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Analysis of Intention to Use *Car Sharing* Services

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Abstract

Context: Although car sharing services represent an alternative for urban mobility and the expansion of practices aimed at sustainability, among the challenges to increasing their offer are the financial viability of the platforms and the change in behavior of individuals around the world. subscribe to such services. **Objective:** In this sense, the study aims to investigate intentions to use the car sharing service. The application of the research is justified by the fact that there is still an empirical gap to be explored with studies applied in emerging countries, with Brazil being in evidence as it has the largest number of car sharing platforms and users in Latin America. Fortaleza stands out on the national scene, due to its high demographic density and offering different shared economy initiatives in the mobility sector, such as bicycles and automobiles. **Methodology:** The research used the Theory of Planned Behavior (TCP) as a theoretical framework. Quantitative research, survey style, was carried out using constructs based on the TPB, identifying relationships between attitude, subjective norm and control of perceived behavior that influence the intention to use. In total, six hypotheses were developed. To this end, structural equation modeling was used to test and confirm hypotheses. **Results:** Regarding the results, it was found that there is a relationship between the subjective norm and the intention to use car sharing. **Conclusion:** Based on the analysis and discussion of the study, it is possible to focus on the attitudes and behaviors of individuals with issues related to sustainability.

Keywords: car sharing, intended use, sustainability, theory of planned behavior

Análise das Intenções de Uso dos serviços de *Car Sharing*

Resumo

Contexto: Apesar dos serviços de *car sharing* corresponderem a uma alternativa para a mobilidade urbana e para a expansão de práticas voltadas à sustentabilidade, dentre os desafios para que aumente a sua oferta, estão a viabilidade financeira das plataformas e a mudança de comportamento de indivíduos ao aderirem tais serviços. **Objetivo:** Neste sentido, o estudo tem como objetivo investigar as intenções de uso do serviço de *car sharing*. Justifica-se a aplicação

da pesquisa pelo fato de que há ainda um gap empírico a ser explorado com estudos aplicados em países emergentes, estando o Brasil em evidência ao possuir o maior número de plataformas de *car sharing* e usuários da América Latina. Já Fortaleza se destaca no cenário nacional, pela alta densidade demográfica e por oferecer diferentes iniciativas de economia compartilhada no setor de mobilidade, como bicicletas e automóveis. **Metodologia:** A pesquisa utilizou a Teoria do Comportamento Planejado (TCP) como arcabouço teórico. Realizou-se uma pesquisa quantitativa, estilo *survey*, utilizando construtos baseados na TCP, identificando relações entre atitude, norma subjetiva e controle do comportamento percebido que influenciam a intenção de uso. No total, seis hipóteses foram desenvolvidas. Para tal, foi utilizada modelagem de equações estruturais para teste e confirmação de hipóteses. **Resultados:** Com relação aos resultados, verificou-se que existe relação entre a norma subjetiva e a intenção de uso do *car sharing*. **Conclusão:** A partir das análises e da discussão do estudo, é possível ater-se às atitudes e comportamentos de indivíduos com questões relativas à sustentabilidade.

Palavras-chave: car sharing, intenção de uso, sustentabilidade, teoria do comportamento planejado

Análisis de Intenciones de Uso del Servicio de Car Sharing

Resumen

Contexto: Si bien los servicios de carsharing representan una alternativa para la movilidad urbana y la expansión de prácticas orientadas a la sostenibilidad, entre los desafíos para incrementar su oferta están la viabilidad financiera de las plataformas y el cambio de comportamiento de los individuos en todo el mundo que se suscriben a dichos servicios. **Objetivo:** En este sentido, el estudio pretende investigar las intenciones de uso del servicio de coche compartido. La aplicación de la investigación se justifica por el hecho de que aún existe un vacío empírico por explorar con estudios aplicados en países emergentes, siendo evidenciado Brasil por tener el mayor número de plataformas y usuarios de autos compartidos en América Latina. Fortaleza se destaca en el panorama nacional, por su alta densidad demográfica y por

ofrecer diferentes iniciativas de economía compartida en el sector de la movilidad, como bicicletas y automóviles. **Metodología:** La investigación utilizó como marco teórico la Teoría del Comportamiento Planificado (TCP). La investigación cuantitativa, estilo encuesta, se realizó utilizando constructos basados en el TPB, identificando relaciones entre actitud, norma subjetiva y control de la conducta percibida que influyen en la intención de uso. En total, se desarrollaron seis hipótesis. Para ello, se utilizó el modelado de ecuaciones estructurales para probar y confirmar hipótesis. **Resultados:** En cuanto a los resultados, se encontró que existe relación entre la norma subjetiva y la intención de utilizar el auto compartido. **Conclusión:** A partir del análisis y discusión del estudio, es posible centrarse en las actitudes y comportamientos de los individuos con cuestiones relacionadas con la sostenibilidad.

Palabras clave: car sharing, intenciones de uso, sustentabilidad, teoría del comportamiento planificado

Introduction

In view of the numerous environmental impacts caused by production and consumption systems around the world, in addition to the need to prolong the life cycle of existing natural resources, discussions around more sustainable practices in all levels of society have become increasingly more common (Braga Junior, Silva, Lopes & Gaspar, 2013, White, Habib & Hardisty, 2019).

One of the concepts that has emerged is the sharing economy, which discusses new formats of consumption, based on exchange and collaboration through the sharing of underutilized assets (Hossain, 2020). In this light, people began to replace the purchase of a good with its access, that is, the monetary transaction is made for the experience of temporary use of this good (Bardhi & Eckhardt, 2012). This form of consumption is updated nowadays by the connectivity structure of consumers who, through digital platforms, find other consumers with common interests, such as: improving the efficiency of services at their disposal,

contemplating their consumption opportunities and generating possible positive results for social-environmental sustainability (Gerhard, Silva Júnior & Câmara, 2019; Acquier, Daudigeos & Pinkse, 2017; Belk, 2014).

