

# Political Comparison: Analysis of North Korea-South Korea Denuclearization Decision Making at a Bilateral Meeting Using Game Theory

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## Abstract

The purpose of this study is to find out and analyze what is behind the conflict that can occur. This study uses an analytical method using game theory because it is appropriate to be used for policy decisions. The political situation on the Korean Peninsula was heating up due to mutual threatening actions by North Korea and the United States (US). South Korea, as an alliance of the US and neighboring North Korea, took action to propose a bilateral meeting with North Korea. Unexpectedly, North Korea accepted the offer which later resulted in the Panmunjom Declaration with content relating to denuclearization. Data obtained from the literature review. Game theory has broad benefits, from the start of forming a disarmament policy to political and economic negotiations. It can also explain why nuclear bombs were never used in war after World War II. The results of this study are that decision making is strongly influenced by the national interests of each group or country in conflict because it is related to the power possessed by that group or country, namely military capability, economic capability, prestige, and social conditions.

**Keywords:** Peacebuilding, Game theory, Political comparison, Denuclearization

## Introduction

The complexity of the conflict after the Cold War cannot be understood merely as a product of differences in interests or identity. As shown by Galtung (Webel, 2007), for example, conflict occurs because of the interaction of three components: contradiction (difference), attitude and behavior. The complexity of the conflict after the Cold War also emerged in its very distinctive character, which tended to be prolonged, repetitive and accompanied by violence. Conflict with this character is known as protracted social conflict. And, like Galtung, protracted social conflict is not solely caused by differences or contradictions, but also by the efforts of communal groups to fight for their basic needs such

as security, recognition, access to political institutions and to economic participation (Webel, 2007).

In relation to efforts to deal with conflict, different strategies or approaches develop, which are caused by different assumptions and understanding of conflict: conflict prevention, conflict resolution, conflict management and conflict transformation. Conflict prevention is the simplest strategy among these strategies. This strategy emphasizes the importance of efforts to prevent conflicts from arising. However, this strategy was considered to be too simplistic in meaning and understanding of conflict and difficult to apply in the context of conflict as it developed after the Cold War.

Game theory is a theory that can take into account the choices that will be taken by those who play in it. Almost every activity that humans do is a game. More precisely, when humans interact with one another it can be said they are playing a 'game'. Game theory can apply with the assumption that the parties involved in it are rational (theory of rational choice). Theory of rational choice is one of the principles in game theory, namely that the player will choose an action or action that he thinks is best or at least in accordance with the player's preferences. (Binmore, 2007)

In almost all game theory models, there are a number of important elements, namely the player, the choice of action the player faces, the player's preference for several courses of action, the reward the player gets for his preference and the balance. Another element is the information each player has and the logical likelihood of the outcome of the game. Nash Equilibrium is a solution concept that uses a series of strategies in negotiations involving two or more parties in which each party is assumed to have known the opponent's strategy, and each party can only benefit by changing its own strategy. If more than two parties are involved, each party can consider rational reasons by forming a coalition with the other parties. Nash Equilibrium helps the player to choose which action is the most rational for him by considering the opponent's choice of action. Players are parties involved in an event.

### **Game theory algorithm explanation**

The first player South-Korea is denoted by  $i$  and the second player North-Korea is denoted  $j$ . The action taken by players— $j$  has two probabilities that are action regarding the nuclear facility (denoted by- $A$ ) and player — $i$  working together regarding with favorable opportunity both parties (denoted by- $U$ ). These concepts can be formulized as follows:

*First*, there are two possibilities of action  $A$  and  $U$  which both of them has elements that contradictory each other, in mathematical form, we can use the negation as following:

$$\begin{aligned}
 \mathbf{A} &= \{a, a'\}, \text{ where:} \\
 a &= \text{Maintain De – nuclear facility} \\
 a' &= \text{Not Maintain De – nuclear activities} \\
 \therefore \text{Relation of element } \mathbf{A}: a &= \text{not}(a) = a'
 \end{aligned}
 \tag{1a}$$

$$\begin{aligned}
 \mathbf{U} &= \{u, u'\}, \text{ where:} \\
 u &= \text{Working together} \\
 u' &= \text{Not Working Together} \\
 \therefore \text{Relation of element } \mathbf{U}: u &= \text{not}(u) = u'
 \end{aligned}
 \tag{1b}$$

