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Shared-mobility Experience in the City of Adelaide: Insight from a Preliminary Study

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Abstract

With increasing mindfulness of car dependency, several strategies included developing sharing-economy mobility systems have been offered to help in restricting private vehicle usage. This study provides the survey results of two progressive and innovative shared-mobility schemes (GoGET and UBER) that have recently commenced operations in Adelaide, South Australia based on the online survey data collected from the actual users of the service. The data was then described and analysed using statistical analysis included correlation tests, mean comparing tests, and analysis of variance. While confirming several aspects already discussed in the literature, this research revealed that, due to their different characteristics, the market of shared-mobility is not sufficiently developed in the City of Adelaide (the inner suburban and belt and CBD), whereas its current market demand is highly dependent on the socio-demographic characteristics.

Keywords: Sharing Economy; Shared-mobility; Modal Shift, Statistical Analysis; the City of Adelaide.

1. Background

Australia's metropolitan areas, have high levels of car dependency comparing to welathy asian and European cities (Kenworthy & Laube 1999). There were 18.8 million registered motor vehicles in Australia as at 31 January 2017 (ABS 2018). Over 90 percent of the Australian population lives in a household with access to a car. This car dependency trend has signficant impacts including a high dependency on oil and fossil fuel energy resources, air pollution, carbon induced climate change and social segregation (Amphlett 2008). Personal vehicles are a major cause of global warming, as road transport accounted for 84 per cent of emissions from the transport sector and over 12per cent of all greenhouse gas emissions produced in Australia (Department of the Environment, Commonwealth of Australia 2013). Whilst zero emission motor vehicles in the form of electric vehicles are now available in the Australian market, their high purchase cost and lack of financial incentives from the government has suppressed sales, with the result that electric vehicles have less than 0.1per cent market share (Gaton, 2018).

Given the extensive range of problems linked with car-dependent cities, there is a lifelong debate about the best pathway forward: is it land use change, a modal switch to public transport, active transport and sharing-mobility modes, is it technological driven (i.e. changing to electrice vehicles (EVs) or is it related to travel behaviors, however, it is apparent that an alteration of Australia's urban travel habits is essential. Adelaide is recognised as one of the most car-dominated capital cities in Australia (Soltani & Allan, 2006; Soltani et al., 2006; Mees, O'Connell, and Stone, 2008; Nguyen et al., 2018), and shared-mobility schemes in forms of car-sharing or ride-sharing could potentially make a contribution to reducing Adelaide's level of car dependency. Shared-mobility potentially has an important contributory role in Adelaide City Council's quest to become a carbon neutral city .

Contemporary studies suggest that shared-mobility has certain pros and cons to both individuals and society. On the positive side, shared-mobility models obtain great potential to curb travel demand as well as its associated energy and environmental impacts (Clewlow 2016). For further clarification, shared-mobility offers commuters an additional transport option, increasing mobility and encouraging multi-nodal communities in which people can reach destinations inaccessible by other means of transport (including walking, cycling or public transit) (Ferrero et. al 2018). Additionally, through allowing users to access the benefits of private vehicles utilisation without bearing all of its inherent costs, carsharing programs represent a potential to reduce car ownership, the total amount of car trips, total vehicle kilometres traveled, and hence supports more environmentally sustainable travel behaviors (Huwer 2004; Martin, Shaheen & Lidicker 2010; Martin & Shaheen 2011a; Schaefers 2013). Luca and Pace (2015, p. 60) also indicates that 'it allows car to be used properly, it makes it possible to use the appropriate mode of transport for each journey, it favours trip-chaining and reduces impulsive trips'. Previous research demonstrates that joining a shared-mobility organisation may contribute to some extent to reducing greenhouse gas emissions of travel, pollution, congestion, and demands for parking spaces (Rabbitt & Ghosh 2013; Furuhata et. al 2013; Stiglic et. al 2016; Chen & Kockelman 2016). Moreover, some scholars argue that shared-mobility can increase equitability of access to autonomous mobility for a wider socio-economic group (especially for poor residents), thereby overcoming social inequity issues created by car-dependent societies (d'Orey & Ferreira 2015; Kent 2014). Furthermore, shared-mobility is also claimed to have the potential to enable commuters to communicate with other people, and thus increase social capital (Meekerk, Koppenjan & Keast 2015).

Along with these benefits, there are also debates on the negative side of shared-mobility programs. From an economic perspective, car-sharing (and ride-sharing) are causing disturbances to the existing mobility services market, with substantial resistance from traditional taxi industry services worldwide (Rogers 2015). Additionally, there are concerns regarding service quality, privacy as well as safety of users or unfair competition raised by the emerging car-sharing and ride-sharing industry (Nielsen et. al 2015; Taeihagh 2017). For instance, in a recent study conducted by Li, Taeihagh & Jong (2018), these scholars interviewed taxi drivers, social media writers and newspaper correspondents, and government officials and researchers working on the sharing economy and transportation policy in Singapore to

determine the risks involved in ridesharing. Five key risks identified are as follows: privacy; safety; influence on incumbent industries; liability and automation.

This preliminary research discusses and analyses the survey results of two progressing shared-mobility models: GoGET and UBER that had extended their enterprise into Adelaide (launched in 2014 and 2015 respectively), based on the interview data collected from the actual users of these services. GoGET services is different from UBER as UBER works much like a taxi service, except rides are booked through an app. GoGET is the equivalent of short term car rental and the user (i.e. the hirer), must have a membership with GoGET, they must have a driving license and be able to drive themselves for the trip they wish to make. For clarification, "car sharing" is a service like GoGET, where the actual vehicle is just booked or hired to the driver as the sole hirer. Although there may be passengers in the vehicle with that driver, they are there as non-paying guests of the driver. Charges (i.e fees) and responsibility for the vehicle accrue to the driver. The passengers in car-sharing have no legal connection with the use of the vehicle. The service is akin to short term car rental/hire. With "ride sharing", it can work several ways. UBER is an example of ride-sharing. An UBER driver provides a service to a person/s wanting to travel under a single booking (in much the same way that a person uses a conventional taxi). Another possibility is for several hirers wanting to travel in a similar direction, to book the same car, but get off at different locations, and paying a share of the cost. Car-pooling is similar to ride-sharing, except that payment is limited to sharing the costs of fuel, and the driver is not paid a salary or reward. In this paper, for staying consistent, we use "shared-mobility" as a unique term for both types of services: car-sharing (e.g. GoGET) and ride-sharing (e.g. UBER).

