Case Studies on Transport Policy 7 (2019) 239–249

Contents lists available at ScienceDirect

Case Studies on Transport Policy

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

Investigating factors affecting bicycle sharing system acceptability in a developing country: The case of Mashhad, Iran

Danial Jahanshahi[a], Bert van Wee[b], Omid Ali Kharazmi[c,*]

[a] Department of Civil and Environmental Engineering, Faculty of Engineering, The University of Auckland, Auckland 1010, New Zealand
[b] Delft University of Technology, Faculty of Technology, Policy and Management, P.O. Box 5015, 2600 GA Delft, the Netherlands
[c] Department of Urban Management, Ferdowsi University of Mashhad, Mashhad, Iran

ARTICLE INFO

Keywords:
Bicycle sharing
Iran
Acceptability

ABSTRACT

The aim of this study is to investigate the factors affecting the acceptability of a bicycle sharing system (BSS) in Mashhad, which is the first BSS to be introduced in Iran. Given the low usage rated of the BSS, we distributed a survey in all stations. 134 users answered the questionnaire. We clustered the potentially relevant factors in five dimensions: *Socio-cultural*, *Economic*, *Infrastructure*, *System function and Environmental*. We eliminated the *Environmental* dimension because of invalid loading factors. Next, we evaluated the importance and significance of these factors and the four remaining dimensions for the acceptance of BSS in Mashhad. Furthermore, MANOVA was used to evaluate the relationship between the demographic characteristics and dimensions. The findings indicate that the system is mainly used by young people, students, people with a low-income and those without a vehicle. The results of the evaluations show that all four dimensions are effective, the impact of the *Economic* dimension being less important than the three other dimensions. The most important factors are the authorities' use of the system and driving behavior (Socio-cultural dimension), easy use and registration, and proper and timely maintenance (System function) and the availability of bike lanes and suitable bike equipment (Infrastructure). This study is the first attempt to investigate different factors and dimensions important for BSS acceptability in Iran. It can be said that the factors affecting the acceptability of BSS is different in different contexts. Nevertheless, we expect our results to be useful for the design and implementation of BSSs in other cities in Iran, and likely also in other developing countries.

1. Introduction

Over recent decades, in many cities worldwide urban population has increased due to the migration of people to cities (Han et al., 2009). It is expected that in 2050, more than 67% of the world's population will live in urban areas, and most of the increased urbanization is in developing countries (UN DESA, 2013). This phenomenon requires correct resource management and adequate service provision for urban residents (Browne et al., 2012). Especially in developing countries, poor resources and services have caused many urban problems, and cities have become very crowded and have suffered from various problems (Pajouhan and Ghadami, 2011; Sasanpour et al., 2014; Han et al., 2017). One of the problems is that the current social and economic developments are causing harm to the environment (Song, 2011). Emerging countries are trying to improve quality of life via economic growth and increasing travel options, but higher levels of car use result in an increase in energy use, polluting emissions and noise, a lower level of physical activity and reduced safety levels (Seidel et al., 2015). In many cities in the developing world today economic growth leads to an increase in the number of urban trips, often by car (Soltani and Shariati, 2013). Due to lifestyle changes and increases in commuting distances urban car use (expressed in kilometers) has increased, leading to negative effects such as increased land and energy use, increasing environmental impacts and congestion levels and more accidents (Shaheen et al., 2011). This also applies to Iran's major cities (Alaeddini and Fayezi, 2011). As a quantitative example of the problems: in developing countries approximately 500 million people die prematurely due to air pollution caused by transportation (Ostadi Jafari and Rasafi, 2013).

