditions. If the early conditions are different, the system may evolve according to the different rules of movement. Accordingly, the science that handles complex system can suggest the possibility that the system can evolve, but it can not confirm the movement path of the system. Also, although the movement rules possible in the complex system are known well, there may occur a case that can not predict accurately which movement rule the system will follow since the system from the bifurcation point that the path changes responds sensitively to an "external condition."

And, complex systems are the systems open to the outside of energy, material and information flow. The type and entirety of a complex system are created by the energy, material and information flow toward the complex system and the coherence of the complex system is maintained by using part of flowing energy and information. The components of a complex system are mutually dependent and influence with each other. Since numerous variables are organically interacting in a complex system, the mechanistic science of one-to-one method is not applied. International system also operates like living systems (brain) that executes the mutually different functions of memory/learning and thinking/reasoning while constructing a network like a cobweb.

3. Nonlinearity of Complex System

While complex system is a nonlinear and interacting system, the openness, interaction and nonlinearity of complex system are making the system more complicated.

1) Difference between Linear System and Nonlinear System

Since the system moving linearly maintains the ratio between input and output, the behavior of the system may be shown on a linear graph. Since a linear system has a certain ratio between input and output, the behavior of the system can be predicted and generally controlled.

However, no proportional relationship exists between the results of input and output or cause and effect in the system moving nonlinearly. This phenomenon occurs frequently in the political system. Although a political system has the system ability that can endure a certain degree of stress, the system enters into a new phase from the appearance of overload phenomenon if the stress exceeds a certain level. Here, although the input request of system constituents for the political system would not become a serious trouble to a certain level, input and output do not appear proportionally from the world of politics as the system enters into a new phase if it has reached to an extreme point. Of course, the proportional relationship may well appear in a democratic society rather than a despotic or authoritarian society, but the proportional relationship between the input requirement and output of constituents will not appear always. From a comprehensive perspective, collapse of the Communist bloc has occurred in a situation of one critical point in the international system.

2) Nonlinear Causality

Nonlinear causality refers to the round-trip causality rather than one-way causality from the relationship between things. As if friction gets far greater if a snow sledge runs even faster, the ratio between input and output under a state of mutually

consistent cause does not exist and rather, a small change may bring an enormous unpredicted result.

The "self systematic criticality" theorywell-known as a sand mountain theory explains well about the nonlinear causality. A physician of the Brookhaven National Research Center observed that sand particles are filled one by one on a sand machine table. They have calculated the weight that one new particle of sand drops on the peak of a sand mountain through a slow-motion video camera and computer simulation. Also, they have discovered that "if the sand mountain gets large and one particle of sand fall on the peak, it causes a small landslide; and if this situation is repeated, a huge landslide has occurred at the moment that a particle of sand drops on the peak." One thing to be noted in this process is that the final sand particle plays the role of freeing the potential power of all sand particles at one time regardless of the size of the last sand particle. Existing sand particles maintain a balance while remembering the shock received by all falling sand particles. A change in the consistent equilibrium state is maintained while not detecting the change made by one drop of sand particle. However if the last particle of sand falls, all sand particles become a potential factor of a huge landslide. In this perspective, if international system can be said to be one complex system, it is necessary to analyze the last "sand particle"in a change of international system. When analyzing the collapse process of the Communist bloc, the reason that the communism system collapsed by one action can be explained as a reaction of the final "sand particle."

3) Phenomenon of International Politics and Nonlinearity

According to a linear thinking method, extermination of a living thing should be processed slowly and proportionally, but there is a view that the extermination process of dinosaur was abruptly made. Likewise, if we examine the collapse of the Communist bloc by a linear thinking method that is the collapse of the East European bloc and disintegration of the Soviet Union, this collapse was processed slowly and proportionally from the perspective of old paradigm. However according to the nonlinear thinking method of new paradigm, the collapse of socialism bloc was made by an "abrupt environmental change" and "sudden external variable" as extermination has been made by influencing the food chain from a slight change as if a meteoric stone is dropped on the earth.

From the viewpoint of complex system that a slight change causes a huge change, the extermination of dinosaur is natural. As the dinosaur that was on the boundary between order and chaos had perished by instantly showing a chaotic behavior and causing an enormous confusion in the food chain, the socialism bloc had also collapsed instantly by an "external condition" while staying between order and chaos.