A practical example of the sharing economy applies to the search for solutions to solve urban mobility problems, hence car rental systems, ride sharing systems and, above all, car sharing services, the topic of this research (Baptista, Melo & Rolim, 2014; Litman, 2007; Nijland & Van Meerkerk, 2017). Car sharing started from collective groups of individuals but took on a proportion where private or mixed startups (private and government) started to offer car fleet services available to consumers for a certain period of time (Shaheen, 2018).

Car sharing has also gained notoriety in the face of discussions about the behavior of a new generation of more practical consumers who replace ownership with the experience of goods (Belk, 2014), the possibilities of new businesses through the use of disruptive technologies (Shaheen, 2018), in addition to the results generated for the improvement in terms of mobility in large urban centers and the development of more sustainable cities (Barile, Ciasullo, Iandolo & Landi, 2021). Therefore, car sharing services are seen as a proposal that encompasses collective benefits: users have the benefits of reducing the costs of owning a private car, diversity in the choice of mobility, in addition to optimizing time in their daily activities and routines. As far as society is concerned, they contribute to reducing the number of cars on the roads and, consequently, traffic time and access to different means of transport (Ornellas, 2012; Shaheen & Cohen, 2019). The benefits generated also include the government, by improving mobility conditions and contributing to the achievement of greenhouse gas (GHG) reduction goals that many cities have recently envisioned (Vélez, 2023; Seo & Lee, 2021). Thus, the practice of car sharing can generate enormous economic, social and environmental benefits (Shaheen, 2018, Seo & Lee, 2021).

Although car sharing services correspond to an alternative for urban mobility and for the expansion of practices aimed at sustainability, there remain many challenges concerning the

change in behavior of individuals with regard to a more rational use of cars and vehicles (Seo & Lee, 2021) and the very provision of these services, where there are many economic and financial challenges for vehicle sharing platforms and the creation of regulation and public policies that enable the existence of such platforms to exist (De Luca & Di Pace, 2015; Seo & Lee, 2021). According to Prieto, Baltas and Stan (2017) the financial sustainability of these services is directly related to the behavior of users, in terms of increasing the number of subscribers to the platforms, as well as the fact that they be willing to use the service frequently.

Therefore, it is relevant to analyze the perspective of users of these services, specifically under the intentions of using car sharing services, since research that portrays the intention of adoption and choice of car sharing services by individual users is still quite scarce (Prieto et al., 2017; Amirnazmiafshar & Diana, 2022).

Thus, the objective of this research is to investigate what are the factors that lead consumers to the intention of adopting car sharing services. The application of this research is justified by the fact that there is still an empirical gap to be explored with studies applied in emerging countries (Tran, Zhao, Diop & Song, 2019), since most studies that relate car sharing services to consumer use intentions are concentrated in the global north (Baptista et al., 2014; De Luca & Di Pace, 2015, Prieto et al., 2017, Shaheen & Cohen, 2020). In addition, Brazil is one of the Latin American countries in evidence, having the largest number of car sharing platforms and number of users (Shaheen & Cohen, 2020). The locus of the research is the city of Fortaleza. The city stands out on the national scene for its high demographic density – it is the largest capital of the Northeastern states and the fourth largest capital in Brazil (IBGE, 2022) and, as any large Brazilian capital, Fortaleza has several mobility problems. On the other hand, the municipality has invested in sustainable mobility projects as part of the Fortaleza 2040 Plan, with the engagement of both public and private authorities (Pereira & Silva, 2018). Initiatives such as the expansion of bus corridors, a wide network of cycle lanes and paths, bicycle

stations and shared electric cars have already won the city some international awards and recognition in the sustainable mobility arena (Staward, 2019).

Furthermore, Prieto et al. (2017) point out that in addition to the intentions of those who are already users, demographic information such as age, education or family size may also be relevant to detect the profiles most likely to use car sharing services in the future. Therefore, knowing the key behavioral, demographic, and geographic factors can help increase the spread of car-sharing services in the city.

As a theoretical basis, this research uses the Theory of Planned Behavior (Ajzen, 1991), with the necessary adjustments and adaptations to the scope of the study, as the main basis for the study of the influences that generate the intention to use car sharing services, since this theory is an important key to understand the possible contributions of the study, from both an academic and managerial standpoint (Mattia, Mugion & Principato, 2019). In addition, TPB has already been used successfully in several domains related to the object of study of this article, such as the sharing economy (Toni, Renzi & Mattia, 2018) and sustainable mobility (Lois, Moriano & Rondinella, 2015) and helps, in a simple but robust way, to explain the intentions of use from a system of psychological variables.

Thus, this research contributes to better clarify the intention of consumers to use car sharing services of a relevant city in the national context and offers insights to other cities that resemble the conditions where the study was performed. From this understanding, it becomes possible to adopt practices and methods of using car sharing services in a given location, more assertively to the context in which it will be applied. This research also aims to contribute as a foundation for discussions on the importance of information about users and/or potential users, for the implementation of public policies or public-private initiatives in the sustainable mobility sector and urban cities landscape in Brazil.

Literature Review

In this session, theoretical concepts about car sharing, its business model and how this service impacts sustainability will be addressed. This study will also comment on the intentions of use related to car sharing services, in order to trace the desired profile, considered a user of this type of service. In addition, a theoretical review will be carried out regarding the Theory of Planned Behavior (TPB), which will assist in the analysis of the intentions to use *car sharing*.

