THE EFFECT OF UNRELIABLE TRAVEL CONDITIONS ON THE NEED FOR ADVANCED PUBLIC TRANSPORT INFORMATION SERVICES

Eric Molin, Caspar Chorus en Ruud van Sloten
Department of Transport Policy and Logistics' Organization
Delft University of Technology
Delft, 2600 GA
The Netherlands
Phone: +31 15 2788510
Fax: +31 15 2782719
Email: e.j.e.molin@tbm.tudelft.nl

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Contents

Samenvatting

Het effect van onzekere reissituaties op de behoefte aan geavanceerde openbaar vervoer reis informatie diensten

Dit paper presenteert een onderzoek naar de behoefte en betalingsbereidheid voor geavanceerde openbaar vervoer reisinformatie. Intercity treinreizigers zijn gevraagd om keuzes te maken uit hypothetische informatie diensten die variëren in type informatie, precisie van de dynamische informatie, of de dienst al dan ongevraagd informatie verstrekt en prijs. De respondenten maakten hun keuze onder een omschreven conditie die de onzekerheid in reis omstandigheden aangeeft. Deze onzekerheid varieert in: geen overstap, een overstap naar een hoog frequente verbinding en een overstap naar een laag frequente verbinding. De resultaten geven aan dat, zoals verondersteld, meer onzekere reis omstandigheden leiden tot een grotere behoefte aan reisinformatie, een grotere voorkeur voor diensten die reisadvies geven in plaats van het presenteren van reistijden, en een hogere betalingsbereidheid voor reisinformatie. Echter, de keuze voor informatiediensten is erg gevoelig voor prijs, hetgeen een lage betalingsbereidheid in het algemeen suggereert.

Summary

The effect of unreliable travel conditions on the need for advanced public transport information services

This paper reports on a stated choice experiment examining the need and willingness to pay for advanced public transport information services. Intercity train travelers are asked to choose among information services that varied in type of information provided by the services, precision of provided dynamic times, whether or not the service can provide information unasked for and price. The respondents made these choices conditional on a specified context, denoting the level of unreliability in travel conditions. This unreliability was indicated by no transfer, transfer to a high frequency connection, and transfer to a low frequency connection. The modeling results indicate that as hypothesized, more unreliable travel conditions induce a larger need for travel information, a higher preference for services that can provide advice and a higher willingness to pay for information. However, the choice for information services is highly price sensitive, which suggest a low willingness to pay in general.

1 Introduction

Recently, rapid technological developments in mobile communications have probed a vision among telecommunication companies, transport agencies, governments and academia of a technological revolution in ATIS towards what can be called next generation ATIS (e.g. Adler and Blue, 1998; Trail, 2002). This next generation ATIS can be conceptualized as a Personal Intelligent Travel Assistant (PITA), being able to provide a traveler at anytime with all the travel information, asked and unasked for, that is relevant given the traveler's time and place in the multimodal transport network and his or her personal characteristics (Trail, 2002; Chorus et al., 2004). It is often suggested that the Public Transport (PT) mode might substantially benefit from the development of ATISes providing PT-information because there exists a general need among PT-users for such high-quality information (Hickman and Wilson, 1995; Kitamura et al. 1995; Ouwersloot et al. 1997; Abdel-Aty, 2001). There is however no empirical knowledge concerning the actual need and willingness to pay among PT-users for PT-information provided through PITA-like services.

Given the large investments in developing and maintaining technology for data-gathering, analysis and distribution, needed to establish a PITA-service, it is deemed very important to gain insights in PT-users' need and willingness to pay for the provision of information through PITA-like services, *before* these are eventually brought to market. Furthermore, as PITA is capable of delivering very sophisticated functionalities (such as providing advice on its own initiative), it is worthwhile to investigate whether there actually exists a latent need for these advanced features. This paper aims at providing these insights.

Naturally, as PITA's functionality reaches far beyond that of currently available ATISes, such insights concerning travelers' need and willingness to pay for PITA cannot be derived by simply combining or extrapolating insights concerning their need for provision of PT-information through current ATISes. Moreover, there exists no literature concerning PT-users' need for the advanced features that distinguish PITA from current ATISes. Furthermore, there currently is no actual product or prototype in the market that has a functionality that comes close to that of the envisaged PITA. Therefore, in this study a Stated Choice-experiment was constructed varying hypothetical PITA services. The external validity of stated data is often thought to be less than that of revealed data (e.g. Cascetta and Kaysi, 2002). However, it is generally acknowledged that SC-experiments serve very well as indicators of the relative importance of product-features as they are useful to gain insights into the trade-offs consumers make when deciding whether or not to buy a given product or service (e.g., Louviere et al., 1999; Mahmassani and Jou, 2000; Louviere and Hensher, 2001*)*. The use of stated data in the present case is therefore justified.