4) Phenomenon of International Politics and Catastrophe

The crisis of the Communist bloc is caused by the overall paralysis rather than the functional disorder of a certain part. A nation is one complex system and the complex system consists of many parts that are interacting. Likewise, the entire system of a complex system normally operates and is not paralyzed by a temporary functional disorder of a certain part. However, the system may face a serious crisis if the functional disorder persists beyond a certain limitation. In this perspective, it is necessary to explain about the crisis and collapse of the Communist bloc.

The Soviet Union had consistently exposed the crisis symptoms everywhere and reached to a catastrophe as the security crisis symptoms caused by economic crisis, political crisis and failure in the competition with the United States of America was

amplified and worsened. Especially, the overall crisis had brought the catastrophe from the complex interactions of economic and political factors - politically from one-party dictatorship of the Communist Party, nondemocratic political recruitment, privilege of nomenklatura and failure of a reform; economically from the inefficiency of economic structure, lowering the standard of living, unbalance of industrial sections, decline of labor productivity and limitation in the economic reform.

According to a catastrophe theory, a fluctuation occurred in one small part of the system causes an enormous catastrophic result over the entire system by a butterfly effect. However from the mathematical perspective, the catastrophic theory explains only about the incident occurred in a small area of output space since the covering area is highly limited and is applied from a highly limited aspect also in the dynamical process. In other words, when the system's behavior becomes more distant from the critical point, it has the disadvantage that we can not tell its behavior. Accordingly, the catastrophic theory has a locality problem.

When considering it in the usual cause and result relationship, the result shows a small and gradual change if a small and gradual change is given to the cause. We commonly think that the structural stability inherent in the system brings the continuity and gradual change of the system. However same as in the complex system, there exists a discontinuity in the phenomenon of international politics and it is necessary to apply the catastrophic theory to explain this phenomenon. If the output appears discontinuously when we have made only a slight change on the input, we have to consider that the international system has a certain catastrophic phenomenon.

5) Phenomenon of International Politics and Chaos

We commonly think that the deterministic behavioral rule causes completely predictable events. However if a system is generally deterministic, the future state has to be completely determined by the present state and rules of the dynamical movement. Generally, the world we see is a stable system like this. However when a thing is not explained by such rule, it is likely to treat it as an exception. However, there may be a system that is quite sensitive to the initial conditions like the butterfly effect. The final result of an unstable process may cause an enormous result.

The chaos theory explains how the system showing a stable movement state is changed to a chaotic state and also, tries to find an order hidden within the chaotic phenomenon. Further more in the practical problem, we are trying to control this chaotic phenomenon.

As a parameter changes in a nonlinear equation, the stable state of the system is diverged and changed either to a stable state or unstable state. If such diverging phenomenon is repeated several times or continued infinitely, the system reaches to a chaotic state. If we change the parameter consistently even after reaching to a chaotic state, it temporally shows a table state for a short period of time. The chaotic system causes a movement appearing as a completely random behavior purely by a deterministic rule.

Since a complex connection is made between a large number of lower-level systems within the international system, a light change in the early condition of one-side system may bring an enormous change in the entire international system. The nonlinear dynamics comes only from nonlinear interdependent systems. The "domino theory" under the past cold war system corresponds to this case. The change movement in Poland that had processed from the late 1970's became the Solidarity Campaign in 1980. As this campaign was more diffused, it had caused the system collapse of the East Europe in 1989, no more than 10 years from this incidence. In the

early 1990's, the trend of pluralism was expanded as many political parties were organized such as 80 parties in Poland, 22 parties in Hungary, 17 parties in the East Germany, 35 parties in Czechoslovakia, 78 parties in Rumania, 35 parties in Bulgaria, and 86 parties in Yugoslavia. At that time, many people have never imagined that the "end of communism" represented as the collapse of the "Berlin Wall"would come that fast. However, system performers were already united with each other through a "social network" and brought a change in the communism system of the East Europe. The communism system that had been already positioned between order and chaos or on the 'edge' of chaos has evolved into a new system.

As explained above, international system holds the nonlinearity implied by the complex systems theory, chaotic attributes and characteristics. Hence, we think that the complex systems theory along with the international system that will be further developed intricately in the future may be a theoretical base that can explain international systems.

