Problem structuring in transport planning: Cognitive mapping approach

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Abstract:
In this paper, we propose a method to analyze the problem perceptions of stakeholders and the structuring of these problems by using their cognitive maps. Here, we provide two case studies. These case studies reveal the effectiveness of the proposed method. The first case study shows that the successful generation of a potential agenda is possible. We also compare the stakeholders’ recognitions by means of an analysis of the problem perceptions of the stakeholders. Additionally, we analyze the interactions among the stakeholders by using a reciprocal expectation matrix. The second case study shows that this method is applicable even to disputes within local transport planning with regard to the introduction of a light rail transit system.

Key words: transdisciplinary research, problem structuring method, transport planning, cognitive map, and potential agenda abstraction
1. Introduction

Transport is one of the most critical factors influencing global and local sustainability. Recently, the importance of interactions between transport planning and other policy/planning often have been highlighted for sustainable transport planning. For example, transport planning must be considered as a part of the land-use planning and development process, which requires an integrated approach toward the analysis (Banister, 2000, 2002; Goodwin et al., 1991). On the basis of this understanding, several recent publications have investigated various approaches on transport planning, including the proposal of new planning processes and new technical tools for transport planning (for example, Kane and Del Mistro, 2003; Loukopoupos and Scholz, 2004; Zegras et al., 2004; Walter and Scholz, 2007). Most of the transport researchers consider transport planning to be a public matter. Transport planning requires multiple participants to cooperate and contribute to the planning process, where a transport planner should understand their interactions (Wachs, 1995; Szyliowicz and Goets, 1995). Extensive interactions among the participants are advantageous to transport planning. Most of the transport researchers also agree to the fact that the transport system is enormous and diverse. The system includes economic, social, environmental, and technological subsystems. Transport planning should be inherently complex, and “problems” can be abstracted from this complex characteristic (Linstone, 1984). Further, it is considered that the complexity of the issues regarding transport systems requires a new planning methodology (for example, Banister, 2003; Szyliowicz, 2003). The new methodology may include (1) the establishment of a vision, (2) understanding the types of decisions, (3) assessing the opportunities and limitations, (4) identifying the near- and long-term consequences, (5) relating alternative decisions to the goals, and (6) providing the information to decision makers and assisting them to establish priorities (Meyer and Miller, 2001). The present study is also one such research that proposes a new method, focusing particularly on problem identification and problem structuring in transport planning.

During the past decade, the definition of transport problems has changed as the problems associated with energy consumption, air quality, equity, safety, congestion, land-use impact, noise, and a further efficient utilization of fiscal resources in urban areas (Meyer and Miller, 2001, p.75). However, these problems may not be completely shared by the people. The problems may be recognized by various participants in a different manner. Recent studies suggest that the individuals’ decision often depends on the decision-making context, which is sometimes referred to as a framing effect (Tversky and Kahneman, 1981; 1986). The framing effect can also be observed in transport planning, particularly in the problem identification process. In order to identify transport problems, a transport planner should understand the multiple participants’ problem identification or perceptions with regard to the transport system as accurately as possible. Additionally, they should analyze the problem structure from a multidisciplinary viewpoint. When more participants are involved in the transport system, their perceptions of problem identification become more difficult to comprehend. The inaccurate speculation and misunderstanding of a participant’s problem perception may lead to a deadlock in building a consensus. A well-designed and sophisticated method for understanding the participant’s problem perception and its feedback to the stakeholders may strongly contribute to better planning and management of the transport system.

Several studies have considered problem identification and problem structuring methods. They can be categorized into the following two types: (1) soft operational researches and (2) transdisciplinary researches. The former, which studies the problem structuring method, includes studies by Ackoff (1979), Checkland (1983), Eden and
Ackermann (2001), Friend (1987), Mason and Mitroff (1981), and Howard (1993). The latter includes studies by Hansmann et al. (2003), Loukopoupos and Scholz (2004), and Scholz et al. (2006). A series of transdisciplinary researches has been referred to as an “embedded case study” (Scholz and Tietje, 2002). The total framework of our case study is very similar to the embedded case study approach. The similarity can be observed in the analysis process and collaborative methods. With regard to the problem structuring method, the method proposed in this study may be the most similar to the approach of Eden and Ackermann (2001). They propose a strategic option development analysis (SODA). Here, they interviewed stakeholders to sketch their cognitive maps. Then, they integrate the maps into a comprehensive problem map to understand the overall problem structure. Although the cognitive map approach is useful to understand the interviewee’s perception, the completion of the maps generally requires a long time and incurs enormous costs. In addition, the simple integration of different maps does not reflect the interactions among the stakeholders. In this study, the proposed method improves the problem structuring method in SODA by reducing the cognitive-mapping requirements and highlighting the interactions among the stakeholders.

This study aims to propose a practical method of problem identification and structuring for transport planning. We present two example cases. Our method is applied to (1) the strategic regional transport planning and (2) local transport planning in the Kanto region, Japan. This paper is organized as follows. Section 1 discusses the study background and its goals. Section 2 overviews the method proposed in this paper and its characteristics are described. Sections 3 and 4 present the first and second case studies, respectively. Finally, Section 5 abstracts the results and discusses future research objectives.

2. Proposed method and its characteristics

2.1 Method description

In general, decisions are made and policies are formulated in response to the perceived differences between the desired state of affairs and the decision-maker’s perception and/or interpretation of the actual situation (Meyer and Miller, 2001). In this study, the proposed problem structuring method considers the participant’s perception of the transport problem. The principal goal of our method is to abstract the potential policy agenda by understanding the problem perception of the stakeholders. An overview of our method can be described as follows:

First, we select the stakeholders in relation to the problem. A “stakeholder” is defined as a participant who can influence or be influenced by the corresponding transport problem. The manner in which a stakeholder is selected depends on the data availability. In the first case study, we utilize problem system maps corresponding with the policy targets in order to list the stakeholder candidates. This is because we were able to derive the system maps from the potential policy targets defined by the respective authorities. Such data was not available in the second case. Therefore, the local university professors provided their recommendations for selecting the potential stakeholders.

Second, we sequentially interviewed the potential stakeholders in order to comprehend their problem perceptions. We sketch hypothetical cognitive maps by collating their profiles via literature surveys or Web searches. The map contains the following three types of items: (1) non-highlighted items, which represent causal factors influencing other factors and/or result factors influenced by other factors; (2) oval symbols, which denote exogenous factors or factors that the stakeholder expects the other stakeholders to perform; and (3) square boxes, which represent the values required by the stakeholder. The arc connecting the items denotes a causal flow, which begins from a
causal factor and terminates at its result factor. We interviewed the stakeholders with their hypothetical maps. In the interviews, we requested the interviewees to reveal their behavioral targets, constraints, and expectations with the other stakeholders. On an average, each interview took around two hours; after explaining the aim of our research, the interviewers requested the interviewees to freely respond about the hypothetical maps. In most of the cases, two or three people were interviewed: most of these people were chief executives or officials responsible of managing their organizations. The interviewers consist of a study team from the University of Tokyo including us.

