TESTING A PARTICIPATORY SELF-DECLARING TRAVEL DAIRY SURVEY METHOD IN A SMALL-SIZED JAPANESE CITY

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ABSTRACT

We examine the applicability of a participatory self-declaring (PSD) survey, proposed by the author. This is done by actually implementing the survey in a small-sized Japanese city. PSD survey allows respondents to personally declare the information required by public policy decisions at any time and at any place in a cost-effective way, completely based on their own will and convenience. PSD survey is user-friendly and can guarantee the representativeness of the population in a much easier way than traditional surveys. It can be also built as a continuous survey. In this survey, 1,000 residents were pre-selected based on recruitments via post cards and the Internet and the total survey period was set to be one month (two weeks for call-for-participation and two weeks for answering the survey). As a result, 46 persons participated in the survey (participation rate: 4.6%). Considering that the survey period was short and the contact methods were limited, the 4.6% participation rate is not low. This is the first time to confirm the applicability of PSD survey in practice. A choice model based analysis revealed that residents who lived in noncentral areas and were younger than 60 years old tend not to participate.

Keywords: participatory self-declaring survey, travel diary survey, participation analysis, volunteerability, Japan

INTRODUCTION

Various types of surveys have been used to provide well-grounded insights for urban and transportation policy decisions. Needless to say, reliable survey data are essential to support better policy decisions. To date, travel diary survey, activity diary survey, panel survey, and stated preference survey (e.g., Richardson et al., 1995; Stopher and Jones, 2003) have been developed one after another to better the understanding of activity and travel behavior for different policy purposes. On the other hand, it is known that activity and travel behavior changes from time to time and from context to context. Temporal changes also show

variations at different time scales (e.g., hour-to-hour, day-to-day, week-to-week, season-to-season, and/or year-to-year variations). To capture such behavioral changes and variations, panel survey could and should be used (e.g., Golob et al., 1997; Stopher, 2009); however, in reality, its application is very limited due to various reasons, one of which is that it is time-consuming and too costly. As a result, in practice, transportation surveys are usually conducted by focusing on a representative (or an average) day (at most several days) and the survey results are then used to predict long-term and/or short-term travel demand. Moreover, it is difficult to apply existing survey methods to capture the influences of various contexts, which can be classified into individual-specific, alternative-specific, and circumstantial contexts (Zhang et al., 2004). The first type refers to individuals' and their households' attributes. The second indicates the context related to the availability of alternatives, the number of alternatives, attributes of alternatives and their correlation structures, etc. The last means circumstantial factors (e.g., weather, economic conditions, and city characteristics), which are common to all decision makers. In theory, it is obvious that information collected on one or several days cannot be used to fully capture temporal and contextual variations included in behaviors of the whole population. Interestingly, several so-called 'continuous' surveys have been conducted around the world both at the national, regional and metropolitan levels, where "data for each respondent are sought for the 24 hours of the day in the seven days of the week and in all seasons of the year; further, the effort should be kept going for several years" (Ortúzar et al., 2011).

In reality, even for the simple single-day person-trip (PT) survey, its implementation is becoming more and more difficult, especially in local cities of Japan, because of the budget constraints (even with the subsidies from central government) caused by long-lasting economic recession and the progress of elderly society and the society with low birth rate. To the authors' best knowledge, the PT survey has been mainly used in Japan and most Asian countries. Internationally, it is known as travel diary survey household travel survey (without detailed activity information). It is true that the number of cities who already conducted the person-trip survey is increasing. It has been argued that such transportation survey should be conducted at least once ten years for long-term policy decision. Short-term policies require more frequent implementation of such survey. However, an inarguable fact is that a majority of PT surveys in Japan were implemented during the late 1980s and the late 1990s when economic development was in prosperity (Up to 2007, 120 surveys were conducted in 60 metropolitan areas). For example, Hiroshima city is the first city in Japan to conduct the PT survey in 1967. To date, three PT surveys were already conducted in Hiroshima metropolitan area, where the second was a small-scale survey. The PT survey should have been done in either 1997 or 2007, because the last survey was done in 1987. Many other cities are facing similar problems. One of the major reasons for such delay of implementing PT survey is that PT survey is too costly and local governments cannot afford it even with the help of subsidies from the central government. This is also true for the surveys used for urban planning and other public policy decisions.

Traditional survey methods usually include mail-out and mail-back survey, mail-out and telephone-back survey, telephone interview, intercept interview, telephone and home interview, and home interview (Richardson et al., 1995; Stopher and Jones, 2003). These

traditional surveys usually set a strict deadline of reporting survey results within a very limited time period (e.g., one or two weeks or a month). Such strict deadline ignores the convenience of respondents and in many cases leads to a very low response rate. To trade off the low response rate, one has to distribute too-many questionnaires, most of which will be thrown away. Especially in case of handing out questionnaires based on personal visits (e.g., home interview and intercept interview), a majority of survey expenditures becomes wasteful. In case of home interview, for example, sometimes several visits are even required to get one sample. Such inefficient efforts result in the rise of survey cost. In this sense, the efficiency of traditional survey methods is very low.

Therefore, it is becoming more and more important how to sustainably collect the needed data for policy decisions, by balancing the cost of survey implementation and the richness of reliable variation information from the survey data as well as respondents' own will and convenience. Since the year of 2003 when the Act on the Protection of Personal Information was enforced in Japan, citizens' attitudes toward personal information protection have been growing year by year. This is also true for other countries (e.g., Cottril and Thakuriah, 2012). However, another fact is that citizen participation is becoming more and more popular in various public policy decision contexts, including urban and transportation contexts, in Japan as well as in other developed countries. For example, the number of non-profit organizations certified in Japan increased nearly 28 times from the year of 1999 (1,176 NPOs) to 2011 (44,291)). The most recently released national survey results revealed that nearly 27% of the Japanese people participated in voluntary activities within a year. Therefore, it could be argued that the above shortcomings of traditional surveys might keep those who are actually willing to participate in travel surveys away from the participation. In other words, there are probably sufficiently enough citizens who are actually willing to participate in travel surveys completely based on their voluntary spirits (volunteerability) and whose attributes could represent the whole population; however, traditional travel surveys might have not successfully recruited them.