This paper is organized as follows: in section 2, literature concerning PT-users' need and willingness to pay for information, as well as their determinants, is briefly reviewed. Then the construction of the choice experiment, the response group characteristics and the model estimation are discussed. This is followed by a discussion of the choice experiment results. This paper finishes by drawing some conclusions.

2 Literature review

This section presents a brief literature review concerning PT-users' need and willingness to pay for information provision through ATISes. As mentioned earlier, no empirical research is available concerning the need for those characteristics that distinguish PITA from current ATISes such as the possibility of warning a traveler of delays and simultaneously providing him with advice on complete trips, unasked for. There does however exist literature describing the determinants of PT-users' need for information in general and describing their willingness to pay for it. We will briefly review this literature here.

Starting with determinants of PT-users' need for information in general, it is found that this need is mainly driven by perceived unreliability aspects of a PT-trip (Hickman and Wilson, 1995; Ouwersloot et al. 1997). This unreliability of PT can be expressed in different ways. First, there are the straightforward issues of schedule delays and waiting times, both having a profound negative impact on PT-users' utility (Ouwersloot et al. 1997; Nielsen, 2000; Wardman, 2001; Bates, 2001; Bates et al. 2001; Koushki et al. 2003; Bovy et al. 2003). However, besides and above these aspects of reliability and contrary to car-users' valuations, it seems that unreliability of a trip by PT is *per se* highly negatively valued by PT-users (Bates, 2001; Bates et al. 2001). This extra negative valuation is probably due to the discrete departure times of PT-services. Generally, PT-travelers appear to have a rather negative focus as they above all try to avoid critical incidents such as getting stuck at a railway station between origin and destination, or arriving late at an important meeting (Friman and Gärling, T., 2001). Given the value PT-users place on PT-reliability let us look at the drivers of this unreliability. There is consensus that the main drivers of perceived reliability of a PT-trip are the frequency of services and the number of interchanges that the traveler faces. PT-users attach a relatively high utility to high-frequency services (Wardman, 2001; Friman and Gärling, T., 2001; Cerchi and Ortuzar, 2002), and place severe penalties on interchanges during the trip (Hickman and Wilson, 1995; Nielsen, 2000; Hoogendoorn-Lanser and Hoogendoorn, 2000; Louviere and Henscher, 2001, Cherchi and Ortuzar, 2002; Hoogendoorn-Lanser and Hoogendoorn, 2000). Combining these two issues, another interesting finding appears: as PT-users value transfers according to the risk of missing a connection (Wardman, 2001), they appear to value transfers to low-frequency services much more negatively than those where connecting services have a high-frequency (Bovy et al. 2003).

As can be seen in the above, literature suggests that PT-users have problems with the unreliability of the mode they use. Providing them with relevant information is argued to help them deal with unreliability, and sometimes even avoid the consequences of unreliability by helping them make better choices (Ouwersloot et al., 1997; Lappin, 2000). In order to be able to identify the relation between the above-mentioned drivers of PT-unreliability –service frequencies and transfers- and the need for information through PITA-services, it is recommendable that these drivers enter the choice experiment as explanatory variables.

Concerning the issue of willingness to pay, literature generally states that there exists a low willingness to pay for information provided through current advanced travel information services in among travelers in general (e.g. Wolinetz et al., 2000; Khattak et al., 2003), and for PT-information by PT-users in specific (Molin and Chorus, 2004). PT-users’ willingness to pay for PT-information appears to be even lower than car-users’ (Wolinetz et al., 2000). PT-users mostly feel that they have already paid for information provision by buying their ticket (Neuhertz et al., 2000). However, the applicability of these findings for the case of PT-information provision through PITA-like services should still be investigated, making the case for inclusion of monetary information costs as explanatory variable in the choice experiment.