NEWLY RECOGNIZED MEANING FROM THE PHENOMENON OF INTERNATIONAL POLITICS

Generally as for the scientific methods of explaining and understanding social phenomenon (including the phenomenon of international politics), three large categories of positivism, realism and conventionalism exist. However, we should consider that these classification methods are built while basing on the determinism and reductionism. According to the deterministic theory, all the events occurred within the world are determined not to be changed from the early time and they are essentially deployed without a choice according to the rules of dynamics. Accordingly, if we can understand all the forces related to the nature and all the states of a certain moment, we can basically calculate all the events occurring in the past and future of the universe. And as for the reductionism, we have tried to explain the world while finding the explanations in the lowest level of world by reducing the macroscopic world into the microscopic world like the atomic theory, by reducing the movement of macroscopic world into the movement of its constituent, and by reducing all the things into a simple basic law.

However as we can see from the development of new science, natural phenomenon can not be deterministically described and can not be reduced to some variables. The development of complex systems theory has opened a possibility that we can overcome the theories of reductionism and determinism by allowing us to find an order even in a chaotic state.

The systems thinking between the traditional view in the perspective of old paradigm and the new view from the perspective of new paradigm may be different. The traditional systems thinking, which are interested in the equilibrium and stability, has believed that the system performed the goal-seeking, self-regulatory or controlling objectives from an external environment by focusing on maintaining the system through the control of negative-feedback loops. However, the new systems thinking based on new paradigm overcomes a weak point of traditional systems thinking. The traditional systems thinking simply interprets things from a simple functional dimension without explaining the development process into new system and the self-regulatory function of a system. However, new systems thinking has been developed up to analyzing the dynamic change process of system.

New systems theory (especially, the complex systems theory) allows better

explaining and understanding the complicated phenomenon of international politics in that it concentrates on the non-equilibrium system and evolution of the system beyond the structural and functional perspectives in the past. Especially, the concepts such as the entropy, energy and information that have borrowed the concept of non-equilibrium thermo-dynamics may become an appropriate concept in studying for the phenomenal analysis and deployment of dynamic international relations.

CHANGE MECHANISM OF A COMPLEX SYSTEM: NON-EQUILIBRIUM THERMO-DYNAMICS

While social science has primarily used the concept ‘equilibrium’in measuring the state of a system, this concept is not appropriate for the method of groping for the criteria on the continuity of a system state as indicated by Kenneth D. Bailey. Rather, the equilibrium of a system can be seen more dynamically if we use the concept of entropy. Traditionally in the general systems theory, entropy has been regarded in the same light as ‘disorder’ and negative-entropy as ‘order.’ For example, Bertalanffy has regarded the "increasing entropy" identically to the "decreasing order"and mentioned that living system maintains itself in a highly ordered state and also, branch and organization evolve into the increasing direction. We intend to apply the traditional meaning of equilibrium concept on international relations while regarding the situation not changed in the level of entropy as 'equilibrium' by updating the traditional meaning of equilibrium concept.

If international system is distant from equilibrium, new type of structure may automatically emerge. This is referred to as a dissipative structure in the natural state, but it corresponds to a lot of international organizations and ‘regimes’ in the international system. If international system is in the state distance from equilibrium, complexity grows large and advances in an ordered state through the nonlinear reaction and bifurcation evolution.

When we view it from the perspective of non-equilibrium thermo-dynamics, the system under a non-equilibrium state holds two characteristics. If the systems are deviating a bit from equilibrium, the rules of linear non-equilibrium thermo-dynamics may be applied and entropy becomes the central concept, but they advance into more complicated and ordered system states as the macroscopic state abruptly changes while passing the nonlinear and non-deterministic phases if deviated greatly from equilibrium. When international system is free under a non-equilibrium state and open to the material-energy and information inflow, international system produces new entropy through a new mechanism by evolving into new order.