Third, the cognitive maps are revised on the basis of the interview results. We delete the incorrect or less important factors or actions from the hypothetical map and insert additional factors or actions, if necessary. Finally, the maps reveal the following three perceptions of the stakeholders: (1) causal flows in relation to the problem, (2) impact flows in relation to the stakeholder’s current actions, and (3) interactions with the other stakeholders.

Fourth, we integrate the stakeholder’s cognitive maps into a unified structure of transport problems. We collect the potential problems pointed out during the interviews with the stakeholders. In order to abstract the main factors, we discuss these problems in a

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**FIGURE 1: The proposed transdisciplinary problem structuring method proposed**

1. **Selection of stakeholders**
   - The potential stakeholders are selected from a set of participants in relation to the problems.
   - The potential policy targets presented by the authority or information obtained from local university professors is used for stakeholder selection.

2. **Interviews with the stakeholders**
   - Hypothetical maps of the stakeholders are formulated via literature surveys or Web searches.
   - The hypothetical map is sent to the interviewees in advance.
   - The study team members sequentially interview the potential stakeholders.

3. **Cognitive map modification**
   - The cognitive map is revised on the basis of interview results.
   - The map indicates the stakeholder’s perception with regard to a causal flow in relation to the problem, impact flow in relation to the actions, and interactions with the other stakeholders.

4. **Problem restructuring and policy agenda analysis**
   - The maps of the stakeholders are integrated via problem restructuring.
   - The main factors and drivers are identified from the interview results.
   - The potential policy agenda is abstracted from a factor-driver matrix.

5. **Comparison of stakeholders’ recognition and their interaction analysis**
   - The problem recognition difference among the stakeholders and the interactions among them are analyzed.

6. **Feedback to the stakeholders**
   - The analysis results are presented to the stakeholders via a workshop.
meeting with the experts. The main factors are abstracted from the stakeholders’ behavioral goals (square boxes) or the factors near the goals in their cognitive maps that have social values. Further, we select the exogenous factors, referred to as “drivers,” which represent the background factors of the problems. The drivers are mainly selected from the oval-shaped factors in the cognitive maps of the stakeholders. Then, we abstract the potential policy agenda from a matrix consisting of the main factors and drivers.

Fifth, we analyze the differences in problem recognition among the stakeholders. We discuss two approaches for performing the comparison. (1) A comparison on the basis of the viewpoints of the stakeholder’s mission, time, and spatial dimensions and (2) a comparison on the basis of the viewpoints of the stakeholder’s main concerns. These viewpoints are referred to as the stakeholders’ “recognition.” Further, we analyze the stakeholders’ interactions by means of a reciprocal expectation matrix. The stakeholders’ expectations of the other stakeholders are abstracted from the oval-shaped factors in the cognitive maps. We present both the analyses results in the first case study, while we present only the problem-perception-difference analysis in the second one.

Finally, the analysis results are fed back to the stakeholders and an implication of our analysis is discussed. The first case study includes a feedback workshop.

2.2 Characteristics of the proposed method
In this study, the proposed method has the following four characteristics. First, our method highlights not only the interactions among the stakeholders but also the interactions between the analysts and stakeholders in transport planning. The latter type of interactions is referred to as the “transdisciplinary” process. The analysts may be transport experts or local researchers. They collate information from the stakeholders and analyze them for the transport planner. Occasionally, even the conventional transport planning processes contain expert participation in the form of a technical committee managed by the transport planner in which the invited experts provide comments or advice to the transport planners. However, the role of the experts in the technical committee may be fairly passive. We expect that the experts and analysts would more proactively contribute to transport planning in the transdisciplinary process. The active interaction between the analysts and the stakeholders may be effective in terms of not only smooth data collection but also an extensive understanding of the transport planner by the stakeholder. This method may propose a novel role of the experts with regard to transport planning.

Second, we employ an active interview approach for a stakeholder interview (Holstein and Gubrium, 1995). In this approach, we interview the stakeholders with hypothetical cognitive maps, which are formulated in advance. The use of these maps may be fairly critical not only to understand the interviewee’s perception but also to convey our intention to them. This means that the interview is not regarded simply as a tool for collecting the interviewee’s information, but the interviewer and interviewees join the same discussion and interact with their ideas on the perception of the interviewee’s problem identification. An interview of both the sides can be considered as a type of learning process. We are sure that the learning process itself has the ability to develop and establish better transport planning.

Third, we determine the potential policy “agenda,” which is discussed in the corresponding transport problem by the factor-driver analysis. In general, each stakeholder may possess a limited perception on problem identification. If the transport planners extract the political agenda simply from the stakeholder’s idea, the extracted agenda may also be fairly limited. By analyzing the scope and range of the stakeholder’s recognition, we can extend the range of the problem structure and determine a completely novel potential political agenda. This may support the transport planners in searching the
Finally, we discuss the potential collaboration of the stakeholders by a comparison of their problem recognition and an analysis of the reciprocal expectation among them. A new collaboration is proposed by feeding back the analysis results to the stakeholders. Our proposal may also be useful for a transport planner to promote the new transport policy, which requires the stakeholder’s collaboration.

3. Case study I: Strategic regional transport planning in Kanto region, Japan

3.1 Case overview
The Kanto region is one of the nine regions in Japan; it includes seven prefectures: Tokyo, Kanagawa, Saitama, Chiba, Tochigi, Gunma, and Ibaragi. The region covers about ten percent of the total area of Japan and comprises over thirty percent of the total population of Japan. The region includes several megacities such as Tokyo, Yokoyama, Kawasaki, Saitama, and Chiba; it also includes rural areas on its fringes. The regional population—over thirty million (in 2006)—has gradually increased as a result of immigrants. The government agency has predicted that the regional population will keep increasing, although the total population of Japan has started to decrease since 2000. When the population trend of the Tokyo Metropolitan Area is investigated in detail, it is observed that the urban population has increased, whereas the rural population has decreased. One of the major reasons for this population decrease in the rural areas is the rapid aging of the rural societies.

With regard to the transport planning system, no statutory planning exists for the regional transport system in Japan as of 2007. Although some informal regional transport plans exist, such as the regional railway master plan, they have no legal background, particularly for policy implementation and budgeting, and no holistic viewpoint. The strategic regional transport plan considered in this case study is regarded as one of the challenges to discuss the regional transport system in the Kanto region from a holistic viewpoint. In 2003, the Kanto Region Transport Bureau under the Ministry of Land, Infrastructure and Transport (MLIT) initiated discussions on a strategic transport plan. The planning work was commissioned to the Kanto Regional Transport Council. The Kanto Regional Transport Council consists of academic researchers and local business organizations. One of the authors is a member of a working group organized by the Council. The Council discussed the strategic regional transport policy for two years; the policy was completed in 2005. The Council does not include the multimodal transport policy, but only the public transport policy. Although we utilize the information provided by the Kanto Regional Transport Council, we emphasize that the analysis in this paper is completely independent of the Council’s discussion.