Three research questions as below are invetsigated based on the outlook of actual shared-mobility service users:

- What are the socio-demographic charactersitics of shared-mobility service users in the City of Adelaide? Are there meningful differences among different social groups in terms of using the service?
- What are the main purposes of using shared-mobility service?
- How satisfied the service users with the current system? What are the main determinants of satisfactions and dissatisfactions? How the satisfaction level can be increased?

The paper is structured as follows. First, it gives an account of research on shared-mobility with a focus on its advatages and disadvantages. Then, based on the data collected for this study, it describes the current percentage of usage and preferences of real users from the system provided, their satisfaction level and the role of a sharing mobility system in individuals' travel patterns. Finally, it offers some guidelines to achieve an integrated and sustainable shared-mobility system in Adelaide considering the limited domain of this preliminary study.

2. Study Area

The City of Adelaide covers 15.6 square kilometres of land in South Australia, and is made up of mixed use development, including residential, commercial, institutional, cultural and entertainment land uses. This area includes the central business district (CBD), North Adelaide and the Adelaide Park Lands.

The results of ABS statistics suggest many distinct characteristics of the population residing in the City of Adelaide are different to that of the surrounding suburbs. Some of the key findings highlighted for the population include the high proportion of the population in employment, implying that many reside in the area for work and/or study purposes. Being in a commercial and business space, with very high costs of real estate means that high-density housing is common. The State Government's current 30-Year Plan for Greater Adelaide reinforces residential growth in the City and includes the targets of an additional 27,300 residents and 50,000 workers by 2040, to make a total of around 50,000 residents and 170,000 workers.

According to the socio-demographic information from ABS 2016, the City of Adelaide is an ideal place to establish sharing mobility services due to following reasons:

- Relatively low car dependency compared to the rest of the Greater Adelaide region;
- A higher share of non-motorised and public transit data;
- Younger population;
- A large share of students, visitors and non-residents of Australia;
- A large share of middle-income households; and
- A good mix of dwelling types and restrictions on the availability of parking spaces.

With regard to the City of Adelaide's circumstances, the most popular form of shared-mobility is identified as a fix-based car-share service (GoGET), which began in 2008 with only two cars in Sturt Street and then grew to 14 vehicles located in 11 nodes in 2016 (Philip Boyle & Associates 2017). Additionally, a survey conducted in December 2016 also shows that the fix-based car-share service supported 446 private and business customers, in which more than 66 percent of users were between 25 and 54 years old (Philip Boyle & Associates 2017). At the beginning, there was only one carsharing company in Adelaide – GoGET; however, in early 2017, General Motors (GM) started the operation of Maven Gig to provide new or near new cars under a short term lease arrangement to UBER drivers (Maven Gig 2017).

3. Data Collection

A web-based online survey was designed with the participation of the actual users of two shared-mobility schemes (GoGET and UBER) in the City of Adelaide. The main objective of this survey was to explore the usage frequency and satisfaction level of Adelaide's current shared-mobility services from the viewpoint of real users. A sample size of sixty achieved for this survey. The participants were randomly approached on the street among those using shared-mobility services. They were introduced the online link to do the survey if reluctant, therefore, the recruitment leaded to a voluntary sample as a non-probability sampling method. This type of sample is almost made up of people who self-select into the survey due to having a strong interest in the survey topic.

The respondents reported their experience of their shared-mobility services trip if they have at least one. The data collection took two weeks due to limitation of finding and tracking an actual user. This approach of sampling has its own limitations since the sample size was relatively small and the selection of cases were not fully arbitrary. No exclusion criteria was applied unless for incomplete or non-honest responses (if detected). The response rate of those introduced the survey outline was 80 percent showing high reluctance of shared-mobility service users to participate in relevant research surveys. The data then analysed by descriptive and inferential methods.

The survey questionnaire included three main parts. Part 1 asked for information on users' attitudes towards the current shared-mobility service (included GoGET and UBER) in City of Adelaide (within the boundary of City of Adelaide). More specifically, close-ended questions using a Likert five-point scale were designed to rank potential factors affecting travellers' modal choice with the inclusion of shared-mobility services. Moreover, the performance of Adelaide's current shared-mobility service was examined by asking sampled participants to evaluate physical and perceived characteristics of the system. The physical features included the location and accessibility to shared-mobility service; basic components such as the availability of mobile apps, the possibility of off-street parking for a shared car (GoGET), the sign up process, and advertising. In addition, other attributes such as the payments which related to the cost of usage, deposit fee, payment method, and incentives for users were also categorised in addition to the physical characteristics of the system. Users' perceived attributes of the service included the maintenance and cleanness, safety and security, and waiting times.

Part 2 of the survey questionnaire asked the participants to report their experience of shared-mobility usage. Their frequency of using the service, the distance and time duration while using the service, were investigated. The questionnaire also included several in-depth questions to explore the main reasons for using the service from the view point of users, in addition to the shortfalls of shared-mobility service, and their general satisfaction with the service in Adelaide. Part 3 includes the socio-demographic characteristics of sampled participants such as the gender, age, education level, type of employment, residency status, household information, and car ownership.

4. Data Analysis

The collected data from the actual users of shared-mobility service was coded using IBM SPSS ver 22. Two levels of analysis undertaken included: a) descriptive analysis on the characteristics of the users and their attitudes towards the service; and b) inferential analysis including median test and one-way analysis of variance (ANOVA) test, in order to examine the association between influential factors and their effects on the usage of the system.

