TRIP MAKERS' NEEDS FOR THE NEXT-GENERATION TRAVEL INFORMATION: A COMPARISON BETWEEN JAPAN AND KOREA

Junyi ZHANG, Graduate School for International Development and Cooperation, Hiroshima University, Japan; E-mail: zjy@hiroshima-u.ac.jp

Backjin LEE, National Infrastructure & GIS Research Division, Korea Research Institute for Human Settlements (KRIHS), 254 Simin-daero, Dongan-gu, Anyang-si, Gyeonggi-do, 431-712, Korea

Hiroshi SHIMAMOTO, Graduate School of Engineering, Kyoto University, Katsura, Nishikyo-ku, Kyoto 615-8540, Japan

Akimasa FUJIWARA Graduate School for International Development and Cooperation, Hiroshima University, Japan; E-mail: afujiw@hiroshima-u.ac.jp

ABSTRACT

It is very challenging how to provide individualized travel information considering personal information tastes and how to make use of travel information to mitigate the negative impacts of travel behavior on transportation systems. Motivated by this challenging issue, this paper presents a comparative study to clarify the similarities and dissimilarities of trip makers' needs for the next-generation travel information of both car and public transportation systems in Japan and Korea, which are two leading countries in the field of information and communication technologies in the world. Analysis is conducted by using two relatively medium-scale questionnaire surveys (1,000 respondents in Japan and 1,181 in Korea), where a variety of information contents and potential influencing factors are investigated. Implications for future travel information system development are also extensively discussed.

Keywords: next-generation travel information, information tastes and needs, comparative study, Japan and Korea,

INTRODUCTION

The roles of travel information in improving current transportation systems and creating new types of transportation systems have been argued in a variety of literature (e.g., Khattak et al.,

2003; Chorus et al., 2006; Grotenhuis, et al., 2007; Farag and Lyons, 2012). One of challenging issues is how to provide the travel information by properly reflecting trip makers' needs and tastes and effectively realizing policy goals of information provision (e.g., avoiding the traffic concentration during peak hours, encouraging car users' shift to use of public transportation systems, and improving the efficiency of road traffic operation and the convenience of public transportation systems). Needless to say, various stakeholders should be involved in providing better travel information. To support better governance of travel information provision and management, it is important to understand trip makers' information searching and use behavior as well as their needs to various types of information.

Looking at current travel information systems, one may find that various sources of travel information are scattered here and there and it is difficult to know where to get better information. It takes time to get the right information from different information sources. Even though the information needed is obtained, it is unclear how the information is reliable. When traffic accidents take place, drivers approaching to the site of accident may not really know when the congestion caused by the accident will disappear. In case that transfer occurs when using complicated public transportation systems like in Tokyo and Seoul, trip makers may face difficulties to have a smooth transfer from one line to another. These issues of current travel information systems are a party to inefficient operation of traffic systems and unattractive public transportation systems. Existence of diverse types of trip makers makes these issues even worse. However, these issues have not well investigated in literature.

Recognizing the importance of travel information in promoting the use of public transportation systems and improving the efficiency of road traffic systems, the objectives of this study are, 1) to understand actual travel information searching and use behavior, 2) to clarify the needs of next-generation travel information and willingness to pay (WTP) for the needs, 3) to reveal factors affecting the needs and WTP, and 4) to provide useful implications to the development of travel information systems. Concretely, actual travel information searching and use behavior investigates "why, when, where, and how to get the information, under what kinds of situations", and difficulties of obtaining the needed information. Furthermore, this study also focuses on analog-type and digital-type information, existing travel information and next-generation information, and travel information and added-value information (e.g., entertainment, health, or environmental emission information). Various types of information tastes are also surveyed considering that they might be inherent factors existing in the deep mind of trip makers. For the above purpose, this study compares Japanese and Korean trip makers' needs for different types of travel information. The two countries are selected because they are two leading countries in the field of information and communication technologies in the world. It is expected that this study could provide useful insights into the development of next-generation travel information systems applicable to other countries.

SURVEY

This study attempts to capture the travel information needs in a relatively comprehensive way. The travel information under study includes both car traffic and public transportation

information. Trip makers may need to know not only the basic level of service information such as travel time, cost, transfer, and access/egress mode information, but also activity-related information because travel is in part a derived demand from activity participation. For car users, they may also need to be informed about traffic accidents and dangerous traffic conditions. For public transportation users, they may need to use different types of travel modes even for a single trip and it might be therefore important for them to obtain multimodal travel information, rather than single mode information. Since people have to use a certain length of time for moving from one place to another (on average 60 minutes per day in Japan), they may just bear the pain of moving, or they may try to adapt to this type of time use behavior by enjoying reading and web surfing, etc. To support people's adaptation behavior, added-value information (e.g., entertainment, music, or news) might be required. People may concern about health and environmental impacts of travel behavior. To understand these needs, various factors might be helpful, such as information taste, actual information searching behavior, and even actual travel behavior as well as individual attributes. The questionnaire survey was designed based on the above-mentioned considerations.

Survey Implementation

Different types of cities have different levels of transportation systems. It is expected that trip making in large cities is complicated than in smaller cities. To reflect relatively higher needs for travel information, relatively large cities are targeted in this study, including Tokyo and government-ordinance-designated cities (16 cities) in Japan and Seoul, Gyeonggi-do, Busan, and Incheon and so on (15 cities) in Korea. The target sample size was 1,000 persons in each country, which attributes have similar distributions to those in the whole population of the selected cities. The surveys in the two countries were implemented in 2009 with the help of major Internet survey companies in each country. As a result, 1,000 respondents in Japan and 1,181 respondents in Korea provided valid questionnaire sheets.

Attributes of Respondents

It is found that 56% of Japanese respondents had a driving license and a car, and 23% had a license but not a car, while in Korea, there are more people (32%) who had a driving license but no car and there are fewer people owing a license and a car. In Japan, 75% of respondents usually use a car, but in Korea the share is just 32%. For the purposes of using a car, the highest share in Japan is shopping (31%), followed by recreation, travel, social activities and eating out (20%). In Korea, commuting and going to school occupies the highest share (17%) and the second highest share is business. In other words, compulsory activities are the main purpose for using a car in Korea. Use of public transportation systems at least once a week accounts for 65% in Japan and 69% in Korea, which are very similar. The most frequent trip purpose by public transportation systems is commuting and going to school in both Japan and Korea. The differences between the two countries are, 1) the pick-up purpose in Korea (23%) is almost twice higher than in Japan (13%), 2) 16% of respondents use public transportation systems for the business purpose in Korea, but only 5% in Japan, and 3) 22% of Japanese trip

makers use public transportation systems for the purpose of recreation, travel, social activities and eating out, which is just 10% in Korea.

Taste of Trip-making and Intention of Behavioral Change under Better Travel Information Provision

As for the taste of trip-making (Figure 1), 78% of Japanese respondents and 82% of Korean respondents agree (hereafter, refers to the share of answering "definitely agree" and "agree") that they tend to make a trip with time to spare. This strongly suggests that most of trip makers worry about uncertain happenings during travel and do not want to take a risk. More than half of respondents become irritable when getting lost (51% in Japan and 54% in Korea). In Korea, 61% of respondents feel uneasy when using public transportation systems, while the corresponding share is just 26% in Japan. This is almost consistent with the evaluation about public transportation systems in the two countries (28% of respondents in Japan and 70% in Korea feel inconvenient). Surprisingly, 47% of Japanese respondents like traveling by car and 68% by public transportation systems, while 78% of respondents in Korea like traveling by car and 70% by public transportation systems. In both countries, comparing more attributes for choosing a travel mode seems not a difficult task because more than 70% of respondents reported that they are good at comparing many mode-specific attributes.

