U.PORTO

FEP FACULDADE DE ECONOMIA
UNIVERSIDADE DO PORTO

Gen Z and the Intention to use Carsharing or Carpooling: a theory of planned behavior approach.

João Cristóvão Lopes Almeida

Dissertação
Mestrado em Gestão de Serviços

Orientado por
Professor João F. Proença
Professora Maria Antónia Rodrigues

2024

Acknowledgements

The development of this dissertation was a personal and academic challenge, but it was also an experience that made me grow on personal level.

All this work wouldn´t be possible, without the support of some amazing people who accompanied me through this journey.

First, I want to thank my family who have always supported me and invested in my education, in order to have access to better professional opportunities.

I´m very thankful to my girlfriend, Sara Ganhão, who accompanied me during this journey, for her patience and understanding in all process.

I also want to thank to the Professors Eufêmia Gamboa, Teresa Pimpão, Luis Ferreira and Tiago Couto, for supporting me on launching the survey on their schools.

Las but not least, I want to thank to my supervisors, Professor Maria Antónia Rodrigues and Professor João F. Proença, for their effort, their attention and for the motivation they gave me during this process.

Abstract

In the last few years, some business models have been developed around car servitization. They have been successful for many reasons, mainly because it provides more flexibility in the customers daily-life, but also enable to save money and fits an ecological way of life. Some of the most recent car services are the carsharing and carpool.

At the same time, Generation Z includes people born between 1996 and 2010, and is now the largest generational group, summing up 32% of the global population. Among the present consumer generations, Gen Z members are the most interested in incorporating sustainability into their lifestyles. They seek green products and services, which implement environmental protection, promote social responsibility, adopt specific measures to protect employees and support local communities

The aim of the study is to understand the influence of different factors on the intention to use carsharing or carpool, exploring the direct effects of each one, using the theory of planned behavior as base, and extending it to price, convenience, ecological awareness and frugality determinants.

The data (275 answers) was collected through a survey released on Portuguese high-schools and universities, but also on Amazon Mturk platform and tested using structural equation modelling.

Findings confirm the role of subjective norm and convenience on predicting intention to use carsharing or carpool. The results revealed that subjective norm has the strongest influence on intention to use it.

When we split in two different groups responders, carsharing and carpool, ecological awareness reveals to influence the intention to use carsharing specifically. By another hand, the convenience seems to have influence only for carpool users.

This research, contribute to literature by analyzing the influence of different factors to use carsharing or carpool, by generation Z, using an extended TPB. To the best knowledge, this is the first time that the intention to use carsharing or carpool is studied, in the same research, using TPB, and focusing on generation Z.

The results reveal relevant information for carsharing and carpool operators, to define their strategies and attract new customers of generation Z to their platforms.

Keywords: Carsharing, Carpool, Generation Z, Theory of Planned Behavior, Car service, Transportation, Sustainability

Resumo

Nos últimos anos, alguns modelos de negócios foram desenvolvidos à volta da servitização automóvel. Estes modelos têm tido sucesso por diversas razões, principalmente porque proporcionam mais flexibilidade no dia a dia dos clientes, mas também porque permitem economizar dinheiro e estão relacionados com modos de vida mais ecológicos. Alguns dos serviços mais recentes são o carsharing e o carpool.

Olhando para a Geração Z, que inclui pessoas nascidas entre 1996 e 2010, e é agora o maior grupo geracional, somando 32% da população global, esta geração destaca-se, por ser a mais interessada em incorporar a sustentabilidade no seu estilo de vida. Os individuos desta geração procuram produtos e serviços verdes, que implementem a proteção ambiental, promovam a responsabilidade social, adotem medidas específicas para proteger os trabalhadores e apoiem as comunidades locais

O objetivo do estudo é compreender a influência de diferentes fatores na intenção de utilização do carsharing ou carpool, explorando os efeitos diretos de cada um, utilizando a teoria do comportamento planeado como base, e estendendo-a aos determinantes de preço, conveniência, consciência ecológica e frugalidade.