Achieving sustainable development is one of the most important goals in many countries (Hassan and Lee, 2015), and this certainly also applies to sustainable urban mobility (Berloco and Colonna, 2012; Ahmad and de Oliveira, 2016). In addition to public transportation urban cycling can play an important role in sustainable mobility, partly

* Corresponding author.
E-mail addresses: djah422@aucklanduni.ac.nz (D. Jahanshahi), G.P.vanWee@tudelft.nl (B. van Wee), Kharazmi@um.ac.ir (O.A. Kharazmi).

https://doi.org/10.1016/j.cstp.2019.03.002
Received 30 September 2018; Received in revised form 30 January 2019; Accepted 4 March 2019
Available online 06 March 2019

because it demands little energy and other resources (Shaheen et al., 2011). In addition bicycle use has a range of health, accessibility, environmental and socioeconomic advantages (Midgley, 2011; Taghvaei & Fathi, 2011; Berloco and Colonna, 2012; Soltani and Shariati, 2013; Gupta et al., 2014; Bernatchez et al., 2015; Tran et al., 2015; Karki and Tao, 2016; Manzi and Saibene, 2018; Morton, 2018). One policy implemented to stimulate cycling is providing rental bikes via Bike Sharing Systems (BSS). In Iran, the city of Mashhad introduced the first BSS, but the use rate is low (Jahanshahi et al., 2018; Jahanshahi et al., 2019): around 500–700 users (based on an estimation described in Section 3.2) out of approximately 1 million potential users (i.e. males above 15 years, they are allowed to use this system according to BSS regulations in Mashhad) in the city. Bike sharing schemes across the world are operated in different ways and under different circumstances, leading to differences in success and impacts, hampering easy implementation of successful schemes elsewhere (Mateo-Babiano, 2015). The success of BSSs in developing countries may depend on its acceptance, and factors affecting acceptance can also vary between cities and countries (Shaheen et al., 2011).

Studies exploring the use and acceptance of BSSs have mainly focused on developed countries, but as explained, results may not apply to developing societies due to their different cultural and social backgrounds (Mateo-Babiano et al., 2016). Therefore, the present study aims to measure the impact factors which were extracted from previous studies on the acceptance of BSSs in Mashhad, Iran. For this purpose, we reviewed papers on BSS implementation (key references being Shaheen et al., 2010; ITDP, 2013; Castillo-Manzano and Sánchez-Braza, 2013; Fishman et al., 2014; Fishman et al., 2015; Tran et al., 2015; Nikitas et al., 2016; Caulfield et al., 2017; Raux et al., 2017; Mattson and Godavarthy, 2017; Manzi and Saibene, 2018; Nikitas, 2018; Morton, 2018; Jahanshahi et al., 2019– see also Section 2), leading to 26 factors which were clustered into five dimensions: "*Socio-cultural*", "*Economic*", "*Environmental*", "*Infrastructure*" and "*system's function*" (see Table 1). Our aim was to explore the importance of each factor and dimension, and the related importance of some key socio-demographic variables, including income, age, education level and experience of using BSS. Our results would provide relevant information for the implementation of BSSs elsewhere in Iran and other developing countries.

More specifically, we aim to answer the question which factors and dimensions (clusters of factors) affect the acceptability of BSS in Mashhad, and to what extent? And secondly: what is the impact of socio-demographic variables on users' perceptions of the effectiveness of the dimensions?

2. Literature overview

This section gives a brief overview of the literature in the areas of BSS and the factors influencing BSS acceptance. In recent decades, cycling has become less attractive and cycling levels have declined due to various factors such as the increasing quality of alternatives (cars, buses, Light Rapid Transit), increasing commuting distances, economic growth and the rapid growth of motorization (Shaheen et al., 2011). However, in recent years promoting cycling has increasingly been seen as a solution for the urban problems set out above, and BSSs are one option to promote cycling. Shared bicycles are non-motorized transportation services that provide the possibility of travelling short distances without the need to own a bicycle. People can take a bike from one station to take a short trip and deliver the bike to the same station or another station (Shaheen et al., 2011; Fishman et al., 2013; Mateo-Babiano, 2015). BSS can reduce the barriers to cycling (Shaheen et al., 2010) and help to change the image of cycling, especially for people who think cycling is just for sport and is risky (Goodman et al., 2014). The first BSS was set up in 1965 in Amsterdam. However, due to theft and vandalism, the program failed (DeMaio, 2009). But over time BSSs have become better, and at the time of writing this paper (2018) worldwide 2598 shared bicycle schemes have been implemented or are being planned/under construction (Meddin & Demaio, 2018). Despite the rapid growth in global motorization, BSS usage rates have generally increased all around the world during the past 30 years (Shaheen et al., 2010).