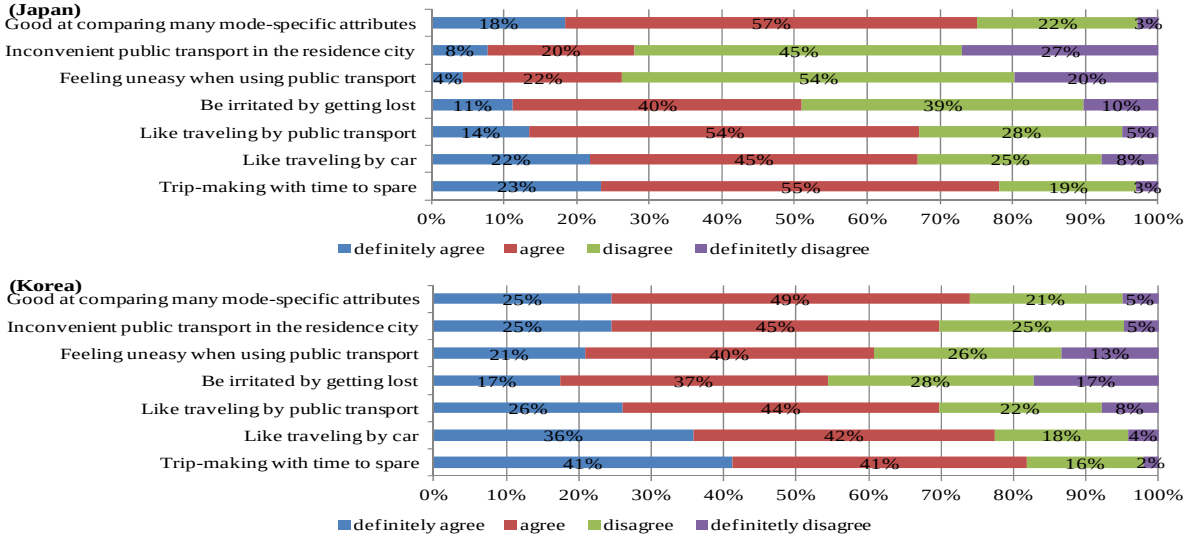


Figure 1 – Taste of trip-making

Before clarifying the needs for various travel information, here, it is attempted to examine how improvement of travel information could change the current travel situations. It is observed from the survey that if public transportation information becomes easy to use, 56% of respondents in Japan and 81% in Korea are likely to use public transportation systems more frequently. On the other hand, it is also found that 36% of Japanese respondents and 62% of Korean respondents may make more trips if travel information provision will be improved. In other words, one may find such potential induced travel in Korea about twice more than in Japan. Such induced travel due to information provision should be paid enough

attention in future. Good news is that 62% of respondents in Japan and 78% in Korea are attempting to make efforts not to make more use of a car by considering the impacts of travel on the environment and/or their own health. The above potential contribution of travel information to the improvement of current transportation systems motivate and convince us to further explore how trip makers actually make use of travel information and how they prefer new types of information that will gradually become available in future thanks for the rapid progress of information and communication technologies and relevant technologies.

Actual Travel Information Search and Use

Japanese respondents possess various types of ICT devices: 96% having a PC with Internet connection (IC), 66% having a cellular phone with IC, 28% owning a car navigation system, 28% having a phone with Fax function, 25% with radio, and 20% with TV having IC. In contrast, 56% of Korean respondents own a cellular phone with IC, 36% have a PC with IC, 5% possess a TV with IC, and only about 1% own other types.

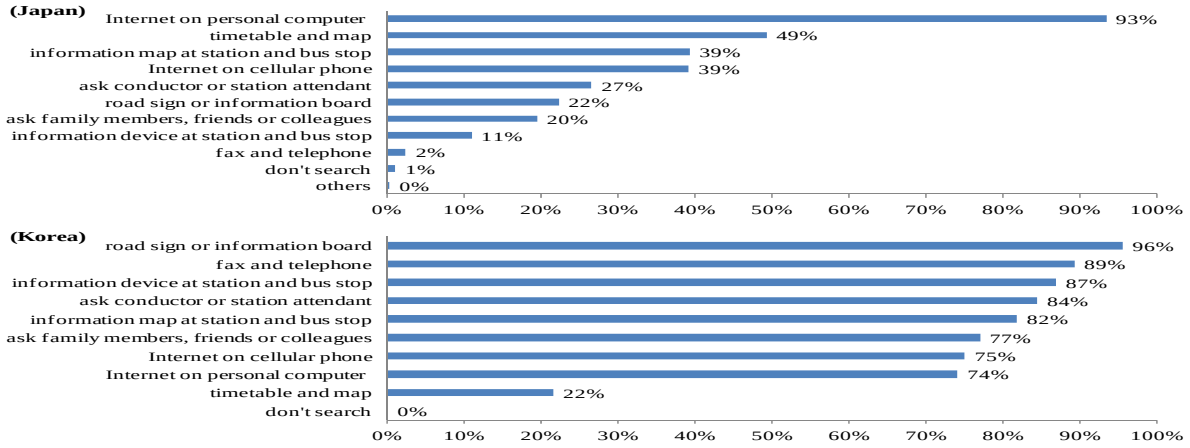


Figure 2 – Means of obtaining travel information

Different from Japan (89% access travel information at home, 31% at office or school, 28% in cars or trains, 21% at stations or bus stops, and 20% at destinations), 96% of Korean respondents access the information in cars or trains, 92% at destinations, 76% at office or school, 45% at stations or bus stops, 35% at home, and 20% do not get any information. In Japan, only 2.5% of respondents do not get the information. In Japan, 69% of respondents spend ten minutes or less for travel information search, but 61% in Korea. In Japan 46% get travel information at least once a week and the relevant share is 74% in Korea. The timing to get travel information is diverse in both Japan (54%: the day before departure; 42%: soon after making a trip plan, 37%: several hours before departure, 37%: just before departure, 26%: during travel) and Korea (82%: several hours before departure, 73%: during travel, 63%: just before departure, 60%: soon after making a trip plan, 31%: the day before departure). Concerning the means of obtaining travel information" (Figure 2), 93% of Japanese trip makers use the Internet via PC, followed by timetable and map (49%), information map at station and bus stop (39%), and Internet via cellular phone (39). In contrast, more than 70% of Korean trip makers access the travel information from road sign

or information board (96%), fax and telephone (89%), information device of station and bus stop (87%), ask conductors or station attendants (84%), ask family members, friends or colleagues (77%), Internet via cellular phone (75%), and Internet via PC (74%). But only 22% of Korean trip makers get the travel information via timetable and map. Korean trip makers more tend to ask people for the information than the Japanese.

There are various reasons why people have to obtain travel information (see Figure 3). Japanese respondents reported more reasons of avoiding negative impacts caused by travel and Koreans reported more reasons of justifying their choices. In Japan, the top reason is "avoid being late" (69%), followed by "avoid unnecessary walk, waiting time or the time of getting lost" (66%), and "do not want to take a wrong vehicle" (53%). In contrast, the top four reasons are "persuade, convince and/or reassure travel companion" (93%), "compare and choose information from multiple sources" (92%), "confirm whether trip maker's own experience is right or not" (87%), and "reconfirm route information etc., after departure" (86%). Such justifying reasons account for only 7% ~ 17% in Japan. At the same time, it is surely true that there are also more Korean respondents obtain travel information for avoiding negative impacts caused by travel (38% ~ 78%). Such differences between the two countries suggest that same types of travel information should be framed differently.

