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Public transport users' and policy makers' perceptions of integrated public transport systems

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ABSTRACT

The planning of public transport systems plays a critical role in improving accessibility for all users. It provides people with opportunities for employment, social activities and involvement in the community. In recent times, many transport agencies are investing in their public transport systems to transform them into an integrated system. However, despite some advancement in this area, the understanding of public transport users' perceptions and how this aligns with policy makers' perceptions of an integrated system is limited. This understanding is critical to attract more commuters to use public transport. This paper conducted an analytical comparison between the users' and policy makers' perception of the various attributes that are used to develop an integrated system. A regional plan, produced in Auckland, New Zealand to implement an integrated system, was used as a case study. User-preference surveys and semi-structured interviews were used to collect the data. Data analysis was performed using the Analytic Hierarchy Process to determine the relative weight of the various attributes. Cluster analysis was used to identify groups of public transport users with similar characteristics. The findings provide the similarities and differences in users' and policy makers' perception of the attributes used to create an integrated system. Future research will investigate the needs of disadvantaged users such as elderly and disabled people, to understand how they are met by an integrated system.

1. Introduction

In many cities, travelers are being encouraged to create a mode shift, from excessive use of their cars to increasing their trips by public transport (PT) (Rabl and deNazelle, 2012). Recently, integration of PT systems has received attention from policy makers. Government authorities are investing in new infrastructure to improve the quality of PT services (Vassallo et al., 2012). A regional plan is typically developed to outline changes in the existing system to transform it into an integrated system. As most cities have an existing PT network, it can be difficult to create the changes that are required for integration. Implementation occurs in steps. For this reason, it is important to determine the key attractive features for the users.

The original contribution of this paper is the analytical comparison between policy makers' and users' perception of services that are required from an integrated system. This understanding will provide a basis for future policies such that a system being implemented in steps will attract enough ridership (due to the new changes) to support on-going work. For a PT system to be attractive, the changes need to meet the users' expectations. As such, public opinion is required for acceptance of changes in policies and services designed by policy makers. To the authors' knowledge, there has not been any studies that investigated this gap.

The purpose of the present study is two-fold. The first objective is to identify which attributes are important to users and which are important to policy makers. The five main attributes and their corresponding sub-attributes developed by Chowdhury et al. (2016) are adopted in this study. In further sections, definition of the attributes is provided. The second objective is to make a comparison between the two groups (policy makers and users) to determine any similarities and differences. Findings of this study are expected to assist policy makers in creating policies and services which will attract ridership. The case study was undertaken in Auckland, New Zealand. Data from the analysis was collected from both PT users and top-tier government officials who are involved in developing regional PT plans. The data is analysed using different statistical methods such as the Analytic Hierarchy Process (AHP) and cluster analysis (Fisher, 1987). Section 2 gives a summary of the previously published research and the research gap, Section 3 describes the five

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integration attributes, Section 4 provides the research method, Section 5 describes the case study, Section 6 is the results, Section 7 gives the discussion and lastly, Section 8 is the conclusion.

2. Literature review

The aim of this literature review is to provide a summary on how an integrated system is planned for an existing system and its impact on ridership. The focus is on the operational aspects as it forms a common ground between the users' and policy makers' perception of the PT system. As such, the integration of organizations, regulatory structure and fleet are outside the scope of this review. These integration structures rely more closely on decision makers and require less consultation, if at all, from the users.

2.1. Creating an integrated system

Most studies on integrated systems focused on the effects of a policy or infrastructure change on ridership, such as a recent study by Hidalgo and King (2014). Their study discussed the impacts and issues due to a gradual implementation of an integrated PT system. Data was collected by interviewing government officials and consultants involved in the process. Fewer studies have investigated how decisions about a new system are taken prior to implementation. Mackett and Edwards (1998) developed a procedure to select the most appropriate form of PT systems (e.g. bus, light rail, train etc.) that can be added to an existing system. Their study collected data by undertaking semi-structured interviews with transportation experts. Solecka (2014) proposed a common variant ranking method, Electre III, to assist policy makers in deciding the most suitable version of an integrated PT system for their city. The assessment criteria included travel time, environmental friendliness, integration level, reliability, accessibility and investment cost. Kash and Hidalgo (2014) developed a framework to include consultation with the users and incorporate their needs into a regional PT plan. They conducted interviews with experts and semi-structured surveys with the public to determine aspirational gaps between the two groups. Experts were defined as operators, city representatives, academics and consultants. Their findings showed that users are more concerned about crime, price and crowding while policy makers were more focused on reliability, integration and formalization.