The first BSS in Asia was in Singapore in 1999 (Shaheen et al., 2010), and the first Iranian system was in Mashhad in 2012 (see Section 3.1). It is expected that the next generation of BSSs will benefit from electric bicycles (Fishman et al., 2014). However, due to budget issues in developing countries as well as high rates of vandalism and theft, the use of electric bikes in these countries seems improbable.

An important question is: which factors contribute to the acceptance of BSS in developing countries? To find out we searched for literature in the Web of Science and Google Scholar databases, using (combinations of) keywords: bike, bicycle, bike-sharing system, bicycle sharing system, cycling, shared bike, public bike, active transport, BSS, BSP, Iran and acceptance. The most relevant papers were published after 2010 owing to the fact that bicycle sharing programmes can be considered to be a relatively new topic of research. After selection based on abstracts there were 46 useful papers. In addition we explored the Iranian database, "SID" (Scientific Information Database, http://www.sid.ir) which contains Iranian journals and conference papers and added seven more useful Iranian sources to our selection. We clustered the different factors into five dimensions: "*Socio-cultural*", "*Economic*", "*Environmental*", "*Infrastructure*" and "*System's function*" (Table 1).

We next give a few examples of relevant papers. In Iran, Alaeddini and Fayezi (2011) evaluated the BSS in Tehran which implemented its pilot scheme in 2009. They included factors such as access, awareness, safety, traffic Infrastructure, satisfaction, sustainability and culture. They conclude that the system was successful in obtaining users, but suffered from a number of deficiencies such as inadequate information, lack of social awareness of cycling benefits, lack of road signs, and poor quality of the bikes and routes). Malek Husseini et al. (2012) focused on cycling in the 8th District of Tehran and reported that people were not used to cycling. Low social status, short bike paths, obstacles and urban traffic, long waiting time at docking stations, and inappropriate routes were all factors that impinged on the use of bicycles. Jahanshahi et al. (2018) investigated factors that influence BSS acceptance in Mashhad through a qualitative study including users, non-users and experts. The study revealed 7 dimensions and 26 factors extracted by using a thematic analysis method. Combining GIS and Multi-criteria analysis, Jahanshahi et al (2019) show that the design of the BSS in Mashhad was not based on their efficiency, but on making profit from the advertising billboards at docking stations. Consequently they tried to address the problems in locating BSS stations, and so to contribute to development of the existing programs and possible future programs in other cities (Jahanshahi et al., 2019).

In recent years various studies outside Iran have pointed to different factors that may influence citizens' use and acceptance of BSS. Assessing these factors can be done in many ways such as focusing on the travel behavior of people (Shaheen et al., 2011; Chen, 2016), investigating different factors enhancing their awareness of the benefits of bicycle sharing (Bernatchez et al., 2015), spatial analysis of citizens' access (Karki and Tao, 2016), and by reviewing motivators and barriers to the use of bicycles (Fishman et al., 2014), examining inequalities in the uptake and usage of BSS (Ogilvie and Goodman, 2012; Goodman and Cheshire, 2014; Goodman et al., 2014), assessing the factors influencing BSS acceptance and membership (Fishman et al., 2015), the impact of the natural and artificial environment (Mateo-Babiano et al., 2016), service quality and satisfaction among the users of a BSS (Castillo-Manzano and Sánchez-Braza, 2013; Zhang et al., 2015; Manzi and Saibene, 2018; Morton, 2018), acceptability and usage patterns of BSS in smaller cities (Nikitas et al., 2016; Caulfield et al., 2017; Nikitas, 2018), evaluating BSS users' characteristics (Raux et al., 2017; Hosford et al., 2018), investigating success factors (Médard de Chardon et al., 2017; Mattson & Godavarthy, 2017), etc.

In this study we build upon the results of the literature (see Table 1.