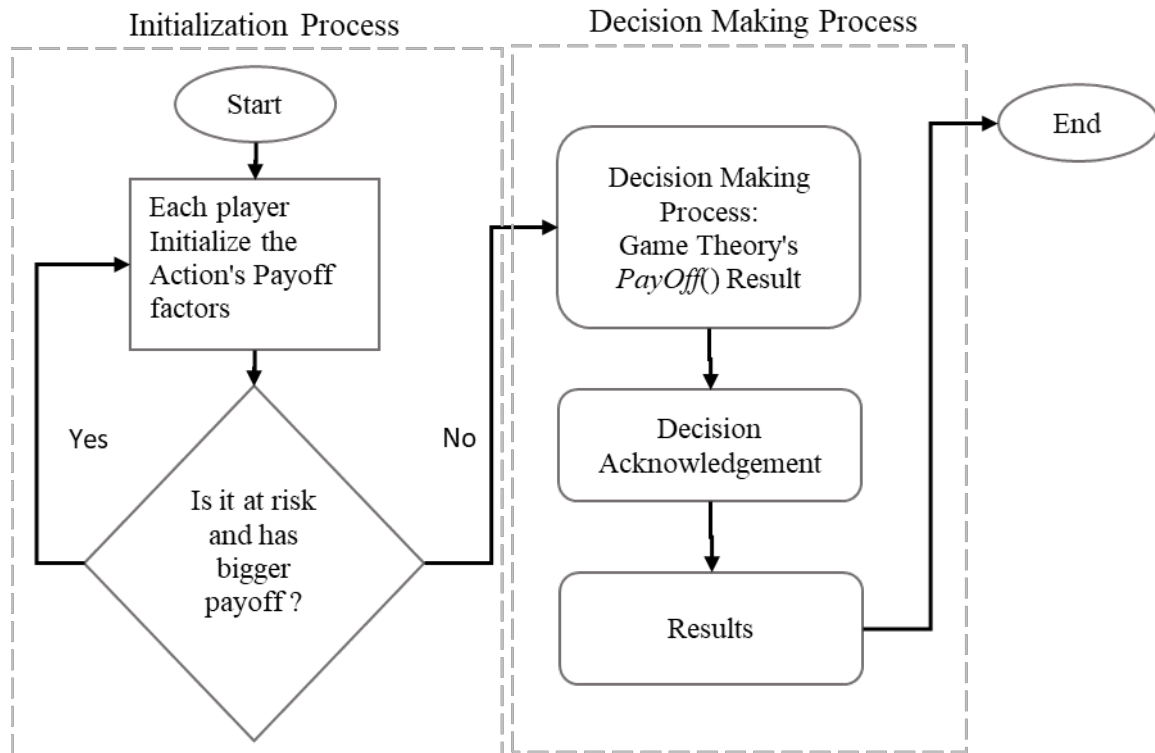
The game theory which used for emphasize the algorithm framework can be described as two players taken four actions because combination of two conditions using formula:  $(2 \text{ actions})^2 \text{ conditions} = 4 \text{ Choices which need to be taken by players}$ .

Table 1 will explain the player's dilemma that need to be taken.

**Table 1** Matrix Table of Player's Action Taken

		<i>player – j</i>	
		Do the De-nuke (a)	Not Do the De-Nuke (a')
<i>player – i</i>	<i>U</i> Working together ( u )	<b><i>Pay_Off</i></b> {u, a}	<b><i>Pay_Off</i></b> {u, a'}
	Not working together (contra) ( u' )	<b><i>Pay_Off</i></b> {u', a}	<b><i>Pay_Off</i></b> {u', a'}

The process of Table 1 can be described by process diagram as following. The process begin with each player initialize the action of factors that impact decision's making. Thus, we call it Payoff factors. After all necessary factors described, player compute the risk which worth to be played. If the factor on first attempt were not yet sufficient then player do the action repeatedly till the desired criteria is met. Player will decide the action by compute highest *PayOff()* value. We assume that this highest value is being acknowledge by all parties. Figure 1 will visualize given process.