3 Methodology

3.1 Construction of the choice experiment

The first step to arrive at a stated choice model is the selection of attributes that are varied in the stated choice experiment and the levels in which these are varied. A first attribute of interest is the type of information the service provides. This attribute is varied in the following levels: i *only times*; ii *times and search possibilities* and iii *times and advice*. The *only times* level refers to an information service that can only provide information on expected departure and arrival times. Such information can be both static and dynamic information, for example, that a specific train service is 10 minutes delayed. A dynamic information service is offered in the Netherlands by 9292, the national public transport information service, which provides emails and SMS messages when specific train services are severely delayed. A major bus company also experimented with such a service (Molin and Chorus, 2004). The *times and search possibility* level refers to a higher level of functionality as in addition to times also possibilities are offered to search for another mode of transport or route in case of severe delays. Such a service is probably mainly used as a pre-trip information service, but can also be used en route by mobile phone or mobile internet. Where search possibilities require that travelers themselves actively search for travel possibilities, the level *times and advice* refers to the provision of advice, for instance on which mode and route to take. Once the service knows where the traveler is located, to where he or she wants to travel to and at what time, it provides advices, thereby taking into account the current state of the transportation network and the traveler's travel preferences that are already known to the system.

Table 1 Attributes and their levels

attribute	level
information type	- only times - times & search possibilities - times & advise
initiative by	traveler information service travel & information service
maximum deviation times from dynamic information messages	0 minutes 2.5 minutes 5 minutes
price per information message	0 euro cents 15 euro cents 30 euro cents

Up to now it was assumed that travelers themselves actively inquire information. However, it is conceivable that an information system itself takes the initiative. Once the information system is aware of the travel plans, it may take initiative whenever the trip cannot be made as planned. The information system then functions as an agent that constantly compares the travel plans with the current and predicted transportation network and reacts when action is required. The attribute *initiative by* is varied in the levels *traveler, information service* and *both.*

To examine the role of reliability of the information provided, an attribute on the maximum deviation time is included. This attribute denotes how many minutes earlier or later a PT vehicle may depart in deviation from a dynamic departure time announced by the information system. This attribute is varied in the levels *0, 2.5* and *5 minutes.* It was told to the respondents that this maximum occurred in only 5% of all information messages. Finally, in order to examine the willingness to pay for public transport information, the attribute price per information message is included. This attribute is varied in the levels *zero euro cents*, thus for free, *15 euro cents* and *30 euro cents (1 euro cent is approximately equal to 1.2 dollar cents)*. The *zero cents* level means that the information service is completely subsidized by, for example, the transportation companies who like to retain their customers or try to attract new ones, or by the central government, who likes to induce a modal shift towards public transport.

In addition to examining the effects of the attributes characterizing the information systems on the choice for information services, it was argued in section 2 that the effect unreliability caused by travel conditions has on the general need for travel information should also be investigated. To that end, respondents are requested to make choices while assuming that a certain travel condition holds. The travel condition context refers to the frequency of the public transport service and the transfer to another pubic transport vehicle, both of which are identified in the literature as key drivers of reliability of any PT-trip. Missing a connection means additional waiting time and arriving later than planned, with the possible result that one arrives to late at an appointment. Hence, it is hypothesized that the need to transfer during the trip, especially when the connecting service has a low frequency, will increase travel uncertainty and therefore increases the need for travel information.

To test this hypothesis, three context conditions were distinguished in the choice experiment. In the first travel condition, travelers have to make choices assuming that they do not need to transfer to another PT vehicle. The second travel condition requests travelers to make choices assuming that to reach their final destination station they have to transfer to a train service that runs only once an hour, thus transferring to a low frequency PT connection. The third travel condition involves that travelers have to change to a train service that runs six times each hour, thus transferring to a high frequency connection. Furthermore, in each of these context conditions it is specified that travelers have to assume that they are making use of a service that runs with the same frequency as the service they are currently traveling in.

A next step in the process of arriving at a stated choice model is the combination of the attribute levels to construct choice alternatives. As the four distinguished attributes each vary in three levels, one would arrive at a 3^4 full factorial design. The smallest possible orthogonal faction of this design has been selected, resulting in 9 choice alternatives. This design allows one to estimate all main effects, thereby assuming that all interaction effects are equal to zero.