The step-8 level of living systems has evolved through the fray-out process for the past 3.8 billion years while sharing the basic characteristics as a system from a cell the smallest to the supranational system the largest. And, all living systems hold 20 kinds of important subordinate systems and maintain individual life by performing relevant functions and roles. Generally, the system staying at a higher level are the suprasystems of the system at a lower level that holds its own constituents and each of them consists of the subsystems that are executing one of activities essential to all living systems. Higher-level systems hold the emergent structure and process that are not appearing from the system at the level lower than that. Since higher-level systems have a large number of components that hold very complex relationships between each other, new emergent structure and process appear. The gradually increasing complexity makes the entire system more larger system rather than the

sum of simple parts and makes more capable system. Higher level systems are more complex and larger than lower level systems on the average and better use the environment that less complex systems could not overcome. And, higher level systems are adapting easier to the environmental variation larger in the scope than lower level systems and overcome more stress.

Living systems maintains the energy state thermo-dynamically through a consistent interaction with the environment within their own boundary. The input and output between matter-energy and information are essential in the living systems. Living systems have to process their own inputs through various methods in order to carrying out essential activities for the structure, reproduction and products of their own while securing food, fuel and other essential inputs that contain the matter-energy needed for survival. And, the metabolism of information is essential for the survival of living systems and information input allows living systems self-orienting within the space-time and enables to react and adapt to the changing environment. Also, information input from the environment allows them to discover food and mate and to accommodate the feedback about the behavioral results of living systems. Further more, the state related information from all the components of the system allows the system to adapt to the internal stress. After all, information comes out from all the lower systems and is used for the guidance, control and coordination of the system. The adaptation process that changes matter-energy and information flow between lower level systems makes living systems to be related to the consistently changing environment by adapting to the imbalance and stress within the system.

As for three analysis levels of generally known international politics, a system can be divided into the personal level, national level and system level. However when viewing from the perspective of systems theory, the level is getting more subdivided and accordingly, the phenomenon of international politics is regarded as to be occurring from the mutual interactions of various levels. And, the lower level systems of international system necessitate the matter-energy and information like living systems; also in the process with the environment, they can be explained as groping for new evolution on the bifurcation point after entering a certain level of extreme entropy while increasing entropy as time passes.

The " supranational system" corresponds to the last system level from three levels of international politics mention earlier. And, the supranational system also had 20 lower level systems and these lower level systems have independent functions and roles. Although they are not dealt in this paper, we think that the detailed aspects on these functions and roles could be applied to international politics. As the whole world is forming one "global society" and the Rome Club has indicated, it would be necessary to discuss about these supranational roles and functions in order to resolve global issues. By discussing about these roles and functions, the complications between lower level systems within an international system may be overcome.

If we summarize the issues discussed above, living systems require matter-energy and information for survival and the input-output relationship of matter-energy and information may vary according to the state of living systems whether they are open or close systems. If they are not completely closed systems, they system can reduce the entropy by receiving energy from the environment even though the entropy within the system increases and this point is the heart of nonlinear non-equilibrium thermo-dynamics. And in the state of non-equilibrium state that has reached to the critical level of entropy, fluctuations are gradually amplified and as the result, it

becomes inevitable to convert into new situation. The result of the conversion is organized into a higher order and can evolve into new system state that complexity increases or disintegrated/ended. Likewise, this bifurcation point becomes the core of nonlinear non-equilibrium thermo-dynamics. The viewpoints of this nonlinear non-equilibrium thermo-dynamics can be a quite useful method in analyzing the static evolution process of international system.

Next, we will apply the viewpoints of nonlinear non-equilibrium thermo-dynamics useful in the static analysis of complex system and major concepts of complex systems theory to four cases of national security, South-North Korean relationship, international relations in the Northeast Asia, and foreign policy decision-making. At this moment, we only deal with the implicative and general perspectives and try to understand the heuristic meaning. More detailed analysis may be made at a later time.

EXAMPLE OF APPLYING COMPLEX SYSTEMS THEORY TO THE PHENOMENON OF INTERNATIONAL POLITICS

1. Application to a Change of Security Recognition

The security environment of the Korean Peninsular after the cold war age has been changed and we can consider the complexity issue of security in the following writing. Here, let us take the following writing as an example.