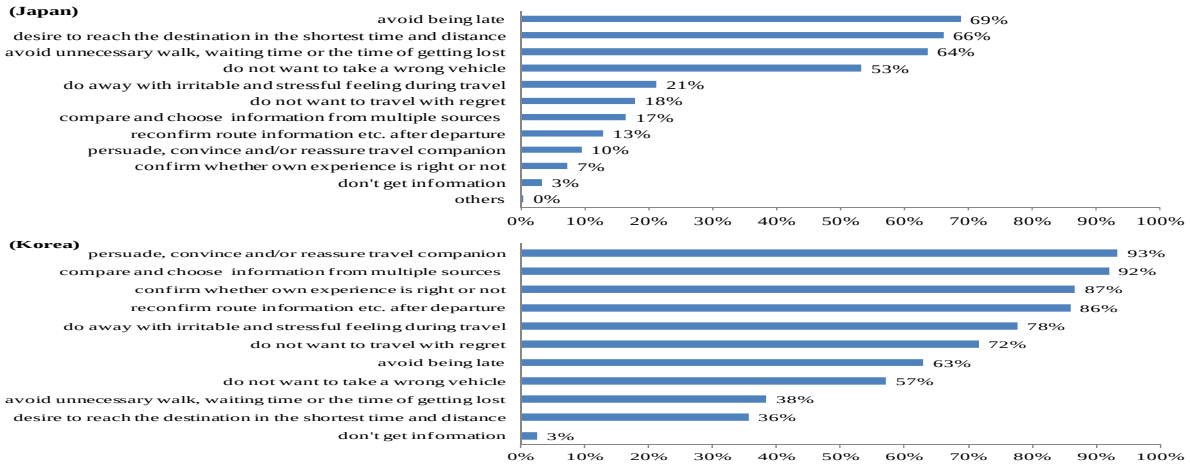


Figure 3 – Reasons of obtaining travel information

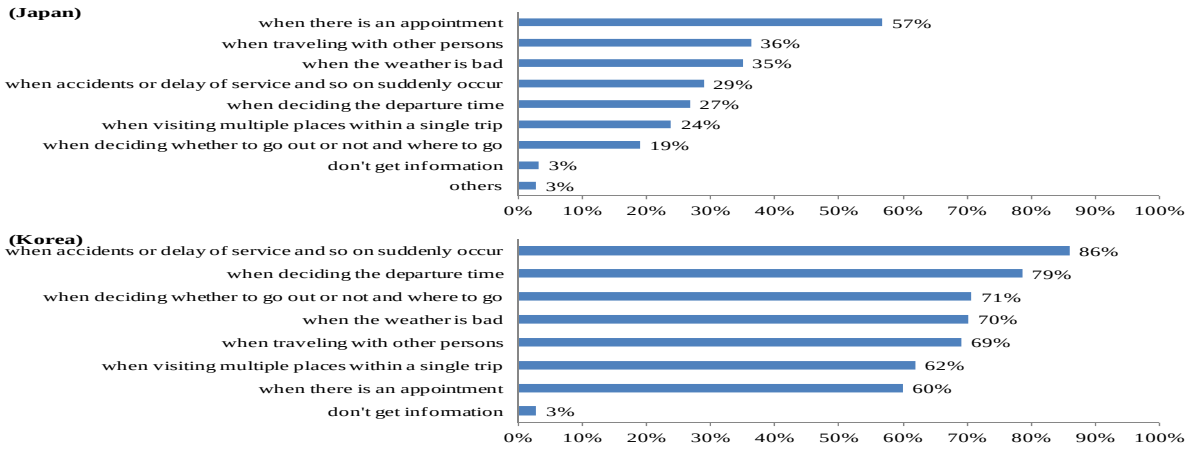


Figure 4 – Situations of obtaining travel information

It is also revealed that situations of obtaining travel information are remarkably different between Japan and Korea (Figure 4). In case of Japan, 57% of respondents obtain travel information when there is an appointment, which is consistent with the top reason "avoid being late". This percentage is 20 points higher than the second-ranked situation "when traveling with other persons". On the other hand, more than 60% of Korean respondents reported a diverse set of situations, including "when accidents or delay of service and so on suddenly occur" (86%), "when deciding the departure time" (79%), "when deciding whether to go out or not and where to go" (71%), "when the weather is bad" (70%), "when traveling with other persons" (69%), "when visiting multiple places within a single trip" (62%), and "when there is an appointment" (60%). The above results suggest that Korean trip makers are more likely to make effective use of limited information for supporting their daily travel.

Looking at the difficulties in obtaining travel information (Figure 5), there are much fewer Japanese respondents encountering difficulties than the Korean in the sense that there are only less than 20% of the Japanese complain about the travel information provision, but the corresponding share ranges between 58% and 84% in case of Korea. Inexplicably, there are also 83% of Korean respondents reported no difficulties to get information. The findings of Korean cases might suggest that there are various sources of travel information, which provide an easy access environment for Korean trip makers, but the quality is not satisfactory.

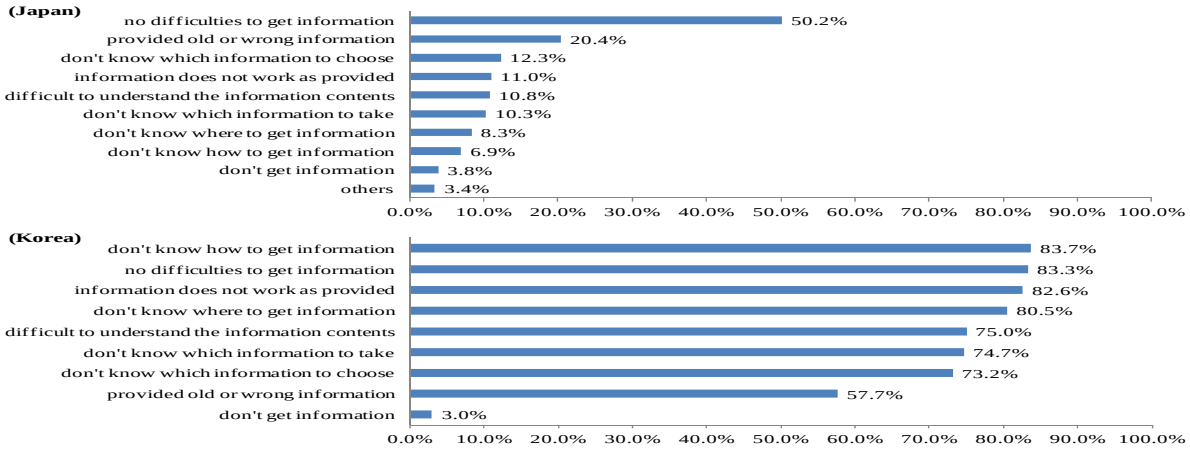


Figure 5 – Difficulties in obtaining travel information

Information Tastes, Needs, and Willingness-to-pay

The above analyses have identified a variety of roles of travel information in supporting travel behavior and the necessity and importance of introducing travel information systems as a part of transportation systems. To further improve the roles of travel information, hereafter, we will mainly analyze trip makers' needs for various types of travel information and travel-related information as well as willingness to pay for the information. In this sub-section, we only show results of aggregate analyses. After this, we will conduct a cause-effect analysis based on a structural equation model.

It is expected that travel information needs might be strongly associated with information tastes, which are measured using 12 indicators (Figure 6). In case of Japan, 93% of respondents like to collect travel information, but only 43% of Korean respondents do. In both countries, nearly 70% of respondents said that they can visit destinations somehow without pre-trip information, which is quite similar to the share of those respondents thinking that self-experience is good enough to daily trip making (there are more Korean respondents (79%) being confident about their own experience). More than 70% of respondents claim that knowing approximate travel time is good enough, suggesting a higher acceptance of providing interval-based travel time information rather than the point-based information. But such lower request of information accuracy does not mean that people do not need more information. On the contrary, there are 74% of Korean respondents attempt to collect travel information as detailed as possible, implying a higher dependence of Korean trip makers on travel information. For the real-time travel information, 41% of Japanese respondents and 56% of Koreans request it. Reflecting personal taste into the travel information provision process is highly requested by Korean trip makers (63%), while the corresponding share in Japan is about 40%. The last part of information tastes is related to the information reliability. In Japan, 66% (70% in Korea) of respondents believe that travel information from websites is more reliable than experience, 72% (79% in Korea) like to follow travel information from websites, 38% (63% in Korea) like to compare travel information from several websites, and 56% (85% in Korea) like to use popular websites.