4.1. Descriptive analysis

The demographics of shared-mobility service users in the City of Adelaide are presented by four main indicators as noted in the data collection process. Details of gender and the age group

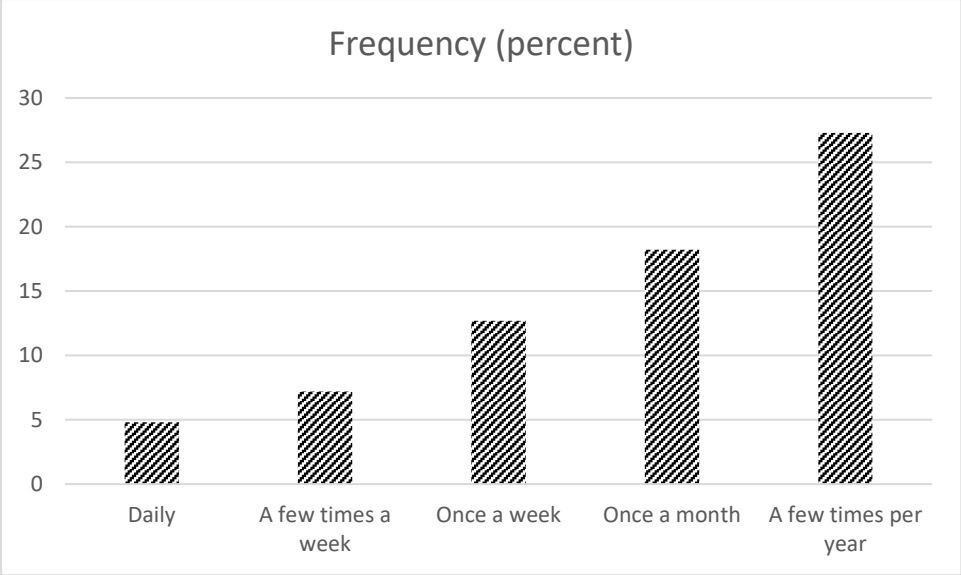
of the respondents are provided below. Approximately 56 per cent the participants were males, while 44 per cent were females. In terms of the dominant age group, most respondents were young people. As such, a considerable share of surveyed users (14.1 per cent) were aged between 17 and 19, 24.6 per cent were aged between 20 and 24 followed by the age group from 25 to 29 (19.5 per cent) and the age group between 30 and 34 (14.9 per cent). The three remaining age cohorts included the age groups of 35-39; 40-44 and 45 and over had similar shares (9.2; 7.3; and 10.6 respectively). The education level of the sampled respondents was dominated by those with an undergraduate degree (39.0 per cent), while roughly 17.1 per cent of respondents had a postgraduate degree. The rest of sampled users are people with high school certificate (36.6 per cent) and no degree (7.3 per cent). With respect to the weekly income level of users, about one fifth of respondents (19.4 per cent) reported their income between 1 and 199 AUD followed by the income category of 200 to 299 AUD (17.1 per cent). The share of individuals with income between 300 to 599 AUD (13.4 per cent) was close to the category of 600 to 799 AUD (14.6 per cent). The relatively high-income groups included 800-999 AUD; 1000-1250 AUD and 1250 or more had shares of 9.9; 11.2 and 9.5 per cent respectively. Also 4.9 per cent reported having no income.

4.2. Performances of shared-car schemes in Adelaide

4.2.1. Frequency of using shared-mobility service

Two key variables in investigating shared-mobility service are membership and frequency of use (Becker, Ciari, and Axhausen, 2017). In the case of Adelaide, all participants were either members of one or two schemes whilst the survey results recorded a low frequency of shared-mobility utilisation among users. Over a one-fourth of respondents (27.3 per cent) stated that they used shared-mobility service a few times per year, while the data for those that utilised the service daily was negligible, at only 4.8 per cent (Fig. 1). A similar trend was found for users with usage of a few times a week (7.2 per cent). It means that despite the existence of two different car schemes in Adelaide including GoGET and UBER, these statistics on the usage rates in the frequent category for these services have been marginal. This finding is similar to research results of Fishman et al. (2015) which concluded that there was low usage of shared-vehicles (shared-bikes and shared-cars) in Australian cities when compared to Europe and East Asia.

Fig. 1. The frequency of using shared-mobility services of the surveyed users in the City of Adelaide



4.2.2. How frequency of using shared-mobility service differs across genders

In order to determine whether there is statistical evidence that the associated population means are significantly different, the parametric Independent Samples t-test was applied and the results showed that with the level of confidence at 95 per cent, there are statistically significant differences in the means of frequency of using shared-mobility between men and women in Adelaide (t= 2.035; p-value < 0.011). The result of Levene's Test for Equality of Variances (F=3.091; Sig. = 0.015) confirms that we have violated the assumption of homogeneity of variances in the population as the basic requirements of doing t-test. This is consistent with finding in a large-scale international study within four major metropolitan areas: London, Madrid, Paris, and Tokyo (Prieto and Baltas, 2017), which found that gender matters with regard to shared-mobility service adoption intention. This result can be attributed to the fact that generally males having less safety concerns than females when using shared vehicles (Shaheen et al., H 2015).

4.2.3. How frequency of using shared-mobility service differs across age groups

The result of one-way ANOVA test found no significant relationship existed between the age category and frequency of shared-mobility service (F= 0.818; p< 0.563). One reason for this was probably that our survey does not have a high variance of age groups. In fact, this is contradictory with some former studies that determined that age was an important factor in shared-mobility service usage (Millard-Ball et al., 2005). Some previous studies (Prieto and Baltas, 2017; Rotaris and Danielis, 2018; Kim, Ko and Park, 2015) argued that older people are less likely to use shared-mobility service. This probably happens because older adults have

the habit of using their own cars for many years and it is difficult for them to change their commuting habits. On the other hand, younger adults due to having lower level of vehicle ownership and being more familiar with smart phone apps, are more likely to make use of shared-mobility service. Younger commuters appear to be less car-oriented and to hold positive attitudes towards substitutes to car ownership (Kuhnimhof et al., 2012), especially for the age group of 25 to 49, who were found to be more likely to take shared-mobility service instead of private vehicles when compared with other age groups (Cervero, 2003; Martin and Shaheen, 2010).