Motivated by, 1) the popularity of citizen participation in Japan and other developed countries, 2) the fact that it is becoming more and more difficult to guarantee survey budgets for public policy decisions, and 3) the necessity of capturing various time-varying and context-dependent behaviors, the author proposed a survey method, called participatory self-declaring (PSD) survey (see Zhang, 2008a, 2008b; Zhang et al., 2009a, 2009b; Zhang et al., 2011a).

> A participatory self-declaring survey method is a method that allows respondents to personally declare the information required by public policy decisions, at any place and at any time in a cost-effective way, based on their own will and convenience.

The assumed survey situation is that there is a pre-designated survey system (e.g., a well-designed web-based survey system), which is open to the public all the time (i.e., respondents can access the survey system at any place and at any time). It is not required that the survey system be a web-based system. For example, it can be simply a collection box installed at city

hall, which allows respondents to post the required questionnaires when visiting the city hall for other businesses.

Since respondents participate in the survey based on their own will and convenience, PSD survey can be built as a truly continuous survey if respondents participate in the survey frequently. The continuous survey method was proposed to capture long-term trends as well as changes in behavior in order to guarantee sustainable development, at least for those metropolitan areas over a certain amount of population (Ortúzar et al., 2011). In the current continuous surveys, however, different respondents are recruited every day and consequently pure changes and variations in individual behavior cannot be captured. In contrast, theoretically, PSD survey can capture time-varying and/or context-dependent travel behavior at any time scale.

With the above consideration, the purpose of this study is to empirically confirm the applicability of the PSD survey in a small-sized local Japanese city (Higashi Hiroshima City) with the help of the governmental office of the city. Before implementing this survey in November-December, 2011, a pilot survey was first conducted in March 2008 and a stated preference (SP) survey was done in December 2008. These two surveys played a very important role in convincing the governmental office to allow us to implement the PSD in the real world. In the remaining part of this paper, features and significance of PSD survey are first discussed and then the findings from the above two existing surveys testing the PSD survey are briefly summarized. After that, the actual PSD survey conducted in the small-sized city is introduced and the participation behavior is examined based on an aggregation analysis and an analysis using a binary logit model. Finally, the study is concluded together with a discussion of future research issues.

FEATURES AND SIGNIFICANCE OF PSD SURVEY

The proposed participatory self-declared (PSD) survey has several attractive features, comparing with traditional survey methods. These features are summarized below.

1. *PSD survey might be more cost-effective*: In traditional surveys, it is necessary to first print questionnaires and/or put them into envelopes, and then distribute and collect the printed questionnaires. In case of mail-back surveys, it is also necessary to pay for mailing cost for returned questionnaires. In addition, in traditional surveys, it is necessary to contact respondents by direct visit, by phone, or by post cards. In case of the direct visit, if the targeted respondents are not at home, it is necessary to either visit them again or to newly select alternative respondents. After collecting the questionnaires, it is further needed to input the raw data. In contrast, in the PSD survey, the above time-consuming tasks are not needed. It is true that the PSD survey needs a system like a web survey, which needs some initial costs. In reality, designing a web survey system is not that costly. And, with such survey system, it is much easier to check missing data and logically wrong data, especially the survey system could be

used repeatedly. Thus, considering the life cycle cost, PSD survey might be more cost-effective than traditional surveys.

2. *Any candidates of respondents can freely participate in the PSD survey*: PSD survey does not select respondents in advance (but may designate the attributes of respondents, for example, a special age group depending on survey purposes). Once the survey system is built, all the candidates of respondents will be informed in various ways (e.g., TV, radio, Internet, newspapers, posters and flyers). Needless to say, how to inform those candidate respondents is very important and should be carefully designed and implemented. The, those who are willing to participate in the survey can freely access the survey system at any place and at any time. In contrast, traditional surveys usually select respondents from a small portion of the whole population (usually less than several percentages). Traditional surveys have to be implemented within a very limited time period and can only collect the information on a representative day, or at most several days. Since the PSD survey is less costly, the survey period could be set much longer in order to capture travel behavior in various time scales and various contexts. Since the PSD survey allows respondents to participate in the survey completely depending on their own will and convenience, to collect the same number of samples as in traditional surveys, PSD survey might take a longer time.

3. *PSD survey can guarantee the representativeness of the population in a much easier way*: Since PSD survey requires respondents to access the survey system by themselves, it becomes important how to properly inform the citizens using various means. If the system can be built in the Internet environment, it is much easier to recruit respondents based on the pre-specified attribute distributions of the population. In other words, one just needs to repeatedly recruit respondents until the attribute distributions are met. To encourage the access to the PSD survey system, flexible access to the system is important, but it is also important how to encourage higher and more frequent access. It can be imagined that a well-designed web-based survey system could be a promising tool. Technically, design of such system is not a difficult task.

4. *PSD is a user-friendly survey system*: Since it is free for the public to access the survey system, respondents can participate in the survey based on their own convenience. In this sense, it is expected that it is much easier for respondents to participate in the PSD survey than traditional surveys. Needless to say, respondents have to access the survey system and fill in the required survey form by themselves. Traditional surveys usually require respondents to fill in questionnaire sheets by hand, which is in fact very time-consuming. In contrast, it is much easier for respondents to fill in on-line web questionnaire forms by just tapping with the keyboard of PC. In addition, since respondents will not be contacted directly by interviewers in case of home surveys, they can feel free with filling in questionnaire forms. Furthermore, since it is much easier to revise the contents of questionnaires, once the survey system is built, it can be used for various survey purposes without more additional efforts. It is

much flexible to set the survey time period. Since the data will be stored in a PC, it is much faster to show the survey results to respondents, because showing survey results to respondents quickly is essential and at least could be regarded as an incentive for participation. At least, respondents have a right to know how survey results are used in a timely and proper way.