The next step is to place the choice alternatives into choice sets. For pragmatic reasons we choose to construct choice sets of three information service alternatives each, which resulted in 3 choice sets. To each of these choice sets a base alternative *none of these* is added. The choice alternatives are randomly placed in choice sets, thereby controlling for domination as far as this could be predicted beforehand. Respondents are requested to choose in each choice set one of the three information services or the option *none of these,* conditional on the travel condition context specified.

Hence, as the complete design required only three choice sets that each only varied three information services, it was felt that the task load could be increased without exhausting the respondents. Therefore, it was decided that each respondent completed three choice sets under each of the three conditions, thus in total completed nine choice sets. To avoid any effects of choice set composition the placement of choice alternatives was randomized per context. Hence, respondents completed three choice sets per context and the choice sets varied among the three contexts, but contained the same choice alternatives. Furthermore, to avoid order effects among context conditions, three variants of the questionnaire were made, each varying the order among the three context conditions (variant 1: {1,2,3}, variant 2: {2,3,1} and variant 3:{3,1,2}). Each of the different variants allowed a further randomization for the placement of the choice alternatives in the choice sets. Hence, in total, the placement of choice alternatives in the choice sets was randomized nine times.

The choice experiment was included in a self-explaining questionnaire that was handed out to respondents in intercity trains. The questionnaire started with some questions on personal characteristics and on the current trip the respondents were making. Then the choice experiment was introduced, partly in the form of questions were respondents had to choose among the options that were included as levels in the experiment. This was done to induce the respondents to read the sometimes-lengthy though necessary explanation of the attributes levels. The completion of the questionnaire took 10 minutes on average.

3.2 Response group

Respondents were recruited in intercity trains in June 2004. Intercity trains were chosen because these have fewer stops, which gave respondents sufficient time to complete the questionnaire between two stops. Two lines were chosen: a high frequency line offering per hour four intercity trains, two fast trains and two stopper trains and a intermediate line offering per hour two intercity trains, two fast trains and in the rush hour two stopper trains. Data were collected during three average weekdays, roughly between 11.30 and 17.00 hours, which means that most of the respondents traveled before and a smaller part in the evening rush hours.

After travelers agreed to cooperate to a research on PT travel information, they were handed a questionnaire. The interviewer recollected the completed questionnaires just before the next stop or picked them up from the respondents' seats after the train had stopped. As the interviewer was in a hurry to distribute the questionnaire as quickly as possible, he did not have time to administer the non-response. However, an estimation of the response percentage could be derived in the following way. In each of the carriages about half the seats were taken, meaning about 80 travelers per carriage. About 30 travelers per carriage agreed to fill out the questionnaire, which means that about 40% of all travelers agreed to respond. In total 246 questionnaires have been distributed of which 239 have been recollected: 202 (82.9%) questionnaires were completely filled out and analyzed in this paper. The total response can thus be estimated as about one third of all travelers of the carriages visited. This is considered as a pretty normal response percentage for written questionnaires in the Netherlands.

The response group characteristics are presented in Table 2. Slightly more women responded than males (56.9% vs. 43.1%). Furthermore, the youngest age group is well represented. This is probably caused by the fact that in the Netherlands all college students have a free public transport card, the choice of lines on which the data were collected, and by the time of day. The data mainly were collected on lines connecting cities with large universities and many higher occupational schools and in the afternoon, when many students return home. This is also reflected in the travel motive *school*, which is the most often-mentioned travel motive (29.4%). However, if the motives *work* and *business* are combined (40.6%), than it can be said that most respondents travel for work related purposes.

Furthermore, only a small part of the respondents (31.9%) can be considered as a daily user of the line they currently traveling at. The largest group (44.1%) even travels less often than once a month on that line. Table 2 also presents the perception of the frequency of the line they currently traveling at: 40.4% perceives that the frequency is 2 times or less per hour, 43.8% that it is 3 or 4 times per hour and only 15.8% that it is 5 or more times per hour. This perception is lower than the actual frequencies on the investigated lines. As data have been collected in Intercity trains, this difference may have been caused by the fact that travelers do not take the fast and stopper trains into account. However, such mis-perceptions of PT-characteristics among travelers, even those who regularly use PT, are also found in other researches (e.g. Bonsal et al., 2004).