4.2.4. How frequency of using shared-mobility service differs across educational groups

Another interesting outcome from this survey was that education level has a significant impact on the frequency of shared-mobility service usage as demonstrated by the one-way ANOVA test result ($F=4.261$; $p<0.022$). The education level was categorised into four groups that included postgraduate; undergraduate; secondary school; primary school or no certificate. This is consistent with findings of some American studies which found that having at least one academic degree is strongly associated with shared-mobility service usage (Cervero, 2003; Martin and Shaheen, 2010). Similarly, Celsor and Millard-Ball (2007) found that car-sharing neighborhoods are more likely to have higher shares of residents with bachelor's degrees than in non-car-sharing neighborhoods. The results from a study in Tokyo showed that educated people more welcome shared-cars and eco-cars due to having a higher level of environmental understanding and concern (Ohta, 2013). In fact, the positive attitudes towards shared-mobility is partly due to environmental and climate change concerns, therefore, attitudes towards the environment as a non-observable variable strongly influence respondents' acceptance of car-sharing (Zheng et al., 2009). For this reason, the degree of knowledge of shared-mobility service and environmental awareness are regarded as the main factor in using the service (Rotaris and Danielis, 2018; Nobis, 2006).

4.2.5. How frequency of using shared-mobility service differs across different residency (visa) status

As Australia is a multicultural country, the residency status (country of birth) in five categories was considered: Australian-born; overseas-born but with Australian citizen/resident status; visiting (temporary visa); student visa; and other visa types. These residency categories were analysed against the frequency of shared-mobility service usage. The ANOVA result showed no statistically significant difference among these four groups in terms of shared-mobility service usage ($F=0.260$; $p<0.854$). This finding is contradictory to the international comparative study by Prieto and Baltas, (2017) which found that British, Spanish and Japanese adults are all less likely to use shared-mobility service services when compared to the French, whereas most of background studies have had little consideration of nationality impact on

shared-mobility service. However, in our case study area, the mobility issue appears to be similar for all groups of residency status and visa type.

4.2.6. How frequency of using shared-mobility service differs across income groups

In examining the association between personal income level and the frequency of usage of shared-mobility service, we categorised both variables and applied the Chi-square test based measure of association: the Gamma coefficient. The association was shown to be significant as shown by the Chi-Square score= 74.411; p< 0.0.31, where the Gamma symmetric coefficient= 0.34; p< .045). This result confirms that increasing the income level would increase the frequency of shared-mobility options. Our results are only partially consistent with those generally reported in the literature. From our analysis, in fact, it emerges that low-income groups such as the students would be less likely users of shared-mobility service, while employers or employees are the most probable users. In Australian cities, as in most developed countries, a considerable discount on fares are guaranteed to students thus making them less likely to catch relatively costly sharing mobility options. Indeed, in the City of Adelaide, tram services and certain bus services are free to all travellers. Cervero, (2003) found that those who were self-employed or worked were more likely to use shared-mobility service. In Seoul, Kim, Ko and Park, (2015) found that while having higher income level was correlated positively with participation in an electric vehicle sharing program, on the contrary, the participants with higher household incomes were found to be less likely to change their existing driving behaviour, which was habitual.

4.2.7. How frequency of using shared-mobility service differs with level of car ownership

Another interesting result of our survey was the positive correlation between the number of cars available by corresponding household and the frequency of shared-mobility service usage although this result was not shown to be statistically significant at 95 per cent (Rho= 0.231; p<0.08). This is contradictory with the literature stating that not-owning a private car leads to higher likelihood of shared-mobility service usage (Celsor and Millard-Ball 2007; Zhou Kockelman 2011) and the average number of cars per household is negatively correlated with shared-mobility service usage (Becker, Ciari, and Axhausen, 2017). The residents of non-car households are more likely to be shared-mobility service users, which is supported by research in the US (Martin and Shaheen, 2011). The connection between income level; car ownership and shared-mobility service usage frequency is uncertain and requires further investigation using advanced statistical analysis. However, shared-mobility service in the Australian context is not regarded as an alternative mobility for low-income and non-car owners as advocated in the literature. An US study explains that car-sharing would be rather well-accepted by those who do not need to own a vehicle (Zhou and Kockelman 2011). On the other hand, Ohta (2013) found that the number of cars per household negatively affects the acceptance of car-sharing

and electric-cars. The author then argued that the association between car ownership and shared-mobility service usage would be moderated in cases where gender was considered. While males show a higher intention for car-sharing than owning a car than females do, females responded with a higher intention towards car-sharing as an alternative to owning an additional car than males do (Ohta, 2013). While car ownership affects shared-mobility service usage, an important related question is whether the model (and type) of owned car matters or not. Having a relatively recent car is directly correlated with shared-mobility service as new vehicle owners might wish to maintain their cars in excellent condition and keep their kilometres low (Prieto and Baltas, 2017). According to Korean research, car owners were less likely to give up their cars, but had a high likelihood of buying electrical vehicles (EVs), thus, this electric car-sharing program appears ineffective in decreasing car ownership (Kim, Ko and Park, 2015). Ferrero et al. (2018) argues that regardless of income level, the perception of today's people is shifting over time with the diffusion of car-sharing services, therefore, many city dwellers are moving from a car ownership vision towards a car-as-a-service vision of urban mobility.

