Decision making framework for the proactive policy conflict management: The case of new airport projects in South Korea

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Abstract
We propose a decision-making framework on infrastructure policy conflict management based on a scientific approach. We developed a decision-making framework that consists of the systematic conflict structure diagnosis, decision-making accordingly, and feedback to be used consistently in the policy life cycle and applied it to new airport projects in South Korea. We suggested a model structure of conflict factors leading to the generation of conflict situations and damages in the process and developed the conflict level diagnosis table and the conflict level matrix formed of the possibility of conflict generation and the severity based on the table. We then implemented a decision-making framework that includes decision-making based on it. The case analysis results confirmed the need for a structural diagnosis of conflict and decision-making based on the framework. The developed framework is expected to have scalability for science progress on infrastructure policy conflict management.

Keywords
Infrastructure policy, conflict management, conflict structure investigation, infrastructure decision making framework technology, systematic conflict structure diagnosis

Introduction
A decision making framework on infrastructure policy conflict management based on scientific approach is suggested in this paper. Policy conflict management over-all policy life needs not only management methodology itself at certain time but
also chain of decision making from the whole system perspective. Based on the concept of the policy conflict framework\(^1\) and the scientific decision-making framework such as SMS (Safety Management System),\(^2\) a policy conflict management decision-making framework (PCDF) is designed, structured, tested, and discussed in the case of new airport projects in Korea.

A policy conflict is a series of past episodes and a composite of current factors,\(^3\) and a successful policy needs consistent decision-making for conflict management considering the characteristics.\(^4,5\) Since the inherent characteristics of policies have a broad effect not only for conflict resolution but also in the entire process of conflict,\(^6\) it is necessary to consider conflicts throughout the process of policymaking. However, although there have been many studies on conflict management, such as the approach to conflict management\(^7,8\) and conflict management strategy,\(^9–12\) there have been relatively few studies on decision-making framework concerning conflict management that can be used systematically from the policy life cycle viewpoint.

Although conflict is a series of processes,\(^13\) the studies on conflict management mostly focused on identifying causes and effects such as the relationship between key variables and conflict resolution\(^14–16\) and the review of various factors that can affect conflict resolution.\(^17–19\) Moreover, it is difficult to generalize studies of public conflicts since they’re subject to a small number of cases\(^17,20\) and existing studies have been criticized for lack of empirical evidence.\(^18,19,21\) In order to overcome these limitations, we suggest an ex-ante methodology that systematically supports decision-making for conflict management based on the possibility of conflict and its severity throughout a series of policymaking processes, instead of an ex-post approach that studies the cause of conflicts from different viewpoints from existing studies. It also includes the testing of the study outcome for the cases of new airport projects in South Korea.

**Literature review**

The concept and scope of conflict management have a broad spectrum. The concept of conflict management has changed from the prevention of worsening of conflict\(^22,23\) to the transformation of conflict into a positive effect.\(^24\) Moreover, conflict management is recognized to include conflict prevention since it includes intervention and resolution of conflict\(^25\) and is regarded as the subjects or manager of conflict going through the conflict.\(^26\) As a field case, the Korean government regards conflict management to be the preemptive prevention and resolution of conflicts. It thus aims to contribute to social integration, rather than just conflict resolution.\(^27\) Therefore, the purpose of decision-making methodology for conflict management suggested by this study is to prevent and resolve conflicts and achieve the policy goal effectively.

The decision-making framework for conflict management suggested by this study can structurally analyze the policy conflicts. The recent models to structurally analyze policy conflicts include ACF (Advocacy Coalition Framework\(^28\)) and
Policy Conflict Framework (PCF). PCF consists of policy setting, episodes of policy conflict, and feedback. It describes a policy with the policy behaviors, policy actors, events, and issues and can reflect the continuous flow of policy and conflicts through the cognitive and behavioral conflict attributes and feedback. As such, we selected PCF as the framework to be suitable for this study for the analysis of conflict analysis suitable for the purpose of this study.

Pondy regarded the process of conflict progress to be a phased and linear flow of five phases of potential conflict, perceived conflict, felt conflict, explicit conflict, and conflict aftermath. Then Fisher regarded the conflict phases to be overlapped and repeated like a vortex. Therefore, the PCF applied in this study presents the dynamic concept that conflicts are mutually dependent and occur through various feedbacks. Since the decision-making framework developed by this study subjected the policy life cycle as the scope, we considered that the PCF was the appropriate selected in that it could reflect the dynamic concept.

**Methodology**

**Scope and assumption**

We suggest a guiding research on the decision-making framework for policy conflict. Its scope is to propose the overall process, not a validation of details like checklist development and opportunity cost calculation. It also applied the framework to new airport development projects in South Korea to simulate the actual case application. Follow-up studies on detailed modules and extension to other policy cases may refer to the framework presented in this paper.

We assumed the PCF as the basic framework for dealing with policy conflicts, and developed the matrix (hereinafter, the conflict level matrix) that includes the possibility and severity of conflict that are parts of the decision-making framework and the checklist (hereinafter, the conflict level diagnosis table) to configure them. We applied the bowtie model as the basic structure of the decision-making framework (Figure 1) that could analyze conflict factors, conflict situations, and damages from the conflict in combination. We presumed that the possibility and severity of the policy conflict were based on the conflict level diagnosis table for the conflict manager. The decision-making framework is used to lower the possibility and severity of conflict situations by resolving the causes of conflict based on the conflict level matrix derived from the bowtie model and conflict level diagnosis table and the structure of decision-making on the mechanism is applied to minimize the damage caused by the conflict when the conflict situation occurred.

We used the social conflict cost based on CVM (contingent valuation method) for an example of a quantitative analysis of damage caused by the policy conflict. We estimated the cost based on the new airport cases and assumed that the change of expected damage amount due to the mitigation countermeasures assumed could be derived by generating its conflict level diagnosis table.

We show the framework process and result based on the case of new airport development and operation policy. In each step of policy life cycle from suggestion
or pre-feasibility study to real operation, this framework could be applied separately and successively. Previous results are input data of present analysis with newly investigated information. Then the model process is performed separately and produces input and reference information for next phase of target case.