1 Table 2 Response group characteristics (N=204)

gender		**age**		**travel motive**	
male	43.1%	<= 24 years	42.6%	werk	22.5%
female	56.9%	25-50 years	45.1%	school	29.5%
		>= 50 years	12.3%	business	17.2%
				recreational	18.1%
				other	12.7%
travel frequency		**frequency train**			
>=4 day / week	31.9%	<= 2 / hour	40.4%		
1-3 days / week	24.0%	3-4 / hour	43.8%		
at least 1 / month	28.9%	> 5 / hour	15.8%		
less 1 / month	15.2%				

Conclusions on whether the response group characteristics are representative for the population of train travelers in the Netherlands cannot be given, as population data are largely missing. However, Table 2 indicates that all distinguished categories are reasonably well represented and thus that the response group is a rather heterogeneous group.

3.3 Model estimation

It is assumed that travelers in each choice set choose the alternative from which they derive the highest random utility. The random utility travelers derives from choosing information service alternative i conditional on context j can be expressed as:

$$U_{ij} = V_{ij} + \varepsilon_i$$

Where:

V_{ij} = the systematic part of the utility
ε_i = an alternative specific error term

The systematic part of the utility can be decomposed as follows:

$$V_{ij} = \sum_k \beta_{ik} \cdot X_{ik} + \sum_j \theta_{ijk} \cdot X_{ik} \cdot C_j$$

Where:

β_{ik} = coefficient for the context-independent utility component for alternative i's attribute k
θ_{ijk} = coefficient for the context-dependent utility component for alternative i's attribute k
X_{ik} = alternative i's attribute k
C_j = context j

By assuming that the error term is Gumbel distributed, applying the Multi Nomial Logit (MNL) model can derive the utilities. This model is estimated from the choice frequencies observed in the choice experiment for each of the four alternatives in the 27 choice sets (nine randomizations of three choice sets each). The three levels of each attribute have been effect coded, which means that coefficients for two indicator variables are estimated. From these estimated coefficients, the three part-worth utilities of the levels of each attribute can be derived. As these coefficients are estimated from the choices made in all three contexts, these part worth utilities represent the context independent effects.

To estimate the context dependent effects, the analysis design is extended by including indicator variables that represent the interaction between the attributes and the contexts. These interaction indicators are constructed by multiplying the indicator variables just discussed with the contexts that are represented by effect codes. This means that two interaction coefficients are estimated per attribute from which the three context dependent part worth utilities of each attribute level can be derived. Significant interaction coefficients indicate that the context has influenced the part worth utility of the attributes. As the interaction indicator variables are effect coded, the context dependent part worth utilities are expressed as deviations from the context independent part worth utilities.

4 Results

Based on the relative choice frequencies an MNL-model is estimated. To arrive at the most parsimonious model, all coefficients with p-levels larger than .05 have been fixed to zero. Table 3 presents the context independent and context dependent part worth utilities of the attribute levels that can be derived from the statistically significant coefficients. Overall it can be seen that almost all reported effects have expected directions, which gives face validity to the model.

Table 3 Context independent and dependent part worth utilities of attribute levels

	context independent	contexts dependent effects (in deviation from context independent effects)		
		no transfer	transfer to low frequency line	transfer to high frequency line
constant	.00	-.29	.41	-.12
information type				
only times	-.27	.00	-.13	.13
times & search	.00	.00	.00	.00
times & advice	.27	.00	.13	-.13
initiative				
traveler	.00	.00	.00	.00
information service	.00	.00	.00	.00
both	.00	.00	.00	.00
deviation				
0 minutes	.21	.00	.00	.00
2.5 minutes	.00	.00	.00	.00
5 minutes	-.21	.00	.00	.00
price per message				
0 cents	1.47	.00	-.23	.23
15 cents	-.17	.00	.00	.00
30 cents	-1.30	.00	.23	-.23

The context independent constant is equal to zero, which means that on average, the average offered information service has the same utility as the base alternative *none of these*, which was given a utility of zero by definition. However, the results for the context dependent effects indicate that this constant depends on the context. If travelers have to transfer to a low frequency line, the utility of all information services increases. If, on the other hand, they have to transfer to a high frequency line or no transfer is being made at all, the utility decreases relative to the context-independent situation. These results indicate that in more unreliable travel conditions, information services are higher valued. Thus, conform our hypothesis, it can be concluded that unreliability travel conditions induces a greater need for travel information in general.