Os dados (275 respostas) foram recolhidos através de um inquérito divulgado em escolas secundárias e universidades portuguesas, mas também na plataforma Amazon Mturk e testados com recurso a modelação de equações estruturais.

Os resultados confirmam o papel da norma subjetiva e da conveniência na previsão da intenção de usar carsharing ou carpool. Os resultados revelaram que a norma subjetiva tem a maior influência sobre a intenção de usar estes serviços.

Quando dividimos as respostas entre os dois grupos, carsharing e carpool, a consciência ecológica revela influenciar a intenção de usar o carsharing. Por outro lado, a conveniência parece ter influência apenas para os utilizadores de carpool.

Esta pesquisa contribui para a literatura através da análise da influência de diferentes fatores, relativamente ao uso de carsharing ou carpool, pela geração Z, utilizando a TPB estendida. Até onde se sabe, esta é a primeira vez que se estuda a intenção de usar carsharing ou carpool, na mesma pesquisa, usando TPB, e com foco na geração Z.

Os resultados revelam informações relevantes para os operadores de carsharing e carpool, de modo a definir estratégias e atrair novos clientes da geração Z, para as suas plataformas.

Palavras-chave: Carsharing, Carpool, Geração Z, Teoria do Comportamento Planeado, Serviços utilizando Carro, Transporte, Sustentabilidade

Table of Contents

1. Introduction **1**

2. Literature Review **5**

2.1 Servitization and automotive industry 5

2.2 Generation Z 9

2.3 Determinants to use carsharing or carpool 11

2.3.1 Theory of Planned Behavior 17

2.3.2 Other variables that influence the intention to use carsharing and carpool 22

3. Methodology **27**

4. Results **32**

4.1 Sample Characterization 32

4.2 Reliability and Validation of the measurements 34

4.3 Hypothesis test 43

4.4 Multi-group analysis 46

5. Discussion **49**

6. Conclusion and contributions **52**

7. Limitations and Future Research´s **54**

8. References **55**

9. Attachments **62**

Index Table

Table 1 Studies with identified factors to use carsharing/carpool **13**

Table 2 Investigation Hypothesis **26**

Table 3 Constructs..... **29**

Table 4 Sociodemographic characteristics of the sample **33**

Table 5 Model Reliability and Validity (first analysis) **35**

Table 6 Model Reliability and Validity (2nd analysis without item Fr2)..... **37**

Table 7 Fornell and Larcker Criterium (without item Fr2)..... **39**

Table 8 Fornell and Larcker Criterium (without item Fr2, Fr4 and SN1) **40**

Table 9 Model Reliability and Validity (3rd analysis without item Fr2, Fr4 and SN1) **41**

Table 10 Hypothesis Test..... **45**

Table 11 Multi-Group Analysis PLS **46**

Table 12 Coefficient Difference **47**

Table 13 Hypothesis validation **48**

Index Figures

Figure 1 The Theory of Planned Behavior model adapted from Ajzen 2005..... **17**

Figure 2 Conceptual Model **27**

Figure 3 Results of the conceptual model (coefficient/ t value/ p value) **43**

1 – Introduction

Until the beginning of the 1990s decade, manufacturers used the traditional product focused strategy. This was based on vertical integration, superior products and economies of scale which provided a sustainable market dominant position and generated scale barriers to new competitors (Kanatli & Karaer, 2022). However, manufacturers realized that business linked to services was way more lucrative than pure products strategies (Wise & Baumgartner, 2000). Since then, servitization, the strategic transformation from pure-product company to a service-oriented company has begun (Wise & Baumgartner, 2000; Genzlinger et al., 2020). In practical-terms, servitization is the activity of selling the services provided by the product, rather than the product itself (Kanatli & Karaer, 2022). In that respect, it has similarities with leasing.