5. *PSD survey can be designed as a continuous survey*: Since the PSD survey is designed to allow any respondents to access the system at any time, in theory, it is possible to collect the information from respondents over 365 days of a year. It therefore makes the observation of various time-varying and context-dependent behavior possible (at various time scales and covering various contexts), completely relying on respondents' voluntary spirits (volunteerability). In other words, the survey could be used to flexibly collect the information required by policy decisions at various time scales, covering various contexts. Depending on whether survey results will be used for short-term or long-term decisions, the required survey period could be a month, half a year, one year, or even several years.

One may argue that the longer survey period required by the PSD survey is a disadvantage. It is true, but it should however be emphasized that such longer survey period should not be regarded as a deficiency or a negative side-effect of the PSD survey. If one SERIOUSLY wants to capture temporal and contextual changes of various behavioral aspects, shorter survey periods of traditional surveys could result in seriously biased outcomes. In such cases, taking more time to collect more reliable and sufficient data is in fact an essential effort. In other words, it is important to prepare/plan more carefully with necessary steps and efforts. It is not convincible at all to implement a survey with temporary or occasional budgets. It is extremely important to conduct surveys in a more planned way for planning and policy decisions. Since the PSD could be implemented in a cost-effective and consequently continuous way, it is expected that it could contribute to a more sustainable urban and transportation planning and management. Furthermore, with the PSD survey, the "give & take" relationship between citizens and government could be established. Concretely speaking, as collateral of providing their personal information to the government, citizens can more actively request the government to further enhance its accountability of policy decisions. Needless to say, citizens are also required to understand their responsibilities and duties to cooperate with public sector.

EXISTING STUDIES OF PSD SURVEY

Before actually implement a new type of survey in practice, it is important to first clarify the public acceptance and applicability of the PSD survey based on experimental surveys. For this purpose, we carried out two web-based questionnaire surveys in Japan in 2008. One is a pilot survey and another is an SP survey. In the pilot survey, respondents were asked to report their opinions about the introduction of PSD survey and their willingness to participate in it without showing any participation conditions. In the SP survey, respondents reported their

participation intention under various conditions, which were picked up from the pilot survey results.

The two surveys were implemented with the help of two major Internet survey companies (with more than 1.4 million pre-registered panels, respectively) in Japan, respectively. The pilot survey was conducted in March 2008, by recruiting respondents from those registered panels living in Hiroshima Prefecture, and the SP survey was carried out in December 2008, which respondents were recruited from registered panels living across the whole Japan.

Pilot Survey

The respondents were randomly selected from these panels, considering the balance of population attributes (including age and gender). Due to the limitation of available budget, 200 respondents were set as the target number of samples. During the survey, 687 panels were pre-contacted. As a result, 295 respondents submitted a complete questionnaire sheet, but 235 responses are valid. Rate of valid response is 34.2%. As a web-based survey, this rate is not low. Total survey duration is 11 days including the raw data input and data cleaning.

It is observed that 51% of respondents are male and the remaining 49% are female. Since the collected samples had different age and gender distributions, the collected samples were weighed for the analysis in this study. The weighed samples show that more than 50% of the samples are businesspersons, followed by housewives (18.5%), students (6.9%) and part-time workers (6.9%). About 40% have an academic degree above university. The average residence duration in Hiroshima Prefecture is more than 16 years.

Experience of participation in public-implemented survey

In total, 8.2% of the samples had experience to participate in some public-implemented surveys, among which only 0.1% of the samples refused to participate. Among the samples with participation experience, more than 80% participated in survey once within the recent three years (average frequency: 1.3 times / three-year). The most popular survey instrument is paper-and-pencil surveys with mail-out & mail-back, accounting for 46.0%, followed by Internet survey (28.5%). Share of hand-in & hand-out surveys is only 9.0%. These imply that recently, the efficiency of survey implementation has been emphasized. The noteworthy fact is that only 9.0% of the samples are satisfied by survey implementation, less than the share of the unsatisfied samples (10.5%), while “neutral” samples occupy 80.5%.

Attitude toward participatory self-declaring survey method

The samples who agree to the introduction of the PSD survey method account for 40.7%, which is more than 4 times higher than those that disagree (only 9.8%). The samples showing neutral attribute are 49.5%. Asking whether those, who do not answer to disagree, willingly participate in the survey, it is found that 88.3% answer to be willing to participate in the survey. Among the whole samples (235 persons), it is observed that one-third of the samples

would even like to participate the PSD survey without any monetary incentive. Concerning the frequency of willingness-to-participate, its average value is 3.0 times per year. This means that at least one can cover seasonal changes of people's behavior, which are not properly observed by traditional survey methods. In addition, 48.1% of the samples think that they have the duty to cooperate with urban planning activities and about 30.0% are willing to provide their personal information to public sector. And, 54.5% show interest in voluntary activities, among which 51.0% experienced the voluntary activities (average frequency in the recent one year is 2.65 times). These facts suggest that the PSD survey method is very acceptable to the public, even after discounting the use of the constrained samples (i.e., the samples collected from the pre-registered panels).

Preferred means to be informed

It is important how to inform the public about the implementation of the PSD survey method, in order to increase the rate of participation. For those who do not disagree to the introduction of PSD survey method, television and newspapers are the first and second most preferred media (23.3% and 22.5% respectively). The third preferred are the Internet (20.2% and flier (14.4%). In other words, the mass media closely linked with people's daily life is the most effective method.