**Figure 1** Game Theory Algorithm Process Diagram

Reason's *PayOff()* function can be described as follows:

- *Player – i* has Set of possibility: {Do Working together when *Player – j* has **do** the De-Nuke, and Do Not Working together when *Player – j* do **not do** the De-Nuke}
- *Player – j* has Set{**Do** the De-Nuke is **not** favorable because of it will make loss of its investment and loss its self-security but omit the international sanction that limit fiscal income, Not Do the Nuke will have a world's sanction and make a change of war which suffer both parties}

Based on the reasoning that described above we can compute the weighting factor as follows:

- Not Do the De-Nuke is favorable to *Player – j* thus we give the value: 4 for *Player – j* but not to *Player – i*, thus we give value: 0 for *Player – i*.
  - If they do Cooperation: *Player – j* got 4 point, and 0 for *Player – i*.
  - If they do not do cooperation: both players got desperate situation because of the threat of war, thus both parties got 0 point.
- Do the De-Nuke is not favorable to player *Player – j*, but favorable to *Player – i* depends on the next section whether they do cooperation or not. Thus value for player *i* and *j* are:
  - If they do Cooperation: Both players got 3 point.
  - If they do not do Cooperation: *Player – i* got favorable 4 point, and *Player – j* got unfavorable 0 point.

Further action needed to compute *PayOff()* function is by calculate the aggregate point needed from those factors can be described by formula 2 as follows.

$$PayOff(w_{i,j}) = w_i + w_j, \quad (2)$$

**Result:** We seek the **max** PayOff( $w_{ij}$ ).

Nash Equilibrium denoted that the highest *PayOff()* function, which regards with maximum weighting function  $w_{ij}$ . It explains the optimal solution of non-cooperative players which can be achieved after reasoning the payoff ratio.

### Materials and methods

National interests are part of determining the contents of a country's foreign policy. Each country involved in international relations has its own national interests. National interests can be considered as a goal to be achieved by the state with consideration of the power they have. Interest is interpreted as something to be achieved, or welfare goals (welfare goals). If A is an individual, group or country, and X is an action taken to achieve the goal; then A doing X will increase A's profit in achieving its goals. The interest itself must be seen as a reference to economic or security objects in personnel, social or state. National interests can be seen from two sides, internally or externally. (Carter & Ricciardi, 2001) Internally, it means that national interests refer to public objects of national security. Externally, it means that national interests refer to policies that aim to pursue specific interests or spread understanding, or expansion of territory. the formulation of national interests is, in practice, the same as the formulation of national security. But when the government forms foreign policy, sometimes the goal is not in accordance with the security of his own country. That means that national interests do not always talk about welfare objectives. (Carter & Ricciardi, 2001)

Hans J. Morgenthau, a thinker in the realist tradition, said that in one of the political principles of realism, the concept of interest can be explained in terms of power. Power is an important component in the concept of national interests (Morgenthau, 1993). There are eight forms of strength that Morgenthau refers to geographic, natural resources, industrial capability, military readiness, population, national character, national morale, and quality of diplomacy. Narrowly, Morgenthau defines national interests as a form of survival, that is protecting the physical, political and cultural identity of other countries. More specifically, to maintain territorial integrity, maintain regimes (democratic, authoritarian, socialist or communist) and maintain ethnic, religious or historical norms. Through these considerations, the leader of a country forms a policy, whether it builds alliances, establishes cooperation to conduct propaganda or an arms race.

The state, as it is an actor in international relations, is inseparable from the individual who is the leader of the country. Morgenthau assumes that people / actors in government think and act in the interests of power. This assumption helps us know what steps to take on a problem. Defining the concept of interest as the power of giving knowledge to the observer, implanting a rational order into a political subject and then making a theoretical understanding of politics possible. Observers here are not only academics but also political leaders or elites in other countries. Thus, national interests can indirectly provide a picture of a country's identity; for example, the system of government adopted, the alliance state, the nation's character and habits that serve as benchmarks for the state in making decisions. On the other

hand, this understanding helps the actor create foreign policy that is clearly visible and rational continuously.