3.2 Selection of the stakeholders
In the Council’s midterm progress report, the Kanto Transport Bureau of MLIT proposed seven targets to solve the present transport problems of the Kanto region. They are as follows: (1) transport policy promotion for the aged population, (2) local and interurban transport improvement, (3) transport service improvement in the rural areas, (4) an efficient freight transport system, (5) environmental impact reduction, (6) safe and secure transport services, and (7) tourism promotion. We use these seven tentative policy targets to set the hypothetical policy agenda, which will be used in the stakeholder interview. First, we set the hypotheses on a causal relationship between the hypothetical targets. The problem system map reveals the causal chains including the causal factors and the corresponding result factors. We sketch causal flows from a specific problem along both
the upstream and downstream directions. The causal relationship is represented by using arcs and nodes in a system map. This map can reveal the stakeholders as well as their relationships with the system. The problem system map in relation to the policy target is sketched with the same concept as the stakeholder’s cognitive map shown later.

After the system maps have been formulated, we list the stakeholder candidates by using these maps; several potential stakeholders are revealed in the Kanto regional transport system. This may indicate that the transport problem in the Kanto region is very complex. We select the interviewees including the following twelve stakeholders: three private rail operators including one urban subway operator, a public highway corporation, three prefectural transport authorities, a local bus operator, an automobile producer, a highway authority, a local tourism policy authority, and a local police agency.

3.3 Hypothetical cognitive mapping and its modification on the basis of the interview results

We formulate the hypothetical cognitive maps of the stakeholders with regard to the regional transport problem in the Kanto region. We browse the stakeholders’ Web pages for the mapping process. The hypothetical maps are sent to interviewees before the interviews are conducted. We sequentially meet with and interview the representatives of the stakeholders. The interviews were started in April 2004, and they were completed in March 2005. Then, we revised the stakeholders’ activity targets on the basis of the interview results. Further, we eliminated the less important items from the original maps after we determined that the stakeholder does not regard these items as important factors. Additionally, we included the factors that the stakeholders consider as barriers for achieving their targets. We also included the factors that they expect the other stakeholders to take into account.

FIGURE 2: Subway operator

FIGURE 3: Railway operator A

FIGURE 4: Railway operator B

FIGURE 5: Public highway corporation

A paper presented at the 11th World Conference on Transport Research (WCTR), Berkeley, US
to perform. The revised cognitive maps are shown in Figures 2–11.

3.4 Problem restructuring and policy-agenda analysis

The potential policy agenda will be abstracted by using problem restructuring. The participation of the experts and multidisciplinary discussions are critical for these analyses. The authors, including a transport planner and public-policy analyst, are involved in the analysis. Further, we utilize the comments of other experts—mainly transport-policy researchers.
Selection of the main factors

We abstract the following five main factors of problem restructuring on the basis of the interview results:
- Transport quantities: a lack of transport supplies, including poor transport facilities in the rural areas and an insufficient investment in the ring-road network.
- Transport quality: a low level of transport service and infrastructure quality, including traffic congestion and low traffic speed.
- Transport marketing: insufficient efforts to generate new transport demand or promote the demand for a less-demanded service, including the promotion of foreign tourism and marketing for weekend transport services.
- Environment: serious environmental impacts, including the lack of environmental technology/regulations and insufficient transport demand management.
- Safety and security: dangers of traffic safety and security, including antiterrorism and disaster prevention.

Selection of drivers

The following five potential drivers have been abstracted on the basis of the interview results: (1) less young generation and more elderly generation, (2) the financial deterioration of the central and local governments, (3) global competition along with globalization, (4) land-use changes (e.g., recent movements of additional population into central business districts (CBDs)), and (5) higher social concerns with regard to the environment. Most of these potential drivers are considered with short-term viewpoints. This is partly because the time scale of the stakeholders’ problem perception is fairly small. Further, it should be noted that many of the potential drivers exhibit low risks or occur with a low probability. This is probably because they find it difficult to reach a consensus.

TABLE 1 Potential policy agenda in relation to the regional transport in the Kanto region

<table>
<thead>
<tr>
<th></th>
<th>Quantity of transport</th>
<th>Quality of transport</th>
<th>Transport marketing</th>
<th>Environment</th>
<th>Safety and security</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less young generation and more elderly generation</td>
<td>Barrier-free in transport network, mobility in rural areas</td>
<td>Public transport service improvement, irregular traffic</td>
<td>Long-term tourism, in-home medical care transport</td>
<td>Traffic safety for elderly people</td>
<td></td>
</tr>
<tr>
<td>Considerable changes in industrial structure</td>
<td>Considerable changes in industrial structure</td>
<td>Social inclusion in rural areas</td>
<td>ICT-aided transport service</td>
<td>ICT-based transport marketing</td>
<td></td>
</tr>
<tr>
<td>Globalization</td>
<td>Efficient freight transport and accessibility to airports</td>
<td>International tourism promotion</td>
<td>Transport security and disaster prevention</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Changes in land use</td>
<td>Transport suitable for compact cities</td>
<td>Reducing traffic congestions</td>
<td>Urban environmental problems</td>
<td>Security measures for traffic services</td>
<td></td>
</tr>
<tr>
<td>Greater number of women workers</td>
<td>Meeting the needs of irregular traffic</td>
<td>Public transport promotion and efficient freight transport</td>
<td>Off-peak time transport marketing</td>
<td>Global and urban environmental problems</td>
<td></td>
</tr>
<tr>
<td>Higher social concerns with environmental issues</td>
<td>Infrastructure management in rural areas</td>
<td>Utilization of existing facilities</td>
<td>Safety measures for traffic service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Financial deterioration in governments</td>
<td>Greater number of foreign workers</td>
<td>Traffic service for foreign people</td>
<td>Model of transit-oriented cities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Larger contribution to international society</td>
<td>Model of transit-oriented cities</td>
<td>Model of transit-oriented cities</td>
<td>Terrorism prevention</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
for taking actions toward low-probability high-risk issues in their organization. These characteristics may bias the selection of the drivers. Thus, by means of the discussions with the experts, we consider the following additional drivers in order to avoid bias in the stakeholders’ perceptions:

- Extensive changes in industrial structures: a change in the industrial structure from conventional heavy industries to knowledge-based industries can probably influence the freight transport patterns. On the other hand, the low-income population has a lesser opportunity to be employed in a knowledge-intensive industry, while the high-income population may have greater opportunities. This may increase the inequality in the level of incomes among the population. As a result, the social inclusion of the low-income population and accessibility improvement in public services may be included in the more important policy agendas.

- Increase in the number of women workers: a new working style or nonconventional workers can emerge with the lack of labor force due to rapid aging of the working population. The penetration of work sharing employment system and part-time employment increase the irregular commuters.

- Greater number of foreign workers: the globalization of the labor force changes the conventional work system into flexible work and English-language-based works. An increase in the number of foreign workers results in further investment toward internationalizing urban facilities, while urban security is included into the more important agenda.