The Sharing economy and *Car Sharing*

The Sharing Economy (CS) can be defined as any activity between market agents, in which there is the sharing of a common good or service (Gerhard, Silva Júnior & Câmara, 2019). Corroborating with this definition, Clewlow (2016) states that the frugal concept of the sharing economy consists of the possibility, preference, and ability of individuals to borrow goods or services instead of owning or buying them.

For Schor (2017), EC activities are divided into four broad categories, which are the exchange of services, the recirculation of goods, the expanded use of durable goods and the sharing of productive goods. The service referred to in this study falls into the third category.

Based on the idea of exchange and collaboration, the sharing economy has developed substantially in the last decade, as well as the development of a society based on the connectivity of digital platforms. Therefore, CE has become central in the business world because it is the setting for innovation in the supply and demand system for products and services, influencing the creation of new business models and new ways of creating value and communicating with the consumer (Rojanakit, Oliveira & Dullleck, 2022; Rossmannek & Chen, 2023). It is also relevant to emphasize that although some researchers emphasize negative aspects of CE, such as the reinforcement of social inequalities (Schor & Vallas, 2021) and the dominance of some digital platforms in the market (Gerwe & Silva, 2020), CE-related activities are considered, for the most part, more sustainable than conventional ones, as they promote the more efficient use of resources and, thus, contribute to the reduction of Greenhouse Gase Emissions (GHG) (Boldrini, Bruno & Conti, 2016; Curtis & Mont, 2020).

EC-based activities may or may not include financial transactions, although the best known examples in the market correspond to the latter group. EC evidence applies to various sectors such as: accommodation (private and rented real estate), mobility (cars and bicycles) and even fashion. However, although they have in common the orientation towards sharing, these different examples also have their peculiarities (Rossmannek & Chen, 2023).

This research includes the discussion of CE applied to motor vehicle sharing, the so-called concept of car sharing. The concept of car sharing has been present for a considerable time in society, dating back to the 1940s, when the first car sharing models emerged (Rooke, Aquiles, Vieira, Teixeira, Almeida & Drago, 2018; Shaheen, Sperling & Wagner, 1999).

According to Seo and Lee (2021), the car sharing market is divided into three categories: car sharing, ride sharing and on-demand ride-sharing services. Car sharing is a form of physical vehicle sharing, involving the rental of vehicles owned by a company or an individual. Ride sharing refers to a system that allows people on similar routes (partial or full) to share vehicle rides. On-demand ride services refer to mobility services that connect riders who want to ride with drivers who provide real-time mobile services (Seo & Lee. 2021).

Therefore, car sharing, at first, can be seen as similar to traditional car rental services, however, this system allows for differentiated rental strategies where, through applications, users can choose whether to use it in hours or minutes, being charged only for the duration of each trip (Seo & Lee, 2021).

Most car sharing services were developed to meet the demands of large metropolitan areas, allowing users to meet objectives at different levels: the main one, which is transport/locomotion and the secondary ones, which are the reduction of congestion, parking and pollution problems (Boldrini et al., 2016; Prieto et al., 2017).

According to Nijland and van Meerkerk (2017), car sharing services have had noticeable impacts on both urban mobility and sustainability. The authors report that, among people who became consumers of this type of service, there was a reduction between 15% and 20% of their

mileage traveled compared to before using car sharing. This fact shows that the use of car sharing can influence consumers' environmental awareness. Furthermore, Baptista et al. (2014) also combine sustainability with resource savings when car sharing is treated in the context of hybrid or electric cars.

Given this context, it is relevant to observe the behavior of consumers in relation to the choices of joining or not *car sharing services.* The following subsection discusses the concepts of consumer behavior and *car sharing*.

Theory of Planned Behavior and the use of car sharing

The theory of planned behavior is an extension of the theory of rational action (Ajzen, 1991), made necessary by the limitations of previous constructs in measuring behavior in which people do not have complete control over. The 1991 theory of planned behavior brings with it personal and social factors that act as predictive variables of behavior. Armitage and Christian (2003) report that among the large number of theories that study human behavior formulated, the Theory of Planned Behavior (TPB) is the most widespread.

Intention, which causes behavior, is influenced by three constructs: attitude, subjective norm, and control of perceived behavior (Fishbein & Ajzen, 1975). The attitude expresses how much an individual demonstrates to be favorable or unfavorable to display a certain behavior, while the subjective norm is an external influence that motivates the individual to perform an action, according to the social influences that are exerted on the individual. Finally, the control of perceived behavior is related to the influence of this individual's perceptions, which are not fully volitionally controlled, on their intention and behavior. That is, according to TPB, a favorable attitude towards a stimulus and a reduced impact of the subjective norm, together with a high perceived control in relation to the stimulus, generates a positive intention for the behavior (action).

TPB has been widely used to conduct research that uses such constructs - attitude, social norms and perceived behavior - to identify the behavioral intentions of individuals in

relation to the adoption of innovation, or about services and products that instigate concerns about social-environmental impacts (Kilbourne & Pickett, 2008; Ramayah, Lee & Lim, 2012; Ip, Liang & Chou, 2022). In this context, it is understood that TPB can be useful in the context of analyzing the intention to adopt *car sharing* services (Mattia et al., 2019).

Attitude

According to Ajzen (1991), behavior attitude refers to the degree to which a person is favorable or unfavorable in relation to the behavior under analysis. According to the author, most psychologists incorporate a cognitive or informational approach to attitude formation. This approach is exemplified by Fishbein and Ajzen (1975), in which the authors state that attitude reasonably derives from beliefs about the object associated with attitude.

Also, according to Ajzen (1991), beliefs about an object are formed when it is associated with certain attributes, that is, with other objects, characteristics, or events. In the case of the attitude toward behavior, each belief connects to the behavior, generating a certain result or being generated a new connection with another attribute. Thus, as the attributes that are connected to the behavior are evaluated positively or negatively, human beings automatically and simultaneously acquire an attitude about the behavior.