**Structure**

Figure 2 shows the developed decision-making framework. With the analysis of the conflict factors and conflict situations with the conflict level diagnosis table, we can obtain the possibility of conflict spread, and the matrix of the conflict level can be produced based on them. Then, the measures to mitigate and manage the conflict is derived with the matrix. We suggested the decision-making steps for conflict management that are applicable to new airport project cases in South Korea (Figure 3).

The first step is to set the subjects and scope of conflict decision-making, summarize the facts about the conflict situations, and generate the conflict level diagnosis table based on them. The conflict level diagnosis table should be usable by all stakeholders, conflict managers, and third parties. The possibility of conflict spread and the conflict severity can be derived from the conflict level diagnosis table, and the intervention level to the conflict situation can be decided based on them. This step reviews the conflict management strategies to mitigate conflict factors, minimizes damage, and updates the conflict level matrix based on the conflict level diagnosis table assuming the reapplied situation. If needed, feedback can be provided until the outcome can achieve the goal. The decision-making framework is set to be a module repeatedly executed at each policy step so that the decision process in a step is reflected as the fact of the conflict situation in the followed step.

![Figure 1. Concept of bowtie model in conflict management.](image-url)
The conflict related factors applied in this study are reconfigured from the aspect of airport development and operation in South Korea based on the PCF (Table 1). Such conflict factors can be extended according to the individual policy situation. While the damage caused by conflict can be assessed in various ways, this study adopted the PCF as the scale to assess the loss of the opportunity cost for the new airport projects in South Korea. We assumed that the decision-making based on the bowtie model (Figure 4) conforms to the ALARP (As Low As Reasonable Practical) principle.

**Development of conflict level diagnosis table and conflict level matrix**

We applied the scaled answers to the questions of the conflict level diagnosis table and allowed some answers in a narrative form. The conflict level diagnosis table summarized the number of survey questions, difficulties, sentence expression, and significance of answers by reflecting the feedback by survey subjects. It was linked with the concept of conflict factor presented in this study to apply it in the conflict level matrix, and the diagnosis table classified residents, civic groups, interest groups, local governments, media trends, and other issues based on basic questions and actors. We configured the questionnaire so that with the classifications the conflict factor presented in the previous section can be assessed.

A five-point Likert scale is applied to quantify the reflection. However, some items were difficult to answer or get the information in some steps of airport development and operation, and some items could not be answered due to the lack of interest, the limitation of collecting information, or intentional avoidance.

**Figure 2. Conflict management system structure.**

A five-point Likert scale is applied to quantify the reflection. However, some items were difficult to answer or get the information in some steps of airport development and operation, and some items could not be answered due to the lack of interest, the limitation of collecting information, or intentional avoidance.
Therefore, we added the selection for “Unknown” to the questionnaire answer options. Moreover, the survey subjects could provide an additional description in the answer for information out of the diagnosis table. The conflict level diagnosis table is organized of three steps and divided into six classifications and 35 sub-classifications with 76 survey questions (see Appendix A–E for details). The answers had the criteria of confirmation of unknown and a five-point Likert scale and configured to evaluate or explain related contents if the additional answers or scores were needed.

We converted the questions presented in the conflict level diagnosis table developed for the analysis of conflict situations into the possibility of conflict occurrence and the conflict severity so that they could be applied to the conflict level matrix. Each item is reflected in the possibility of conflict occurrence, conflict severity, or
Table 1. Decision framework and PCF reflection.

| PCF standard                        | Reflected (O/X) | Reason                        |
|-------------------------------------|-----------------|-------------------------------|
| Policy environment (policy setting) |                 |                               |
| Political system                    | X               | Out of scope                  |
| Policy subsystems                   | X               | Out of scope                  |
| Policy action situations            | O               | Reflected as the conflict situation |
| Attributes of levels                | O               | Reflected as the conflict situation |
| Policy actor (intrapersonal)        | O               | Reflection                    |
| Policy actor (interpersonal)        | O               | Reflection                    |
| Morality of policy issue            | O               | Reflection                    |
| Complexity of policy issue          | O               | Reflection                    |
| Proximity of important events       | O               | Reflection                    |
| Complexity of important events      | O               | Reflection                    |
| Characteristics of policy conflicts |                 |                               |
| Difference in the policy position   | O               | Reflection                    |
| Level of threat recognized          | X               | Follow-up study needed        |
| from the third party’s policy position |             |                               |
| Unwillingness to compromise         | O               | Reflection                    |
| Political strategy and tactics      | O               | Reflection                    |
| Feedback effects                    |                 |                               |
| Outputs                             | X               | Out of scope                  |
| Outcomes                            | X               | Out of scope                  |

Figure 4. Structure of bowtie model in conflict management.

both as applicable. If the answer was “Unknown,” we assumed that it increased the conflict level and conflict severity the most and assigned a six point. Since the possibility of the conflict spread is intuitive in the system’s classification system, there was no difficulty in selecting the items. For selecting the items for
the conflict severity, however, it was necessary to set the clear classification criteria, such as the link with the possibility of the conflict occurrence and diversity of analysis according to the conflict level. Finally, the conflict factors applied in this test are based on PCF. Therefore, we applied the concept of the conflict severity in the PCF theory, as shown in Figure 5.

A conflict matrix is created for each factor and aggregates all factors by integration. An example is multiple items for each factor in the conflict level diagnosis table. We applied the arithmetic average without weight factors for them. Although a geographic average or applying weight factors may be an option, we assumed the research scope to examine the suitability using a standard deviation. A follow-up study may examine the way to aggregate the results of each question or factor based on field cases using the conflict level diagnosis table developed in this study. The number of questions linked with the possibility of conflict occurrence is 45, and those related to the conflict severity is 40. The number of overlapped questions is 14 (see Appendix D for details). The questions related to the policy actor (intrapersonal) accounted for the most in the conflict level diagnosis table. The questions related to the policy issue (morality) and policy actor (interpersonal) accounted for the fewest for the possibility of policy occurrence and the conflict severity, respectively.