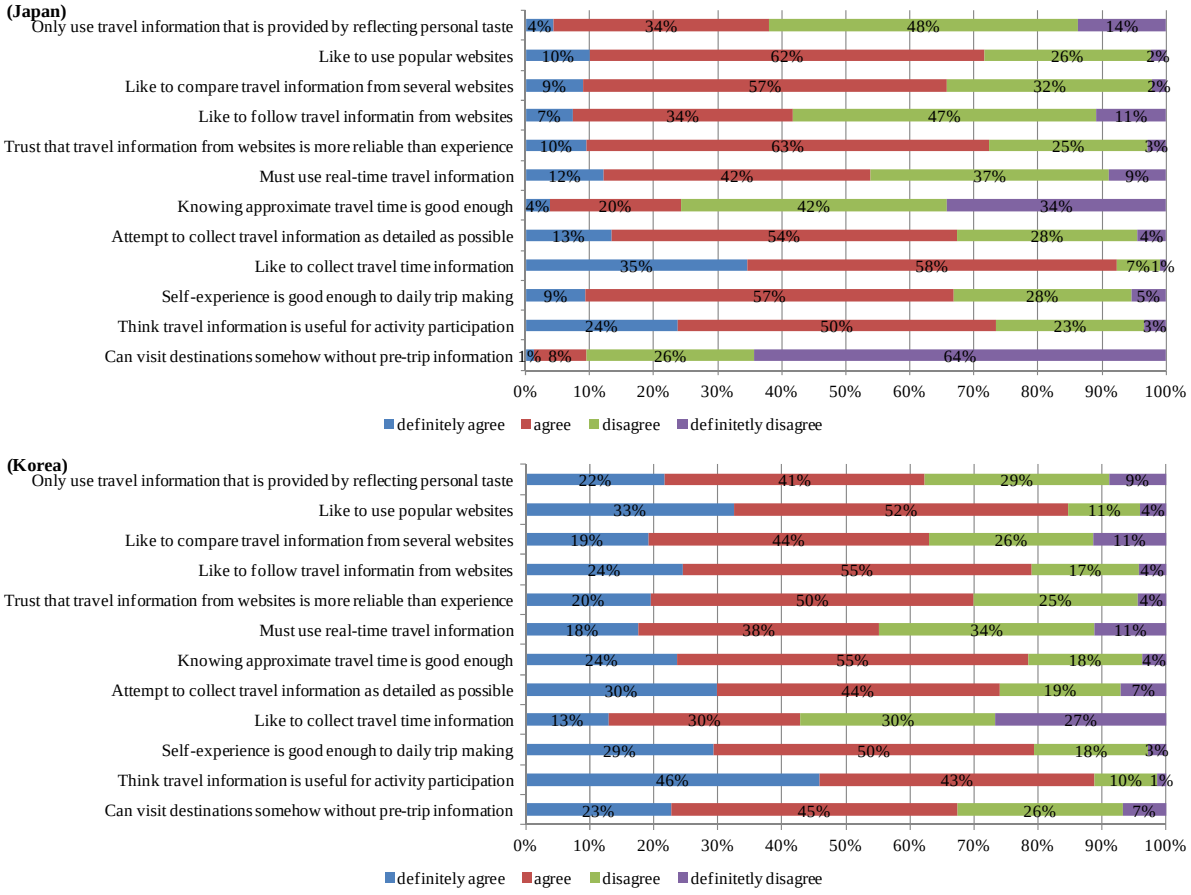


Figure 6 – Taste for travel information

For the types of travel information, we prepare 26 items for car users and 20 items for public transportation users based on literature review and best-of-practice proposals mainly in developed countries, including existing travel information and new types of information.

For car users (Figure 7), traffic information (e.g., congestion, traffic accidents and construction sites), optimal driving route information (e.g., minimal travel time, distance or cost), and reliable guidance information of chosen routes are the top three needed information (77% ~ 82% in Japan and 87% ~ 90% in Korea). This result is straightforward, suggesting these three types of information are the fundamental information for trip making. Within the

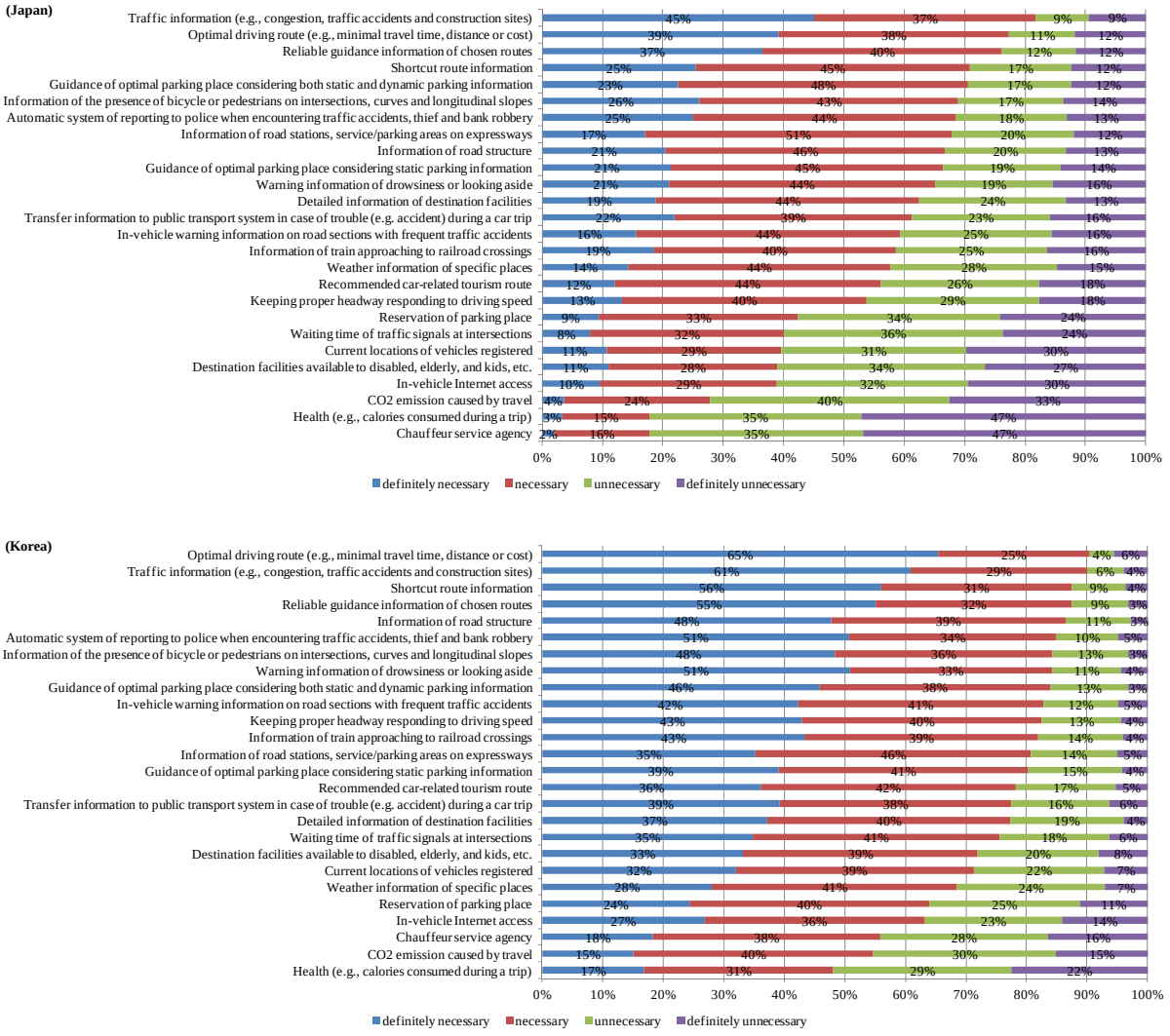


Figure 7 – Needs for car traffic information

top four of travel information, shortcut travel information is ranked in, suggesting higher needs of avoiding traffic congestions. The 5th needed information is guidance of optimal parking place considering both static and dynamic parking information in Japan and information of road structure in Korea. In both Japan and Korea, "information of the presence of bicycle or pedestrians on intersections, curves and longitudinal slopes" and "automatic

system of reporting to police when encountering traffic accidents, thief and bank robbery" are ranked as the 6th and 7th places. "Warning information of drowsiness or looking aside" is also highly requested (11th in Japan and 8th in Korea) as well as other types of traffic safety information such as keeping proper headway responding to driving speed (53% in Japan, 83% in Korea), in-vehicle warning information on road sections with frequent traffic accidents (60% in Japan, 83% in Korea), and information of train approaching to railroad crossing (59% in Japan, 82% in Korea). This implies that traffic safety related to bicycle and pedestrians and drivers' human errors and security during a trip are highly concerned by trip makers. The types of information requested by less than 50% of respondents in Japan are reservation of parking place (42%), waiting time of traffic signal at an intersection (40%), current locations of vehicles registered (40%)[1], in-vehicle Internet access (39%), CO_2 emission caused by travel (28%), health (e.g., calories consumed during a trip) (18%), and information of chauffeur service agency (18%). In Korea, health-related information is needed by less than 50% of respondents.