- Larger contribution to the international society: A larger number of international viewpoints from the international society are required. For example, since the Kanto region is one of the most successful public-transport-oriented megacities, many developing countries request Japan to share the knowledge about this system.

- Catastrophic natural disasters: Japan encounters several natural disasters, which include earthquakes, typhoons, and floods. Since the Kanto region includes the national capital (Tokyo), robustness with regard to natural disasters is extremely critical.

Policy-agenda abstraction
The abstracted potential policy agenda is listed in Table 1. For this abstraction, the experts in our study team, including the transport planners and the public-policy researcher, extensively discuss the potential policy agenda. On the basis of these intensive discussions and analysis, we find out certain new agendas that have not been pointed out in the stakeholder interviews. For example, the combination of “a greater number of women workers” and “transport quality” generates the agenda in relation to “irregular transport.” The pair of “larger contribution to the international society” and “environment” generates an international contribution as the “model city with a sustainable transport policy.” The pair of “less young generation and more elderly generation” and “transport marketing” generates an agenda associated with “transport for long-stay tourism” and “in-house medical-care transport.” It might prove worthwhile to discuss these issues furthermore with regard to transport planning, although they have not been discussed in detail.

3.5 Comparison of stakeholders’ recognition and their interaction analysis

Comparison of the stakeholders’ recognition
We analyze the stakeholders’ perceptions according to the following five viewpoints: (1) the mission: “what the stakeholder pursues?”; (2) the networking range with the other stakeholders: “who are the major stakeholders that a stakeholder pays attention to?”; (3) the spatial-dimension range: “what is the spatial framework under which each stakeholder acts?”; (4) the environmental conditions: “what environmental conditions, including
technical, social, and institutional conditions, are important for each stakeholder?"; and (5) the time-dimension range: “what is the time framework under which each stakeholder acts?”.

Table 2 summarizes the comparisons of the problem recognition of the stakeholders. First, stakeholders, even in the same category, have different recognitions. For example, although all the railway operators recognize the importance of networking with other railway operators, their attitudes toward railway networking varies along with their missions. Railway operator A shows a passive attitude toward collaborations with local governments and local communities in terms of station-space use and tourism promotion. On the other hand, railway operator B recognizes the importance of increasing the value of the railway neighborhood area and shows a proactive attitude toward collaborations with the local government and local communities in terms of local development. The subway operator’s concern regarding the local community is very limited; it is concerning the issue of connecting the underground regions to the surface. The prefectural governments recognize their lack of capacity in relation to the transport policy. One of the reasons is because they do not have their own regulatory authority in the local transport market. The other reason is because they have weak cooperation with the prefectural governments. Further, we find variations in the recognition of stakeholders, even those belonging to the same category. Prefectural government A directly provides the transport service to their area because it possesses municipal government functions. On the other hand, prefectural governments B and C do not provide a direct service because they include powerful municipal governments that are responsible for direct service provision. Prefectural government A shows a strong concern about the local transport service in their area, whereas prefectural governments B and C have other concerns, mainly in relation with the balance among the subregions in their area.

Second, different stakeholders have different recognitions. With regard to the spatial dimension, the automobile producer pursues a leadership role at a global level. On the other hand, the concerns of railway operator A, railway operator B, and the bus operator are limited to their operating areas. With regard to the time dimension, private companies tend to have greater time recognitions, whereas governmental units tend to have smaller time recognitions. For example, the automobile producer has set the target year as 2050. One of the major concerns of the local bus operator is a sustainable bus market for the next generation. On the other hand, the governments whose officers usually move their positions every two to three years and with an annually fixed budget cannot have long-term viewpoints.
<table>
<thead>
<tr>
<th>Mission</th>
<th>Interaction with other stakeholders</th>
<th>Spatial domain of interest</th>
<th>Time domain of interest</th>
<th>Critical factors</th>
<th>Change of environmental conditions</th>
<th>Other plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subway operator</td>
<td>Safe and punctual operation</td>
<td>Competition and coordination with other railway operators</td>
<td>Long-term</td>
<td>Life-cycle time of facilities and vehicles</td>
<td>Life-cycle time of facilities and vehicles</td>
<td>Other plans</td>
</tr>
<tr>
<td>Railway operator A</td>
<td>Sustainable operation and profit maximization</td>
<td>Coordination with local authorities and local residents</td>
<td>Short-term</td>
<td>De-centralization</td>
<td>Deregulation</td>
<td>Other plans</td>
</tr>
<tr>
<td>Railway operator B</td>
<td>Profit maximization and coordination to local authorities and local residents</td>
<td>Coordination with other railway operators and local rail networks</td>
<td>Medium-term</td>
<td>Smart card technology</td>
<td>Smart card technology</td>
<td>Other plans</td>
</tr>
<tr>
<td>Local bus operator</td>
<td>Profits maximization and coordination to local authorities and local residents</td>
<td>Coordination with local bus companies and local bus routes</td>
<td>Short-term</td>
<td>Demand decrease</td>
<td>Demand decrease</td>
<td>Other plans</td>
</tr>
<tr>
<td>Prefectural government A</td>
<td>Improvement in the local quality of life</td>
<td>Coordination with local government and local authorities</td>
<td>Long-term</td>
<td>Decentralization</td>
<td>Deregulation</td>
<td>Other plans</td>
</tr>
<tr>
<td>Prefectural government B</td>
<td>Inter-district balance and better integration</td>
<td>Coordination with other prefectures and local councils</td>
<td>Short-term</td>
<td>Smart card technology</td>
<td>Smart card technology</td>
<td>Other plans</td>
</tr>
<tr>
<td>Prefectural government C</td>
<td>Inter-district balance and better environmental protection</td>
<td>Coordination with local authorities and local residents</td>
<td>Short-term</td>
<td>Demand decrease</td>
<td>Demand decrease</td>
<td>Other plans</td>
</tr>
<tr>
<td>Highway authority</td>
<td>Traffic congestion reduction and utilization of road spaces and local rail networks</td>
<td>Coordination with police and other local authorities</td>
<td>Medium-term</td>
<td>De-centralization</td>
<td>Deregulation</td>
<td>Other plans</td>
</tr>
<tr>
<td>Automobile producer</td>
<td>Sustainable car-oriented society and profit maximization</td>
<td>Coordination with vehicle regulator and other manufacturers</td>
<td>Long-term</td>
<td>Decentralization</td>
<td>Deregulation</td>
<td>Other plans</td>
</tr>
</tbody>
</table>

**TABLE 2: Comparison of the problem recognitions of the stakeholders**
Interactions among stakeholders: reciprocal expectation analysis

Now, we identify the stakeholders’ networking range and their expectations toward the other stakeholders. The relationship among the stakeholders is listed in Table 3. The table includes airline companies and citizens who have not been interviewed thus far. Their expectations are hypothetically described on the basis of the results from the interviews with the experts. Each cell in Table 3 lists what the stakeholder in the vertical line expects from the stakeholder in the horizontal column to perform.

