



Integrating smart mobility and electric car sharing adoption in a common framework: Antecedents and mediators

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ABSTRACT

The present research set out to provide an answer to various calls for further analysis of the car sharing consumer behavior. In this sense, the investigation has advanced an integrative conceptual model by studying the antecedents of electric car sharing adoption, based on two general attitudinal influencers environmental consciousness and technology embracement and two mediators – the perceived benefits of car sharing and the importance attached to smart mobility. The empirical undertaking relied on a questionnaire-based survey with 399 Romanian respondents from generation Z. According to the findings, the proposed model has confirmed a substantive effect of environmental consciousness and technology embracement on smart mobility and a less powerful effect of the latter on electric car sharing adoption. The results have both theoretical and practical implications given that achieving a paradigm shift towards smart mobility and electric car sharing adoption requires substantial changes in social habits and orientation, as well as attitudinal transformations in terms of environmental and technological dynamics. The study originally contributes to the extant literature by inter-relating different attitudinal factors as relevant drivers for car sharing adoption within a comprehensive framework. From a practical perspective, while focusing on electric car sharing from a context-driven angle, the investigation adds knowledge about the behavioral intentions for car sharing usage in a country where the phenomenon is yet to develop. In this sense, the findings support providers of car sharing services and authorities in their promotion strategies regarding car sharing services as a form of sustainable transportation apposite for smart cities.

1. Introduction

Urban mobility and transportation are essential parts of the good functioning of a city's life (Faria et al., 2017; Wawer et al., 2022), but at the same time they can generate numerous problems, such as polluting the air, insufficient appropriate car spacing, congesting traffic, noise pollution (Curtale et al., 2021a) with negative effects on the environment (Vejchodská et al., 2023) and on the welfare of cities and citizens' wellbeing (Savastano et al., 2023).

In order to lessen the above mentioned urban mobility challenges, possible options are to support alternative solutions to carbon fueled private vehicles (Curtale et al., 2021b), solutions that envisage low carbon forms of transportation. During the recent years, the use of smart mobility has been seen as a solution for reducing the traffic, for reducing

the rates of car accidents, for improving air quality, for reducing the carbon print and developing a low-carbon economy (Faria et al., 2017; Savastano et al., 2023; Standar et al., 2022).

Focusing on smart mobility, it may be considered among the main characteristics of smart cities, a realm where humans and social capital interact through technology-based solutions (Wawer et al., 2022; Savastano et al., 2023; Turoń, 2023a). Smart mobility is seen as “the use of Information and Communication Technology (ICT) in modern transport technologies in order to improve urban traffic” (Albino et al., 2015), that by combining traffic services with smart technology (Chun and Lee, 2015) ensures a sustainable, modern and safe transport system (Vanolo, 2014) that improve the quality of life of citizens based on the sustainable development principle (Wawer et al., 2022). Smart mobility allows for real time access to information of the public (Savastano et al., 2023), so

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that to shorten the time of travelling and make the journey more efficient (Acheampong and Siiba, 2020), but also to develop a low-carbon economy, that among others can be achieved by arranging joint commuting and supporting the use of electric cars (Standar et al., 2022). In this sense, as part of the solutions for diminishing urban mobility problems and introducing smart mobility, authorities and policy makers can incentivize the acquisition of less polluting vehicles, such as the electric vehicles and can introduce and support car sharing services, including electric car sharing services (Curtale et al., 2021a).

Car sharing is described as “a new form of technology enabled mobility that leverages ICT and combines aspects of conventional public transportation and private car use” (Acheampong and Siiba, 2020, p. 2559). Car sharing is seen as a solution for sustainable urban mobility (Hjortset and Böcker, 2020; Shaheen and Cohen, 2013; Turoń, 2023b), because the decreasing number of owned cars associated with increasing use of car sharing, contributes to reduced carbon emissions and ensures more environmentally friendly transportation modes and more sustainable cities (Amatuni et al., 2020; Namazu and Dowlatabadi, 2018; Wawer et al., 2022). A higher level of sustainable transportation is also associated with the use of electric cars (Curtale et al., 2021a, 2021b), including in the car sharing services.

Because car sharing is a smart mobility solution that can contribute to the development of smart cities (Faria et al., 2017; Wawer et al., 2022), it is of interest to see how the system can be spread at city level. Consumer acceptance has a high importance for the success of shared mobility systems (Acheampong and Siiba, 2020), such as car sharing and consequently the aspects that contribute to the assimilation and use of these new forms of mobility need to be known. The interest is to identify what determines the use of car sharing services, as a form of smart shared mobility. The focus of the present research is on the investigation and comprehension of the consumer behaviour related to electric car sharing services, by analyzing the adoption (i.e., the interest, intention and actual use) of electric car sharing services by individuals, as prospective and present customers. The results of the study can be used from a managerial perspective, as a better understanding of the factors influencing car sharing adoption can simultaneously support car sharing companies to suitably address customers and also local authorities and policy makers to promote car sharing services as a form of smart mobility that can contribute to the development of smart cities. The appropriate promotion of car sharing services and electric car sharing services by companies and authorities - expected to generate higher service adoption - has both environmental and economic positive implications for cities and societies (Curtale et al., 2021a, 2021b).