In this instance, it is found that the individual creates a favorable attitude when he believes that the attributes will generate positive consequences, while generating an unfavorable attitude when he believes that the consequences of the attributes of that behavior will be negative. More specifically: the value of the subjective outcome of a behavior contributes to the attitude in the same proportions as the strength of belief about the same attitude (Ajzen, 1991).

In addition, according to the theory and academic contributions raised by Mattia et al. (2019) and Joo (2017), the cognitive decision process that would lead to the attitude to use a *car sharing* service can be seen from the following perspectives: environmental, social and economic aspects. The convenience aspects are added to this study as predictors of the

attitude construct, a condition supported and accepted in the studies of intention to use a *car sharing* service carried out by Joo (2017).

In a study with *millennials,* people born between 1980 and 2000, concluded that the main decision factor for the use of *car sharing* would be the high cost of owning a vehicle and sustainability factors (Wolánski & Pieróg, 2017). Although such research has shown that sharing economy services are consumed because they bring economic, hedonic and sustainability benefits to their users (Hamari, Sjöklint & Ukkonen, 2016), much is also said about the importance of convenience and the user's ability to save time when using such services (Joo, 2017). Also, Eckhardt and Bardhi (2015) state that services based on generating access of underutilized assets to other users create value by demonstrating convenience, ease and economy, whether financial or time. Paundra, Rook, van Dalen and Ketter (2017) also state that the main determining factors for the preference for a *car sharing* service over vehicle ownership or the use of public modes of transportation would be the price, convenience, ease of parking and the type of shared vehicle.

On the other hand, a study by Diógenes, Silva and Costa (2017) attests and supports hypotheses related to consumer skepticism that can affect the attitude and intention to buy products that can be beneficial to sustainability. According to the authors, consumers who have prior environmental knowledge are also more likely to be skeptical of advertising information that considers itself to be aimed at sustainability.

Contributing to the importance of convenience and ease of use, past research has also found that consumers prefer transport modes that are close and easily available to them (Tkaczyk & Awdziej, 2017). Within this context, being easily available means convenience in relation to parking, especially in cities. Regarding the behavior of use of the *car sharing* service, it is also important to understand the impact of the use of this service and its recurrence on the future decisions of users in relation to their consumption pattern and use of other modes of transport.

As an example, Burkhardt and Millard-Ball (2006) demonstrated that many members of *car sharing* services either showed interest in canceling or giving up the purchase of a second vehicle for their homes or even sold it, estimating that, in the United States alone, *car sharing* services have resulted in the reduction of 90,000 to 130,000 units of motor vehicles that should be on the streets, increasing the number of available spaces, improving vehicle traffic and reducing air pollution (Rodier & Shaheen, 2003). Therefore, in contrast to the studies that show that the attitude towards the use of mobility services has a significant positive effect (Nogueira, Dias & Santos, 2023; Peterson & Simkins, 2019), some cases also demonstrate that in some specific contexts the attitude towards environmental issues may also have a non-significant effect (Nogueira et al., 2023).

Therefore, it has been observed that a series of studies explored the theme of intentions and motivations for the use of *car sharing* systems. Evidence of economic motivations such as decreasing costs related to vehicle ownership and maintenance (Paundra et al., 2017), environmental evidence related to the possibility of decreasing the level of environmental pollution that the reduction of the fleet of vehicles would generate (Shaheen, Guzman & Zhang, 2010), as well as social evidence, such as hedonic benefits (Joo, 2017). Thus, the following hypotheses are suggested:

H1. Environmental aspects (EA) influence the intention to use *car sharing* services (INT);

H2. Social aspects (SA) influence the intention to use *car sharing* services (INT);

H3 Economic benefits (BE) influence the intention to use *car sharing* services (INT);

H4. Convenience aspects (CO) influence the intention to use *car sharing* services (INT).

Subjective Norms

According to Ajzen (1991), normative belief is related to the probability that reference groups or individuals approve or disapprove the action of a given behavior. The strength with which each normative belief is multiplied by the individual's personal motivation to accept the

group's position of approval or disapproval regarding the issue, and the subjective norm is directly proportional to the sum of the result of the products of the references.

Roos and Hahn (2019) also define subjective norms as a social pressure perceived by other individuals significantly capable of influencing their behavior. In the context of sustainable and collaborative consumption, Roos and Hahn (2019) observed that the intentions of consumers, in this specific context, are more influenced by regulations and personal attitudes than by subjective norms.

According to Ham, Jeger and Ivković (2015), the subjective norm can be defined as the conviction that the individual or a group of people will support a certain behavior and can be determined by the social pressure that a group exerts on this individual. It can be said that intention and behavior are manifested through social norms. For example, although ethical behavior is considered a good predictor of attitude toward the intention to purchase environmentally sustainable products or services, this relationship is likely to be more robust under the influence of the subjective norm in a collectivist culture (Lee & Gretzel, 2014). On the other hand, Ham et al. (2015) mention that previous studies have proven that, in the context of intention formation, the influence of attitude can still be stronger than the influence of the subjective norm.

Xie and Madni (2023) report in their study aimed at green consumption that people have a greater predisposition to this consumption when consumers have subjective norms such as information to share. Thus, when understanding that the use of *car sharing* can be well seen by friends and family, assume that subjective norms can increase the use of these services (Abutaleb, El-Bassiouny & Hamed, 2020; Peterson & Simkins, 2019). Another factor that influences subjective norms is the issue of sustainability, society approves the use of sustainable services and products (Gulzari, Wang & Prybutok, 2022), although there is a gap between intention and behavior (White, Habib & Hardisty, 2019). Thus, it is believed that

subjective norms are factors that can influence the intention to use *car sharing services* (Park & Ha, 2014; Abutaleb et al., 2020). Therefore, the hypothesis presented is as follows:

H5. Subjective norms (NS) influence the intention to use *car sharing* (INT) services.