Preferred survey instrument

The most preferred survey instrument is the web-based survey using PC (44.7%) while the second preferred is to use e-mail (22.2%), followed by traditional paper-pencil questionnaire survey. Considering that the Internet users in Japan account for about 70% of the whole population, it is to be concluded that the web-based PSD survey method is sufficiently operational.

Incentives

It is revealed that 51.8% of the respondents answered that monetary incentives should be provided to survey participants, and 88.1% agree to the introduction of point-based incentive. The willingness-to-accept (WTA) is 962 Yens per 30 minutes. Based on the author's personal experience, when employing a graduate student, the required part-time payment under the university rule is 900 Yens/hour. It is reported that average payment of part-time job in Tokyo, Nagoya and Osaka regions is 946 Yens/hour in 2008[1], and average payment of temporary worker across the whole country is 1,617 Yens/hour[2]. Comparing with the above average payments, the obtained WTA might be too high as the payment to respondents. But, this surely suggests the importance and necessity of incentive design for the effective implementation of the proposed participatory self-declaring survey method.

[1] http://www.j-carrera.net/modules/news/storyid-382.html (Accessed May 10, 2008)
[2] http://www.atmarkit.co.jp/news/200805/09/haken.html (Accessed May 10, 2008)

In summary, 51.8% of respondents answer that monetary incentives should be provided to those who participate in urban planning survey, in general. In addition, 88.1% of respondents agree to the introduction of point-based incentive for the PSD survey. About 30% ask for the provision of preferential services from public sector (33.8%) and private sector (30.8%), respectively. These facts suggest that respondents ask for rewards corresponding to survey participation. In other words, it becomes important how to properly design and provide the incentives to respondents. Thus, incentive-based survey is surely required, but the incentive is not necessarily money-based, even though the money-based incentive is more preferred by respondents. Since the PSD method is proposed to reduce the survey cost, the money-based incentive is not a desirable way to encourage the participation. It should be emphasized here that about one-third of the respondents would like to participate in the PSD survey without any monetary incentive.

SP Survey

Based on the above-described results of pilot survey, an SP survey was designed by incorporating the following attributes and levels: 1) survey type: trip diary or activity diary, 2) answering time: 15 minutes or 30 minutes, 3) purpose of data usage: short-term measures or long-term strategies, 4) media of notice: Internet/e-mail, newspaper, TV, or poster/flier, 5) participation rate of other people in the population: 5%, 20%, or 50%, 6) reward: with or without. For the participation rate of other people in the population, its levels are decided based on widely adopted sampling rate of trip diary survey in Japan and the innovation theory (Rogers, 1983): 5% is decided considering the sampling rate of trip diary survey and the share of innovators, 20% and 50% are decided considering the shares of early adopters and early majority. For the "with" case of the reward, a given budget (1.0 million Yen) is assumed and it is distributed across the whole sample in three ways: 1) 1000 Yen bus card for the purpose of promoting the usage of transit systems are randomly given to 1000 respondents, 2) 10,000 Yen gift certificate that can be used only in central urban areas are given to 100 respondents for the purpose of revitalizing urban economic activities in central urban areas, 3) 100,000 Yen cashes are given to 10 respondents without any restriction of its usage. It is assumed that the probability of being the award winners increases with the increase of the participation frequency. Thus, the reward is defined with 4 levels. To answer the participation intention, 4 categories are used: "participate", "probably participate", "do not participate probably", and "do not participate". For the participation frequency, detailed values are asked to report.

Respondents were randomly selected from those panels living in major Japanese cities (23 wards of Tokyo and 17 ordinance-designated cities), considering the balance of population attributes (age and gender is taken as references) in these cities. Due to the limited budget, we only asked the company to select the sample randomly considering the balance of population attributes, but without the consideration of the balanced attributes of returned samples. Due to the limitation of available budget, 1,000 respondents were set as the target number of samples. To collect data from 1,000 respondents, 14,000 panels were pre-contacted. Total survey duration is about 7 days including the raw data input and data cleaning.

Public acceptance and representativeness of samples collected

In the pilot survey, 41% of respondents were in favor of the introduction of PSD survey, and in contrast, only 10% disagreed, and the remaining respondents showed a neutral attitude. Among those without any disagreement, 88% were willing to participate in the PSD survey. In the whole sample, 79% of respondents were willing to participate. Assuming the whole sample as the population, it is found that no statistically significant differences between the whole sample and those who were willing to participate are confirmed with respect to any individual attributes, attitude toward participation duty in public activities, and the share of participating in voluntary activities, based on χ^2 tests.

The SP survey results show that on average, 50% of respondents are willing to participate in the PSD survey. Same as the pilot survey, statistically significant differences between the whole sample and those who were willing to participate are not confirmed with respect to individual attributes, attitude toward participation duty in public activities, and the share of participating in voluntary activities as well as the frequency of the Internet usage.

The above results reveal that the PSD survey could be applicable to capture the characteristics of the population.

Participation intention under the most unfavorable conditions

It is expected that the SP survey might over-estimate the willingness to participation. To figure out the participation intention under the most unfavorable conditions, we first built an ordered-response probit model, where "4: participate", "3: probably participate", "2: do not participate probably", and "1: do not participate" are treated as dependent variables.. To capture more general influence of each variable, the attributes introduced in the SP survey are treated as dummy variables. It is observed that, factors enhancing the participation intention are, the travel diary based survey format, the Internet/E-mail as a means of public notice, the 5% participation rate of others, and 10,000 Yen gift certificate that can be only used at central urban areas (given to 100 respondents). On the other hand, factors increasing the participation frequency include, the travel diary based survey format, the Internet/E-mail as a means of public notice, the 5% participation rate of others, and 1,000 Yen bus cards for the purpose of promoting the usage of transit systems (given to 1,000 respondents). For the reward, the one with higher probability of being a winner increases the participation frequency, and for the others' participation rate, the 5% rate increases the participation frequency, in contrast, the 20% reduce the frequency.