Typically, in a service business model, the customers only use the asset for a limited duration and will pay only per-use, or per duration of use. In the last few years, some business models have been developed around car servitization. They have been successful for many reasons, mainly because it provides more flexibility in the customers daily-life (Correia et al., 2014), enable to save money and fits an ecological way of life (Jain et al., 2021; Mattia et al., 2019).

Looking at the variety of services which are output of the automotive industry we can list some of them like maintenance, repair, credits/finance, leasing, renting or more recently carsharing and carpool.

Carsharing and carpool, have in common that both has risen from technology and digital platforms development. Carsharing is a system where a group of individuals can rent and drive a car, or fleet of cars, for a limited period (even hours or minutes), at the same time (Martin, 2023; Uniplanet, 2018). Carpool involves sharing a ride with others, who are going in the same direction, and in most of the times, the car is owned by one of the individuals and the remaining users are taking a ride, paying for it (Martin, 2023; Uniplanet, 2018).

There are several studies about the motivations to use carsharing, developed by Zhang & Li, (2020), Li & Zhang, (2021), Jain et al., (2021) and Mattia et al., (2019), or about carpool

developed by Bachmann et al., (2018) and others around the servitization in the automotive industry, which studied how manufacturers become mobility service providers from Genzlinger et al., (2020).
Moreover, the impact of carsharing on cities developed by Bocken et al., (2020), and on the reduction of vehicles from Ke et al., (2019), the servitization of the car industry and the impact on product durability, profitability and environmental were studied in the last years by Kanatli & Karaer, (2022).

Zhang & Li (2020) has studied the intention to use carsharing focusing the analysis on Chinese university students. By another hand, Li & Zhang (2021) has analyzed the intention to use carsharing on a multi-group of different sociodemographic characteristics, which included a wide age range. In the study of Mattia et al. (2019), where was studied the intention to re-use free floating car sharing, and on the study of Bachmann et al., (2018) about what drives people to carpool, the authors did not focus in a specific age range.
Looking at the new costumers, and in specific the new generations, we found important to focus our research on Generation Z. Generation Z includes people born between 1996 and 2010 (Dolot, 2018; Cilliers, 2017), and is now the largest generational group, summing up 32% of the global population (Spitznagel, 2020). Among the present consumer generations, Gen Z members are the most interested in incorporating sustainability into their lifestyles (Dabija & Bejan, 2017). They seek green products and services, which implement environmental protection, promote social responsibility, adopt specific measures to protect employees and support local communities (Dabija & Bejan, 2017).

Also, Generation Z consumption habits are different than other generations. For them, consumption means having access to products or services, not necessarily owning it (Francis & Hoefel, 2018). On the other hand, this generation was very exposed to financial crashes, resulting in multiple global recessions, which has built a strong sense of frugality (Fromm & Read, 2018). Most of the people from these generation are finalizing university studies and beginning work careers, starting to be more active consumers, which means they are now implementing new trends and demanding new services from the market (Balchandani et al., 2023). For that reasons we found relevant to develop the study, on this specific generation.

At the same time, investigate about how technology facilitates or hinders the adoption of carsharing/carpool practices, as well as its impact on user behavior, it´s relevant and contemporary (Mitropoulos et al., 2021).

Also, understanding the social and behavioral aspects to choose the carsharing and carpooling platforms is interesting in an era that most of the people look at the car as something that can be shared (Cetelem, 2018).

According to a study developed by Cetelem, in 2014, 3 out of 4 European Citizens sees carpool or carsharing as a reality in the next 10 years, looking at the car as a service, instead of a product that we need to buy (Cetelem, 2018).

The average car sits unused for more than 90% of the time, carries on average just one and a half people (Transport&Environment, 2017). According to the platform Car2Go, launched by Mercedes-Benz, a shared car is up to 6 times more used than a private car (Uniplanet, 2018). Ride sharing apps reduce number of vehicles on the road and vehicle kilometers driven, but also importantly, encourage a behavioral shift towards multi-modal, sustainable transport which complement public and active forms of transport (Transport&Environment, 2017).
Car sharing schemes, whether point-to-point or free floating, also lead to reduced car ownership with studies indicating 5-15 cars replaced for each shared car (Transport&Environment, 2017).