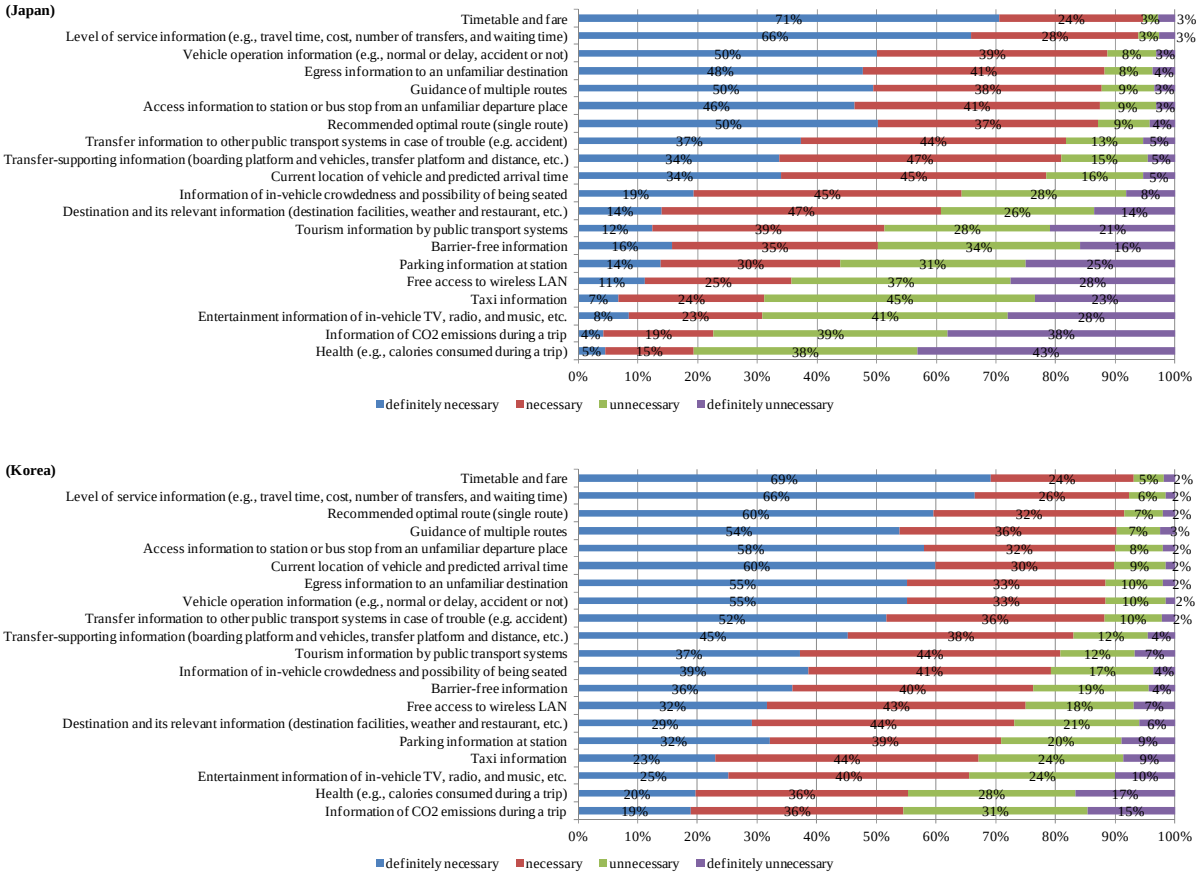


Figure 8 – Needs for public transportation information

As for public transportation users (see Figure 8), the top five needs are "timetable and fare" (the most fundamental information: 95% in Japan and 92% in Korea), level of service

[1] When traveling with other persons by different cars, one may need to know the location of travel companion's vehicle. It is expected that registering these vehicles in advance may assist drivers to confirm the mutual location for avoiding "getting lost from each other".

information (e.g., travel time, cost, number of transfers, and waiting time) (94% in Japan and 92% in Korea), vehicle operation information (e.g., normal or delay, accident or not) (only in Japan: 89%, the 3rd place), recommended optimal route (single route) (only in Korea: 92%, the 3rd place), egress information to an unfamiliar destination in Japan (the 4th place: 89%), guidance of multiple routes in Japan (88%: the 5th place) and access information to station or bus stop from an unfamiliar departure place in Korea (90%: the 5th place). Among those types of information requested by more than 50% of respondents, information of in-vehicle crowdedness and possibility of being seated is included. For the entertainment information, about 30% of Japanese respondents responded, but 65% of Koreans did. As for the health-related and CO_2 emission information, they are ranked as the lowest two types (response rate in Japan is about 20%, but it is about 55% in Korea). For free access to wireless LAN, only 36% of Japanese respondents requested it, but the rate reaches 75% in Korea. In contrast, respondents in both countries show relatively high interest emergency information (i.e., transfer information to other public transport systems in case of trouble (e.g. accident)) (81% in Japan and 88% in Korea). Current location of vehicle and predicted arrival time is ranked as the 10th place in Japan and 6th in Korea. As a whole, Korean trip makers' attitudes toward different types of travel and travel-related information is more active than the Japanese. Such differences may be in part due to the current development level of travel information systems on one hand and caused by cultural differences.

The last item in this part of analysis is the willingness to pay (WTP) for the information (see Figure 9). It is found that the average WTP is about 41 Yen per time in Japan and about 303 Won per time in Korea. Considering the currency exchange rate, the WTP in both countries is similar. Looking at the variations of WTP values, more Korean respondents (88%) reported lower than 500 Won than Japanese respondents reporting lower than 50 Yen. Value range of WTP in Japan is bigger than in Korea. This implies that it is easier to differentiate travel information for different groups of users based on pricing schemes, for example, providing more added-value and higher quality information to those trip makers with higher WTP. However, in Korea, equal information provision under reasonable lower price for added-value and higher quality information might be more successful.

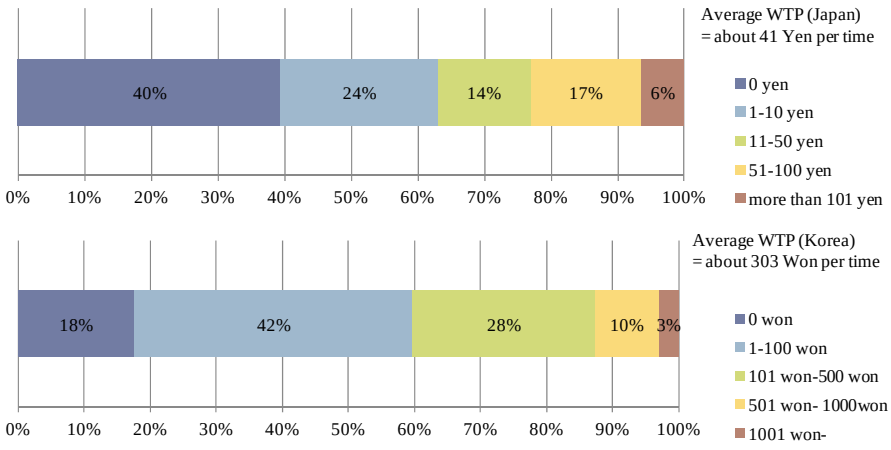
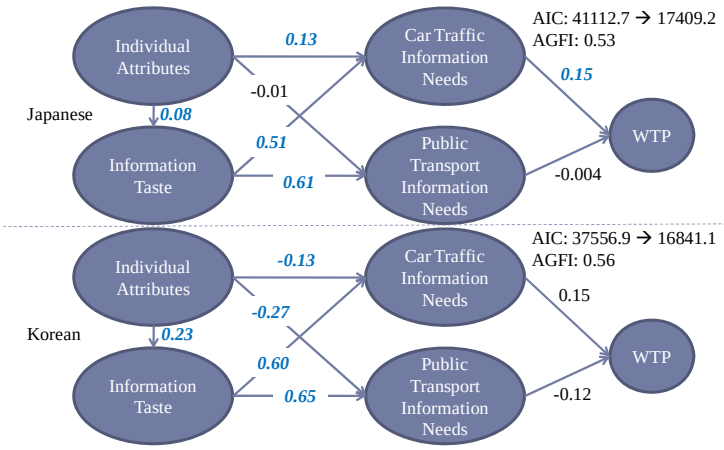