According to Morgenthau, the background for policy formation is ideological motives and actor preferences. Motives are considered as a form of psychological data that is distorted by the emotions and interests of the actors themselves; not in the national interest. The motives may provide clues as to where foreign policy is headed but do not provide predictions about what types of policy. Foreign policy is also not related to ideological or political preferences of certain actors. However, actors may under certain conditions introduce their policies by bringing their ideological / political preferences to attract support for those policies. Not all foreign policies are always rational, objective and apathetic. But if other factors such as motives, personal preferences and subjective views are considered in foreign policy, then it will turn it away from the path of rationality(Morgenthau, 1993).

K. J. Holsti divides the national interests of a country into four elements, namely:

1. Security; aims to protect oneself which means also to protect the citizens, territories and sovereignty of the country itself physically, politically or ideologically
2. Autonomy; means the country is able to regulate domestic affairs through the formation of domestic policies and be able to withstand threats or influences from other countries.
3. Welfare; as a measure of the success of a country. The state will be considered successful when it has a prosperous people even though it does not have great military power and vice versa.
4. Achievement; seen from the progress of a country in the field of science and technology which will give a high status when the country has sophisticated technology. (Holsti, 2004)

The research method used is a qualitative research method. The qualitative research method is an approach to explore and understand a phenomenon. In understanding a problem, it is necessary to search for information in the form of text or oral. The information becomes data analyzed by the researcher descriptively. In qualitative methods, the process in research is something more important than the results of the research itself. (Creswell, 2009)

Data collection techniques used by the author is to use library techniques. The author searches the literature on topics related to the object of research. Literature considered relevant are selected and classified in several categories. The author reads the literature and takes several ideas or important points. Then the writer uses these ideas or points to do a conflict analysis.

In qualitative research, data is processed and analyzed into systematic, orderly, structured and meaningful data. The data analysis technique was carried out in five stages. First, organizing data; the writer reads the data repeatedly so that the data is found in accordance with the research and discards data that is not appropriate or unnecessary. Second, create categories, determine themes and patterns; the writer groups the selected data into a similar theme category so that the regularity of the data can be seen. Third, test hypotheses using existing data; the author tests the possibility of developing a hypothesis and tests using existing data. Fourth, looking for alternative explanations of data; the author provides information on existing data based on the logical meaning contained therein. Fifth, write a report to describe the data along with the results of research analysis.

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Political comparative studies have two roles at once namely: the first, political comparative studies as theories, and second, the role of political comparative studies as methods. The study of political comparison as a theory is more directed to a set of generalizations that are systematically related, while the study of political comparison as a method is more directed to the process or procedure that involves the use of techniques and instruments. (Hergianasari, 2019) in this study using political comparison as a method using game theory.

## Results and discussion



**Figure 1** Peacebuilding Triangle

**Source** Doyle and Sambanis (2014)

Based on this peacebuilding triangle, it is clear that in order to guarantee the success of a peace mission, there is a need for every international assistance to understand the character and level of hostility that occurs at the local level. As explained by them, this stage is crucial because it involves identifying conflict patterns and their opportunity for intervention. (Doyle & Sambanis, 2014)

However, as they have admitted that it is different from conflicts between countries which are likely to be easily resolved, in intrastate conflicts this problem is so complex because it involves tangible aspects such as political conditions and distribution of economic resources to intangible (not seen) for example issues of identity and mass psychology.

Doyle and Sambanis write that understanding the level of hostility will be particularly useful in avoiding hostility escalation due to strategy errors and timing of intervention. In addition, this phase is also useful for identifying opportunities for failure to achieve a state of peace due to fraud committed by one of the warring parties. By understanding these opportunities, third party assistance will be able to prevent this from happening so as to increase trust between the parties in conflict. (Doyle & Sambanis, 2014)