Planned behavior control

Planned Behavior Control is a construct that occurs due to the presence or absence of resources and opportunities among the individual, which makes them capable or unable to transform the behavior into action. For example, according to Peixoto and Pereira (2013), in their studies on environmentally responsible behavior, this type of behavior is not always consistent with the environmentally responsible discourse that is employed, since contextual and motivational elements can influence the way a given individual acts.

According to Ajzen (1991), beliefs about perceived control over behavior may derive from past experiences with the same behavior, but can usually be influenced by second-hand information, experiences of users and friends, and other factors that increase or reduce the perceived difficulty or ease of acting in relation to a given behavior. Thus, the more opportunities that present themselves to the individual and the fewer obstacles and difficulties are imposed between them and the behavior, the greater the perceived control over the behavior. That is, each control belief is multiplied by the perceived power to take an action, within a particular control factor that facilitates or inhibits the performance of a behavior (Ajzen, 1991).

As Ajzen (1991) states, the result of the sum of control beliefs is the perceived control of perceived behavior. Thus, in the same way that beliefs about the consequences, positive or negative, of a given triggered behavior generate the construct of attitude towards a given behavior, and normative beliefs are seen as determinants for subjective norms, beliefs about resources and opportunities, favorable or not, will also be seen as predecessors of the control of perceived behavior.

It is understood, therefore, that the control of perceived behavior is an important factor in demand generation, as it influences the purchase intention of consumers. To the point that

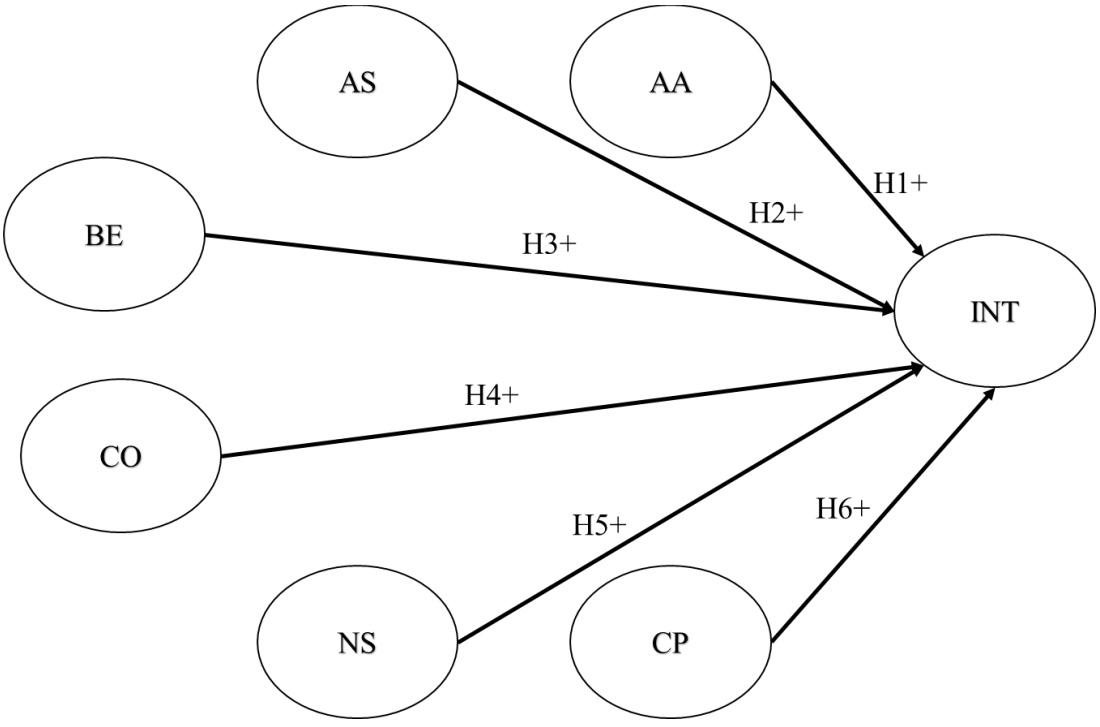
when realizing that the individual has control over the situation and that they can choose between all means of transport, it is believed that behavioral control will influence the intention to use *car sharing* services (Liu, Sheng, Mundorf, Redding & Ye, 2017; Abutaleb et al., 2020). The perception that there is a control over the choice of means of transport and that this can be beneficial in the mid term, it helps that the perception of behavioral control influences the intention to choose the use of *car sharing* (Nogueira et al., 2023). Thus, the hypothesis presented is:

H6: The control of perceived behavior (PC) influences the intention to use the *car sharing* service (INT).

The following is Figure 1 with the research framework, contemplating all the hypotheses developed in the study:

Figure 1

Study framework



Source: Developed by the authors (2021).

Methodology

This research is classified as descriptive and quantitative. A *survey-type* study was applied through questionnaires collected by non-probabilistic sampling and convenience. The questionnaires were shared through electronic address networks and on the researchers' social media networks. This criterion was used because, as reported in the research by Martin, Shaheen and Lidicker (2010), *car sharing* users mostly have higher education, being an easily accessible audience for researchers. The questionnaire was applied from June to July 2021. Table 1 shows the hypotheses tested in the research.