Carsharing and Carpool are both transportation options, that are very linked to share economy, use digital platforms to be accessed, are more sustainable and both can be solutions for people that want to avoid the expenses and burden part of having a car. Once there are several similarities on both services, we think that is interesting to study these together in the same research.

Also, as explained above, frugality is very much present on generation Z, and so it is interesting to understand what services or products can be developed to fulfill this need.

Leasing and renting services have been used by companies and individuals for many years, to fulfill their transportation needs, on a daily routine or seasonality periods. However, nowadays with the cities expansion, the lack of space to keep a car, the high investment

needed to buy and maintain a new car, and also with the ecological awareness that more and more customers are currently developing, the car users are changing their behaviors (Mattia et al., 2019; Rosa, 2018; Munzel et al., 2019). They are choosing to use carsharing, carpool and other related services to fulfill their transportation needs (Bachmann et al., 2018; Prieto et al., 2017).

From a management perspective, it's important to understand the customer behavior and needs, to define strategies that contribute for customer satisfaction, increase demand for company's services while support company's growth and transformation.

To our knowledge, this is the first study that combine both business models (carsharing and carpool), that expanded the theory of planned behavior and focusing on generation Z.

For the reasons previously stated we also found interesting to study in this research, the main motivations for generation Z to use car sharing and carpool.

There are two main questions that we would like to investigate:

- What are the main drivers that influences the purchase of a carsharing or carpool service?
- How can we expand the TPB (Theory of Planned Behavior), to predict the purchase of a carsharing or carpool service?

To develop the literature on this field and fill the gap of studies in this area, we expanded the TPB linked to 7 variables: Attitude, Subjective Norms, Perceived Behavioral Control, Price, Convenience, Ecological Awareness and Frugality.

This dissertation is divided into 6 sections, it starts with the literature review where the hypothesis are created, then the methodology, after that the results section will show the results collected. To finalize, the results will be discussed, then the conclusion and it ends with the limitations and future research.

2- Literature Review

In this chapter we will analyze the main themes and definitions related to this dissertation.

2.1 Servitization and automotive industry

Over the last years and decades, the services have gained more and more space into the business world, nowadays it has an important % of the GDP generated globally. If we compare attachment 1 and 2, which represents the evolution of services GDP % and manufacturing GDP %, in the European Union, from 1991 to 2021, we can easily understand that services % GDP is growing, at the same time that manufacturing % GDP is decreasing (WorldBankGroup, 2023b; WorldBankGroup, 2023a).

Nowadays, the services sector represents 65% of the GDP in the European Union (attachment 1) and 73% of the employment in the European Union (attachment 3) (WorldBankGroup, 2023b; Eurostat, 2023).

If we investigate the manufacturing sector, not only manufacturers are inputting more services into their products, but they are also buying more services, due to the outsourcing contracts with other companies.

If we look overall, on the manufacturer industry, we can see that a high percentage of the final product, has services incorporated, for example design and engineering, quality control, supply chain of components, packaging and shipping, customer service, maintenance and repair etc. And so, today purchase main driver is not the product but the service itself.

As an example, of pure industry brands that developed strong servitization business models around their products, there is caterpillar with rental service of construction equipment (*Caterpillar Rental Services*, 2022), or xerox which developed a business model that instead of selling the print machine they charge a fee by each print or copy (*Xerox print services*, 2022).

Analyzing the automotive industry, we can see this area is on continuing innovation and evolution, sophistication is a constant on the new car models. Nevertheless, a major part of this sophistication is provided by services, which are incorporated in the car during the

construction process, for example incorporating a new design or developing the engineering part.