Figure 9 – Willingness to pay for travel information

CAUSE-EFFECT ANALYSIS

Having explored various aspects of travel information, here, we will conduct a cause-effect analysis based on a structural equation model by focusing on the relationships between travel information needs and WTP, and between tastes of trip-making and information and needs of travel information. Heterogeneous cause-effect relationships will be captured by introducing individual attributes. A common cause-effect structure is assumed to both Japan and Korea cases. Five types of latent variables are introduced: individual attributes (IA), trip-making and information taste (TMIT), car traffic information needs (CTIN), public transport information needs (PTIN), and WTP. It is assumed that WTP is directly influenced by information needs (i.e., CTIN and PTIN), where CTIN and PTIN are further directly influenced by TMIT and IA. Finally, IT is also assumed to be influenced by IA. WTP is used to measure "pay or not (Yes: 1, No: 0)" and "amount of payment (actual amount of money paid per time)". CTIN is used to describe 26 car traffic related information contents while PTIN describes 20 public transportation related information contents. TMIT illustrates 7 types of trip-making tastes and 12 types of information taste, and IA is introduced to reflect the influence of seven individual attributes.

The above cause-effect models are estimated separately for the two countries and their standardized estimation results are shown in Figure 10 and Tables 1 ~ 3. AGFI values are 0.53 for Japanese trip makers and 0.56 for Korean trip makers, which is not high enough but acceptable for identifying the above cause-effect relationships. Most of the parameters are statistically significant at 5% level. In the Japanese case, WTP is only influenced by CTIN; however, it is not influenced by either CTIN or PTIN in the Korean case. Significant influence from TMIT on CTIN and PTIN is confirmed in both cases. IA does not affect TMIT and PTIN in the Japanese case.



Bold and *italic* figure: Significant at 95% level

Figure 10 – Results of structural equation model

Observing the above total effects (Table 1), for both Japan and Korea, the most influential variable for WTP is CTIN, which increases the value of WTP, and PTCN reduce the WTP. This implies that people derive values mainly from car traffic information. This is consistent

with the aggregation results, which say that PTIN is higher but its WTP is lower. Taking IA as a reference, it is found that the influence of CTIN and PTIN is 5.8 times and 0.1 times larger and that of IA in Japan, respectively, while the influence of CTIN and PTIN is 12.0 times and 9.9 times larger and that of IA in Korea, respectively. In this sense, the influence of CTIN and PTIN is much stronger in Korea than in Japan. TMIT shows the second largest influence on WTP in Japan and the least influence in Korea. CTIN and PTIN are strongly affected by TMIT, compared with IA (the influence of TMIT on CTIN is 3.0 times higher in Japan and 45.8 times higher in Korea than IA, respectively; the influence of TMIT on PTIN is 14.9 times higher in Japan and 6.4 times higher in Korea, respectively).

Table 1 – Standardized total effects

(Upper value: Japan: Lower value: Korea)

Explanatory variable / Dependent variable	Individual attributes	Trip-making information taste	Car traffic information needs	Public transportation information needs
Trip-making and information tastes	.081798 .230387			
Car traffic information needs	.174517 .013181	.514581 .604018		
Public transportation information needs	.041040 -.117476	.612672 .647601		
WTP	.026861 .016286	.077374 .009757	.154791 .147091	-.003719 -.122126

Influence of Trip-making and Information Tastes on Travel Information Needs

Remember that the influence of trip-making and information tastes on travel information needs is positive in both countries (see the total effects shown in Table 1). Since "trip-making and information tastes" is used as an exogenous variable to measure the 19 taste variables (dependent variable), the magnitude of the influence of each taste variable on the needs is inversely proportional to the estimated parameter. This is a general rule to explain the influence of observed variables described by exogenous latent variables on endogenous variables (both latent and observed variables). Keeping this rule in mind, we can observe that within the top ten taste variables, four travel information taste indicators and five trip-making taste indicators in Japan and four information taste indicators and four trip-making taste indicators in Korea are respectively ranked in.

The case of Japan

1. The top four travel information taste indicators: "can visit destinations somehow without pre-trip information" (0.01), "self-experience is good enough to daily trip making" (0.03), "knowing approximate travel time is good enough" (0.03), and "like to collect travel information" (0.37).

2. The top five rip-making taste indicators: "trip-making with time to spare" (0.15), "inconvenient public transport in residence city" (0.20), "feeling uneasy when using public transport" (0.26), "be irritated by getting lost" (0.32), and "good at comparing many mode-specific attributes" (0.38).

The case of Korea

1. The top four travel information taste indicators: "can visit destinations somehow without pre-trip information" (0.30), "self-experience is good enough to daily trip making" (0.37), "think travel information is useful for activity participation" (0.37), and "only use travel information that is provided by reflecting personal taste" (0.38).

2. The top four rip-making taste indicators: "be irritated by getting lost" (0.26), "trip-making with time to spare" (0.28), "inconvenient public transport in residence city" (0.29), and "feeling uneasy when using public transport" (0.33).

In addition, one general information taste indicator (bad at using computer and Internet: 0.07) in Japan and two general information taste indicators (bad at using computer and Internet: the top taste indicator (0.24), and like to enjoy an Internet-dependent life: the 10th taste indicator (0.40)) in Korea.

Travel Information Needs with Higher WTP

As shown in Figure 10, it is found that car traffic information needs (CTIN) increase WTP and public transportation information needs (PTIN) reduce WTP for both Japanese and Korean respondents. Travel information needs with higher WTP (Tables 2 and 3) are summarized. Understanding of the following descriptions should be paid enough attention to the fact that only the parameter of CTIN on WTP is statistically significant at 5% level.

Car Traffic Information Needs with Higher WTP

Comparing Figure 7 and Table 2, one can easily observe that highly needed car traffic information is not always consistent with the information with higher WTP, except the fundamental transport service information "optimal driving route" in both countries, traffic information and shortcut route information in Korea. For example, even thought the health-related information is ranked at the lowest level in Figure 7, but it is the most information for car users in both countries. Common information with higher WTP (the top ten types of information), but ranked at the lower level in Figure 7 in both countries includes chauffeur service agency, in-vehicle internet access, current locations of vehicles registered, CO_2 emission caused by travel, and reservation of parking place. The differences between Japan and Korea are, 1) Japanese trip makers highly value destination facilities available to disabled, elderly, and kids, etc. (the 6th place;), 2) Korean trip makers attach higher monetary evaluation on optimal driving route information (the 2nd place).