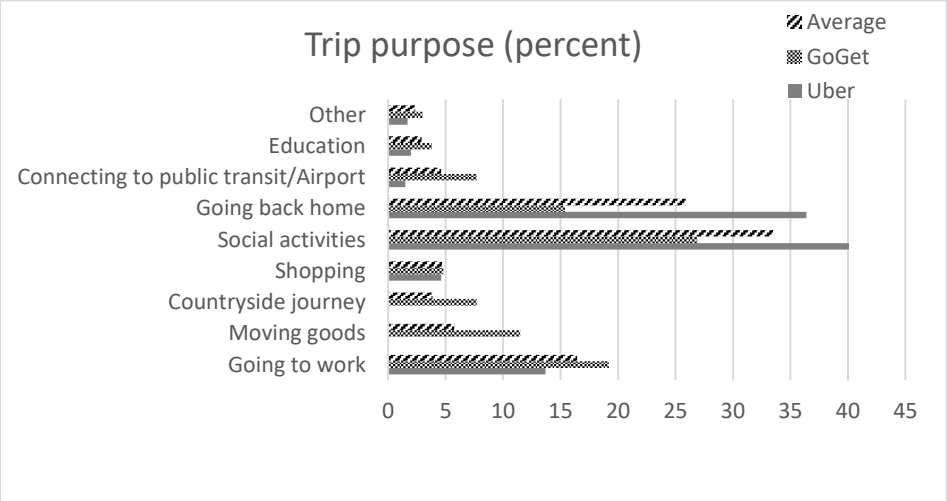
4.2.8. How frequency of using SHARED-MOBILITY SERVICE differs with household size

The size of household was positively associated with the frequency of shared-mobility service usage although not determined statistically significant when using bi-variate Spearman correlation test (Rho= 0.017, p> 0.155). Millard-Ball et al. (2005) comparative study between Canadian and American users on a sampled population (with average 2.2 persons per household) found a different result, where household size directly affects shared-mobility usage. The positive correlation between frequency of shared-mobility service usage and household size is justified because large families have higher mobility needs, thus requiring more vehicles. Some argue that household composition is influential in choosing shared modes instead of household size (Rotaris and Danielis, 2018), especially where children are present and a family mobility pattern with a substantial dependence on private cars are correlated with a higher tendency to take shared-mobility service. According to Kim, Ko and Park (2015) single families showed a greater likelihood of relinquishing a car and enduring participation in the sharing-car scheme. Both station-based car-sharing, and free-floating car-sharing schemes attract mostly young adults living in small households (Schmöller et al., 2015). Householders as younger and highly educated adults living in households with few private cars are more likely to take shared-mobility service (Burkhardt and Millard-Ball, 2006, Firnkorn and Müller, 2012). In similar research, Celsor and Millard-Ball (2007) found that car-sharing neighborhoods in the US are more likely to have greater shares of one-person households. Some argue that having a person employed or not-employed in a household affects the likelihood of shared-mobility service usage by the household. However, the arguments are arbitrary. The presence of unemployed people in a family increase the likelihood of shared-mobility service usage (Zheng et al., 2009; Rotaris and Danielis, 2018). On the other hand, the presence of employed people in a household is an indication of affordability thus increasing the chances of taking a service.

4.2.9. How frequency of using shared-mobility service changes with travel purpose

The last connection examined was the relationship between travel purpose and the frequency of service usage (Fig. 2). Carsharing trips are more likely to be used for shopping, personal business, and recreation trips versus commute trips as found by Millard-Ball et al. (2005) and Cervero et al. (2007) in the US. However, in our data, we only classified them into two categories: work trips; non-work (included shopping, education, social activity, linking to public transit and airport, getting kids to/from school, going back home) trips. The results of Two Independent Samples t-test showed that there is significant difference between these two groups ($t=2.680$, $p<0.05$), while Levene's Test for Equality of Variances was also significant ($F= 3.081$, $p<0.007$).

Fig. 2. The trip purpose of using shared-car of the surveyed users in the City of Adelaide

