Transport Policy 63 (2018) 189–199

Contents lists available at ScienceDirect

Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

Is carsharing for everyone? Understanding the diffusion of carsharing services

Michiko Namazu [a,*], Don MacKenzie [b], Hisham Zerriffi [c], Hadi Dowlatabadi [d]

[a] University of British Columbia, Institute for Resources, Environment and Sustainability, AERL Building 429-2202 Main Mall, Vancouver, BC, V6T 1Z4, Canada
[b] University of Washington, Department of Civil and Environmental Engineering, More Hall 121B, Seattle, WA, 98195-2700, USA
[c] University of British Columbia, Department of Forest Resources Management, 2424 Main Mall, Vancouver, BC, V6T 1Z4, Canada
[d] University of British Columbia, Institute for Resources, Environment and Sustainability, AERL Building 422-2202 Main Mall, Vancouver, BC, V6T 1Z4, Canada

ARTICLE INFO

Keywords:
Carsharing
Adoption
Technology diffusion
Shared-mobility

ABSTRACT

Carsharing (CS) has gained attention as a measure to reduce vehicle ownership, motivate multimodal mobility and cut greenhouse gases and other pollutants. Some municipalities have adopted specific regulations to support adoption of CS. Initial studies, reflecting outcomes from early adopters, have confirmed the expected effects of CS on reduced car ownership and GHG emissions associated with mobility. This study addresses three questions: a) are early adopters sensitive to one-way vs. two-way carsharing? b) do early and late adopters have different household characteristics? and c) can outcomes associated with early adopters be projected onto later adopters? Our study is based on a 2013 survey of residents in 110 apartment buildings in Metro Vancouver, Canada. 2011 responses were analyzed for possible differentiating factors for early adopters at the household level. We find that early adopters (24% of respondents) have more wage-earners per household, live with fewer older family members in neighbourhoods with better CS access and own fewer cars. Among non-CS membership holders (76% of respondents), roughly one-third stated they would never choose CS. The rest expressed interest in joining if CS accessibility was improved and usage/membership fees were lowered. These households are dissimilar to early adopters; they are more likely to live with elderly family members and to own automobile(s) while less likely to have multiple wage earners in their households. The specific characteristics and circumstances of early CS adopters mean that as CS memberships expand, the past patterns of vehicle utilization, car-shedding, vehicle kilometres travelled shifts, and greenhouse gas reductions may not be replicated. Further investigations are required before concluding that the long-term effects of CS services align with observed benefits to date.

1. Introduction

Private cars are, on average, parked for 95% of the time in their life (Shoup, 2011; Morency et al., 2015). Carsharing (CS) offers an alternative where multiple individuals can access a fleet of cars for their private use. Shared cars have much higher utilization rates reducing lifecycle environmental impacts of cars. In 2014, there were close to 5 million CS members and more than 100,000 shared cars globally (Shaheen and Cohen, 2016).

Local governments have supported the expansion of CS based on a range of expected benefits to society. In its development strategy, the City of Vancouver, Canada lists CS as a method to realize sustainable transportation systems and to build a multi-modal city (City of Vancouver, 2012). Other cities base their interest on the possibility of CS to make more parking spaces available and help in reducing vehicle kilometres travelled (VKT) (Schreier et al., 2016).

A number of studies have shown CS benefits, e.g., lowering the frequency of car use (Meijkamp, 1998); overall reductions in VKT (Meijkamp, 1998; Firnkorn and Shaheen, 2015; Lane, 2005); and, giving up car ownership (Millard-Ball et al., 2005; Katzev, 2003; Cervero et al., 2007; Namazu and Dowlatabadi, in printing; Klincevicius et al., 2014; Martin and Shaheen, 2011a). In addition to these reductions in car use by CS, the supply of a variety of cars, which are often newer and more fuel efficient compared to typical private cars (Gleave, 2015a, 2015b), via CS platforms can motivate the optimization of vehicle size and features depending on trip purposes. As a result, CS users can cut transportation-related carbon dioxide emissions up to 45–55% per household (Namazu and Dowlatabadi, 2015a).

The focus of this study is on how outcomes may evolve with the adoption of CS by the broader population. Existing studies are almost

* Corresponding author.
E-mail addresses: michiko.namazu@alumni.ubc.ca (M. Namazu), dwhm@uw.edu (D. MacKenzie), hisham.zerriffi@ubc.ca (H. Zerriffi), hadi.d@ubc.ca (H. Dowlatabadi).

https://doi.org/10.1016/j.tranpol.2017.12.012
Received 29 September 2016; Received in revised form 11 December 2017; Accepted 11 December 2017

exclusively based on surveys of current CS users yet CS is in the early stages of technology diffusion, assuming that the service eventually may be adopted by the majority of city residents. According to Rogers' technology diffusion theory (Rogers, 2003) there are five stages of technology adoption: Innovators, Early Adopters, Early Majority, Late Majority and Laggards. A technology takes off at the transition between Early Adopters and Early Majority. By convention, this threshold between early adopters and early majority is usually set at 15% of the population that could eventually adopt a technology. At the time of the survey 13% of the city of Vancouver residents were members of CS services (Ch2m Hill, 2015). A key question motivating our study is whether these early adopters differ from the broader public and outcomes associated with their adoption of CS can be amplified as CS membership rolls grow. A key determinant of the answer will be whether early adopters are especially well disposed to changing their private transportation choices, or are financially forced in to not considering or giving up vehicle ownership.[1] Prior studies have found that early CS adopters can be characterized as being younger, non-vehicle owners, more highly educated, more likely to live in urban centres and less likely to have children than the general population (Government of Canada, 2006; Prettenthaler and Steininger, 1999; Loose, 2010).