Table 2 – Standardized estimation results: Car traffic information needs ranked by the influence on WTP

Rank	Item of Car Traffic Information Needs	Japanese	Korean	Item of Car Traffic Information Needs
1	Health (e.g., calories consumed during a trip)	***0.44***	***0.36***	Health (e.g., calories consumed during a trip)
2	Chauffeur service agency	***0.47***	0.40	Optimal driving route (e.g., minimal travel time, distance or cost)
3	In-vehicle Internet access	***0.56***	***0.44***	In-vehicle Internet access
4	Current locations of vehicles registered	***0.58***	***0.44***	CO2 emission caused by travel
5	CO2 emission caused by travel	***0.60***	***0.46***	Chauffeur service agency
6	Destination facilities available to disabled, elderly, and kids, etc.	***0.62***	***0.47***	Current locations of vehicles registered
7	Reservation of parking place	***0.63***	***0.53***	Traffic information (e.g., congestion, traffic accidents and construction sites)
8	Waiting time of traffic signals at intersections	***0.64***	***0.55***	Reservation of parking place
9	Optimal driving route (e.g., minimal travel time, distance or cost)	0.66	***0.56***	Shortcut route information
10	Detailed information of destination facilities	***0.67***	***0.59***	Information of road stations, service/parking areas on expressways
11	Weather information of specific places	***0.68***	***0.59***	Detailed information of destination facilities
12	Recommended car-related tourism route	***0.68***	***0.59***	Weather information of specific places
13	Shortcut route information	***0.69***	***0.60***	Destination facilities available to disabled, elderly, and kids, etc.
14	Information of road stations, service/parking areas on expressways	***0.72***	***0.60***	Recommended car-related tourism route
15	Reliable guidance information of chosen routes	***0.73***	***0.60***	Transfer information to public transport system in case of trouble (e.g., accident) during a car trip
16	Transfer information to public transport system in case of trouble (e.g., accident) during a car trip	***0.73***	***0.61***	Waiting time of traffic signals at intersections
17	Traffic information (e.g., congestion, traffic accidents and construction sites)	***0.74***	***0.62***	Reliable guidance information of chosen routes
18	Information of train approaching to railroad crossings	***0.74***	***0.64***	Guidance of optimal parking place considering both static and dynamic parking information
19	In-vehicle warning information on road sections with frequent traffic accidents	***0.75***	***0.66***	Warning information of drowsiness or looking aside
20	Guidance of optimal parking place considering static parking information	***0.75***	***0.67***	Information of train approaching to railroad crossings
21	Keeping proper headway responding to driving speed	***0.76***	***0.68***	Guidance of optimal parking place considering static parking information
22	Warning information of drowsiness or looking aside	***0.76***	***0.68***	In-vehicle warning information on road sections with frequent traffic accidents
23	Guidance of optimal parking place considering both static and dynamic parking information	***0.77***	***0.68***	Keeping proper headway responding to driving speed
24	Information of the presence of bicycle or pedestrians on intersections, curves and longitudinal slopes	***0.77***	***0.69***	Automatic system of reporting to police when encountering traffic accidents, thief and bank robbery
25	Information of road structure	***0.78***	***0.69***	Information of road structure
26	Automatic system of reporting to police when encountering traffic accidents, thief and bank robbery	***0.78***	***0.71***	Information of the presence of bicycle or pedestrians on intersections, curves and longitudinal slopes

Note: **Bold** and *italic* figure: Significant at 5% level; Underlined figure means that the value was fixed to one during the model estimation. All the values are standardized.

Public Transportation Information Needs with Higher WTP

Since the influence of PTIN on WTP is negative, different from CTIN, most of the highly needed PTIN items (Figure 8) are also highly valued in monetary term (Table 3), but the ranking order in Table 3 is not the same as that in Figure 8. In Japan, the top three valued information items are, 1) access information to station or bus stop from an unfamiliar departure place, 2) transfer-supporting information, and 3) guidance of multiple routes, while in Korea, the corresponding information items include, 1) egress information to an unfamiliar

destination, 2) access information to station or bus stop from an unfamiliar departure place, and transfer-supporting information. Since guidance of multiple routes is ranked as the 3rd place, this might imply that Japanese trip makers request more options for choices. Both Japanese and Korea trip makers highly evaluate transfer information and vehicle operation information. Differently, the evaluation of level of service information is higher in Japan and the barrier-free information is highly evaluated in Korea as well as information of in-vehicle crowdedness and possibility of being seated. The information of current location of vehicle and predicted arrival time is almost equally valued in both countries. The highly valued health and environment related information by car users are ranked as the lowest information by public transportation users. Entertainment information is valued as one of the lowest information items by public transportation users.

Table 3 – Public transportation information needs ranked by the influence on WTP

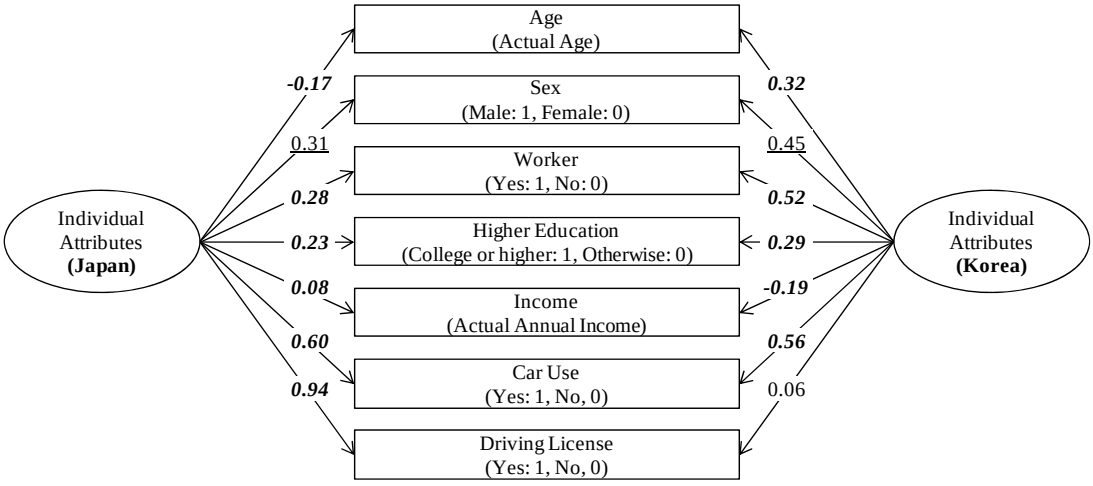
Rank	Item of Public Transport Information Needs	Japanese	Korean	Item of Public Transport Information Needs
1	Access information to station or bus stop from an unfamiliar departure place	***0.76***	***0.71***	Egress information to an unfamiliar destination
2	Transfer-supporting information (boarding platform and vehicles, transfer platform and distance, etc.)	***0.75***	***0.71***	Access information to station or bus stop from an unfamiliar departure place
3	Guidance of multiple routes	***0.75***	***0.71***	Transfer-supporting information (boarding platform and vehicles, transfer platform and distance, etc.)
4	Vehicle operation information (e.g., normal or delay, accident or not)	***0.75***	***0.69***	Transfer information to other public transport systems in case of trouble (e.g. accident)
5	Egress information to an unfamiliar destination	***0.75***	***0.68***	Vehicle operation information (e.g., normal or delay, accident or not)
6	Level of service information (e.g., travel time, cost, number of transfers, and waiting time)	***0.72***	***0.65***	Barrier-free information
7	Current location of vehicle and predicted arrival time	***0.71***	***0.63***	Information of in-vehicle crowdedness and possibility of being seated
8	Recommended optimal route (single route)	***0.70***	***0.62***	Current location of vehicle and predicted arrival time
9	Transfer information to other public transport systems in case of trouble (e.g. accident)	***0.69***	***0.61***	Guidance of multiple routes
10	Timetable and fare	***0.66***	***0.60***	Recommended optimal route (single route)
11	Information of in-vehicle crowdedness and possibility of being seated	***0.64***	***0.59***	Level of service information (e.g., travel time, cost, number of transfers, and waiting time)
12	Destination and its relevant information (destination facilities, weather and restaurant, etc.)	***0.53***	***0.57***	Tourism information by public transport systems
13	Barrier-free information	***0.50***	***0.56***	Timetable and fare
14	Tourism information by public transport systems	***0.47***	***0.56***	Destination and its relevant information (destination facilities, weather and restaurant, etc.)
15	Parking information at station	***0.46***	***0.54***	Taxi information
16	Free access to wireless LAN	***0.44***	***0.54***	Parking information at station
17	Taxi information	***0.43***	***0.45***	Free access to wireless LAN
18	Entertainment information of in-vehicle TV, radio, and music, etc.	***0.40***	***0.44***	Information of CO2 emissions during a trip
19	Information of CO2 emissions during a trip	***0.34***	***0.44***	Entertainment information of in-vehicle TV, radio, and music, etc.
20	Health (e.g., calories consumed during a trip)	***0.34***	***0.42***	Health (e.g., calories consumed during a trip)

Note: **Bold** and *italic* figure: Significant at 5% level; Underlined figure means that the value was fixed to one during the model estimation. All the values are standardized.