It is shown from the estimation results that the most unfavorable participation conditions are "survey format: activity-based survey", "answering time: 30 minutes", "survey purpose: long-term strategy", "notice media: newspapers", and "no incentive to participation". Under these most unfavorable conditions, the participation rates are calculated with respect to the participation rates of others. As a result, it is found that even under the most unfavorable conditions, 21% ~ 35% of respondents are willing to participate. Especially, the participation probability shows the largest value when the participation rate of other people is 5%.

Interestingly, there is almost no difference of participation probability between 20% and 50% participation rates of others.

DATA AND ANALYSIS

The PSD survey in this study was implemented in November – December, 2011 via the Internet as a part of a full-scale travel diary survey conducted by Higashi-Hiroshima City (population: about 180,000; see Figure 1), which is the first travel diary survey conducted in such small-sized Japanese cities. Since the PSD survey was done just as a pilot, the target population and survey period were limited. First, a call for online survey participation was announced on the City website on November 11. And then, 1,000 residents were randomly selected from the population registration system by reflecting the population distribution by age, gender and residential area. A post card with registration number and request for participation in the survey was posted to each selected residents on November 23. On December 1, the web-based questionnaire form was uploaded to the City website. Each selected respondent was asked to report his/her travel behavior (a two-day travel dairy) on the designated website on both December 8 (Thursday) and 11 (Sunday). The deadline of survey was set to December 14 (Wednesday) due to the constraints of budget and governmental administration.

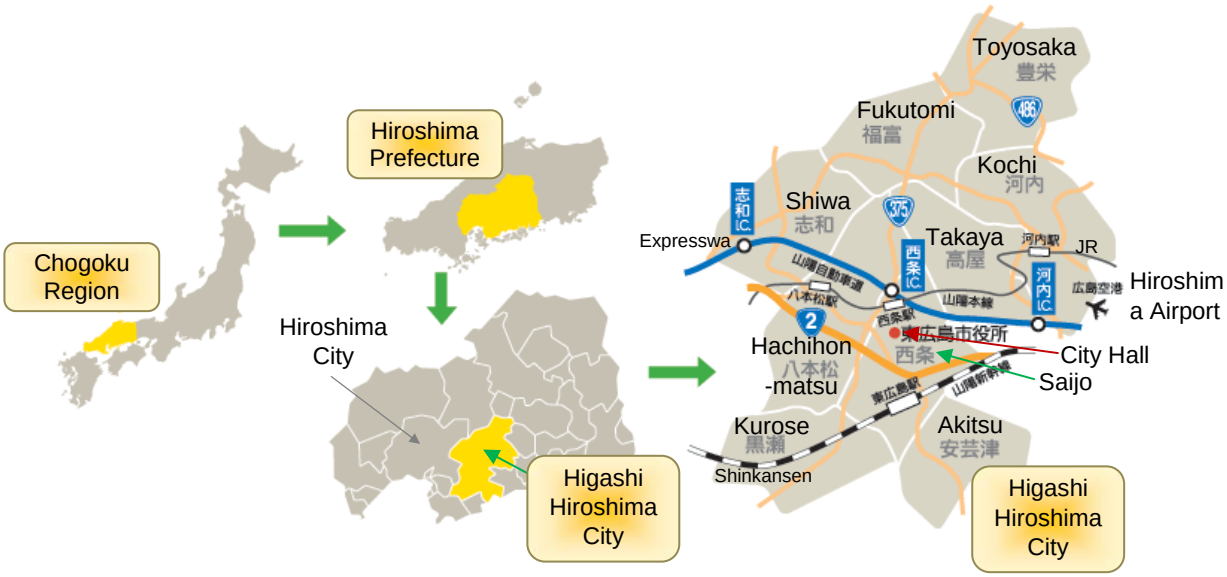

Figure 1 – Comparing participants and population by gender

Differences between participants and non-participants

As a result, 46 residents participated in the survey and provided valid questionnaire sheets. The valid return rate was 4.6%. Considering that the survey period was short and the contact methods were limited (the website of the target city and post cards), the 4.6% participation rate is not low. This is the first time to confirm the applicability of PSD survey in practice.

There are various factors affecting the participation in the PSD, as discussed previously. Due to the privacy issue, here, only gender, age, and residential location were available for clarifying the differences between participants and non-participants (Figures 2 – 4).

Gender

Among the participants, 63% are male and the remaining 37% are female. Comparing with the population, it is clear that the share of female participants is much lower (13 points lower).

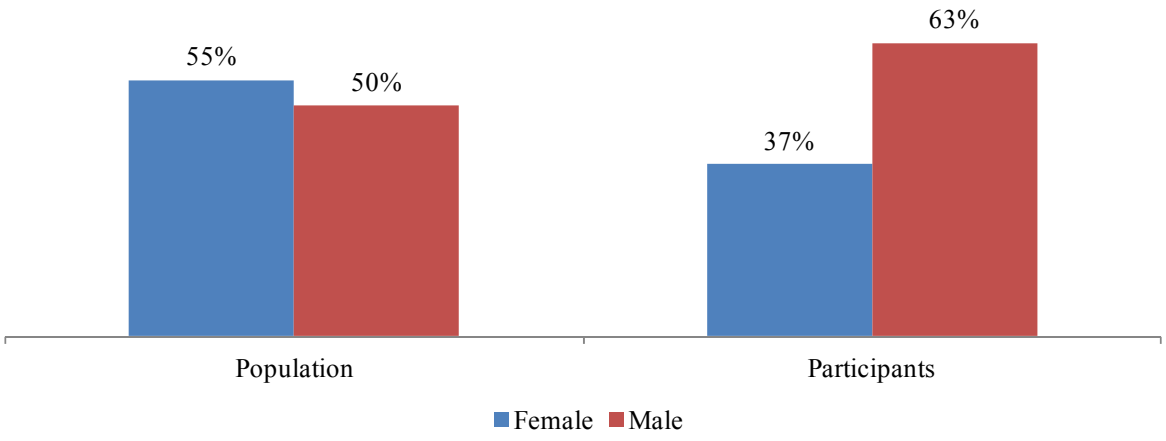

Figure 2 – Comparing participants and population by gender

Age

Participants aged 20's and 60-64 years old show the highest share (17%), respectively, among eight age categories. The lowest share is that of 40's. Comparing with the population, there are fewer participants aged 30's, 40's, and over 70's.