In addition to the level of conflict, the capacity of both third parties and local actors also plays an important role. The transformation to effective peace is, according to them, the success of harmonizing the capacities of local actors to support the transition to peace with the assistance that international actors or third parties can provide. Countries that experience intrastate warfare differ in economic and social capacity. In some countries, such as the former Yugoslavia, they have better social capacity and economic and political infrastructure compared to Rwanda, Somalia or Cambodia when the United Nations intervened. In these cases, a reconstruction of both social and infrastructure is vital for the creation of peace, such as building education and health facilities, establishing bureaucratic structures and facilities,

rebuilding police and army units, and creating social cohesiveness among damaged elements of society. The better the local capacity of a conflict-affected area, the international assistance or third-party state will not be as big as for those who have low social or economic and political capacity. Therefore, the capacity of international assistance must be in accordance with the conditions on the ground because the mismatch between what is needed and what can be helped will cause imbalances that result in an international peacebuilding mission such as the United Nations will fail.

In order to analyze the decisions of each country in peace agreement, the authors use a simple model of game theory. In the context of this peace agreement, there are only two players involved in it. There are two players  $i$  and  $j$ . The strategies or actions possessed by each player are denoted by possibilities of action taken which all event is described from Table 2.

**Table 2** Panmunjom Declaration Analysis Matrix

		North Korea	
		Denuclearization	Not Denuclearization
South Korea	Cooperating	3, 3	0, 4
	Non-cooperating	4, 0	1, 1

To get the answer from the matrix table above, we need to find out the Nash Equilibrium first. The highest value is 4 to get what is needed without sacrificing anything, 1 to maintain the status quo, 0 is the lowest value because it gets nothing. Based on the analysis we found that Nash Equilibrium of  $PayOff()$ , can be achieved as follows:

- The profile of action (working together, denuclearization) is the balance of equilibrium because both players will defend this option which  $Player - i$  no longer feel threatened by the nuclear and  $Player - j$  cannot afford the war threat risk.
- The profile of action (working together, not denuclearization) is not a balance equilibrium because  $Player - i$  still feel threatened despite giving assistance so  $Player - i$  will prefer the option others provide higher wages than this option.
- The profile of action (not cooperating, denuclearization) is not a balance equilibrium because  $Player - j$  releases the only source of self-defense without guarantee of assistance from  $Player - i$  or any party.
- The profile of action (not cooperating, not denuclearization) is not the balance of equilibrium because the two countries will be in a tense situation but  $Player - j$  still has a nuclear which is more threatening for  $Player - i$ .

From the above explanation, the equilibrium text is found in  $\{A, U\}$  = (cooperating, denuclearization) and (not cooperating, not denuclearizing). But keep in mind that the profile of action (not cooperating, not denuclearizing) means maintaining the status quo which leads to an undesirable situation between the two countries, namely the increasing security tension on the Korean Peninsula. Thus, the profile of action (working together, denuclearization) is the text of equilibrium which is also a rational choice for both players.



If the basis for decision making on the Panmunjom Declaration is known, how is the continuation of inter-Korean relations after the approval of the declaration? To find out this requires a scenario that is expected to be a trend and will occur in the future. Since the Panmunjom Declaration was approved until this research was written, several important events have occurred, namely 2018 North Korea-United States Singapore Summit, September 2018 Inter-Korean Summit in Pyongyang, 2019 North Korea-United States Hanoi Summit and three trials of missile launches by Korea North during July-August 2019. The first three events are good signals of the continuation of the Panmunjom Declaration. All of these signals, then, were slightly lost due to joint US-South Korean military exercises which made North Korea furious again. On the other hand, despite having approved the Panmunjom Declaration, North Korea has another option to keep / re-develop nuclear weapons secretly. If this situation continues then it is possible that North Korea will ignore the agreement on denuclearization in the Panmunjom Declaration. Then what is the decision that the two Korean countries must take.