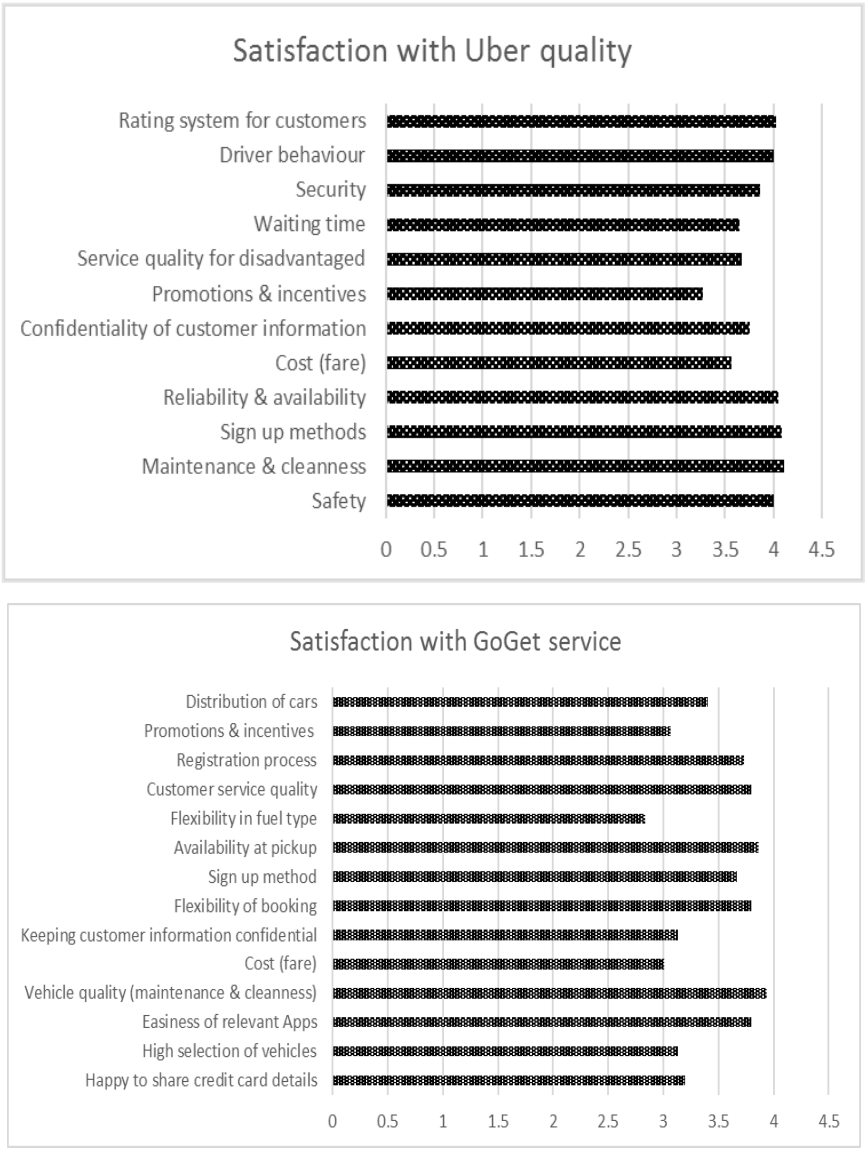


This is consistent with the literature suggesting that shared-mobility is mostly welcomed as an appropriate mode of travel for educational trips (Zheng et al., 2009); shopping and socio-recreational trips (Schmöller et al., 2015) rather than work-related trips. A similar survey in Turin, Italy showed that car-sharing scheme users use it for non-work destinations and in case that no other modes of travel are accessible (Lerro, 2015).

4.3. Satisfaction analysis

The questionnaire asked about the respondents' opinions on the quality of the service. The answers were collected as to whether they agreed or disagreed with different statements about shared-mobility service attributes. 23 attributes were rated. All ratings applied the following scale: (1) strongly disagree; (2) disagree; (3) neutral; (4) agree; and (5) strongly agree. They also answered some questions regarding the desirable policies to improve the quality of shared mobility systems (Fig. 3).

Fig. 3. Satisfaction with shared-mobility options: (a)UBER quality; (b)GoGET quality



From Fig. 3(a), it can be witnessed that maintenance and cleanliness, sign up methods, reliability and availability were by far three most satisfied components of users with UBER's "quality". In this context, the three least satisfied factors were identified as promotions and incentives, cost (fare) and waiting time. The surge pricing model of UBER, and the variability and uncertainty in pricing that this causes may be the reason that the cost of fares attracted user dissatisfaction. As presented in Fig. 3(b), three most satisfied components of users with GoGET service were vehicle quality (maintenance and cleanness), availability at pick up and customer service quality. In contrast, the three least satisfied factors were indicated as flexibility in fuel type, cost (fare), promotions and incentives.

Amongst the people with the opinion that shared mobility services were too expensive, they may not be taking into account the high fixed costs related to operating and maintaining a private car. These results suggest that users could have distorted perceptions of the actual costs of car when compared to car-sharing costs (Lerro, 2015). However, this finding can be argued

because shared-mobility models (at least in Australian context), itself is not cheap unless the car usage is very low. In fact, the judgment depends on the annual distance travelled, and the choice of car too, because with making the wrong choices, costs for private car ownership can be double than that what an individual expects, if for example he/she has an accident or an unexpected mechanical failure.

5. Discussion and Conclusion

This research is one of the first studies of two shared-mobility schemes operating in the City of Adelaide using empirical data. The scope of this paper was to realise the socio-demographic characteristics of current users of the system; travel purpose and the primary motivations behind the choice of using car-sharing and identifying the features of the service that affect the satisfaction with shared-mobility service in order to be improved to better meet users' needs.

While confirming several aspects already discussed in the literature, this research revealed that, due to their different natures, the market of shared-mobility is not sufficiently well developed in the Adelaide context, and that its current level of activity is highly dependent on socio-demographic characteristics. This study recommends a revision in shared-mobility business model to make it as much flexible and economic option for most car owners in order to servicing daily commuting, given that the economic savings are ensured when traveling for these short distances. The satisfaction with current UBER and GoGET services is moderately high and the maintenance and cleanliness, sign up methods, reliability and availability and the quality of the mobile app (with its ability to securely pre-order, pre-pay, review services and track vehicle location) are the main reasons why people use these services. By contrast, an absence of promotions and incentives, the high cost (i.e. fares, particularly the uncertainty with UBER's "surge" demand pricing model) and long waiting times are the primary weaknesses for these services. A key concern of users was that the service is not reliable (i.e. in terms of availability or waiting times). Given the fact that this system was only introduced within the past two years, there is considerable market potential for much greater take-up of shared-mobility service, particularly for those who live or work in the City of Adelaide where parking spaces are limited and can be costly for households that do not have their own dedicated off-street parking space. However, further research is required to investigate about the real potential for increased market share of shared-mobility service, for example, key statistics about what share of mileage travelled these shared-mobility services are meeting the needs of. If the proportion of residents using shared-mobility service and their pattern of usage is discovered, then it could be better possible to infer what this might be. Therefore, targeted information campaigns on the potential benefits and economic savings related to shared-mobility, in combination with a better distribution (ensuring reliable access to shared-mobility service) and wider availability of the vehicles could initiate growth in shared-mobility service adoption rates. The users also expect that regulators provide regulations to protect passengers' personal safety and help ensure safe driving behaviour by UBER drivers.

To extend this research it is recommended investigating the multimodality capability of sharing systems and the issue of "first mile" and "last mile" of urban commuter trips which relates to

the movement of people from a transportation hub to a destination such as home or work-place (Schaefers, 2013). As the literature shown, shared-mobility service work more efficiently where a reliable public transit system exists (Martin and Shaheen, 2011; Huwer, 2004). Furthermore, one of the primary goals of shared-car schemes is to environmental sustainability, however, more research is required into discovering the role that shared-mobility service has on the environment. Shared-mobility services not only require designated parking spots (particularly for GoGET where a car must be parked until a user collects it), but also have access to a public space, which normally requires local governmental intervention. It is expected that governmental support is increased if shared-mobility complements travel demand management and environmental goals, while the reason for sharing services is simply to exploit demand for this type of service as a business opportunity. Shared-mobility service still has a considerable way to go before it becomes commonplace in cities such as Adelaide. However, this research has shown that there is positive support for shared-mobility service that can be built upon and expanded to allow shared-mobility services to play a dominant role in meeting the travel needs of inner city residents.