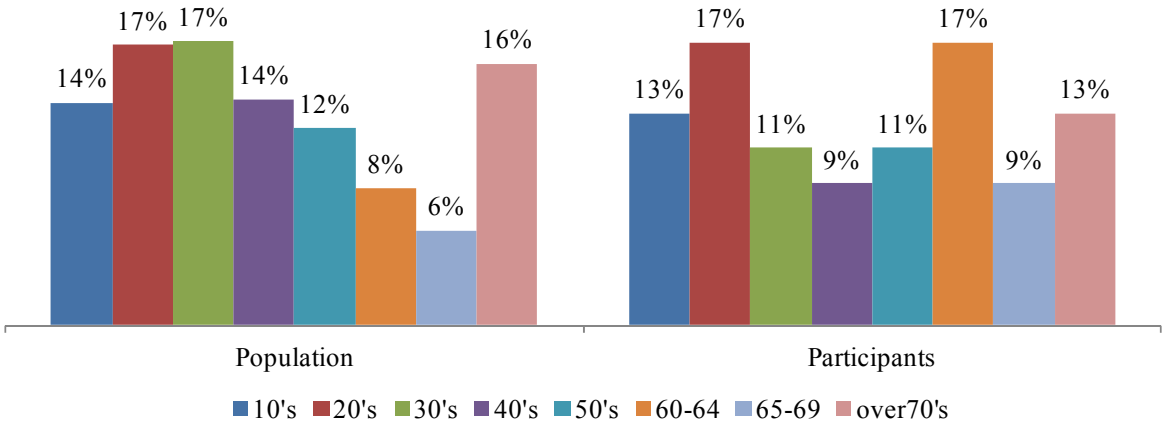

Figure 3 – Comparing participants and population by age

Residential location

Among the participants, those living in Saijo town, which is the city center, shows the highest share (46%), followed by those in Hachihonmatsu town (17%) and Takaya town (15%). Comparing with the population, there are fewer participants residing in Korose and Akitsu towns, which are far the city center. Note that the original urban area of the city included Saijo, Hachihonmatsu, Takaya, and Shiwa towns, and the other four towns were merged into the city in 2005. In the latter four towns, there are more elderly residents.

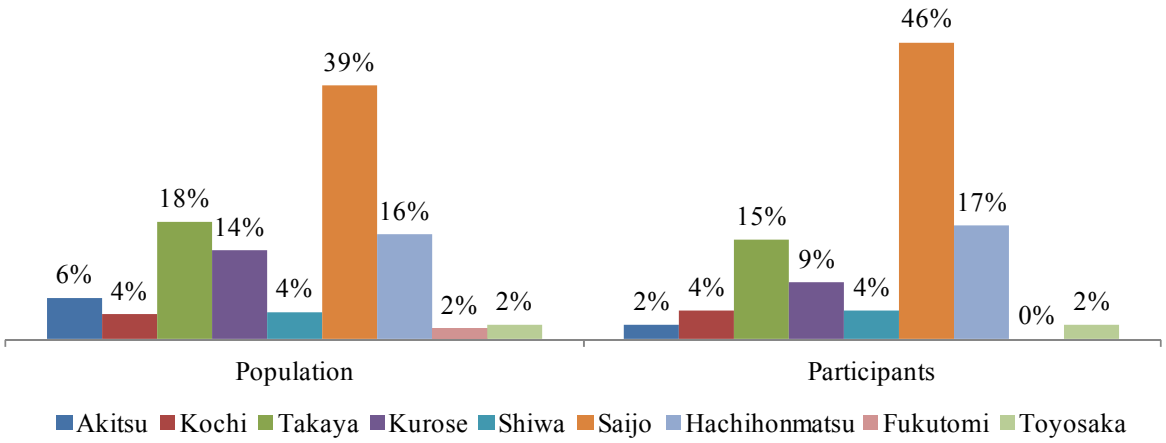

Figure 4 – Comparing participants and population by residential location

Clarifying Influential Factors based on a Binary Logit Model

To quantitatively clarify the influential factors to the participation in the PSD survey, a binary logit model is built, where the non-participation is regarded as a reference. The model estimation results are shown in Table 1. The model accuracy index, McFadden's rho-squared, is 0.70, which is higher enough. Except gender, other parameters are all statistically significant at 5% level. These results support the use of the binary logit model to understand the factors affecting people's participation behavior.

All the parameters are negative. As for gender, it is not statistically significant. As for the residential location, comparing with residents in Saijo town, those residing in other towns tend not to participate in the survey. Residents aged younger than 60 years old are not likely to participate, either.

Variance proportion explained by each variable is calculated together with that by the error term. It is found that the error term just explains 7.7% of the total variance. The most influential factor is the age group "30's" (13.3%), followed by Akitsu town dummy variable (12.6%) and the age group "40's" (10.2%). Comparing the three types of explanatory variables, gender does not work on explaining the participation behavior. Residential location explains more variance (48.0%) than age (43.8%).