**Principle of decision-making on conflict**

For the decision-making of conflict management, we set four levels of “Not acceptable,” “Management needed,” “Establishment of measures,” and “Monitoring”
from the airport development and operation aspects (Table 2). “Not acceptable” means that the proactive intervention to conflict is necessary through the conflict impact analysis more urgent than the continued project execution or management in the current situation. “Management needed” means that the conflict management to mitigate conflict is necessary for the current situation, and “Establishment of measures” means that it is necessary to establish the plan to manage expected conflicts. Lastly, “Monitoring” means that although there are no apparent conflict factors, they must be continuously monitored. Note that it does not mean that conflict management is not necessary for the Establishment of measures and Monitoring levels and mean that preparation in advance is necessary before the conflict occurs or becomes serious.

Table 3 shows the results of applying the decision-making category to the conflict level matrix. Although we organized the survey questionnaire to obtain reasonable outcomes, the margin for it should be determined according to the applicable targets and purpose.

For the ALARP decision-making based on the conflict level matrix, it is necessary to quantify the damage caused by the conflict based on the conflict level matrix. We conducted CVM survey to estimate the opportunity cost of damage caused by conflict for new airports in Korea and derived WTP (Willingness to Pay) as the example case.

**Case study**

**Data**

We assumed all new airports were being developed in South Korea to be a virtual airport and applied the decision-making framework to enhance the transferability of the case application. The survey was conducted with 25 people in five groups, including conflict experts, business stakeholders, airport experts, and other stakeholders. Although we tried to balance the number of people for each group, we excluded the uniform answers during the survey or questions that did not show significant deviation within the factor for the final reflection. As expected at the
| Item                        | Conflict severity | 6 | 5 | 4 | 3 | 2 | 1 |
|-----------------------------|-------------------|---|---|---|---|---|---|
| Possibility of conflict occurrence | Not acceptable     | Not acceptable | Not acceptable | Not acceptable | Management needed | Management needed | Establishment of measures |
| 5                           | Not acceptable     | Not acceptable | Not acceptable | Management needed | Management needed | Establishment of measures |
| 4                           | Not acceptable     | Management needed | Management needed | Establishment of measures |
| 3                           | Not acceptable     | Management needed | Management needed | Establishment of measures |
| 2                           | Management needed  | Management needed | Establishment of measures |
| 1                           | Management needed  | Establishment of measures | Establishment of measures |

Table 3. Decision-making for measures applied to reduce conflict level.
beginning, the answers of four out of five business stakeholders and airport experts were significant, and only two general civilians gave significant answers.

**Analysis of the conflict level diagnosis table**

A high level of conflict on new airports development projects already have been in South Korea, and the group and the overall assessment confirmed the expectation. Table 4 shows the possibility of conflict occurrence for each conflict factor, and Figure 6 shows the result of answers by 16 samples to the possibility of the conflict occurrence. Assuming that the score of 6 points being the highest possibility, the score of all respondents for each factor ranged from 4.63 points to 5.31 points with the final average of 5.13 points. Although the difference was negligible, the general civilians answered the possibility of conflict occurrence to be high while the conflict expert group answered low.

The assessment results (Table 5 and Figure 7) show the conflict factor plays the biggest role for increasing the possibility of conflict occurrence for the studied groups was the difference in the policy position. On the other hand, the policy issue (morality) had the lowest impact. However, the policy issue (morality) has the largest standard deviation between groups of all factors as the respondents gave a wide range of answers. For conflict severity, all respondents showed a score range from 4.45 points to 5.78 points, with the final average of 5.13 points. Although the difference was negligible, the general civilians answered the conflict severity to be high while the conflict expert group answered low. The difference is attributed to the conflict expert group's being better aware of the conflict situations, as was the case for the possibility of conflict occurrence. However, the standard deviation was 0.37, and there was not much difference among the respondents.

Although there were some differences among the groups according to the assessment results, the conflict factor that increased the conflict severity of the subject airports the most was the policy actor (interpersonal). On the other hand, the policy issue (morality) had the lowest impact on increasing the possibility of conflict occurrence. For the differences among the answers, the political strategy and tactics showed the biggest standard deviation, indicating that there was a larger difference between the groups than other factors.

**Decision-making results and calculation of damage cost**

The results of the survey on decision-making (Table 6) showed that all respondents answered the current conflict level to be “Not acceptable” level except for the group 1 (conflict experts), group 2 (business stakeholders), and group 4 (other stakeholders) answered “Management needed” for the policy issue (morality). For the conflict level, this study estimated the willingness to pay through a sample survey (online survey) of 250 people in September 2019. We then applied KRW 9354 which was the estimated willingness to pay per household to the total number of
Table 4. Each group’s assessment of the possibility of conflict occurrence.

| Item                                         | All   | Conflict experts (Group 1) | Business stakeholders (Group 2) | Airport experts (Group 3) | Other stakeholders (Group 4) | General public (Group 5) | Standard deviation |
|----------------------------------------------|-------|---------------------------|--------------------------------|--------------------------|----------------------------|-------------------------|-------------------|
| Policy issues (morality)                     | 4.63  | 4.33                      | 4.50                           | 4.88                     | 4.33                       | 5.25                    | 0.82              |
| Policy issues (complexity)                   | 5.18  | 5.04                      | 4.69                           | 5.41                     | 5.42                       | 5.50                    | 0.67              |
| Difference in the policy position            | 5.31  | 5.11                      | 5.03                           | 5.67                     | 5.11                       | 5.72                    | 0.43              |
| Policy actor (intrapersonal)                 | 5.31  | 5.06                      | 5.33                           | 5.34                     | 5.30                       | 5.55                    | 0.35              |
| Policy actor (interpersonal)                 | 5.23  | 4.93                      | 5.50                           | 4.91                     | 5.47                       | 5.40                    | 0.68              |
| Political strategy and tactics               | 5.13  | 5.05                      | 5.14                           | 5.15                     | 5.00                       | 5.36                    | 0.75              |
| Unwillingness to compromise                  | 5.03  | 4.67                      | 5.00                           | 5.33                     | 5.22                       | 4.83                    | 0.69              |
| All                                          | 5.13  | 4.91                      | 5.01                           | 5.22                     | 5.21                       | 5.32                    | 0.40              |
households in South Korea to calculate the cost. As a result, the current social cost of the conflict was KRW 191.6 billion.