The small sample size of the survey could reduce the reliability of the research findings and could lead the fact that a number of targeted participants had been ignored to include within the survey. In fact, the relatively small sample size is more likely to be the reason for some of the non-significant results than being a reliable indication that there are no statistical differences across the subgroups being considered. With regard to the future work, a comprehensive research about the all exist car and bicycle sharing schemes in Metropolitan Adelaide would be an interesting research topic to conduct. This proposed research will continue to pursue the main research objectives of the study about characteristics of shared-mobility service and their viewpoints on the system and go deeper on recognising the causal factors.

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References

Amphlett, K 2008, ‘Car dependence in Australian cities: a discussion of causes, environmental impact and possible solutions’, *GEOView: Online Undergraduate Review of Geography and Environmental Studies,* ISSN: 1448-6482.

Australian Bureau of Statistics (ABS) 2013, ‘Statistical Language – Types of Error, Census Data, Australian Bureau of Statistics’, viewed 05 June 2018, <http://www.abs.gov.au/websitedbs/a3121120.nsf/home/statistical+language+-+types+of+error>

Australian Bureau of Statistics (ABS) 2018, ‘2007.0 Census of Population and Housing: Consultation on Content and Procedures, Supporting Information on Topics’, *Census Data*, Australian Bureau of Statistics, viewed 30 May 2018, <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2007.0Appendix22016>

Australian Bureau of Statistics (ABS) 2018, 2071.0 Census of Population and Housing: Reflecting Australia – Stories from the Census, *Census Data*, Australian Bureau of Statistics, viewed 29 May 2018, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/2071.0>

Australian Bureau of Statistics (ABS) 2018, ‘2900.0 Census of Population and Housing: Understanding the Census and Census Data, Australia, Summary of differences between the Census and Labour Force Survey’, *Census Data*, Australian Bureau of Statistics, viewed 01 June 2018, <http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/2900.0main%20features101432016>

Australian Bureau of Statistics (ABS) 2006, ‘1345.4 SA Stats, Feature Article: Journey to work in the City of Adelaide’, *Census Data*, Australian Bureau of Statistics, viewed 29 May 2018, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/1345.4Feature%20Article1May%202009>

Becker, H, Ciari, F & W. Axhausen, K 2017, 'Comparing car-sharing schemes in Switzerland: User groups and usage patterns', *Transportation Research Part A,* vol. 97, pp. 17-29.

Burkhardt, JE & Millard-Ball, A 2006, 'Who Is Attracted to Carsharing?', *Transportation Research Record, No. 1986. Transportation Research Board of the National Academies*, Washington D.C., pp. 98-105.

Celsor, C & Millard-Ball, A 2007, 'Where does carsharing work?: Using geographic information systems to assess market potential', *Transportation Research Record: Journal of the Transportation Research Board*, no. 1992, pp. 61–69.

Cervero, R 2003, 'City CarShare: First-Year Travel Demand Impacts', *Transportation Research Record: Journal of the Transportation Research Board 1839,* pp. 159-166.

Cervero, R, Golub, A, & Nee, B 2007, *San Francisco city carshare: Longerterm travel-demand and car ownership impacts*, Technical report, Working Paper, Institute of Urban and Regional Development.

Chen, TD & Kockelman, KM 2016, 'Carsharing's life-cycle impacts on energy use and greenhouse gas emissions', *Transportation Research Part D*, vol. 47, pp. 276-284.

Clewlow, RR 2016, 'Carsharing and sustainable travel behavior: Results from the San Francisco Bay Area', *Transport Policy*, vol. 51, pp. 158-164.

Department of the Environment, Commonwealth of Australia, Australia's Abatement Task and 2013 Emissions Projections, Department of the Environment, Commonwealth of Australia 2013, p.11

d'Orey, PM & Ferreira, M 2015, 'Can ride-sharing become attractive? A case study of taxi-sharing employing a simulation modelling approach', *IET Intelligent Transport Systems*, vol. 9, no. 2, pp. 210-220.

Ferrero, F, Perboli, G, Rosano, M & Vesco, A 2018, 'Car-sharing services: An annotated review', *Sustainable Cities and Society*, vol. 37, pp. 501-518.

Firnkorn, J & Müller, M 2011, 'What will be the environmental effects of new free-floating car-sharing systems? the case of car2go in ulm', *Ecological Economics*, vol. 70, no. 8, pp. 1519–1528.

Fishman, E, Washington, S, Haworth, N & Watson, A 2015, 'Factors influencing bike share membership: an analysis of Melbourne and Brisbane', *Transportation research part A: policy and practice*, vol. 71, pp. 17-30.

Furuhata, M, Dessouky, M, Ordonez, F, Brunet, ME, Wang, XQ & Koenig, S 2013, 'Ridesharing: the state-of-the-art and future directions', *Transportation Research Part B*, vol. 57, pp. 28-46.

Gaton, B (2018) Australia's EV options vs the world's – why are we waiting? viewed 18 August 2018, <https://reneweconomy.com.au/australias-ev-options-vs-the-worlds-why-are-we-waiting-82878/>.

Huwer, U 2004, 'Public transport and car-sharing—benefits and effects of combined services', *Transport Policy*, vol. 11, pp. 77-87.

Kent, JL 2014, 'Carsharing as active transport: What are the potential health benefits?', *Journal of Transport & Health*, vol. 1, pp. 54-62.

Kenworthy, JR & Laube, FB 1999, 'Patterns of Automobile dependence in cities: an international overview of key physical and economic dimensions with some implications for urban policy', *Transportation Research*, vol. 33, pp. 691–23.

Kim, D, Ko, J, & Park, Y 2015, 'Factors affecting electric vehicle sharing program participants' attitudes about car ownership and program participation', *Transportation Research Part D: Transport and Environment*, vol. 36, pp. 96–106.

Kuhnimhof, T, Armoogum, J, Buehler, R, Dargay, J, Denstadli, JM & Yamamoto, T 2012, 'Men shape a downward trend in car use among young adults - evidence from six industrialized countries', *Transport Reviews: A Transnational Transdisciplinary Journal*, vol. 32, no. 6, pp. 761-779.