Table 1 – Estimation results of survey participation model

Utility function	Parameter	t-score		Average Value	Variance	Partial Utility	Variance Proportion
Explanatory variables							
Gender (Male: 1, Female: 0)	-0.4374	-1.627		47.4%	0.4996	6.4%	0.4%
Residential location: Saijo town serves as a reference							
Takaya town (Yes=1, No=0)	-2.0257	-4.893	*	17.1%	0.3771	10.7%	7.3%
Hachihonmatsu town (Yes=1, No=0)	-1.7321	-4.143	*	15.4%	0.3607	8.2%	5.1%
Shiwa town (Yes=1, No=0)	-2.0644	-2.718	*	4.0%	0.1958	2.5%	3.9%
Kurose town (Yes=1, No=0)	-2.4043	-4.293	*	13.0%	0.3360	9.6%	9.1%
Kochi & Fukutomi towns (Yes=1, No=0)	-2.4908	-3.372	*	5.2%	0.2218	4.0%	6.4%
Toyosaka town (Yes=1, No=0)	-2.3343	-2.210	*	2.1%	0.1433	1.5%	3.7%
Akitsu town (Yes=1, No=0)	-3.3479	-3.214	*	6.1%	0.2391	6.3%	12.6%
Subtotal							48.0%
Age: 60 years old and above serves as a reference							
10's (Yes=1, No=0)	-2.2408	-4.646	*	13.1%	0.3371	9.0%	7.9%
20's (Yes=1, No=0)	-2.0952	-5.198	*	16.5%	0.3709	10.7%	7.6%
30's (Yes=1, No=0)	-2.7568	-5.658	*	16.7%	0.3727	14.2%	13.3%
40's (Yes=1, No=0)	-2.5324	-4.357	*	13.3%	0.3393	10.4%	10.2%
50's (Yes=1, No=0)	-1.7905	-3.370	*	11.6%	0.3200	6.4%	4.8%
Subtotal							43.8%
Error term	*: significant at 5% level					0.0%	7.7%
Total						100.0%	191.9%
Model accuracy							
Initial log-likelihood	-695.23						
Converged log-likelihood	-209.86						
McFaddens's rho-squared	0.70						
Sample size (persons)	1,003						

The findings of this study have both practical and research implications. As practical implications, the PSD survey surely has the potential to service as an alternative survey method to conventional surveys. Extending the survey period might increase the participation rate and consequently the cost-effectiveness of travel surveys based on the PSD survey might be considerably improved. As research implications, the characteristics of those "hard to reach" population can be satisfactorily captured by a limited number of individual attributes.

CONCLUSIONS AND FUTURE RESEARCH ISSUES

At least in Japan, it is becoming more and more difficult to prepare enough budgets for conducting surveys required by urban and transportation policy decisions, due to the influence of retrenchment finance, especially in many local cities. The progress of aging society in Japan further worsens this problem. To the author's understanding, some of other developed countries are facing or will face similar problems. One of the most important causes is that traditional survey methods are too costly. After entering the so-called mature society in Japan, residents' needs are becoming more and more diverse and heterogeneous, compared with those in, for example, the 1960s when it was positioned as the period of rapid economic growth. This suggests that traditional one-day survey methods are becoming inapplicable, especially considering that both people's subjective attitudes and objective behaviors change

over time and across contexts. Effective and efficient polices are required to be decided with careful understanding of people' dynamic behavior. Under such circumstances, we proposed a new survey method, called participatory self-declaring survey (PSD) method. The PSD survey relies on people's voluntary spirit, but it allows that people can participate in the survey completely based on their own convenience without pushing. Under the PSD survey system, respondents will be equally and effectively contacted for the request of participation. The voluntary respondents are required to access the survey system by themselves. It is expected that such new survey method could collect respondents' personal attributes, objective behaviors and subjective attitudes over time, across space and from context to context, and such voluntary participation could largely reduce the cost of survey implementation.

This study implemented a small-scaled web-based PSD survey in Higashi Hiroshima City, a small-sized Japanese city. Before implementing this survey, we also conducted two web-based questionnaire surveys (a pilot survey and an SP survey) in order to confirm the public acceptance and applicability of the PSD survey.

The conclusions of the pilot and SP surveys are first summarized as follows.

(1) *Public acceptance and applicability*: In the pilot survey with showing any participation conditions, it is confirmed that about 90% of respondents did not disagree to the introduction of the PSD survey. Excluding those showing a neutral attitude, it is found that nearly 40% of the whole recruited respondents would accept the introduction of the PSD survey and are willing to participate in it. In the SP survey with detailed participation conditions, on average, about 50% of respondents answered to be willing to participate in the survey. It is also revealed that about 20%~35% of respondents would participate in the survey even under the most unfavorable participation conditions (coincidently, the average participation rate is very close to the national participation rate of voluntary activities in Japan). The above participation rate might be overestimated because the two surveys were conducted with respect to those Internet users. Considering that sampling rates of travel surveys in practice are usually less than several percentages, the above results confirmed the public acceptance and applicability of the PSD survey, even by taking into account of the overestimation. Same as other surveys, there are also some "hard to reach" groups in travel surveys (Behrens et al., 2009; Riandey and Quaglia, 2009). Adopting the PSD survey might clear away some physical and psychological barriers of those "hard to reach" groups to participate in surveys. On the other hand, it is also necessary to further promote the participation in various voluntary activities, including travel surveys. Globally, the role of volunteering has been emphasized in assist governments to carry out more targeted, efficient, participatory and transparent public programs and policies (Meijs and Brudney, 2006). In future, public education about volunteering might be required for sustainable social development.