**Example of policy countermeasures to decision-making**

We applied the decision making framework for conflict management of new airport projects in South Korea. We then applied the policy alternatives that were produced based on reviewing the decision making process and result based on the decision making framework and Figure 8 shows the results of the conflict situation analysis concerning the analyzed situations.

We suggested different alternative plans for each factor as the countermeasure. For the policy actors, we reflected proactive intervention by conflict experts as the alternative. The alternative makes sure that the conflict experts who have an accurate judgment of the conflict situation to play the role of an intermediary and negotiator. For the policy issues, the problem is that there is no established direction. It also requires the effort to lower the complexity of policy issues by stakeholders during negotiations. For the differences in the policy positions, credible airport experts should play a role in resolving the differences. They need to be actively involved in mitigating the perception that the experts’ judgment is not shared or neutral.

For the unwillingness to compromise, it is necessary to have the legal validity of the procedure as the appropriate measures to resolve the conflicts in the current situation. For the political strategy and tactics, it is necessary to implement the routine information dissemination system to prevent the spread of biased information. We consider that the authorized public conflict management organization should have an active role in the overall management aspect of mitigating the conflict factors. There should be a social consensus on the importance of the conflict management organization and studies on conflict management.
| Respondents                     | All   | Conflict experts (Group 1) | Business stakeholders (Group 2) | Airport experts (Group 3) | Other stakeholders (Group 4) | General public (Group 5) | Standard deviation |
|--------------------------------|-------|---------------------------|--------------------------------|--------------------------|-----------------------------|---------------------------|-------------------|
| Policy issues (morality)       | 4.45  | 3.83                      | 4.50                           | 4.65                     | 4.33                        | 5.00                      | 0.71              |
| Policy issues (complexity)     | 5.48  | 5.08                      | 5.44                           | 5.75                     | 5.50                        | 5.63                      | 0.44              |
| Difference in the policy position | 5.12 | 4.87                      | 5.05                           | 5.10                     | 4.95                        | 5.80                      | 0.38              |
| Policy actor (intrapersonal)   | 5.28  | 5.09                      | 5.20                           | 5.28                     | 5.21                        | 5.73                      | 0.38              |
| Policy actor (interpersonal)   | 5.78  | 6.00                      | 5.75                           | 5.33                     | 6.00                        | 6.00                      | 0.67              |
| Political strategy and tactics | 5.33  | 5.00                      | 5.72                           | 5.00                     | 5.58                        | 5.31                      | 0.81              |
| Unwillingness to compromise    | 5.01  | 4.80                      | 5.10                           | 5.05                     | 5.00                        | 5.10                      | 0.59              |
| All                            | 5.13  | 4.85                      | 5.17                           | 5.09                     | 5.23                        | 5.34                      | 0.37              |
Moreover, it is necessary to implement compensation measures to eventually reduce the social conflict cost through active conflict management even when the possibility of conflict occurrence and the conflict severity are mitigated and when an irresistible conflict occurs. Figure 9 shows the analysis results of the decision-making framework for conflict management after applying the alternatives. The survey results of the same group show that by a level after changing the risk matrix, lowering the conflict level would have an effect of lowering the social conflict cost by KRW 28.8 billion.

Figure 7. Assessment of conflict severity.

Figure 8. Results of conflict management system before applying the conflict management.

Moreover, it is necessary to implement compensation measures to eventually reduce the social conflict cost through active conflict management even when the possibility of conflict occurrence and the conflict severity are mitigated and when an irresistible conflict occurs. Figure 9 shows the analysis results of the decision-making framework for conflict management after applying the alternatives. The survey results of the same group show that by a level after changing the risk matrix, lowering the conflict level would have an effect of lowering the social conflict cost by KRW 28.8 billion.
| Respondents | All | Group 1 (conflict experts) | Group 2 (business stakeholders) | Group 3 (airport experts) | Group 4 (other stakeholders) | Group 5 (general public) |
|-------------|-----|----------------------------|-------------------------------|---------------------------|-----------------------------|--------------------------|
| Policy issue (morality) | Not acceptable | Management needed | Management needed | Not acceptable | Management needed | Not acceptable |
| Policy issue (complexity) | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable |
| Difference in the policy position | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable |
| Policy actor (intrapersonal) | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable |
| Policy actor (interpersonal) | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable |
| Political strategy and tactics | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable |
| Unwillingness to compromise | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable |
| All | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable |
| Total cost | KRW 191.6 billion | Not acceptable | Not acceptable | Not acceptable | Not acceptable | Not acceptable |
We simulated the answers to each individual item of the conflict level diagnosis table and reviewed the sensitivity and significance of the methodology to validate the developed conflict management system. The validation included the analysis of whether the surveyed case analysis of the random answers produced discriminatory results and which decision-making changes were resulted when the judgment by the individual respondent was reflected within the scope to the deduced conflict level diagnosis table. Specifically, we analyzed the possibility and severity using a uniform distribution scenario with 1 and 6 points as the lower and upper limits and a triangular distribution scenario with 1 and 6 as the lower and upper limits and the answer by each respondent as the median value. We conducted 1000 simulations based on the random Latin hypercube sampling methodology and the minimal standard random generator for each normal distribution scenario.

The median values of the simulation results (Tables 7 and 8) were 4 for both possibility and severity for the uniform distribution scenario as expected. Thus we judged that there was no bias of the simulation. In the case of the triangular distribution scenario, the average conflict management level was equal to or less than “Not acceptable” except for one individual respondent. We consider that it should conform to the purpose of the conflict management system with the characteristics of primary diagnosis before detailed analysis and response, such as conflict impact analysis. The groups’ simulation results show that the median or average values are consistent with the individual answers. We consider that the results are indirect evidence that the conflict level diagnosis table of each group.