Lerro, F 2015, *Car-sharing Services: Users' Behaviour and Factors of Adoption*, Master Degree Thesis, Polytechnic University of Turin.

Li, Y, Taeihagh, A & Jong, Md 2018, 'The Governance of Risks in Ridesharing: A Revelatory Case from Singapore', *Energies*, vol. 11, no. 5, p. 1277.

Luca, S & Pace, RD 2015, 'Modelling users' behaviour in inter-urban carsharing program: A stated preference approach', *Transportation Research Part A*, vol. 71, pp. 59-76.

Martin, E, Shaheen, S & Lidicker, J 2010, 'Impact of carsharing on household vehicle holdings', *Transportation Research Record*, vol. 2143, pp. 150-158.

Martin, E & Shaheen, S 2011b, 'The impact of carsharing on public transit and non-motorized travel: an exploration of North American carsharing survey data ', *Energies*, vol. 4, no. 11, pp. 2094-2114.

Martin, EW & Shaheen, SA 2011a, 'Greenhouse gas emission impacts of carsharing in North America', *IEEE Transactions on Intelligent Transportation Systems*, vol. 12, no. 4, pp. 1074-1086.

Maven Gig 2017, *Welcome Australian UBER driver-partners*, viewed 15 December 2017, <https://mavengig.maven.com/au/>.

Meekerk, IV, Koppenjan, J & Keast, R 2015, 'New citizen collectives, their democratic potential and their implications for public management', *IRSPM conference*.

Mees, P, O'Connell, G & Stone, J 2008, 'Travel to work in Australian capital cities, 1976-2006', *Urban Policy and Research*, vol. 26, no. 3, pp. 363 - 378.

Millard-Ball, A, Murray, G, Schure, JT, Fox, C & Burkhardt, J 2005, *TCRP Report 108: Car-Sharing: Where and How It Succeeds*.

Nielsen, JR, Hovmoller, H, Blyth, PL & Sovacool, BK 2015, 'Of “white crows” ad “cash savers:” a qualitative study of travel behavior and perceptions of ridesharing in Denmark', *Transportation Research Part A*, vol. 78, pp. 113-123.

Nguyen, HA, Soltani, A & Allan, A 2018, 'Adelaide’s East End tramline: Effects on modal shift and carbon reduction', *Travel Behaviour and Society,* vol. 11**,** pp. 21-30.

Nobis, C 2006, 'Carsharing as key contribution to multimodal and sustainable mobility behavior: Carsharing in germany', *Transportation Research Record: Journal of the Transportation Research Board,* no. 1986, pp. 89–97.

Ohta, H, Fujii, Sm Nishimura, Y, Kozuka, M 2013, 'Analysis of the Acceptance of Carsharing and Eco-Cars in Japan', *International Journal of Sustainable Transportation,* vol. 7, no. 6, pp. 449–467.

Philip Boyle & Associates 2017, *The Impact of Car Share Services in Australia*, International Car Sharing Association.

Prieto, M, Baltas, G & Stan, V 2017, 'Car sharing adoption intention in urban areas: What are the key sociodemographic drivers?', *Transportation Research Part A: Policy and Practice*, vol 101, pp 218-227.

Rabbitt, N & Ghosh, B 2013, 'A study of feasibility and potential benefits of organised car sharing in Ireland', *Transportation Research Part D*, vol. 25, pp. 49-58.

Rogers, B 2015, 'The social costs of UBER', *University of Chicago Law Review Dialogue*, vol. 85, pp. 85-102.

Rotaris, L & Danielis, R 2018, 'The role for carsharing in medium to small-sized towns and in less-densely populated rural areas', *Transportation Research Part A: Policy and Practice*, vol. 115, pp. 49-62.

Schaefers, T 2013, 'Exploring carsharing usage motives: A hierarchical means-end chain analysis', *Transportation Research Part A*, vol. 47, pp. 69-77.

Schmöller, T, Weikl, S, Müller, J & Bogenberger, K 2015, 'Empirical analysis of free-floating carsharing usage: The Munich and Berlin case', *Transportation Research Part C: Emerging Technologies*, vol. 56, pp. 34-51.

Soltani, A, Primerano, F, Allan, A & Somenahalli, S 2007, 'Design for movement, Linking non-work travel and activity level to local urban design dimensions', *Urban Design International Journal*, vol. 11, no. 3, pp. 83–92.

Soltani, A & Allan, A 2006, 'Analysing the Impacts of Micro-scale Urban Attributes on Travel: Evidence from Suburban Adelaide, Australia', Journal of Urban Planning and Development, vol. 132, no. 3, pp. 132-137.

Stefansdotter, A, Danielsson, C, Nielsen, CK, & Sunesen, ER 2015, *Economic benefits of peer-to peer transport services*, retrieved from <http://www.copenhageneconomics.com/dyn/resources/Publication/publicationPDF/0/320/1441009386/economics-benefits-of-peer-to-peer-transport-services.pdf>

Stiglic, M, Agatz, N, Savelsbergh, M & Gradisar, M 2016, 'Making dynamic ride-sharing work: the impact of driver and rider flexibility', *Transportation Research Part E*, vol. 91, pp. 190-207.

Taeihagh, A 2017, 'Crowdsourcing, sharing economies and development', *Journal of Developing Societies*, vol. 33, no. 2, pp. 191-222.

Zheng, J, Scott, M, Rodriguez, M, Sierzchula, W, Platz, D, Guo, J & Adams, T 2009, 'Carsharing in a university community: Assessing potential demand and distinct market characteristics', *Transportation Research Record: Journal of the Transportation Research Board*, no. 2110, pp. 18–26.

Zhou, BB & Kockelman, KM 2011, 'Opportunities for and Impacts of Carsharing: A Survey of the Austin, Texas Market', *International Journal of Sustainable Transportation*, vol. 5, no. 3, pp. 135–152.