"The structural 'pluralism' and 'complexity' from the threat of North Korea: The threat of North Korea to South Korea after the cold war age has been changed into a way of structural 'pluralism' and 'complexity.' If the threat of North Korea in the past was based on a 'single line' type of threat in the military perspective, today multi-dimensional threat factors such as politics, economy and society have been added. The multidimensional aspects of the threat of North Korea have arisen from the internal weakness of North Korea that is facing the crisis within the regime. The closed economic system of North Korea after the cold war age has lost the support power and recorded minus growth since the late 1980's. While shortage of foreign currency and lack of energy and consumer goods have been continued, they have not overcome a chronic economic slump yet. Additionally, the state of the increased shortage of food after a flood disaster in 1995 pushes the population to a state of starvation. Furthermore, this economic crisis situation caused a collective escape of residents and elite people from North Korea together with the slackness of discipline across the whole North Korean society and presents a serious criticism for the stability of North Korean government. The enlargement of such internal weakness has been connected to the uncertainty of North Korean regime in the future and increased the complexity of threat structure. Here, various scenarios for the future of North Korean regime and the risk factors accompanied with them have been suggested."

The recognition that the threat of North Korea appears in connection with several factors multi-dimensionally and complexly may be consider as the point that emphasizes the complexity of security problem.

2. Application to the South-North Korea Relations

Second, the matter-energy, entropy and information concept used in the static

analysis of complex system change may be applied to the improved situation of South-North Korea relations in the 1970's.

Historically, the "international system in the Southeast Asia"at the time of the joint communique of 4 July 1972 between the South and the North of Korea was initiated by the Nixon Doctrine and has decreased the entropy that had been increased under the cold war age for a long period of time by the Joint Statement of 4 February 1972 between USA and China in Shanghai. Thus, the countries under the cold war that caused the increase of entropy proportionally by consuming their own energy while confronting each other under the cold war have overcome the suffocation and death of "international system in the Northeast Asia" through mutual exchanges of information and interactions. Especially, the Nixon Doctrine emerged as new nucleate that have amplified change from the system characteristics under the structure of the cold war in the past from the "international system in the Northeast Asia."

The Nixon Doctrine as new nucleate was diffused in this area through fluctuations. The most critical fluctuation was the "Joint Statement of Shanghai between USA and China." Under the cold war, individual countries that are the components of an "international system in the Northeast Asia" consumed their own energy with an extreme confrontation; and as the result, they maximized entropy. In this process, they formed dissipative interaction and structure. The "Joint Statement of Shanghai between USA and China" that appeared as the most critical fluctuation in this process advanced the "international system in the Southeast Asia" of having kept a thermal equilibrium at that time into the "international system far from equilibrium system." Fluctuations made the system unstable and caused the phenomena that were never predicted.

The stability of system structure, no matter which system it is, is related to complex attractors and the survival and evolution of a system are determined according to the appearance and ability of a dissipative structure. While system equilibrium is referred to as a stop or death, a high degree of non-equilibrium that maintains self-organizing processes is accomplished by a consistent exchange of environment, matter-energy and information. In other words, survival of a system requires the incessant exchanges of matter-energy and information with the surrounding environment. A function is expressed by a chemical equation; the space-time structure is caused by instabilities; and fluctuations cause instabilities. These three types of interactions cause the phenomenon (that is new order) that is seldom predicted, including the "order through fluctuations."

New order begins from the interactions between critical fluctuations while going through the crucial phase-change under a state of instability. The Nixon Doctrine has made the greatest influence on the "international system in the Northeast Asia"as the most critical nucleate from the interaction of fluctuations and allowed South Korea and North Korea to have a talk. The "international system in the Northeast Asia" in this process has experienced a bifurcation and entered a phase of new evolution. In the meanwhile, the United States, China, Japan, Russia, South Korea and North Korea that are components of the "international system in the Northeast Asia" have groped for new kind of relations in the flow of matter-energy and information. The phase transition and symmetry destruction on the "international system in the Northeast Asia" were caused by an external international system that is a larger system environment. The relationship of big powers such as the United States and China that plays an attractor role in the international system has fluctuated and destroyed existing symmetric relations and in the end has created new macroscopic

time-space pattern and order. The "international system in the Northeast Asia" holds a dissipative self-organization process that is far from thermal equilibrium. The dissipative self-organization process is caused by a change of external parameter. Even in the "international system in the Southeast Asia" that is a lower level system of the whole international system, the relation changes of big powers as an external parameter was flowed in and influenced on the relations between the South and North Korea. In such process, the lower level systems and higher level systems have evolved while influencing each other and the lower level systems in this process have helped each other while evolving together with the whole upper level system.