A potential collaboration among the stakeholders is listed in Table 3. First, we identify the potential collaborations that are partly realized in practice. For example, there is a potential collaboration between the railway operators and airline companies with regard to the use of a common credit card system, tourism promotion, and airport access. A potential collaboration also exists among governmental units. The highway authority can collaborate with the public transport authority with regard to the use of gas tax revenues. The reallocation of the tax revenues to the public transport system can be a potential compromise, at least among these two stakeholders. There is another potential collaboration between the local transport authority and the police agency with regard to transport demand management (TDM), the strict enforcement of illegal parking regulations, and the sharing of traffic data; however, their relationship is asymmetrical, that is, the police agency is strongly expected by the other stakeholders to perform something, although the agency does not expect a considerable amount from the other stakeholders.

Second, we also identify the potential collaborations among the stakeholders that have still not been realized in practice. For example, first, there may be a potential collaboration among the automobile producer, highway authority, and police agency with regard to implementing countermeasures against global warming. The automobile producer owns the production technology, whereas the highway authority is responsible for infrastructure development and the police agency possesses the power to control the traffic flow. The highway authority will benefit if the illegal parking regulations are tightened by the police agency and automobile technologies are improved by the automobile producers. This is because they can improve the traffic capacity without any additional investment of their own. The police agency can also benefit by tightening the traffic regulations, while it expects the highway authority to invest further in highway development. This is because the police agency has lesser resources than the highway authority. The automobile producer has the incentives to support the highway authority as well as the police agency because they cannot earn profits from the automobile users unless the road and traffic services are well managed. Second, the automobile producer can collaborate even with the public transport operators. This is because they consider that they cannot achieve social support for a sustainable and global automobile society unless the automobile industry and public transport system effectively coexist. Further, they can collaborate with the public transport operators with regard to implementing countermeasures to deal with irregular transport demands. The local bus operators and railway operators may find a new business as a means of utilizing their capacity by providing special services to young people who are not regularly employed, elderly people, and part-time-working women. The automobile producer may find comparative advantages in an irregular transport market because such demand requires greater flexibility.

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1 The current tax system does not allow gas tax to be allocated to the public transport system in principle. However, the tax revenue system is currently facing strong social pressure for relaxing this allocation rule. A recent example is that the gas tax revenue is used in the subway investment in Tokyo.
### TABLE 3: Interactions among the stakeholders: What the stakeholders expect the others to perform

<table>
<thead>
<tr>
<th>Public transport authority</th>
<th>Highway authority</th>
<th>Police agency</th>
<th>Local governments</th>
<th>Railway operators</th>
<th>Local bus operators</th>
<th>Airlines companies</th>
<th>Automobile producers</th>
<th>Citizens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public transport</td>
<td>Reallocation of gas tax revenue to public transport investment</td>
<td>Coordination for highway investment</td>
<td>Coordination for local government’s service-level control</td>
<td>Coordination for railway transport investment</td>
<td>Coordination for local bus transport investment</td>
<td>Coordination for airline companies’ infrastructure</td>
<td>Coordination for automobile producers’ product development</td>
<td>Support to transit-oriented policy implementation</td>
</tr>
<tr>
<td>Highway authority</td>
<td>Corporation for intermodal policies</td>
<td>Coordination among regional bureaus</td>
<td>Coordination for regional traffic congestion control</td>
<td>Coordination for traffic accident prevention</td>
<td>Coordination for railway station development</td>
<td>Coordination for airport access improvement</td>
<td>Coordination with other public sectors</td>
<td>Support to transit-oriented policy implementation</td>
</tr>
<tr>
<td>Police agency</td>
<td>Subsidy to railway operator</td>
<td>Subsidy to bus operator</td>
<td>Subsidy to railway operator</td>
<td>Subsidy to local government</td>
<td>Subsidy to local government</td>
<td>Subsidy to local government</td>
<td>Subsidy to local government</td>
<td>Support to local government’s service-level improvement</td>
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<tr>
<td>Local governments</td>
<td>Highway investment plan coordination for smooth connections and common fare-card introduction</td>
<td>Coordination for joint credit card and airport access improvement</td>
<td>Coordination for station area development and rail crossing improvement</td>
<td>Coordination for smooth bus operation</td>
<td>Coordination for smooth bus operation</td>
<td>Coordination for smooth bus operation</td>
<td>Coordination for smooth bus operation</td>
<td>Support to local government’s service-level improvement</td>
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<tr>
<td>Railway operators</td>
<td>Support to airport access improvement</td>
<td>Support to airport access improvement</td>
<td>Support to airport access improvement</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
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<tr>
<td>Local bus operators</td>
<td>Support to local government’s service-level improvement</td>
<td>Support to local government’s service-level improvement</td>
<td>Support to local government’s service-level improvement</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
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<tr>
<td>Airlines companies</td>
<td>Support to airport access improvement</td>
<td>Support to airport access improvement</td>
<td>Support to airport access improvement</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
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<tr>
<td>Automobile producers</td>
<td>Support to local government’s service-level improvement</td>
<td>Support to local government’s service-level improvement</td>
<td>Support to local government’s service-level improvement</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
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<td>Support to railway investment</td>
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<tr>
<td>Citizens</td>
<td>Support to local government’s service-level improvement</td>
<td>Support to local government’s service-level improvement</td>
<td>Support to local government’s service-level improvement</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
<td>Support to railway investment</td>
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<td>Support to railway investment</td>
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</tbody>
</table>
Furthermore, a potential collaboration can exist among the many stakeholders in the long-stay tourism business. The public transport operators can collaborate with the automobile service providers (e.g., rental car companies dealing mainly with tourists). There is also room for innovation by introducing a common seasonal ticket or card system for long-stay tourists that can be shared among various transport operators. The local governments can provide sufficient incentives to promote tourism because they can obtain taxes from tourist activities. The participation of local farmers and hotels can prove to be important for ecotourism and participatory tourism.

3.6 Feedback to stakeholders via workshops
After completing the analysis, we held a workshop with the stakeholders at the end of March 2005. Not only the interviewees but also other stakeholders were invited to the workshop; here, the analysis results were discussed. The total number of participants in the workshop was ten; it took around two hours. The participants pointed out the mistakes or misunderstandings in the revised cognitive maps shown by us. All the participants showed a greater concern, particularly with the cognitive maps of the other stakeholders. Further, they commented that a reciprocal expectation matrix seemed to be very useful in their decision making.