South Korea has **A** strategy = {delaying joint exercise, continuing joint exercise}. South Korea cannot stop joint training with the US because it is a form of cooperation between the two countries. So that South Korea can at least ask for the postponement of the joint training session until a better agreement is reached between North-US and North Korea-South Korea. North Korea has an **U** strategy = {threatening, not threatening}. North Korea is unlikely to take extreme actions aimed at thwarting the Panmunjom Declaration. This will make his image worse in the eyes of the world. The matrix table for the prediction scenario after the Panmunjom Declaration above is as follows:

**Tabel 3** Scenario Analysis Matrix Post Panmunjom Declaration

		North Korea	
		Non-threatening	Threatening
South Korea	Postpone joint exercise	2, 1	0, 3
	Continue joint exercise	3, 0	1, 2

From the table above explains that:

- Profile of action (postpone joint exercise, non-threatening) {2,1} is not a balanced equilibrium because player *i* can ensure the Panmunjom Declaration continues to open other meetings and not get threats from *Player – j*. They cannot ignore the declaration but still maintains an image in the eyes of the international community.
- Profile of action (postpone joint exercise, threaten) {0,3} is not the balance equilibrium because *Player – i* will feel very threatened without any military preparation from joint exercise and *Player – j* shows its dominance by threatening through missile launches so that *Player – i* will prefer other options that pay more than this option.
- The profile of action (continuing joint exercise, not threatening) {3,0} is not a balanced equilibrium because because *Player – i* can be guaranteed security and can ensure the sustainability of the declaration while *Player – j* feel dominated by the implementation of the joint exercise.

- d) The profile of action (continuing joint exercise, threatening)  $\{1,2\}$  is not a balanced equilibrium because this situation will lead to the possibility that *Player – j* will ignore the declaration and it is not wanted by the *Player – i*.

The above model does not have a balanced equilibrium but it can still be seen which option is the most logical for each player. North Korea will not choose to stop making threats because the wage he gets is only 1 and, even worst, 0 points. This is because North Korea has agreed to give up its only means of self-defense plus it must act as if it were following a policy program prepared by South Korea. So, it makes more sense if North Korea makes threats as another form of self-defense and proves that it still has power. This action also did not do much harm to North Korea because it did not violate the declaration. Because North Korea hasn't completely redeveloped its nuclear capabilities either after the destruction of its facilities after the April 2019 Inter-Korea Summit. Knowing that North Korea chose not to stop threatening, North Korea's option was to continue joint exercises with the US. Even wages are better than choosing to postpone joint exercise. Thus, the profile of action (continuing joint exercise, threatening) is a rational choice for each player. The result, if this trend will happen again, is that North Korea is predicted to ignore the Panmunjom Declaration.

## Conclusion

Game theory is an analytical tool that can be used in political science. In this context, game theory functions to predict or find out the decision-making process of political actors. Game theory uses the principle of rationality so that the results of the analysis are quite accurate but not absolute. Even so, game theory is able to present the mindset or behaviour of actors in making decisions.

In the case of the Korean Peninsula, peace efforts are not easy. The change from a tense situation to a positive one is not without cause. There are several considerations that make these changes possible. North Korea, with all its prestige and survival desires, in the end, prefers to put aside its prestige temporarily in order to stay alive. South Korea, with all of its resources, is working hard not to feel threatened by its siblings. From there, an agreement was written in the Panmunjom Declaration.

But the declaration is certainly are not just streaks on the paper. Both countries recognize that peace is the first step that must be achieved. The reunification discourse will come automatically afterwards. Although peace efforts involve several parties, such as the United States, China, Russia and Japan, all decisions are ultimately in the hands of the two Korean countries themselves.

In addition, the road to unification between the two countries is still very long. Even President Moon has declared that unification is projected to be realized in 2045. The road will certainly be more difficult and more complex. The determination is in the decisions made by each actor or player in the future with every possibility that will occur.

Suggestions and Recommendations, a Game theory is not a new knife of analysis among academics in International Relations. But game theory is not popular enough to be used as an analysis tool. Though the use of game theory is quite simple compared to other theories that consider other factors such as the nature of the actor itself. This theory is more suitable to

be used in predicting a country's policy decision making. But to understand game theory is not as easy as understanding other theories for international relations academics. Because this theory was originally rooted in mathematics which was then applied to economics and finally to political science. So, there is a gap for social people who usually have difficulty understanding mathematics.

The author hopes there are other studies that can cover the shortcomings of this research. One of them is to discuss game theory between the United States of America and North Korea in the context of peace efforts on the Korean Peninsula.

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