The context independent part worth utilities for information type indicate that information services that offer *times and advice* are more preferred than *times and search,* which is turn is more preferred than *only times.* Moreover, if the traveler has to transfer to a low frequency train service, an even higher utility is derived from services that offer *advice* and a lower utility from services that offer *only times.* If, on the other hand, the traveler has to transfer to a high frequency line, this effect is reversed: services offering *times and advice* are valued less than services offering *only times.* In the context *transfer to high frequency line,* advice is even less valued than in the context *no transfer*. This seems strange as a transfer would result in a more unreliable travel condition than no transfer and thus would result in a higher need for advice. A possible explanation for this finding is that respondents in the context *transfer to high frequency line* may perceive the current line they are traveling on also runs at a higher frequency than in the context where they are not supposed to transfer, even though the context description told them this runs with the same frequency as the line they are currently traveling on. However, it is clear that this effect needs further research. Overall, it can be concluded that in more unreliable travel condition, the need for services that offer advice increases.

The results for the attribute *initiative* indicate that at the aggregate level, no significant differences exist among the levels initiative by traveler, by information service or by both. Also the contexts have no effect on this finding. The estimated model is however not conclusive whether travelers are homogeneous in their indifference, or whether they are heterogeneous, with preferences averaging out at the aggregate level.

The results for the *deviation* attribute indicate that travelers derive a higher utility from information services that provide more precise information. The effect does not differ among the contexts. However, we expected this attribute to be more important. This may be caused by the fact that travelers consider even a deviation of five minutes as relatively precise. In addition, as they were told that the maximum deviation only occurs in 5% of all information messages, they tolerate this low frequency of occurrence and perceive that all information services provide rather precise information.

Finally, Table 2 indicates that as expected, utility decreases with increasing price per message. Utility decreases more rapidly when price is increased from a free service to a service that that charges 15 euro cents per message compared to a further increase from 15 c. to 30 c. The utility range (difference between the lowest and highest part worth utility) becomes smaller in the context *transfer to* a *low frequency line*, meaning that price is less important in a more unreliable travel condition. Thus, people are more willing to pay for travel information in unreliable travel situations. On the other hand, they are less willing to pay for information in more reliable travel conditions, as suggested by the results for the context *transfer to high frequency line.* From comparing the utility ranges across the attributes can be concluded that the attribute price is by far the most important attribute. This suggests that the demand for advanced travel information is highly price sensitive and confirms earlier findings in that regard (Neuhertz, 2000; Wolinetz et al., 2000; Khattak et al., 2003; Molin and Chorus, 2004).

5 Conclusions

In this paper the need and willingness to pay for advanced public transport information services conditional on unreliable travel conditions have been examined by a stated choice experiment. The results indicate that as hypothesized, more unreliable travel conditions, i.e. the need to transfer or to use low frequency services, increase the need for travel information. Moreover, unreliable travel conditions increase the need for advice on alternative routes or modes and increase the willingness to pay for public transport travel information. These findings imply that public transport companies that offer low frequency-services that include transfers should provide their customers with adequate, high-quality information, in order to maintain their customer base. This may for example be the case in The Netherlands, where the Dutch railways (NS) have recently decided to substantially lower frequencies and cut in direct services in less urbanized areas. Moreover, these findings suggest that low-quality information formats (such as providing travel times only) may not be sufficient to fulfill travelers’ needs in an intermodal travel environment that is gaining complexity by the year. A next-generation of PITA-like services must, in order to be successful, provide travelers with advises that are tailored to their personal preferences and their location in the transport network.

Furthermore, the results indicate that on average, travelers are indifferent on who takes the initiative to provide travel information: travelers themselves or the information service. Form this results can at least be concluded that travelers do not dislike the idea that advanced information services provide information unasked for. When the results of this study based on train travelers could be generalized to car drivers, this offers possibilities to provide car drivers with public transport information unasked for. When informed on public transport, car drivers may be induced to change to public transport when faced with congestion. However, further research should point out whether travelers are really indifferent on the possibility to receive information unasked for or whether preferences for this feature are heterogeneous. Further research should also examine whether the results based on public transport travelers may be generalized to car drives.

Although advanced traveler information systems have the potential to retain PT customers and even to attract more car drivers to public transport, it is uncertain whether personal advanced travel services such as the PITA will be further developed because of its high price sensitivity meaning a rather low willingness to pay for these services. If future research points out that these information services can really induce a modal shift towards public transport and the willingness to pay remains low, central governments probably have to consider subsidizing these systems as they may help solving accessibility problems.

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