Over the last years, a myriad of studies have focused on the factors that influence the car sharing services adoption by customers. Among the influencing factors, psychological factors looking into attitudes, beliefs and motivations (Becker et al., 2017; Hjortset and Böcker, 2020; Long and Axsen, 2022) are seen as important drivers for car sharing adoption. For example, Becker et al. (2017) identified as main influencers of the adoption decision for using car sharing services the following benefits: convenience, affordability, comfort and flexibility. Turoń (2023a) classified factors influencing car sharing services in six categories (economic, technical, transport related, social, environmental, organizational). Among these categories, the social factors' category (including aspects such as sharing economy experience, technology advancement, pro-ecological attitudes) plays an important role in car sharing adoption and use by consumers. Another study identified that environmental friendliness and the perception that car sharing reduces the adverse effects of automobility, as being prime motivators for using car sharing services (Vejchodská et al., 2023). In the case of electric car sharing services, Curtale et al. (2021a, 2021b) confirmed that psychological factors have a say in the individuals' intention to use electric car sharing services. They identified as the main three most important factors affecting behavioural intention for the use of electric car sharing: social influence, performance expectancy and personal attitudes, such as environmental orientation.

As can be noticed, various car sharing adopting factors have been identified by researchers. However, there are still numerous calls in the literature for more studies to be conducted about the adoption of car sharing, both in general terms and in specific terms. At a general level, even though research on car sharing has encountered a substantial increase in the last years (Hjortset and Böcker, 2020) and lots of scientific studies have been conducted in the field (Turoń, 2023a), research in this field is seen as not being saturated and as urgently requiring more empirical studies (Hjortset and Böcker, 2020), mainly because car sharing services spread at a fast speed and develop at a significant pace in urban areas in the last years (Turoń, 2023b). In more specific terms, Curtale et al. (2021b) call for dedicated research to identify psychological dimensions that explain people's acceptance of electric car sharing because they consider that the study of psychological constructs can offer a higher understanding of individual's behavioural intention for this type of services. Particularly, research gaps related to two main categories of psychological constructs, namely environmental consciousness and technology embracement, as drivers of car sharing adoption were brought forward. For example, Acheampong and Siiba (2020) consider that there is the need to examine the relationship between the overall attitudes towards environmental sustainability and the intention of users to adopt car sharing. At the same time, Long and Axsen (2022) consider that future research can explore consumers' behaviour related to car sharing solutions based on their interest in technologies. Here, the present study intends to contribute to filling in these research gaps by investigating environmental consciousness and technology embracement (i.e., psychological constructs) as car sharing adoption determinants.

Previous studies illustrated that the typical profile of the car sharing user is male, young adult, living in urban areas, highly educated, who owns fewer cars on average (Long and Axsen, 2022; Vejchodská et al., 2023) and is open minded towards app-based mobility services (Schulz et al., 2021). In this context, one specific group of the young generation is generation Z comprising people who were born between 1995 and 2010 and who are now in their early youth and among those, the studious ones are in their studenthood (Wawer et al., 2022). Researchers see people belonging to generation Z, as being digital natives and early adopters of new technology, open to new challenges and adventures and therefore they are potentially interested in smart mobility and their attitudes need to be studied (Wawer et al., 2022). Consequently, the present paper focuses on educated individuals from generation Z because they represent prospective customers for car sharing and a thorough understanding of the drivers for their adoption of car sharing in general and electric car sharing in particular is of interest for theorists, practitioners and policy makers. As a major prospective group of customers for car sharing services their opinions and behaviours are important in order to understand what influences the adoption of car sharing services.

Conflating the aforementioned considerations, the current undertaking aims to answer the following research question: *How do particular psychological factors influence the adoption of electric car sharing by generation Z?* In this front, the research objectives are multifold: a) to analyze the influence of the generation's Z attitudes towards environmental sustainability on the adoption of the electric car sharing services; b) to analyze the influence of the generation's Z propensity towards technology on the adoption of the electric car sharing services; c) to investigate the role of the perceived benefits of car sharing on the adoption of electric car sharing services; d) to investigate the role of the importance attached to smart mobility on the adoption of electric car sharing services and e) to assess the mediating roles of perceived benefits of car sharing and of the importance given to smart mobility in the relationships between general psychological factors (i.e., environmental awareness and technology embracement) and the adoption of electric car sharing.

The paper is structured as follows: after the first section which introduces the topic, makes a review of the literature in the field and