(2) *Desirable survey forms*: In the pilot survey, it is shown that the most favorable survey means is the web-based survey on PC (45%), followed by the web survey via e-mail (22%). Only 18% of respondents prefer the traditional paper-pencil survey. Higher

preference for the Internet survey might be because many people hate to be directly contacted. Such results might be due to the implementation of the survey on the Internet. Conducting a one-day travel diary with more than 5,000 respondents based on mixed survey modes, Kalenoja et al. (2012) confirmed that the Internet survey increased the response rate, which supports our observation, and also revealed that the quality of data in Internet survey was high compared to other survey modes. Existing studies has shown that the advantages of the Internet survey are low unit costs, flexibility in the administration of the questionnaire, real-time automatic data quality checks and continuous monitoring of the data collection processes (e.g., Diana, 2012), and reducing respondents' answering burdens and fatigue (e.g., Doherty and Miller, 2000). Considering that the diffusion rate of the Internet usage in Japan was more than 78% in 2010[3], building the PSD survey in the web-based form is realistic and could become a considerably promising survey means. Recently, the Internet environment has been changing dramatically.

(3) *Methods to promote the participation*: In the pilot survey, it is shown that about half of respondents requested some incentives (not only monetary rewards) for participating in the survey. To provide the incentives, it is more effective for encouraging the participation to give the incentives in a more equal way. In the future, it seems more important how to design the incentive schemes without monetary rewards for a successful implementation of surveys, considering budget constraints. For this purpose, needless to say, it is required to have much more reliable security management of personal information and to build more reliable relationship between government and citizens. At the same time, it is also necessary to build, maintain, and/or operate the survey systems by making effective use of private sectors. To increase the participate rate, it is important to properly inform citizens about the necessity and importance of participation. For this purpose, media campaigns are useful (e.g., National Academy of Sciences, 2011), for example, TV, Internet and newspapers, which has become indispensible media for citizens' daily lives, should be fully utilized. In practice, however, due to the time and budget constraint, such 'marketing' efforts are often ignored. Moreover, since the participation probability is influenced by the participation of other people, careful attention should be paid to the way how to inform other people's participation situations when implementing various campaigns.

The study of the web-based PSD survey in Higashi Hiroshima City is concluded as follows.

(1) During a one-month survey period, about 5% of 1,000 recruited respondent candidates participated in the survey. This response rate is quite similar to the sampling rate of full-scale paper-pencil travel diary survey in practice. Based on the results of the pilot and SP surveys, it can be reasonably inferred that extending the survey period and implementing the survey campaign via more channels would encourage more participation. Since the questionnaire sheets were filled in on the Internet, manual data inputs were completely omitted. It is known that manual data inputs are normally costly and input errors cannot

[3] http://www.soumu.go.jp/johotsusintokei/statistics/ data/110518_1.pdf

be avoided. All the above facts strongly support the applicability of the PSD survey for practical use.

(2) More efforts should be made to encourage residents who reside in the towns beyond Saijo town (central urban area) and are younger than 60 years old. Especially, there are more elderly residents in Akitsu, Kochi, Kurose, Shiwa, Fukutomi, and Toyosaka towns. Considering that many of these elderly residents are not good at using the Internet, it is worth making some instructions via Cable TV, on the Internet, or even during community gatherings. Easily understood instruction materials should be prepared.

(3) In the survey, respondents were asked to report a two-day travel dairy, but only four of them correctly did. This is also strongly influenced by the shorter survey period (about one month), which could not give potential participants more time to participate in the survey based on their own convenience.

(4) The above identified survey problems are mainly due to the fact that the pre-survey announcement and campaign had not been well done because the survey was conducted in December, which means that there were only three months to the end of fiscal year of Japan. The lack of good planning governance has to be criticized. In fact, this problem is not specific to this small-sized city, but more general in all cities across the whole Japan. In Japan the fiscal year starts in April and ends in March. Normally, public budgets are formally decided and actually allocated during the later period of each fiscal year. This means that the whole period of each public project is usually less than a half year. Now we can imagine how difficult for consulting companies in Japan to participate in public projects. This fact forces us to question the quality of many public planning projects in Japan. Without reforming this institutional defect, better surveys could not be done and better public policies could not be scientifically supported.

This study only focuses on the transport survey. In reality, various surveys related to different aspects of citizens' daily lives are conducted. Since there are many overlapped parts, these surveys could be implemented in a more efficient way. For example, they could be packaged together and implemented at the same time. With such packaged surveys, it is expected that survey costs could be reduced, and the most important advantage is that such packaged surveys could become a trigger to make cross-sector decisions, which are extremely important in practice (e.g., Zhang et al., 2011b, 2012). The adoption of PSD survey could be also helpful to support other types of public policy decisions. Remember that surveys are needed not only for planning, but also for monitoring the expected impacts of planning after actually introducing it to the real world. In this sense, it is desirable to implements surveys continuously. PSD survey could make this continuous effort possible.

Having summarized the conclusions and argued the significance of the proposed PSD survey, some issues should be mentioned. It is argued that the PSD survey could be cost-effective. This point should be clarified in a more detailed way, by carefully considering all the life circle costs. In this study, the representativeness of the assumed population was evaluated by focusing on respondents' attributes. It is more important to clarify the representativeness of

behavioral outcomes. It should be noted that the PSD survey is not a panacea that can overcome all the shortcomings of traditional survey methods. In any surveys, there are some "hard to reach" groups (Behrens et al., 2009; Riandey and Quaglia, 2009). It is also true for the PSD survey. Even though it is better to build the PSD survey system on the Internet, the problem of self-selection might occur because some people cannot access the Internet (it is true that the Internet users in almost every country are increasing year by year). In this sense, on the one hand, it is necessary to allow those without the Internet access to participate in the survey by using the Internet at public facilities and some available firm or organization facilities, and on the other hand, to effectively encourage the participation, various socio-psychological approaches and marketing approaches should be examined and fully utilized. In reality, it is important to clarify how to combine the PSD survey with other data collection methods, because different types of surveys can attract different types of respondents. For this purpose, data fusion techniques should be applied. It might be also needed to test this proposed survey method in different countries with more large-scale samples.

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