Besides the services incorporated on the products, automotive manufacturers have been developing and innovating on services provided to the final customer, as example we have leasing, renting, carsharing, maintenance, direct assistance 24/7 or even credit and financial services.

Even though, the core business of the manufacturers it's still the car production, the variety of services available are gaining more space into the business and this is changing the relationship between customer and manufacturer, promoting a closer contact between both, developing a relationship and increasing customer value creation (Kamp, 2019; Coreynen et al., 2017).

The first service provided related to the automotive industry, was the maintenance service. This was naturally born with the massive production of cars and for a while was the only service provided by car manufacturers (Tate, 2017).

However, there are much more services available nowadays, and they are the main source of revenue (Genzlinger et al., 2020), the main connection-bridge to customer and retention strategy (Baines, 2013). Looking at Car Renting business model, it has appeared by the first time on 1916 and become popular in the US mainly because of the railway expansion (Fee et al., 2016). By 2019, car renting business has achieved the peak of revenue, about 89 billion $ worldwide and is expected to achieve the 119 billion $ by 2027 (attachment 4).

However, this business model is not controlled by car manufacturers, some of the main global players of this business are Enterprise, Hertz or Sixt (Brady, 2021), which are only rent a car companies, with few influences of the big manufacturers.

In regards to credit and financial services, the first car manufacturer to provide this service was General Motors Group, by 1919 (Lezotte, 2021). Then, in Europe Citroen followed GM steps and also created a credit subsidiary in 1920, which provided credit to their customers (Paribas, 2022a). After *Citroen* also *Renault* and *Peugeot* followed their steps (Paribas, 2022b).

The Car Leasing business model has appeared for the first time in 1939, in the USA, by the hand of Frank Zolman, when a pharmaceutical company requested this type of service for their salesman car-fleet (Lezotte, 2021).

However, Car Leasing only become popular on the 2000s decade, when almost 25% of the new cars produced were redirected to leasing business (Johnson & Waldman, 2010).

The after-sales service is an important service provided by many manufacturers, not only of the automotive industry, and it may generate at least three times the turnover of the original purchase, during a given product's life-cycle (Wise & Baumgartner, 2000).

Looking at car sharing business model, this is considered as contemporaneous, however the literature date it back to 1948, in Zurich, created by a housing cooperative which offered their clients a short-term car rent (Doherty et al., 1987). Later, in the 1970s, also some initiatives were gradually tested in other European countries, however, it was only short living practices (Mindur et al., 2018). In the attachment 5, we can see a table of car-sharing projects of the XX century, in Europe, USA and Asia (Mindur et al., 2018).

By 2008, in Europe, carsharing started to be offered by traditional car rental companies, such as Hertz, and then by car manufacturers as well, e.g. Daimler and car2go. By 2009, car-sharing systems already operated in 14 European countries (Mindur et al., 2018).

By 2014, the one-way car-sharing systems operated in 33 countries with about 4.8 million users and 104,000 vehicles (Shaheen & Cohen, 2016). Europe accounted 46% of the global car-sharing business. North America came second (data from Canada, Mexico, and the United States) with 34% of the global carsharing business and 23% of the fleet (Shaheen & Cohen, 2016). By 2021, the number of vehicles worldwide on carsharing business model, has achieved the 610.6 thousand (Statista, 2022).

Carpool dates to the first world war years, when USA was in the beginning of a recession and car owners started to offering seats in their cars (Cozza, 2012). After oil crises of 2005 and financial crisis of 2008, the number of users of carpooling increased, and at the same time some internet-based agencies emerged to provide ridesharing services for travelers (Cozza, 2012). Then, with the internet and the mobile-phone applications available to everyone, use carpool was suddenly much more easier, companies like BlaBlaCar, Zimride or Lyftshare accelerated the market (Amirkiaee & Evangelopoulos,

2018; Jaffe, 2015). Looking at attachment 6, we can see that trend of use of this transportation solution is positive. By 2015, the number of cars worldwide on a carpooling program was around 7.67 thousand, by 2020 was 23.16 thousand and by 2025 is expected to be around 44.98 thousand.