2.2. Impact of integrated systems on ridership

The main purpose of an integrated transport system is to provide PT users with a "wide spectrum" of destination choices and also with a convenient, accessible, comfortable, safe, speedy and affordable system (Ibrahim, 2003; Luk and Olszewski, 2003; Ulengin et al., 2007). Studies have shown that integrated systems can attract a greater number of users. Ibrahim (2003) discussed that in Singapore, where PT use is considerably high at 60% of mode share, the government aimed to increase the mode share to 75% through integration. Matas (2004) investigated the significant increase of PT use (>40%) in Madrid, Spain from 1986 to 2004 and found the reason to be the changes made for integration. The study discussed that integrated fare system and network integration had the most impact on ridership. Buehler (2011) conducted a comparison study between USA and Germany and showed the ridership of sustainable transport in Germany to be greater; 40% of German travelers used sustainable modes (8% for PT) while only 11% of American travelers used sustainable modes (2% for PT). One of the reasons given was better integration of PT services in Germany. Abrate et al. (2009) assessed the impact of fare integration on the ridership of services from 69 Italian operators. The effects of integrated fare systems on patronage were 2% in the short-run and 12% in the long–run.

2.3. Research need

As can be seen from the review, there has not been any study which investigated the attributes of an integrated system that are most important to users and policy makers. The review reveals that attributes such as fare and ticketing systems, and network integration have a positive effect on ridership; however, the studies do not explain why the focus has predominantly been on these two attributes. Chowdhury et al. (2013) asked PT users to compare between information integration and physical integration. Results showed that users place more importance on physical integration than information integration when deciding to make a transfer. The present study follows this line of work. Findings as such are required to reduce the gap in understanding between users and policy makers. Without a holistic comparison of the attributes from both the users' and the policy makers' perspective, increasing ridership of PT systems will remain a challenge. The present study addresses this gap.

The approach to compare users' perception with policy makers' is common in transportation planning, particularly in urban mobility. For example, Whitmarsh et al. (2009) found the similarities and differences in experts' and public's opinion on visions of sustainable mobility, that was used to create an Integrated Sustainability Assessment. A similar study by Gerike et al. (2008) looked at policy makers' and public's perception of policies which produce a modal shift (from private car to sustainable transport) and found that the public prefer policies which are perceived to be fair, effective and which do not limit freedom. Xenias and Whitmarsh (2013) investigated the difference between transport experts' and public's attitude towards sustainable transport. AHP was adopted to rank and compare the items, used to measure attitude, for the two groups. Their study emphasised the importance of public-engagement in the development of transport options.

3. Defining the five integration attributes

This paper adopts the typology developed by Chowdhury and Ceder (2013) as it focuses on operation, exclusively. Transfers are a key component of an integrated system. They allow integrated systems to operate as "one unit" for the users. As such, the definition of the attributes will have a strong focus on transfers. In this paper, an integrated PT system has five main attributes: (a) network integration, (b) fare integration, (c) information integration, (d) physical integration of stations, and (e) coordinated schedules. There are other similar typologies. For example, Nosal and Solecka (2014) used a slightly different typology of integrated transport systems. Their definition included infrastructure integration, organizational integration, economic and financial integration, information integration and spatial integration.

3.1. Network integration

Network integration is where routes are required to connect with one another to create access a wide range of destinations. Clever (1997) stated that an integrated system is where users are exposed to a whole system of travel routes instead of a single boarding service. Planned connections and coordination of connectivity of different routes allow users to visualize that from a single point they can travel to multiple destinations (Clever, 1997; Ceder et al., 2009). A fully multimodal integrated system optimizes the resources available, and therefore reduces wasteful duplication of services, while still maintaining an adequate coverage area (Ibrahim, 2003; Hidalgo, 2009).

3.2. Integrated timed-transfers

An integrated timed-transfer connects the multimodal PT networks such that the transfer times are minimized. PT operators must