4. Case study II: Local transport planning in Kanto region, Japan

4.1 Case overview
City X is located at the northern fringe of the Kanto region, which is one of the prefectural capitals in Japan. It has a population of about 450,000 (as of 2006) and an area of approximately 300 square kilometers. This city is well known as a typical automobile-oriented city of Japan. A CBD is located at the centre of the city area along with a main railway station. The main railway line runs from the north to south, whereas a river flows along the same direction in the eastern region of city. A large-scale industrial district is located in the eastern part of the river near the city; here, industrial factories exist, which mainly produce mechanical goods. Each morning, several workers working in the industrial factories commute from the CBD and/or its neighboring regions toward the industrial district. They create a large traffic demand, which seriously impacts the neighborhood traffic. In order to reduce traffic congestion, a public transport system connecting the CBD with the industrial district has been proposed since 1993. The original proposal included a monorail system and an automated guideway transit (AGT) system. The city transport authority suggested a local transport plan in 1996 that included the introduction of a new bus rapid transit (BRT) system. The new BRT system has been planned to run from the eastern to the western part of the city crossing the railway line at the central railway station.

In 2001, the prefectoral transport authority in prefecture Y proposed another transport plan that included a light rail transit (LRT) system instead of the BRT system. Following this proposal, the city and prefectoral transport authorities jointly started to investigate the feasibility of introducing the LRT system. After two years, the feasibility study proposed the introduction of a fifteen-kilometer-long LRT system. They suggested that the project’s mission should include not only a reduction in traffic congestion but also CBD revitalization, environmental impact reduction, and the social inclusion of the aged population. Further, they estimated the project costs and travel demands. According to

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2 Long-stay vacations are not so popular in Japan during the summer season. Recently, the central government has proposed long-stay tourism.
their estimation, the project costs cannot be covered by the fare revenue, which implies that the project is unfeasible from the financial viewpoint.

In 2003, the then-governor of the prefecture suddenly appealed his opposition against the LRT proposal based on the reported project evaluation. The governor presented two counterproposals: (1) discussions about the project should be discontinued for around five years and (2) the prefectural authority will provide no financial support to the project. Although the latter proposal may allow the city authority to independently promote the project, the city authority undoubtedly cannot afford the project cost. The city mayor held several citizen-participated meetings to ensure their support to the project; he also requested the prefectural transport authority to support the LRT project.

The governor’s election was held in December 2003. In this election, the ex-governor opposing the project lost his chair, while the ex-mayor promoting the project was elected as the new governor. A new city mayor who supported the project was elected in the mayor’s election after the ex-mayor became the prefectural governor. An additional feasibility study was started in 2004; it is planned to conclude in 2007.

The local transport planning is still continuing and has not yet completed its process in this case. Thus, the following subsections will discuss the temporal analysis results that have been completed.

4.2 Selection of the stakeholders
We began by examining the case of the literature survey. The literature includes newspaper articles, project feasibility reports, Web pages on the Internet, and other related materials. We selected the potential stakeholders from the literature survey results. Then, we visited the local university professors who have been involved in this case since a long time. We were presented the planning process and the current status by them. During this visit, we requested them to provide information regarding the stakeholder candidates. Since they have served as chairpersons in technical surveys as well as assumed roles of opinion leaders in local discussions, they have different experiences and knowledge about the human relationships within the local community. Thus, we followed their advice in selecting the stakeholder candidates. The stakeholder candidates include the prefectural transport authority, the city transport authority, a chairman of the city council, a local railway company, a nonprofit organization promoting the introduction of the LRT system, the prefectural council members opposing the introduction of the LRT system, a representative of the CBD shopkeepers union, a member of the industry’s labor union, and a newspaper publisher.

4.3 Hypothetical cognitive map of the stakeholders and its revision on the basis of the interview results
We formulated the stakeholders’ hypothetical perceptions with regard to the local transport planning in city X. We browsed the Web sites provided by the stakeholders and sketched the cognitive maps according to this data. We portrayed the cognitive maps in the same way as that in the first case. Then, we sequentially interviewed the stakeholders in September and October 2006. We revised the maps after the interviews. The revised maps are shown in Figures 12–19.

4.4 Problem restructuring and policy-agenda analysis
In this case study, the agenda was fairly clear. All the stakeholders were more or less concerned with the introduction of the LRT system. However, the problem perceptions seemed to vary among the stakeholders. The problem was restructured by using a factor-driver matrix.
Selection of the main factors
We abstracted the following four main factors from the interview results:
- Sustainability of the city: serious environmental impacts due to excessive dependence on automobile usage, low mobility of the elderly population, and population decrease.
- Local economy: low vitality in the central area, whereas a greater number of shopping malls in the suburban areas.
- Efficiency and safety of the transport system: traffic congestion during the peak hours and the traffic safety of the local communities.
- Financial viability: operation costs that cannot be covered by fare revenues and low LRT demand.

Selection of the drivers
The following drivers were abstracted from the interview results: less young generation and more elderly generation, financial deterioration of the central and local governments, and interpretation of LRT problem as a voting issue to election candidates. The interdisciplinary discussions among the experts including the authors resulted in the
addition of the following issues: institutional changes in the transport funding system, regionalization, and the development of information technology. The first additional driver indicates that the transit service may be well subsidized by means of tax revenues (including gas tax reallocation), although the transit system cannot be effectively supported under the current funding scheme. The second additional driver indicates that the northern part of the Kanto region may be regarded as an independent region of Japan as a result of the recent decentralization discussions.

Policy-agenda abstraction
The experts including the transport planners and public-policy researchers discuss the interview results to abstract the potential policy agenda. Table 4 lists the potential policy agenda abstracted from the factor-driver matrix. Since all the stakeholders consider the introduction of the LRT system as the main policy agenda in this case, the abstracted...
We determine the potential agendas that have not been explicitly pointed out in the LRT-introduction discussions. They include, for example, the “new local tax introduction,” “local stakeholder participation in the planning process,” “regional ticketing/fare system,” and “the LRT system as a regional symbol.” The present discussions on the introduction of the LRT system mainly focused on whether the LRT is required or not. They have not effectively examined the planning process regarding the introduction of the LRT system and the additional policy assuming that the LRT is introduced. In addition, they need to further discuss the legitimacy of the introduction of the LRT system. This discussion may require integrated regional spatial planning or transport planning that is consistent with the introduction of the LRT system.

4.5 Comparison of stakeholders’ recognition and their interaction analysis

**Comparison of the stakeholders’ recognition**

The interview results revealed that some stakeholders supported the LRT proposal, while others opposed it. Further, it indicated the reasons for the support or opposition of each stakeholder toward the proposal. We observed the disputed issues among the stakeholders and analyzed them. The experts of our study team including the transport planner and public-policy researcher discussed the interview results in detail for this analysis.

The first is the difference in the stakeholders’ recognition on the project’s financial viability and its resources. The feasibility study revealed that the fare revenues obtained from LRT operations cannot cover its operation costs. Therefore, some prefectural council members criticized the introduction of the LRT system because of the lack of resources. Evidently, the local governments, especially Prefecture Y, have suffered from the lack of tax revenues for several years. They do not propose a new LRT system, but do propose another transport system that can be introduced with a lesser investment. On the other hand, NPO and city council members who are promoting the LRT system suggest that the LRT system should be regarded as a public service with social benefits. In other words, they propose that the LRT system should be maintained by using tax revenues, even if the project is unfeasible purely financially.