If future adopters have different household characteristics than early adopters, extrapolation of outcomes based on studies of early adopters is likely to be biased. In other words, further expansion of CS may fail to generate similar patterns of benefits for society. This study has three objectives:

- examining whether early CS adopters are sensitive to type of car-sharing service;
- are early adopter households different from potential late adopters and;
- understanding characteristics and limits to further adoption of CS and the implications of these on outcomes associated with CS.

To the best of our knowledge, this is the first study of its kind.

This paper consists of five sections. Section two describes the survey context, data and methods. Section three presents results of statistical analyses to understand differences in characteristics among CS adoption groups (Early Adopters, Followers, and Non-adopters). The fourth section shows the characteristics of future adopters and least likely adopters in detail, exploring how the Followers can be motivated to join CS, and the reasons why a significant portion of the population (25%) may never adopt CS. The fifth section provides a discussion and summary of findings and their policy implications for local governments.

2. Methodology

2.1. Study area

The study area is the Vancouver Metropolitan region in British Columbia, Canada. The municipality with the highest population density and best public transit in this region is the city of Vancouver. The city has one of the highest CS adoption rates in the world; at the time of survey (2013), 13% of its population was a member of one or more of CS services available locally (Ch2m Hill, 2015).

2.2. The survey

Metro Vancouver is a political body and service provider to 24 local municipalities in the region including the City of Vancouver. In the fall of 2013, Metro Vancouver used a survey of 20 questions to understand the role of CS in the region (Metro Vancouver, 2014b). At the time, the region was served by three CS systems as summarized in Table 1.[2]

We used the data from this survey to compare the characteristics of CS adopters and non-adopters. This survey was the first with a focus on CS services in the region (Metro Vancouver, 2014a). 110 apartment complexes in Metro Vancouver were targeted for the survey. They were selected on the basis of two criteria: being located within 800 m of a two-way CS station; and, being built between 2006 and 2008. All residents of these apartment buildings were invited to participate in the online survey by mail (Metro Vancouver, 2014a).[3] Fig. 1 shows the locations of the buildings along with survey responses. 2,054 responses were collected with a calculated response rate of 12.8% (Metro Vancouver, 2014a).[4]

About 40% of the respondents to this targeted survey are residents of the City of Vancouver (Metro core and Vancouver in Fig. 1). The average number of vehicles per household among these respondents was 1.06 while the Metro Vancouver average in 2011 was 1.66 (Metro Vancouver, 2015; Metro Vancouver, 2012). Among respondents 23% had one or more CS memberships. By comparison, the City of Vancouver reports that 13% of its residents were CS users in 2013 (Ch2m Hill, 2015). CS membership continues to expand in the region and had doubled by 2015. We suspect the low vehicle ownership rate and high membership in CS among survey participants may be an artifact of the sample design, which deliberately targeted households near CS stations.

3. Heterogeneities among CS adaptation groups

3.1. Grouping

Depending on their actual and expected CS adoption, respondents were first classified into three groups: Early Adopters, Followers, and Non-adopters. This classification is modified from the original since Rogers' theory (Martin and Shaheen, 2011a) applies to the final population that eventually adopt a technology. In our case, the surveyed population contains a subgroup that self-identify as having mobility needs that cannot be met through CS. Early Adopters are already members of CS services. Note that this Early Adopter group contains both Innovators and Early Adopters as defined in Rogers' theory (Martin and Shaheen, 2011a). Followers do not have a CS membership, but identified at least one approach that may persuade them to join a CS program (e.g., more cars, lower fees). Non-adopters do not have a CS membership and declared that there was no way to encourage them to join. Respondents who are inactive CS members and/or cancelled their membership prior to the survey were excluded from analysis (8 responses).

After this first grouping, the Early Adopter group was subcategorized into two groups: one-way CS users and two-way CS users. Here, two-way CS services mean traditional CS services where CS vehicles need to be returned to the original vehicle pick-up locations. On the other hand, one-way CS services allow users to drop off CS vehicles at any approved parking spots, which could be different from the original vehicle pick-up locations. Because of this fundamental difference in their services, it has been argued that this difference need to be scrutinized (Le Vine and Polak, 2015; Le Vine et al., 2014a). Since it is fairly recent that one-way CS services have become practical (the very first practical one-way CS service was launched by Daimler as Car2go service in 2008 (Le Vine et al., 2014b; Shaheen et al., 2015)), there is a limited number of studies covering one-way CS services. In addition, the majority of such studies do

[1] Early carsharing studies reported that most users were medium-high income (see for example, Cervero et al., 2007; Prettenthaler and Steininger, 1999) while recent studies reported that users are more likely to be low-medium income (see for example, de Lorimier and El-Geneidy, 2013). In addition, one does not have to have low to medium income to struggle with living expenses.

[2] Evo, a new free-floating CS, was introduced after the survey used in this study.

[3] An opportunity to win one of two $50 worth gift cards was given to survey respondents as an incentive.

[4] Unfortunately, a technical glitch in data collection led to no data being collected about the number of family members aged between 55 and 64.