2.2 Generation Z

Generation Z is characterized by being born in the 1990s but raised in 2000s during the most profound changes in the century, they saw the creation of internet, smart phones, laptops, freely available networks and digital media (Dolot, 2018; Singh, 2016). Having been exposed to technology from a young age, Generation Z tends to be proficient in using various digital tools and platform (Francis & Hoefel, 2018). They often embrace new technologies and adapt quickly to changes (Amberblog, 2023).

Generation Z is known for its commitment to diversity and inclusion. They are more accepting of differences in race, gender, sexual orientation, and other characteristics (Rodriguez), and they advocate for social justice issues (Why Gen Z Values Diversity, 2021).

At the same time, Generation Z tends to value individualistic, with a stronger sense of personal expression. They are generally more pragmatic, with both complicated idealism and worries for the future.

Gen Z dream of personal career fulfillment but expect economic struggles. They are more politically and socially active, advocating for what they believe on social media (Balchandani et al., 2023).

They are more interested in belonging to an inclusive, supportive community (Balchandani et al., 2023).

In terms of health and lifestyle field, Generation Z is generally more health-conscious than previous generations. They are concerned about physical and mental well-being, and there is an increased focus on healthy lifestyles (Callaghan, 2024).

As consumers, Gen Z customers like to shop both online and in-store, giving them a variety of options to choose from, they are much more comfortable than older ones with shopping online, particularly for non-necessities beyond the typical categories of food, medicine, and household goods. Also, they are more available to use digital wallets and mobile payment options. With alternative payment methods like buy now, pay later (BNPL) and other forms of digital payment gaining popularity, these generation are leading the charge for change (staff, 2023; Costa & Gardner, 2021; Finneman & Spagnuolo, 2020).

Due to the heavily influence of social media, they tend to trust recommendations from influencers (Shaw, 2023; Kuzminov, 2023). Influencer marketing plays a significant role in

shaping their preferences and purchasing decisions (Donovan, 2024).With an abundance of information available, Generation Z prefers visually engaging content, such as short videos and images, easy to read and load quickly (Shaw, 2023; Kuzminov, 2023).

Moreover, Generation Z are socially and environmentally conscious. They tend to support brands that align with their values, including those that are sustainable, ethical, and socially responsible. And as a generation committed to its values, Gen Z expects the same of its retailers. Gen Z often choose brands that have a strong story or purpose, as well as those committed to green practices (Balchandani et al., 2023).

Growing up during economic uncertainties, Generation Z tends to be financially pragmatic, so they may be more conservative with their spending and are often concerned about financial stability (Desjardins, 2018).

As consumer is also characterized as less brand-loyal compared to previous generations. They are willing to try new brands, but these brands must align with their values and offer quality products (Balchandani et al., 2023; Gutfreund, 2016).

To finalize, Generation Z is also characterized by often values experiences over material possessions, for Gen Z, and increasingly for older generations as well, consumption means having access to products or services, not necessarily owning them (Francis & Hoefel, 2018). Gen Z users subscribe to streaming platforms instead of buying films or music. This trend extends even to services like car shares (Balchandani et al., 2023).

2.3 Determinants to use Carsharing or Carpool

There are several reasons that define the demand to use carsharing or carpool. Depending on the customer profile, company or individual, the motivations can be multiples.

Table 1 shows the available literature and studies relevant to the topic. The table includes factors such as cost savings, economic benefits, environmental concerns, convenience, but not only. These will be some of the study focus and as such, will be introduced into the conceptual model.

Regarding carsharing, in 2018, Rosa (2018) has studied the general perception of carsharing and attraction of the service in Portugal, the main factors that consumers and non-consumers value the most, and also what values, the brands present in the market, should focus on, in order to retain customers and attract new ones.