Under the order being newly formed, the components of "international system in the Northeast Asia"have groped for new relations and in this process the components of "international system in the Northeast Asia"have consumed the self-regenerated energy from the environment that was formed through the flow of new matter-energy and information. In this process, respective regimes have increased inner entropy.

Although it is a successful evolution as compared to the phase in the past, respective components have used internal energy even in this new order as time passes; accordingly, as entropy increases, each regime has created dissipative interactions and structural forms. While respective components of the "international system in the Northeast Asia" have made a dissipative structure within their regime, it has reached to a limit and there were opportunities of energy and information inflow from the outside. Under such a situation, new system change nucleate has appeared within the "international system in the Northeast Asia" has emerged and the critical nucleate was a collapse of the Soviet Union. The collapse of the Soviet Union was diffused throughout the entire "international system in the Northeast Asia" and the "international system in the Northeast Asia" confronted a crossroad of development and retrogression, standing at a turning point of another evolution. On this bifurcation point, the "international system in the Northeast Asia"was looking for new relations through the flow of new type of matter-energy and information and the relationship between the South and North Korea has entered a phase of the second evolution under this new order of the "international system in the Northeast Asia."

3. Application to the Recent Changing Relations of the Northeast Asian Countries

Third, the matter-energy, entropy and information concept used in the static analysis of complex system change may be used to explain the aspects that the relations of countries in the international system in the Northeast Asia are changing as in the following.

The recent international system in the Northeast Asia is characterized by openness and flexibility, drawing energy from external environment and frequently discharging internal entropy. Due to this dynamics of the international system in the Northeast Asia, relevant countries are consistently experiencing an evolution. The recent development in the Northeast Asia is characterized by negentropic complexification. Such complexification has been occurred after the cold war age. However, this situation has been extremely fluctuated and consequentially, these uncertainties have given rise to a certain level of disequilibrium. However, disequilibrium is not fundamentally negative. This is because it is a preparatory phase for positive development. Most countries in this area under the cold war had drained their internal energy and produced the entropy harmful in curing their political situations.

Accordingly, when we look into these perspectives, the countries in the Northeast Asia will further accelerate the access and will try to maintain their own regime.

4. Application to the Foreign Policy Decisions

And, the following piece of writing raises the importance of environmental complexity in the foreign policy decisions.

"Especially after the cold war age, international relations were getting extremely complicated. Recently, the successive summit meetings of big powers around the Korean Peninsula show the reality of international relations that have been fundamentally changed after the cold war age. Under a confrontation structure of the cold war age in the past, the strength of tension was high, but the demarcation of international relations was clear and accurate and the diplomatic relations was also simple. However after the cold war age, countries could not cope with the changing international relations with the behavior and attitude of the past. Accordingly in the diplomatic relations of South Korea, we shall have to manage the goal awareness and strategy of foreign policy and the complexity of diplomatic environment."

Therefore, through the awareness for the diplomatic environment connected to the diversified and complex issues as compared to the past, the foreign policy decisions that improve national benefits are required.

CONCLUSION

Up to now, we have tried to explain the phenomena of international politics in an extremely limited scope from the perspectives of nonlinear non-equilibrium thermodynamics that are used for the major concepts of complex systems theory and for the static analysis of complex system.

Today's international system as compared to that of the past is interconnected to the functions and roles of the lower level systems and is moving to the open and off-controlling directions as compared to that of the cold war age. Therefore, today's international system is considered to show chaotic characteristics conspicuously rather than Newton's deterministic characteristics of the world. Although there may be the phenomena that need to be explained by the interactions of cause and effect, many phenomena need to be understood in the perspectives of complex systems theory and they will increase further in the future.

In this perspective, it is getting more difficult to explain and describe the phenomena of international politics as compared to those in the past. As for the reasons, international system components are diversified and nonlinear interactions are realized between components. Accordingly in order to conduct a scientific analysis for an international system, it will be important more than anything else to classify various components and to identify the interactions between these components. In order to accomplish these, it will be necessary to apply the thinking method of complex systems theory to the analysis of international system while basing on new paradigms and new sciences rather than the logics based on old paradigms. Especially, it is important to understand the interactions of countries, international organizations and multinational corporations (that are the major players of international system) from the perspectives of complex systems theory and to analyze the overall phenomena of international relations.