Table 1

1 Research hypotheses

Hypotheses	Description	Relationship
H1	Environmental aspects (EA) influence the intention to use car sharing services (INT).	AA -> INT
H2	Social aspects (SA) influence the intention to use car sharing services (INT).	AS -> INT
H3	Economic benefits (BE) influence the intention to use car sharing services (INT).	BE -> INT
H4	The control of perceived behavior (CP) influences the intention to use the car sharing service	CO -> INT
H5	Subjective norms (NS) influence the intention to use car sharing services (INT).	NS -> INT
H6	Convenience aspects (CO) influence the intention to use car sharing services (INT).	CP -> INT

Source: the authors (2023)

The questionnaire was divided into three parts: the first part asks for the respondent's city, if there is a car-sharing service available in the city, and if the respondent has any vehicles. In the second part, there are the scales of attitude towards environmental aspects (Mattia et al., 2019), attitude towards social aspects (Mattia et al., 2019), economic benefits (Mattia et al., 2019), convenience (Joo, 2017), subjective norm (Mattia et al., 2019), control of perceived behavior (Mattia et al., 2019) and intention to use (Joo, 2017). To measure the constructs, a 7-point Likert scale was used (1 = strongly disagree, 7 = strongly agree. Table 2 shows the

questions included in the survey, with the questions, codes, and references of each construct. In the last part, the social-demographic variables were surveyed.

Table 2

2 Constructs used in the study

Construct	Construct Item	Code	References
Environmental Aspects	Using Car Sharing could reduce the level of pollution in the city	AA1	Mattia, Mugion and Principato (2019)
	Using Vehicle Sharing could reduce the level of traffic jams in the city	AA2	
	The use of Vehicle Sharing could reduce the level of capacity in city parking lots	AA3	
Social Aspects	Using Vehicle Sharing gives me access to a vehicle whenever I want, even if I do not own one	As1	Mattia, Mugion and Principato (2019)
	Using Vehicle Sharing can be safer than using public transport	AS2	
	Using Vehicle Sharing improves the quality of the way I transport myself in terms of waiting time, availability and capacity, compared to the quality of public transport services.	AS3
Economic Benefits	Using Vehicle Sharing saves me money by not having to buy a vehicle	BE1	Mattia, Mugion and Principato (2019)
	Compared to the costs of maintaining a vehicle, using Vehicle Sharing is much more economical	BE2	
	Using Vehicle Sharing gives me access to use a vehicle that, in other circumstances, I could not have	BE3	
Convenience	Using Vehicle Sharing saves me time	CO1	Joo (2017)
	By using Vehicle Sharing I can use my idle time more efficiently	CO2	
	I can use Vehicle Sharing whenever I want	CO3	
Subjective norm	I hope to use Vehicle Sharing more	SN1	Mattia, Mugion and Principato (2019)
	People that are important to me expect me to use Vehicle Sharing	SN2	
	People I care about use Vehicle Sharing	SN3	
Control of Perceived Behavior	Using Vehicle Sharing can be complex	CP1	Mattia, Mugion and Principato (2019)
	Shared vehicles may sometimes not be easily available	CP2	
	The geographic coverage of Vehicle Sharing is not large enough	CP3	
Intention	I want to use Vehicle Sharing continuously	INT1	Joo (2017)
	I want to use Vehicle Sharing continuously	INT2	
	I will recommend using Vehicle Sharing to others	INT3	

Source: Developed by the authors (2021).

For data analysis, structural equation modeling was used using SmartPLS 3.0 software. Convergent and discriminant validity was made through the criterion of Fornell and Larcker (1981). After the validation of the constructs, the hypothesis test was analyzed.

RESULTS

This section presents the descriptive analysis of the sample related to the research, based on its variables. In addition, the section addresses the results obtained from the use of the *SmartPLS*software, in addition to discussing the numbers reached and their inferences related to the theme to which the study aims to analyze.

Descriptive analysis of the sample

A total of 164 responses were obtained. However, 39 people answered that in their city there was no car sharing service available and for this reason they were removed from the sample. No questionnaires were removed for *missing values* or for being *outliers*. Regarding social-demographic data, in Table 2, it can be noted that most of the were female, 52.8% and not far ahead of the 47.2% participants, who were male individuals. The mean age of the individuals corresponds to almost 29 years of age.

Table 3

3 Survey sample data

Variable	Variable specifications	Frequency	%
Gender	Male	59	47.2
	Female	66	52.8
Age	Average	28.95	-
Household Income	Up to R$ 500,000.00	0	0
	R$ 500,00 to R$ 1.000,00	1	0.8
	More than R$1,000.00 to R$2,000.00	3	2.4
	More than R$2,000.00 to R$3,000.00	9	7.2
	More than R$3,000.00 to R$5,000.00	18	14.4
	More than R$5,000.00 to R$10,000.00	34	27,2
	From R$ 10,000.01 to R$ 20.000,00	32	25.6
	above R$ 5,000,001.00	24	19.2
	No income	4	3.2
Education Level	Elementary School	0	0
	High School	28	22.4
	Higher Education	52	41.6
	Postgraduate Degree	23	18.4
	Master's degree	17	13.6
	Doctoral studies	5	4

Source: Developed by the authors (2021).

When analyzing the social-demographic data, it was observed in relation to the household income of the research participants that more than 70% of the individuals have an income greater than R$5,000.00, with 27.2% of the sample in the stratum between R$5,000.00 and R$10,000.00, 25.6% with an income between R$10,000.00 to R$20,000.00 and 19.2% with a household income of more than R$20,000.00. From the perspective of the variable level of education, it was seen that most respondents have completed higher education, corresponding to 41.6%. Subsequently, there are individuals who completed high school (22.4%), postgraduate studies (18.4%), master's degree (13.6%) and doctoral degree (4.0%).

Modeling of Structural Equations

For convergent and discriminant validity analysis, all results presented acceptable values, except, to a low degree, for the Social Aspects (SA) construct, with a Cronbach's Alpha value (0.620) less than 0.7 (Hair, Black, Babin, Anderson & Tatham, 2009). However, since the construct presented an adequate value for composite reliability (CC) greater than 0.7 and the Average Variance Extracted (VME) greater than 0.5, it was decided to accept the validity of the construct. No variables were removed from the constructs since the factorial loads presented satisfactory results. Table 4 shows the results of convergent and discriminant validity following the criteria of Fornell and Larcker (1981).