In 2019, Munzel et al. (2019) investigated if the characteristics and motives differ between B2C and P2P carsharing adopters, focusing their analysis in Netherlands. In the same year, Matia et al. (2019), developed studies around the motives for re-use of free-floating car sharing.

Then, Zhang & Li (2020) has focused the analysis on the intention of Chinese students to use carsharing, then in the year after, the same authors has extended the study to the overall population of 4 Chinese cities. In the same year Jain et al (2021) developed studies to understand the range of psycho-social factors which determine the adoption of car share.

In terms of carpool, Bachmann et al. (2018) did investigation about carpooling behavior focused on Swiss users, and later in 2023, Lowe et al. (2023) developed a study in Thailand about the behavioral influences of carpool adoption, also Gangakhedkar et al. (2023) investigated about the drivers and barriers, to the adoption of carpooling by Generation Z in India.

Looking at the studies developed about generation Z, focused on carsharing and carpool, there are already some.

The study developed by (Madalina et al., 2023), focused on Romanian users, analyzed the antecedents of electric car sharing adoption, based on two general attitudinal influencers, the environmental consciousness, and the technology embracement, with two mediators, the perceived benefits of carsharing and the importance attached to smart mobility. On this study

the model has confirmed that there is substantive effect of environmental consciousness and technology embracement, on smart mobility, however less powerful effect of the latter on electric car sharing adoption.

Also, there are studies by Pelech & Holendová (2022), conducted in Czech Republic, which assessed the influence of different generations (X, Y and Z) on their willingness to prefer a shared car, to their own car, in specifically defined situations. They analyzed the specific situations, travel to work/school, shopping and authorities travel, travel and entertainment, travel with kids to activities. The results showed that there is no significant relationship between the respondents' generation and the situation, where they might prefer a shared car to their owned car. From other perspective, a significant relationship between the generations in the situation where they would prefer a shared car to their own, was only confirmed for the use of a shared car when traveling to work or school. This significant relationship was found between Generations Y and Z.

On the studies, of Pelech (2024), which focused on examining if the brand of the car is important to car-sharing users, this study focused on 3 generations (X,Y,Z), to determine whether preferences for car-sharing attributes would differ. They found statistically significant differences across generations concerning car-sharing brand, price, equipment, appearance, propulsion, gearbox, consumption, maintenance and insurance, carefree parking, and availability only in some variables. They rated availability and price as the most important attributes of the car sharing. The brand of the car is the last attribute that car-sharing users care about.

The studies of Mavlutova et al. (2021) investigated car sharing from users' perspectives, in Latvia, and tried determine the most significant factors influencing their choice for carsharing service. The studies focused not only on generation Z, but also on generation X and Y. They concluded that younger people tend to use car-sharing services, more often, comparing generation Y and Z versus generation X and older. They also concluded the male population use this service more often, and that car-sharing service users are highly motivated by the accessibility of a car (78.8%), price (57.7%), comfort (36.5%) and possible driving distance (36.5%). Only 14.7% of respondents chose ecological footprint as a motivating factor to use a car-sharing service.

In the carpooling part, we can see one paper developed by Gangakhedkar et al. (2023), which explores the drivers and barriers to the adoption of carpooling by Generation Z, in India. This particular study used a conceptual framework, based on the extended theory of planned behavior (TPB), adding three more variables: energy saving self-identity, trust propensity and perceived risk to the original three variables. The perceived behavioral control, attitude, and trust propensity respectively showed a significant positive direct impact on the intentions to carpool.

The aim of this study is to contribute to the development of the literature trying to identify the influence of the different factors, highlighted in previous studies, on the intention to use carsharing or carpool.