Heterogeneous Travel Information Needs

Figure 11 shows the parameters of seven individual attributes. Since the influence of IA on CTIN in both countries is positive in both countries (see Table 1), trip makers who show

higher car traffic information needs are younger, male, workers, and mainly car users, hold a higher education degree, earn more money (higher income), and have a driving license. Concerning PTIN in Japan, the above observation is still applicable because the influence of IA on PTIN is positive. However, PTIN in Korea shows opposite results because the influence of IA on PTIN is negative. Trip makers with higher values of PTIN are female, older persons, do not have a driving license, usually do not use a car, and have no job (including part-time workers, housewives, and students). But the influence of income on both CTIN and PTIN is positive: i.e., the higher the income is, the higher the needs are. In fact, income is the most influential individual attribute: its parameter is 0.08 in Japan and -0.19 in Korea, which is the lowest value among the seven attributes (note that smaller values of parameter corresponds to higher influence on the needs).



Note: **Bold** and *italic* figure: Significant at 5% level; Underlined figure means that the value was fixed to one during the model estimation. All the values are standardized.

Figure 11 – Parameters of individual attributes

CONCLUSIONS

Japan and Korea are two leading countries in the field of information and communication technologies (ICT) in the world. It is expected that the role of ICT in improving transportation systems will become more and more important. The rapid progress of ICT development has made more and more information available to trip makers by reflecting their personal preference. It therefore becomes possible to make transport policies targeting individual trip makers rather than unspecified groups. This study compared trip-makers' needs for travel information, especially the next-generation information in Japan and Korea based on two relatively medium-scale questionnaire surveys (1,000 respondents in Japan and 1,181 in Korea). The needs have been examined from the perspectives of information tastes, actual travel information search and use, and willingness-to-pay. Similarities and dissimilarities in the two countries are clarified. The derived conclusions are useful to improve not only car traffic and public transportation information systems, separately, but also multi-modal travel

information systems that unify the contents of car traffic and public transportation information in a consistent and user-friendly way.

Major Findings

Trip makers in both countries show considerably different actual travel information search and use behavior in the sense that means, reasons, and situations of obtaining the information as well as difficulties in information search and use behavior are quite different. A majority of Korean trip makers have faced various difficulties in getting travel information. This might be the reason why most Korean trip makers make use of various means for searching travel information. Japanese trip makers are more likely to use travel information for avoiding negative impacts caused by travel while trip makers in Korea tend to justify their choices. Our analyses suggest that Korean trip makers are more actively make use of travel information, even though there are more difficulties in Korea than in Japan.

Car users and public transportation users have different needs for travel information. This is straightforward. Car users in the two countries attach the highest value to the health and environment related information, and in-vehicle Internet access, which is much higher than trip-oriented information, among the 26 pre-given information items. Differently, public transportation users in the two countries value the access and egress, and transfer information with the highest WTP. Car users more emphasize the roles of information in mitigating negative impacts caused by car trips and public transportation users are more "conservative" in the sense that those most fundamental transport service contents are still their core concerns. Among the pre-given next-generation travel information, current locations of registered vehicles and reservation of parking place are the top two types. We expected that those safety related information could be among the information contents with higher WTP. Unfortunately, information of trains approaching to railroad crossings, keeping proper headway responding to driving speed, warning information of drowsiness and looking around, and information of the presence of bicycles or pedestrians on intersections, curves and longitudinal slopes are ranked even beyond the top ten information contents. It should be noted that the above findings show larger variations among trip makers. Heterogeneous preference and tastes of individual trip makers must be properly reflected in the development of future travel information systems.

Implications for Travel Information System Development

Since the needs for travel information differ from trip-making contexts and travel experience, it seems important how to provide travel information by reflecting individual trip-making and activity schedule. For example, individualized ICT devices are becoming more and more popular. If activity scheduler can be linked with activity locations, semi-automatic travel guidance system can be developed. Since most of Japanese and Korean trip makers (about 70%) only spend 5 to 10 minutes on the travel information searching. The system design should take into account this search behavior with shorter time. Since the searching time is very short, this means that if trip makers cannot successfully obtain the needed information

shortly from few websites, they will give up the searching. This further supports the idea to establish a one-stop travel information searching site, from which trip makers can easily access all the needed information stored/managed in different websites, without visiting different websites intentionally. For this purpose, standardization of travel information becomes important, at least within a country. For tourism related information, international standardization becomes crucial.

It is revealed that the needs for CO_2 emission and health information are quite low for public transportation users. Since behavioral changes in transportation systems are required from the perspective of sustainable transportation development, it becomes a challenging issue how to make effective use of travel information provision mechanisms to encourage car users to shift from the current unsustainable travel behavior to the sustainable mobility life supported by better public transportation systems.

Directions of Travel Information Systems Development

Considering the current ICT development trends and the travel information search and use behavior clarified in this study, it seems important to develop individual schedulers that should be powered by handful ICT devices and should be location-sensitive, context-sensitive, experience-sensitive, and preference-sensitive. Once the location and time of activity are decided, the required travel information will be automatically displayed by the pre-designated time before departure after automatic searching from different websites, and the information will be automatically updated. The supporting reasons for such individual schedulers are given below.

1. 50% ~ 70% of respondents reported that the reasons why they search travel information are "avoid being late", "desire to reach the destination in the shortest travel time and distance", and "do not want to taking a wrong vehicle". More people want to obtain travel information when there is a time commitment and travel together with other people. In this sense, it is important to provide the information in a timely manner in accordance with the schedule of individual activities.

2. Travel conditions change from time to time. Changes of travel conditions will bring trouble to individual participation in activities. In this study, it is revealed that more than 90% of respondents think that travel information is very useful to the smooth conduct of activities at destinations. Information provision in accordance with individual activity schedule at destination is required.

3. Many respondents reported that they want to save unnecessary time for travel. This might be because unnecessary time loss will hinder the activity participation. It is expected that individualized travel information provision could save such unnecessary time loss.

4. It is usually assumed that trip making only generates negative impacts (e.g., loss of time for activity participation, and emotional distress due to tiredness of not being

seated). Our survey reveals that there are a larger number of trip makers who, in fact, like traveling by car or public transportation systems. But it is surely true that there are more than 50% of respondents feeling irritable when getting lost on the way to destination. In this sense, since individualized information provision could assist trip makers' decisions on travel, the above stressful experience might be mitigated.

5. Since many people do not want to spend more time on information searching for travel, people might be happier to receive the needed information provided by the information system that is sensitive to individual requests in accordance with their schedule.

Looking back to the history of travel information system development, we have experienced the analog travel information for a long and long time, online static level of travel service information, online dynamic travel information, and added-value information. We are surely observing the development of individualized travel information system, even though it is still in an immature stage. The development history is also supportive to the proposal of the development of ICT-powered personal schedulers. Future studies should focus on the development of such ICT-powered personal schedulers, and more innovative transport policies should be developed to mitigate the impacts of induced travel by the introduction of more and more ICT-powered means in transportation systems.

ACKNOWLEDGEMENT

This research is supported by Korea Research Institute for Human Settlements under the project titled "Research and Development for User-Oriented Public Transportation" (project duration: December 2007 ~ September 2011) as well as the Grants-in-Aid for Scientific Research (A) ''Development of Cross-Sector Urban Planning and Management Methodologies by Establishing Theory of Citizens' Life Decisions and Behavior'' (No.22246068) of the Japan Society for the Promotion of Science (JSPS), Japan.

REFERENCES

Khattak, A.J., Yim, Y. and Prokopy, L.S. (2003). Willingness to pay for travel information. Transportation Research Part C, 11 (2), 137-159.

Chorus, C.G., Arentze, T.A., Molin, E.J.E., Timmermans, H.J.P., Van Wee, B. (2006). The value of travel information: Decision strategy-specific conceptualizations and numerical examples. Transportation Research Part B, 40 (6), 504-519.

Grotenhuis, J.W., Wiegmans, B.W. and Rietveld, P. (2007). The desired quality of integrated multimodal travel information in public transport: Customer needs for time and effort savings. Transport Policy, 14 (1), 27-38.

Farag, S. and Lyons, G. (2012). To use or not to use? An empirical study of pre-trip public transport information for business and leisure trips and comparison with car travel. Transport Policy, 20, 82-92.