Table 4

4 Convergent and discriminant validity

Construct	Cronbach's alpha 0.898	GR	AVE	AA	AS	BE	CO	CP	INT	NS
AA	0.772	0.868	688	**0.829**						
AS	0.620	0.794	0.564	0.075	**751.**					
BE	0.718	0.843	.644	0.433	425	**0.802**				
CO	0.828	0.897	0.743	0.260	0.592	0.499	**0.862**			
CP	0.804	0.884	0.718	0.166	0.347	0.320	0.492	**0.847**		
INT	0.884	0.928	0.812	0.411	0.486	0.524	0.558	0.466	**901**	
NS	0.809	0.888	0.725	0.375	0.485	0.473	0.544	0.466	0.763	**0.852**

Source: Developed by the authors (2021).

After analyzing the convergent and discriminant validity of the constructs, we therefore proceeded to the hypothesis testing and model analysis in Table 5. The results showed that there is only a positive influence of the subjective norm (NS) on the intention to use the *car sharing* service, since the p values for the other constructs in relation to the intention are greater than 0.05. In addition, it was identified that, for the significant relationship, there was predictive validity, since f^2 was greater than 0.02 and R^2 greater than 0.25 (Hair et al., 2019).

Table 5

5 Hypothesis testing and predictive validity

Ratio	Original Sample	Standard Deviation	Statistics t	P values	F²	Adjusted R²	Hypothesis
AA -> INT	0.113	0.059	1,926	0,054	0.027	0.634	H1 - Rejected
AS -> INT	0.088	0.069	1,277	0.202	0.013		H2 - Rejected
BE -> INT	0.108	0.073	1,474	0.140	0.020		H3 - Rejected
CO -> INT	0.088	0.077	1,132	0.257	0.011		H4 - Rejected
NS -> INT	0.543	0.075	7,209	0.000	0.460		H5 - Accepted
CP -> INT	0.086	0.061	1,411	0.158	0.015		H6 - Rejected

Source: Developed by the authors (2021).

Additional Results

In addition to these results, analyses of variance (ANOVA) were performed in order to verify if there are significant differences between the means of different respondent groups, in view of the constructs formulated, in relation to some variables verified in the questionnaire developed.

Thus, for the variable **number of cars**, the individuals who answered the questionnaire were divided into two groups, those who owned a car and those who owned more than one car. From this, it was seen that those who own a car have a higher average value **in relation to the construct social aspects**: M1c= 5.62, SD= 1.08; M2c= 5.03, SD= 1.32; F(1, 126) = 7.282 p= 0.008; and higher value in **relation to the construct of intention to use**: M1c= 4.32, SD= 1.80; M2c=3.54, SD= 1.82; F(1, 126) = 5.892 p= 0.017. From the perspective of the **gender** variable, the results of the groups, male and female, show that the female sex presented higher values **in**

relation to the construct of social aspects: Mmasc = 4.90, SD= 1.14; Mfem = 5.63, SD= 1.26; F(1, 126) = 11.420 p= 0.001. For the variable **age group**, the results, considering the quartiles (groups) up to 23 years, up to 26 years, up to 32 years and over 32 years, **in relation to the construct of social norms** were: $M_{>23}$ = 2.79, SD= 1.69; $M_{>26}$ = 2.84, SD= 1.30, $M_{>32}$ = 3.05, SD = 1.54, M32 = 4.23, SD= 1.85, F(3, 124) = 5.351 p= 0.002, in which people over 32 years presented higher values.

Discussion

The present study had a model based on the Theory of Planned Behavior (TPB), with the variables: environmental aspects, social aspects, economic benefits, convenience synthesizing the attitude that influences the intention, in addition to the constructs of subjective norms and control of perceived behavior that also influence the intention to use *car sharing* services. Thus, the effect of each of the variables on the intention to use such services was analyzed.

Hypothesis H1, which proposed that environmental aspects (EA) influence the intention to use was rejected, not corroborating the results obtained by Mattia et al. (2019), despite agreeing with the results found by Joo (2017). Therefore, it is identified that, for the research region, environmental aspects do not contribute to positively influence the respondents and their intention to use *car sharing services*.

Hypothesis H2 tests the proposal that social aspects (SA) influence the intention to use. The hypothesis was rejected in the study, not corroborating the results of past research such as Mattia et al. (2019), showing that, for the respondents surveyed, social aspects did not influence their intention to use.

Hypothesis H3, which states that economic benefits (BE) influence the intention to use was also rejected, contrary to the findings of Mattia et al. (2019), but corroborating the results discussed by Joo (2017), in which the economic benefits of using *car sharing* services did not contribute to a greater intention to use.

Hypothesis H4, which analyzed if convenience has effects on attitude and its consequent influence on the intention to use the *car sharing* service, was also rejected, in contrast to what Joo (2017) states, showing that respondents from the surveyed region probably do not find sufficient convenience benefits to generate an influence factor on their intention to use.

Since all hypotheses related to specific contexts of the attitude were rejected, it is noted that this demonstrates that by specifying the result of the attitude, the individual does not intend to use the service, as observed in the work of Nogueira et al. (2023). However, other studies have shown that in the context of general attitude, the individual demonstrates a greater significant attitude in using the car sharing services (Nogueira et al., 2023; Peterson, & Simkins, 2019).

Hypothesis H5, which dealt with the influence of the subjective norm (NS) on the intention to use *car sharing*, was accepted because, as Mattia et al. (2019) also states, the adoption of practices related to more conscious modes of transport would be at least partially influenced by a moral obligation or adherence to consumption patterns considered socially desirable.