**Discussion**

We assumed policies from a system perspective and presupposed conflicts as the management targets for the system operation. We suggested a decision-making
Table 7. Median values of simulation for each group.

| Item                  | Conflict experts | Business stakeholders | Airport experts | Other stakeholders | General public |
|-----------------------|------------------|-----------------------|----------------|-------------------|----------------|
| Possibility           | 4.99             | 5.08                  | 5.33           | 5.21              | 5.47           |
| Severity              | 4.94             | 5.27                  | 5.20           | 5.23              | 5.51           |
| Decision making       | Not acceptable   | Not acceptable        | Not acceptable | Not acceptable    | Not acceptable |
| Possibility_Useful    | 4                | 4                     | 4              | 4                 | 4              |
| Severity_Useful       | 4                | 4                     | 4              | 4                 | 4              |
| Decision-making_Useful| Management needed| Management needed     | Management needed | Management needed | Management needed |
| Possibility_Severe    | 4.11             | 4.16                  | 4.26           | 4.20              | 4.31           |
| Severity_Severe       | 4.09             | 4.23                  | 4.20           | 4.21              | 4.33           |
| Decision-making_Severe| Management needed| Management needed     | Management needed | Management needed | Management needed |

Table 8. Median values by simulation of each scenario.

| Item                  | Conflict experts | Business stakeholders | Airport experts | Other stakeholders | General public |
|-----------------------|------------------|-----------------------|----------------|-------------------|----------------|
| Possibility           | 4.99             | 5.08                  | 5.33           | 5.21              | 5.47           |
| Severity              | 4.94             | 5.27                  | 5.20           | 5.23              | 5.51           |
| Decision making       | Not acceptable   | Not acceptable        | Not acceptable | Not acceptable    | Not acceptable |
| Possibility_Useful    | 3.50             | 3.50                  | 3.50           | 3.50              | 3.50           |
| Severity_Useful       | 3.50             | 3.50                  | 3.50           | 3.50              | 3.50           |
| Decision-making_Useful| Management needed| Management needed     | Management needed | Management needed | Management needed |
| Possibility_Severe    | 4.00             | 4.03                  | 4.11           | 4.07              | 4.16           |
| Severity_Severe       | 3.98             | 4.09                  | 4.07           | 4.08              | 4.17           |
| Decision-making_Severe| Management needed| Management needed     | Management needed | Management needed | Management needed |
framework based on the analysis of conflict in terms of the possibility of occurrence and the severity and assessment with a two-dimensional matrix. As the conflict level related to new airports is high in South Korea, the result of aggregated case analysis showed the possibility of conflict occurrence and the severity to be high, confirming the consistency with the expected direction.

The decision-making framework enabled the analysis in a three-dimensional structure for the possibility of conflict occurrence, severity, conflict factors, such as the policy issues and differences in the policy positions, and the judgment by various stakeholder groups. In the case of new airports in South Korea, the groups similarly agreed that the additional conflicts were possible even though they recognized that there were already serious conflicts. We consider it is as such because the new airport projects are in the pre-initiation phase, and opposition to the projects is high. All groups assessed that the conflicts concerning the new airports in South Korea would intensify rather than becoming resolved.

Moreover, the possibility of conflict occurrence and the conflict severity was the most serious from the perspective of the policy actor attribute. It is because the central government, local government, and environmental groups were regarded as the parties involved in the conflicts, and public attention waned as the conflict prolonged. The respondents regarded the conflicts to be the problem of complexity rather than morality because airport development was not the value issue of right or wrong. However, the complicated problem intertwined stakeholders and conflict structure to the conflict situation. However, the problem regarding new airports in South Korea is a serious conflict problem, and the survey showed that the possibility of conflict occurrence and the conflict severity was not low for all conflict factors.

The survey showed that the conflict expert group and the general public group had the largest difference of opinion in the assessment. Although there were some differences between the business stakeholders, airport experts, and other stakeholders, who all could be regarded as stakeholders, generally had a similar assessment of the conflict situation with the conflict experts within the stakeholders’ assessment range. The conflict expert group assessed the possibility of conflict occurrence and severity to be lower than the general public did. We deem it as such because while the conflict expert group could experience various conflict situations and approach them objectively, the general public’s perception is influenced by personally assessed information through news or social media.

The groups had the consensus that the conflicts represented a serious situation but showed structural differences among the stakeholder groups in the possibility of conflict occurrence, the conflict severity, and the cause of conflict. The framework proposed by this study reflects such structural differences for decision-making on conflict management. Moreover, it facilitates rational decision-making based on the ALARP principle after the conflict diagnosis reflecting the structural differences. We suggested the optimal alternative that could reduce the social cost loss of KRW 28.8 billion each year for the case of airports in South Korea.

The outcomes of the developed framework in this study can enable the conflict structural analysis linked with the PCF. Moreover, the conflict level diagnosis table
that is part of the framework can be the basis for a theoretical analysis of various conflict structures, such as ACF. It is validated that the framework is academically significant in that it is the platform that the qualitative studies related to conflict can utilize.

In terms of potential validation of the proposed framework, we suggest two tests such as cross-section and longitudinal profile analysis. For example, cross-section study investigates standard deviation of survey between each response to validate the model result. Then longitudinal profile review examines availability of the developed model through linking and comparing the present decision result with the previous ones respectively and successively. Based on our framework, we expect more studies could adopt various methodologies for the potential validation.

We enhance sustainability, objectivity, practicality compared to conventional methodologies. The proposed framework introduces the concept of whole policy life cycle conflict management. Conventional frameworks for public policy conflict management mainly focuses on not whole policy life but target situation and use previous limited information even though it might be crucial. The developed framework adopts the procedure management technique from the system perspective and tries to overcome the strong dependency on expert capacity, relevant case, available resource, and so on, which is limit of conventional technique. We also make the proposed framework result understandable more clearly and intuitively than previous methods. Though it is composed of several steps, it directly shows results in terms of decision-making based on quantitative analysis.