The second is the difference in the recognition of the project purpose. In fact, the purpose of introducing a new transport service has changed from traffic congestion...
reduction (in the original proposal) into the revitalization of the CBD and social inclusion (in the latest proposal). The labor union of the industrial companies is concerned only with the traffic congestion problem for the commuters, whereas the CBD shopkeepers union has strong concerns about the revitalization of the city center. We can also observe differences in purpose recognitions between the city and prefectural transport authorities. The former has a strong willingness to improve the local people’s mobility from a local viewpoint, whereas the latter considers the spatial balance among city X and other cities in prefecture Y. As a matter of fact, the prefectural transport authority has its own transport plan that includes the longer transport corridor passing through city X.

The third is the difference in the approach toward the LRT problem. Many stakeholders consider that the introduction of the LRT system has been treated as not only a genuine transport-planning problem but also a political problem. As shown earlier, the prefectural ex-governor opposed the introduction of the LRT system, while the incumbent governor promotes it. The LRT problem was explicitly disputed in the last governor’s election. This means that the transport planning issue was interpreted as a voting issue for a candidate governor. In addition, although the ex-governor lost the governor’s election, he has been selected as a member of the House of Councilors following the governor’s election. Thus, the LRT issue is still one of the most controversial political issues in city X. However, the city transport authority and the prefectural transport authority want to treat the LRT problem as the genuine transport-planning problem.

The fourth is the decision-process in relation to LRT introduction. The local experts and NPO promoting the LRT expect the city mayor to make a final decision on the LRT introduction, whereas the prefectural council members opposing the LRT consider that the local citizens should make the decision via a referendum.

Interactions among stakeholders: reciprocal expectation analysis
The relationship among the stakeholders is listed in Table 5. The table includes local citizens who have not been interviewed thus far. It also includes the newspaper company and local university professors, although their cognitive maps have not been sketched yet. Their expectations are hypothetically described on the basis of the results from the interviews with the stakeholders. Each cell in Table 5 lists what the stakeholder in the vertical line expects from the stakeholder in the horizontal column to perform.

First, we identify the potential collaborations that are partly realized in practice. Table 5 revealed that there are many expectations in relation to the understanding of real facts about the LRT project. First, many stakeholders expect the local universities to analyze the travel demand and to examine the financial viability of the LRT introduction. Second, the city transport authority and the prefectural transport authority request the local industry’s labor union to understand the bridge construction impact. Third, the citizens’ basic knowledge and their participation are highly expected by many stakeholders. They may be satisfied by promoting the communication among the stakeholders or by sharing the information among them. However, we should note that the LRT introduction may not be supported even when more information relating to LRT is provided, because the financial facts or estimated demand may not support the LRT introduction.

With regards to the interaction between the city transport authority and the prefectural transport authority, their main concern is focused on how to share the cost if the LRT is introduced. On one hand, they have suffered from the lack of resources. On the other hand, there has been a special development fund for the industrial district in the eastern part of the river near the city. This fund was collected from the local industry when they built factories and facilities in the industrial district. The fund managers include the city X and the prefecture Y. The purpose of the fund was originally to improve the
<table>
<thead>
<tr>
<th>City transport authority</th>
<th>City council member promoting LRT</th>
<th>Prefectural transport authority</th>
<th>NPO promoting LRT</th>
<th>Prefectural council members opposing LRT</th>
<th>Local citizens</th>
<th>CBD shopkeeper union</th>
<th>Local industry’s labor union</th>
<th>Local railway operator</th>
<th>Local bus operator</th>
<th>Local universities</th>
<th>Local newspaper company</th>
</tr>
</thead>
<tbody>
<tr>
<td>City transport authority</td>
<td>Decision-making of financial resources for LRT introduction</td>
<td>Financial support for LRT introduction</td>
<td>Basic knowledge about LRT system</td>
<td>Right understanding of bridge construction impact</td>
<td>Bus operation consistent with LRT operation</td>
<td>Investment for Connecting railway and LRT</td>
<td>Bus operation consistent with LRT operation</td>
<td>Transport demand analysis and financial analysis of LRT introduction</td>
<td>Balanced report about LRT issues in the paper</td>
<td></td>
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</tr>
<tr>
<td>City council member promoting LRT</td>
<td>Realization of the industrial development area function of LRT introduction and reduction of highway investment</td>
<td>Consideration of the expected external effect of LRT project and realization of the industrial development area linked to LRT introduction</td>
<td>Basic knowledge about LRT system and higher concern with LRT issues</td>
<td>Right understanding of bridge construction impact</td>
<td>Investment for Connecting railway and LRT</td>
<td>Bus operation consistent with LRT operation</td>
<td>Transport demand analysis and financial analysis of LRT introduction</td>
<td>Balanced report about LRT issues in the paper</td>
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<tr>
<td>Prefectural transport authority</td>
<td>Leadership in promoting LRT and cost sharing</td>
<td>Presentation of visions on public transport system</td>
<td>Opposition against LRT in political debates</td>
<td>Decision-making</td>
<td>Right understanding of bridge construction impact</td>
<td>Investment for Connecting railway and LRT</td>
<td>Bus operation consistent with LRT operation</td>
<td>Transport demand analysis and financial analysis of LRT introduction</td>
<td>Balanced report about LRT issues in the paper</td>
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<tr>
<td>NPO promoting LRT</td>
<td>Presentation of visions on public transport system</td>
<td>Presentation of visions on public transport system</td>
<td>Basic knowledge about LRT system</td>
<td>Basic knowledge about LRT system</td>
<td>Basic knowledge about LRT system</td>
<td>Basic knowledge about LRT system</td>
<td>Investment for Connecting railway and LRT</td>
<td>Bus operation consistent with LRT operation</td>
<td>Transport demand analysis and financial analysis of LRT introduction</td>
<td>Report on city transport authority’s idea</td>
<td></td>
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<tr>
<td>Prefectural council member promoting LRT</td>
<td>Improvement of legitimacy in planning process and cooperation of LRT with other alternatives</td>
<td>Comparison of LRT with other alternatives and decision-making after the bridge construction</td>
<td>Comparison of LRT with other alternatives and decision-making after the bridge construction</td>
<td>Respect for opposing citizens and deeper examination of LRT introduction</td>
<td>Basic knowledge about LRT system</td>
<td>Basic knowledge about LRT system</td>
<td>Basic knowledge about LRT system</td>
<td>Investment for Connecting railway and LRT</td>
<td>Bus operation consistent with LRT operation</td>
<td>Transport demand analysis and financial analysis of LRT introduction</td>
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<tr>
<td>CBD shopkeepers union</td>
<td>Revisions of asset tax, subsidy to local activities and investment of parking spaces around the LRT steps</td>
<td>Completion of the ring road and investment of parking spaces around the LRT steps</td>
<td>Basic knowledge about LRT system and higher concern with LRT issues</td>
<td>Right understanding of bridge construction impact and voluntary actions for decreasing traffic congestion</td>
<td>Voluntary actions for decreasing traffic congestion</td>
<td>Transport demand analysis and financial analysis of LRT introduction</td>
<td>Report on city transport authority’s idea</td>
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<tr>
<td>Local industry’s labor union</td>
<td>Considerations against traffic congestion and immediate provision about LRT planning</td>
<td>Immediate construction of the bridge</td>
<td>Basic knowledge about LRT system</td>
<td>Basic knowledge about LRT system</td>
<td>Basic knowledge about LRT system</td>
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<td>Basic knowledge about LRT system</td>
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<tr>
<td>Local railway operator</td>
<td>Promotion of local public transport service, mobility improvement and cooperation in improving the regional attractiveness</td>
<td>Mobility improvement, cooperation in improving the transport attractiveness and support to own business</td>
<td>Introduction of community-based currency</td>
<td>Consideration of the expected external effect of LRT project</td>
<td>Investment for Connecting railway and LRT</td>
<td>Bus operation consistent with LRT operation</td>
<td>Transport demand analysis and financial analysis of LRT introduction</td>
<td>Report on city transport authority’s idea</td>
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<tr>
<td>Local bus operator</td>
<td>LRT planning compatible with bus operation</td>
<td>Support to local transport services</td>
<td>Bus operation consistent with LRT operation</td>
<td>Basic knowledge about LRT system</td>
<td>Basic knowledge about LRT system</td>
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<tr>
<td>Local universities</td>
<td>Mayor’s decision-making and disclosure of information on LRT planning</td>
<td>Reassessment of bridge construction cost</td>
<td>Basic knowledge about LRT system</td>
<td>Consideration of the expected external effect of LRT project</td>
<td>Right understanding of bridge construction impact and voluntary actions for decreasing railway and LRT traffic congestion</td>
<td>Investment for Connecting railway and LRT</td>
<td>Bus operation consistent with LRT operation</td>
<td>Transport demand analysis and financial analysis of LRT introduction</td>
<td>Report on city transport authority’s idea</td>
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TABLE 5: Interactions among the stakeholders: What the stakeholders expect the others to perform
industrial district from various viewpoints. Although the fund includes the enormous amount of resources which may cover the cost of LRT introduction or the bridge construction, how to use the fund has not yet been decided. Thus, the city council members promoting the LRT expect the prefectural transport authority and the prefectural council members to support the reallocation of this fund to the LRT introduction project. It seems that even the prefecture side may find the advantage to utilize the fund from the viewpoint of prefectural welfare. The collaboration between them with regards to the fund use may guide them to the solution on the budget problem.