Finally, hypothesis H6, which states about the influence of the control of perceived behavior (PC) on the intention to use *car sharing* services, was also rejected, not corroborating the results of Mattia et al. (2019), who demonstrates this construct as negatively influential. This result implies that, probably, the respondents of the collected survey do not notice influence, whether positive or negative, on the perceived ease of behavior control in relation to the intention to use the *car sharing* service. Regarding the rejection of this hypothesis, it can be understood that the respondents do not see themselves with so much control over the choice of their means of transport. *Car sharing* places are still scarce, and information is not yet widely disseminated, making citizens not feel that they are in control of this situation.

In the context of the ANOVA tests carried out, in relation to the number of cars that a person owns, it was seen that this factor has relevance that can justify their use or not of the *car* sharing service, when the social aspects and their intentions of use are considered, leading to the belief that, for those who have only one vehicle at home, the social aspects add positive value to the intention to use the *car sharing* service, since the average value of the responses for this audience (5.60) was higher than for the respondents who indicated having more than one car at home (5.00), indicating, in a managerial bias, that this would be a more adequate audience to perceive the social values, such as safety and accessibility generated by *car sharing*.

The results obtained in this research can be explained by studies applied in the empirical context in which this research was developed. Pereira and Silva (2019), when exploring the context of the city of Fortaleza, state that the diffusion of electric car sharing services in the city was still slow and the general public viewed them skeptically.

In addition, Tran et al. (2019) state that the acceptance of car sharing services may vary according to cultural factors in different regions of the world. For example, according to the authors, applied research in China showed that such services were less attractive due to a cultural preference among Chinese for car ownership. This may also explain the results obtained in this study, since car ownership is seen as a status symbol in Brazilian culture (De Trói, 2017), which may induce less adherence to *car sharing* services in the context studied.

Finally, also Luna (2020), when studying the electric car sharing platform in the city of Fortaleza, despite proving the environmental benefits of such a system, advocate the need for greater public investment aimed at increasing the fleet of vehicles, and dissemination to increase the impact and reach of such services to the local population.

Regarding social-demographic data, the results partially correspond to those found in the literature, regarding purchasing power and age group. According to Prieto et al. (2017) factors such as individuals having a high educational level and living in large urban centers

influence the behavior of choice in relation to *car sharing* services. Goodwin (2013) also shows that the choice for these services is partially driven by younger individuals, suggesting the generational effect in a new automobile culture, in which car ownership is no longer as appealing. However, it is also important to consider that such studies reflect the reality of urban centers in countries of the global north, better developed in economic terms. In this research, female respondents stand out, with a significant difference in the construction of social aspects, leading to the belief that this public considers issues such as safety, comfort and accessibility when looking for alternative means of transport.

Subsequently, the construct of social norms was also analyzed by comparing it between the age groups of the respondents, demonstrating a significant difference in the average of the responses from the age of 32, contributing to the belief that people above this age consider the opinion of others, their neighbors or society, regarding their intentions to use *car sharing* services.

Conclusions

This article aimed to investigate the intentions of users in one of the main capitals of Brazil to use *car sharing* services. For this, the Theory of Planned Behavior (TPB) was used as the basis for the development of the study constructs. According to the results obtained from the questionnaire prepared for the research and using the SmartPLS software for data analysis, it was observed that only hypothesis H5, referring to the influence of the subjective norms (NS) on the intention of personal use regarding the car sharing service, was accepted. Thus, hypotheses H1, H2, H3, H4 and H6 were rejected.

This result shows that attitudes when specified do not lead to the intention to use *car sharing*, however, other studies have shown that when a general attitude is measured there is influence, this suggests that it is not a single specific point that makes the individual intend to use *car sharing*, but the sum of many factors. This finding becomes more emphatic when subjective norms have an effect, showing that individuals understand that the use of car sharing

is good and well accepted among their peers. However, it should also be noted that behavioral control did not have a significant effect, this demonstrates that respondents do not feel in control of being able to choose this type of service.

In addition, analysis of variance (ANOVA) tests were performed, comparing the means of different groups present among the respondents. From this, it was seen that the number of cars that an individual has in relation to the constructs social aspects and intention, has a relevant significance, which can be a determining factor for the use of *car sharing* services. In addition, the respondent's gender, when social aspects are considered, also has a relevant significance in this context. Considering the variable age group (age), a possible construct that can impact are social norms, with significance, as in previous cases, also less than 0.05.

It is believed that these results can be motivated by a combination of factors: the culture of *car sharing* services is not yet so present in the empirical context studied, linked to the need for greater investments in the adequacy of urban structures and in new service platforms of this type, respectively. Also, the greater dissemination of services can lead to an engagement of users not yet adhering to car sharing services.

From this perspective, analyzing the specific consumer public of this type of service instead of the general public, or even analyzing the use of the *car sharing* service from another approach for the formation of constructs, may correspond to possible research opportunities related to car sharing. Further discussions, using analysis of variance (ANOVA) to analyze the different respondent groups regarding the intention to use the *car sharing* service throughout the Brazilian territory, can also be of great benefit for future studies. Finally, we also suggest the study of *car sharing* within the theme of smart and sustainable cities.

In addition, this research strives to make a practical contribution and the need to better specify the effects that the use of *car sharing* brings to society, since increasing specific attitudes can increase the effect of attitude and consequently of intention. As a theoretical contribution, the authors aim to broaden the discussion on the sharing economy and observing

that there is still room for discussion with citizens and hope to show that *car sharing* services and platforms still deserve further research.

It is also important to note that the fact that the research was developed during the time of the COVID-19 pandemic along with limitations to the study, especially with regard to the search for a greater number of respondents to the questionnaire utilized in this study. In addition, the use of a non-probabilistic sample is also a limitation.

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