When limited data is available, the effectiveness of the proposed method would be less effective. In order to compensate that limit, we include “Unknown” to answer items of the survey and assume that “Unknown” answers are considered as the negative direction in the diagnosis table. Moreover, as the target policy proceeds, we are able to gather and investigate unknown data and the framework becomes to be more validated and effective with data supplement. That is because we suggested the continuous upgraded method through whole policy life cycle. We also suggest that method users would keep the record on the lack of data together with the analysis result for the next policy step.

Conclusion

The decision making framework for conflict management suggested in this study is significant in that it is a guiding study for the methodology for a scientific approach from the policy consistency perspective that attracted little attention in conflict management. We could present a new alternative for conflict management using it, and applying it for the cases of new airport projects with serious conflicts in South Korea showed that it was useful from a systematic viewpoint.

The developed framework was the primary diagnostic tool for conflict management and can be highly useful and flexible as the local solution is based on the individual urban development policy. A wide range of stakeholders can utilize the implemented framework, and the detailed methodology and criteria of the
framework are modularized and thus can be configured differently. It has another advantage that outcomes of the application to the individual case can be provided as feedback to the framework.

We expect that legal and regulatory measures and public consensus on the scientific conflict management approach are established to facilitate the consistent policy life cycle management of conflict level in the infrastructure policy, which is the goal of the decision making system suggested in this study. It is necessary to further discuss the need for the decision making system for conflict management from the policy implementation viewpoint, and it should be applied in the field and facilitate feedback. It would ensure continuous conflict management to identify and respond to potential conflicts in advance and minimize unnecessary social costs.

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## Appendix A

Table 9. Overview of conflict level diagnosis table.

| Classification   | Sub-classification                                                                 | Number of questions |
|------------------|-------------------------------------------------------------------------------------|---------------------|
| 1                | Basic question                                                                      |                     |
|                  | 1-1 When did the conflict occur?                                                    | 1                   |
|                  | 1-2 What is the current stage of project execution?                                 | 1                   |
|                  | 1-3 What is the current stage of the conflict?                                       | 1                   |
|                  | 1-4 Have you met the involved organization? If so, how many times have you met with the organization? | 1                   |
|                  | 1-5 Whom did you mostly meet?                                                       | 1                   |
|                  | 1-6 Do you know related experts who can help the project? Who are they?             | 1                   |
|                  | 1-7 Are the stakeholders between government agencies cooperating well?               | 1                   |
|                  | 1-8 Do you know of the existence of internal operating regulation or meeting regulation? | 1                   |
|                  | 1-9 Are you aware of what each organization claims?                                  | 1                   |
| 2                | Residents, civic groups, interest groups, etc.                                       |                     |
|                  | 2-1 Existence of local community groups claiming to be related parties               | 2                   |
|                  | 2-2 Structural analysis of each organization                                          | 12                  |
|                  | 2-3 Awareness of the conflict of each organization                                   | 5                   |
|                  | 2-4 Analysis of act frequency and type of each organization                          | 12                  |
| 3                | Local government                                                                     |                     |
|                  | 3-1 Do you know of the number of related local governments (basic and metropolitan)?| 1                   |
|                  | 3-2 Do you know of the position and requirements of the local government?            | 1                   |
|                  | 3-3 Association or confrontation of local governments                                | 1                   |
|                  | 3-4 Frequency and type of local government’s behaviors                                | 5                   |

(continued)
| Classification | Sub-classification | Number of questions |
|----------------|--------------------|----------------------|
| 4 Political sector | 4-1 Are there any related politicians? | 1 |
|                 | 4-2 Is there a position or requirement of each politician? | 1 |
|                 | 4-3 Is there an association or confrontation of politicians? | 1 |
|                 | 4-4 Do you know of the frequency and type of politician’s behavior? | 7 |
| 5 Media trend   | 5-1 Are you aware of whether the issue is exposed to online media or social media? | 1 |
|                 | 5-2 Was there exposure to media? | 5 |
| zz Other issues | zz-1 What is the official project completion date, and is there a possibility of its extension? | 1 |
|                 | zz-2 Is there an information gap between stakeholders? | 1 |
|                 | zz-3 Was there outside pressure for a resolution of the problem? | 1 |
|                 | zz-4 Are you aware of any potential stakeholders? | 1 |
|                 | zz-5 Are you aware of local successful or failed cases of similar projects? | 1 |
|                 | zz-6 Was there a change in the plan of similar projects? | 1 |
|                 | zz-7 Is there a possibility of reviewing the project from the root of the project owner’s perspective? | 1 |
|                 | zz-8 Was there an information disclosure procedure, such as public hearing and discussion meetings conducted by the project owner? How many times? | 1 |
|                 | zz-9 Is there the accumulated time series data for the project owner’s internal projects? | 1 |
|                 | zz-10 Are you aware of the frequency of changes and the average number of years of the project officer at the project owner? | 1 |
|                 | zz-11 Was there intervention by a third party such as the conflict expert (intermittent intervention, case-by-case intervention, long-term intervention, etc.)? | 1 |
|                 | zz-12 Are you aware of the remaining days until an election at this point? | 1 |
### Appendix B

**Table 10.** Linking of items in diagnosis table and conflict factors.

| Item                                                      | Items in the diagnosis table |
|-----------------------------------------------------------|-------------------------------|
| Description of the conflict situations                   | 1-1, 1-2, 1-3, 1-4, 1-5       |
| Policy actor (intrapersonal)                              | 1-6, 1-8, 1-9, 2-1-1, 2-2-1~2-2-9, 2-3-1, 3-1, zz-5, zz-9~11 |
| Policy actor (interpersonal)                              | 1-7, 2-2-10, 2-2-11, 2-4-2, 2-4-3, 4-1, zz-2 |
| Policy issue (morality)                                   | 2-1-2, 2-3-3, 3-4-1, 4-2,     |
| Policy issue (complexity)                                 | 2-2-12, 2-3-2, 3-4-2, 4-4-4, 5-2-1, 5-2-5, zz-1, zz-4, zz-6 |
| Difference in the policy positions                        | 2-3-5, 2-4-1, 2-4-10, 3-2, 3-3, 3-4-5, 4-4-1~3, 4-4-7, 5-2-2~4, zz-8 |
| Unwillingness to compromise                               | 2-3-4, 2-4-11, 3-4-3, zz-3, zz-7 |
| Political strategy and tactics                            | 2-4-4~2-4-9, 2-4-12, 3-4-4, 4-3, 4-4-5, 4-4-6, 5-1, zz-12 |