Next, we also identify the potential collaborations among the stakeholders that have still not been realized in practice. For example, the prefectural transport authority, NPO promoting LRT and local universities expect the local railway operator to invest the facilities connecting the railway and the LRT line. The local railway operator expects the local transport authorities to promote the local public transport service, to improve the mobility and the regional attractiveness. The collaboration among them may make these stakeholders happier.

5. Conclusions

In this paper, we propose a method to analyze the problem perceptions of stakeholders and structuring these problems by using their cognitive maps. We present two case studies. They show that the proposed method is fairly effective. The first case study shows that the successful generation of a potential agenda is possible. Further, we compare the stakeholders’ recognitions by means of an analysis of the problem perceptions of the stakeholders. Additionally, we analyze the interactions among the stakeholders by using a reciprocal expectation matrix. The second case study shows that this method is applicable even to disputes within local transport planning with regard to the introduction of an LRT system. We note that the second case may be a little different from the first case in terms of the meaning of agenda abstraction. The first case study abstracted the potential agenda without the given issue, whereas the second case study reexamined the potential agenda under the condition that the LRT introduction is given as a main issue. This paper showed that the proposed method can be used in both conditions.

In this study, although the problem structuring method is mainly applied to transport planning, the method itself may be so general that it can be used for other purposes such as urban planning, educational planning, medical and public health planning, and so on. As a matter of fact, public policy studies have emphasized the importance of agenda setting along with the policy decision-making, policy implementation, and policy evaluation stages. For example, a conventional textbook for public policy studies (Dunn, 2004) includes an independent chapter regarding problem structuring in which various methodologies of problem structuring are discussed. However, even such textbooks do not clearly describe detailed methodologies to problem structuring according to the stakeholders’ perceptions. Thus, the method proposed in this paper may be expanded and can contribute to public policy studies.

Although the proposed method overcomes some difficulties in the earlier problem structuring methods, several further research issues still remain. They can be categorized into two issues. The first one is the methodological issue. Here, we initially select the interviewees from a list of potential stakeholders, although it is ideal to interview all the potential stakeholders. This is simply because we do not have sufficient time and resources to interview all the potential stakeholders. We have to face this kind of resource limitation when we apply the methodology in practical world. However, the interviewee selection may bias the analysis results. Therefore, a method to prioritize the stakeholders should be
investigated. Then, the interview results depend considerably on the interviewed individuals. Although we attempt to meet with the persons who have sufficient knowledge and experience in their own organizations, the responses may vary from one person to another, even if the other person belongs to the same organization. A method to eliminate bias in the interviewee selection should be examined. Finally, the cognitive map depends on the individual who sketches the map. The selection of such an individual may also bias the results. The variations in the maps among such individuals should be investigated under the condition that the same interview results are obtained.

The remaining research issue is about the analytical method, particularly with regard to the stakeholder’s problem recognition and potential collaboration. The first case study compares the stakeholder’s recognition mainly with regard to the spatial and time dimensions. Although they definitely are important items, other items may also influence the stakeholder’s recognition. The second case study does not prepare such dimensions but use the stakeholder’s recognition for the comparison. We should examine other viewpoints for a better recognition analysis. Further, the potential collaboration in our case studies is limited to the collaboration that entails a win-win situation for each stakeholder. Although it is undoubtedly important to identify the win-win criteria, the public policy alternatives are, of course, not limited to such criteria. In some cases, it might be more important to make decisions that result in losses to specific stakeholders when the social benefit is substantial. Thus, it is necessary to identify under what conditions it is impossible to determine the win-win options using our problem structuring method. Furthermore, there is an uncertainty in some drivers, which can influence the stakeholder’s perception. Scenario planning can be useful to consider this uncertainty (Martelli, 2000; Wilson, 2000; Zegras et al., 2004). However, earlier studies considering this scenario analysis do not explicitly analyze the interactions among the stakeholders. There might be room to investigate it further.

Finally, it should be noted that the potential agenda abstracted from the problem structuring method shown in this study are the agenda candidates, which are further discussed in the decision-making process. To proceed with the planning process, we should select a specific agenda from a set of potential policy agendas with certain selection criteria. The decision makers should discuss and decide the selection criteria by selecting the values for public welfare. The values may include economic efficiency, social equity, government financial balance, and so on. This selection is one of the most important planning processes; however, the methodology for selection of the value is not well developed thus far. This forms a future research issue that should be considered.

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