### Appendix C

**Table 11.** Number of questions in the conflict level diagnosis table applicable to the conflict matrix.

| Item                        | Possibility of conflict occurrence | Conflict severity | Simultaneous reflection |
|-----------------------------|-----------------------------------|-------------------|-------------------------|
| Policy issue (morality)     | 2                                 | 4                 | 2                       |
| Policy issue (complexity)   | 8                                 | 4                 | 3                       |
| Difference in the policy positions | 9                                 | 5                 | 1                       |
| Policy actor (intrapersonal)| 11                                | 11                | 3                       |
| Policy actor (interpersonal)| 5                                 | 3                 | 1                       |
| Political strategy and tactics | 7                                 | 8                 | 2                       |
| Unwillingness to compromise | 3                                 | 5                 | 2                       |
| Grand total                 | 45                                | 40                | 14                      |
### Appendix D

**Table 12.** Linking of conflict level diagnosis table with the conflict matrix.

| Classification | Sub-classification | Minor classification | PCF | Possibility | Severity |
|----------------|--------------------|----------------------|-----|-------------|----------|
| 1              | 6                  | –                    | Policy actor (intrapersonal) | Not applicable | Applicable |
| 1              | 7                  | –                    | Policy actor (interpersonal) | Not applicable | Applicable |
| 1              | 8                  | –                    | Policy actor (intrapersonal) | Not applicable | Applicable |
| 1              | 9                  | –                    | Policy actor (intrapersonal) | Applicable | Not applicable |
| 2              | 1                  | 1                    | Policy actor (intrapersonal) | Not applicable | Applicable |
| 2              | 1                  | 2                    | Policy issue (morality) | Not applicable | Applicable |
| 2              | 2                  | 1                    | Policy actor (intrapersonal) | Applicable | Not applicable |
| 2              | 2                  | 2                    | Policy actor (intrapersonal) | Applicable | Not applicable |
| 2              | 2                  | 3                    | Policy actor (intrapersonal) | Applicable | Not applicable |
| 2              | 2                  | 4                    | Policy actor (intrapersonal) | Applicable | Not applicable |
| 2              | 2                  | 5                    | Policy actor (intrapersonal) | Applicable | Not applicable |
| 2              | 2                  | 6                    | Policy actor (intrapersonal) | Applicable | Not applicable |
| 2              | 2                  | 7                    | Policy actor (intrapersonal) | Applicable | Not applicable |
| 2              | 2                  | 8                    | Policy actor (intrapersonal) | Applicable | Applicable |
| 2              | 2                  | 9                    | Policy actor (intrapersonal) | Not applicable | Applicable |
| 2              | 2                  | 10                   | Policy actor (interpersonal) | Applicable | Applicable |
| 2              | 2                  | 11                   | Policy actor (interpersonal) | Not applicable | Applicable |
| 2              | 2                  | 12                   | Policy issue (complexity) | Not applicable | Applicable |
| 2              | 3                  | 1                    | Policy actor (intrapersonal) | Applicable | Applicable |
| 2              | 3                  | 2                    | Policy issue (complexity) | Applicable | Applicable |
| 2              | 3                  | 3                    | Policy issue (morality) | Not applicable | Applicable |
| 2              | 3                  | 4                    | Unwillingness to compromise | Not applicable | Applicable |
| 2              | 3                  | 5                    | Unwillingness to compromise | Applicable | Not applicable |
| 2              | 4                  | 1                    | Difference in the policy position | Applicable | Not applicable |
| 2              | 4                  | 2                    | Policy actor (interpersonal) | Applicable | Not applicable |
| 2              | 4                  | 3                    | Policy actor (interpersonal) | Applicable | Not applicable |
| 2              | 4                  | 4                    | Political strategy and tactics | Applicable | Applicable |
| Classification | Sub-classification | Minor classification | PCF                  | Possibility       | Severity       |
|----------------|--------------------|----------------------|----------------------|-------------------|----------------|
| 2              | 4                  | 5                    | Political strategy and tactics | Not applicable   | Applicable     |
| 2              | 4                  | 6                    | Political strategy and tactics | Not applicable   | Applicable     |
| 2              | 4                  | 7                    | Political strategy and tactics | Not applicable   | Applicable     |
| 2              | 4                  | 8                    | Political strategy and tactics | Not applicable   | Applicable     |
| 2              | 4                  | 9                    | Difference in the policy position | Not applicable   | Not applicable |
| 2              | 4                  | 10                   | Difference in the policy position | Not applicable   | Applicable     |
| 2              | 4                  | 11                   | Unwillingness to compromise | Applicable       | Applicable     |
| 2              | 4                  | 12                   | Political strategy and tactics | Applicable       | Applicable     |
| 3              | 1                  | –                    | Policy actor (intrapersonal) | Applicable       | Not applicable |
| 3              | 2                  | –                    | Difference in the policy position | Applicable       | Applicable     |
| 3              | 3                  | –                    | Difference in the policy position | Not applicable   | Applicable     |
| 3              | 4                  | 1                    | Policy issue (morality)      | Applicable       | Applicable     |
| 3              | 4                  | 2                    | Policy issue (complexity)     | Applicable       | Applicable     |
| 3              | 4                  | 3                    | Unwillingness to compromise  | Not applicable   | Applicable     |
| 3              | 4                  | 4                    | Political strategy and tactics | Applicable       | Not applicable |
| 3              | 4                  | 5                    | Difference in the policy position | Not applicable   | Applicable     |
| 4              | 1                  | –                    | Policy actor (interpersonal) | Applicable       | Not applicable |
| 4              | 2                  | –                    | Policy issue (morality)      | Applicable       | Applicable     |
| 4              | 3                  | –                    | Political strategy and tactics | Not applicable   | Applicable     |
| 4              | 4                  | 1                    | Difference in the policy position | Applicable       | Not applicable |
| 4              | 4                  | 2                    | Difference in the policy position | Applicable       | Not applicable |
| 4              | 4                  | 3                    | Difference in the policy position | Applicable       | Not applicable |
| 4              | 4                  | 4                    | Policy issue (complexity)     | Applicable       | Applicable     |
| 4              | 4                  | 5                    | Political strategy and tactics | Not applicable   | Applicable     |
| 4              | 4                  | 6                    | Political strategy and tactics | Applicable       | Not applicable |
| 4              | 4                  | 7                    | Difference in the policy position | Not applicable   | Applicable     |
| 5              | 1                  | –                    | Political strategy and tactics | Applicable       | Not applicable |
| 5              | 2                  | 1                    | Policy issue (complexity)     | Applicable       | Not applicable |

(continued)
| Classification | Sub-classification | Minor classification | PCF                        | Possibility    | Severity          |
|----------------|--------------------|----------------------|----------------------------|----------------|-------------------|
| 5              | 2                  | 2                    | Difference in the policy position | Applicable    | Not applicable    |
| 5              | 2                  | 3                    | Difference in the policy position | Applicable    | Not applicable    |
| 5              | 2                  | 4                    | Difference in the policy position | Applicable    | Not applicable    |
| 5              | 2                  | 5                    | Policy issue (complexity)    | Applicable    | Not applicable    |
| zz             | 1                  | –                    | Policy issue (complexity)    | Applicable    | Not applicable    |
| zz             | 2                  | –                    | Policy actor (interpersonal) | Applicable    | Not applicable    |
| zz             | 3                  | –                    | Unwillingness to compromise  | Not applicable| Applicable        |
| zz             | 4                  | –                    | Policy issue (complexity)    | Applicable    | Not applicable    |
| zz             | 5                  | –                    | Policy actor (intrapersonal) | Not applicable| Applicable        |
| zz             | 6                  | –                    | Policy issue (complexity)    | Applicable    | Not applicable    |
| zz             | 7                  | –                    | Unwillingness to compromise  | Applicable    | Not applicable    |
| zz             | 8                  | –                    | Difference in the policy position | Applicable    | Not applicable    |
| zz             | 9                  | –                    | Policy actor (intrapersonal) | Not applicable| Applicable        |
| zz             | 10                 | –                    | Policy actor (intrapersonal) | Applicable    | Not applicable    |
| zz             | 11                 | –                    | Policy actor (intrapersonal) | Applicable    | Applicable        |
| zz             | 12                 | –                    | Political strategy and tactics | Applicable    | Not applicable    |
## Appendix E

Table 13. Median values by simulation of each scenario.

| Individual respondents | Possibility | Severity | Decision making | Possibility | Severity | Decision making | Possibility severe | Severity severe | Decision making severe |
|------------------------|-------------|----------|-----------------|-------------|----------|-----------------|-------------------|-------------------|------------------------|
|                        |             |          |                 |             |          |                 |                   |                   |                         |
| 1                      | 5.49        | 5.46     | Not acceptable  | 4           | 4        | Management needed | 4.32              | 4.31              | Management needed     |
| 2                      | 5.04        | 5.03     | Not acceptable  | 4           | 4        | Management needed | 4.13              | 4.12              | Management needed     |
| 3                      | 5.64        | 5.23     | Not acceptable  | 4           | 4        | Management needed | 4.39              | 4.22              | Management needed     |
| 4                      | 5.18        | 5.20     | Not acceptable  | 4           | 4        | Management needed | 4.20              | 4.20              | Management needed     |
| 5                      | 5.02        | 5.15     | Not acceptable  | 4           | 4        | Management needed | 4.13              | 4.18              | Management needed     |
| 6                      | 4.82        | 4.98     | Not acceptable  | 4           | 4        | Management needed | 4.04              | 4.11              | Management needed     |
| 7                      | 5.07        | 5.33     | Not acceptable  | 4           | 4        | Management needed | 4.15              | 4.26              | Management needed     |
| 8                      | 5.42        | 5.63     | Not acceptable  | 4           | 4        | Management needed | 4.30              | 4.38              | Management needed     |
| 9                      | 5.82        | 5.95     | Not acceptable  | 4           | 4        | Management needed | 4.46              | 4.52              | Not acceptable        |
| 10                     | 4.40        | 4.44     | Management Needed | 4           | 4        | Management needed | 3.86              | 3.88              | Management needed     |
| 11                     | 5.47        | 5.18     | Not acceptable  | 4           | 4        | Management needed | 4.31              | 4.19              | Management needed     |
| 12                     | 4.96        | 5.03     | Not acceptable  | 4           | 4        | Management needed | 4.10              | 4.13              | Management needed     |
| 13                     | 5.73        | 5.85     | Not acceptable  | 4           | 4        | Management needed | 4.42              | 4.47              | Management needed     |
| 14                     | 5.20        | 5.18     | Not acceptable  | 4           | 4        | Management needed | 4.20              | 4.19              | Management needed     |
| 15                     | 4.29        | 4.41     | Management Needed | 4           | 4        | Management needed | 3.81              | 3.86              | Management needed     |
| 16                     | 5.64        | 5.38     | Not acceptable  | 4           | 4        | Management needed | 4.39              | 4.28              | Management needed     |
**Author biographies**

Ki Han Song joined Korea Transport Institute in 2009 and currently he is a research fellow and chief director of the department of aviation. He fulfilled the role as the director of division for aviation policy & information analysis and Center for Airport and Aircraft Noise & Environment by 2016. He graduated from Seoul National University in 2000, granted a degree of PhD, School of Civil, Urban and Geo-system Engineering in 2007. He achieved the Engineer Information Processing License in 1999 and the Professional Engineer Transportation License in 2008. Currently, he is conducting various researches related to transportation engineering.

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