Table 1 – Studies with identified factors to use carsharing/carpool:

Identification of factors	Research Target	Methodology	Authors
Directly: Subjective norm, Perceived behavioral control, Indirectly: Environmental Concern over attitude, subjective norm and perceived behavioral control	Investigate the behavior intention of Chinese college students to use carsharing through a psychological lens based on the theory of planned behavior (TPB)	Quantitative about 356 college students from four China universities	(Zhang & Li, 2020)
Directly: Attitude, Subjective norm, Perceived Behavioral Control Indirectly: Environmental Concern over attitude, subjective norm and	Expand the understanding and knowledge of Chinese people intention to use carsharing	Quantitative through 1165 surveys in four cities of China	(Li & Zhang, 2021)

perceived behavioral control			
Attitudes, Social Norms, Perceived Behavioral Control	Comprehensively explore the range of psycho-social factors which determine the adoption of car share.	Qualitative on five focus groups and 18 semi-structured interviews, conducted in Melbourne, Australia. Quantitative through 306 surveys	(Jain et al., 2021)
Directly:Attitude, Subjective Norm, perceived behavioral control Indirectly: Attitude over Environmental Aspects, over Social Aspects and over Economic Benefits	Enhance the knowledge of motives for re-use of free-floating car sharing through the theory of planned behavior	Integration of qualitative and quantitative data collection (300 surveys)	(Mattia et al., 2019)
Direct: Descriptive Norm, Behavioral Control, Personal Norm; Indirect: Trust over attitude, descriptive norm and perceived behavioral control	Investigated carpooling behavior based on a theoretical background that integrates, the theory of planned behavior, the norm activation model, and dispositional trust	Survey with a representative sample of 342 participants in Switzerland	(Bachmann et al., 2018)

Cost Savings, Convenience, Attitude toward Environment	Investigate whether characteristics and motives differ between B2C and P2P carsharing adopters, in Netherlands	Quantitative through survey to 1835 participants	(Munzel et al., 2019)
Social Influence, Hedonic motivation, Effort expectancy, Time credits as payment method	Understand the behavioral influences of carpool adoption in Thailand	Quantitative through 307 survey responses	(Lowe, 2023)
Knowledge, Convenience, Environmental, Attitude	Understand the general perception of carsharing and attraction of the service in Portugal; Understand what the main factor about carsharing is that consumers and non-consumers value the most; Understand in what values the brands present in the market should focus on, in order to retain customers and attract new ones.	Quantitative through 300 surveys responses	(Rosa, 2018)
Direct: Perceived behavioral control, attitude, and trust propensity; Indirect: Energy saving over attitude, subjective norm, perceived behavioral	Explore the drivers and barriers to the adoption of carpooling by Generation Z in India	Quantitative through 335 respondents	(Gangakhedkar et al., 2023)

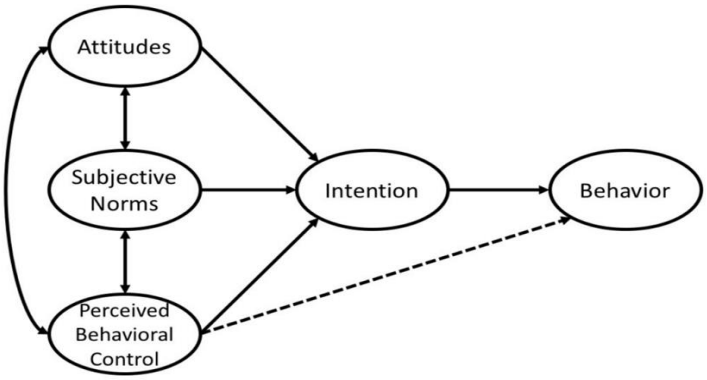
control and trust propensity			
Environmental consciousness, Technology embracement	Analyze the antecedents of electric car sharing adoption	Quantitative through questionnaire to 399 Romanian responders	(Madalina et al., 2023)
Travel to work or school (for Gen Y an Z)	Assessed the influence of different generations (X, Y, Z) on their willingness to prefer a shared car, instead of their own car, in specific situations	Quantitative through 741 questionnaires in Czech Republic	(Pelech & Holendová, 2022)
Availability and price are the most important factors, brand is the less important	Examined if the brand of the car is important to car-sharing users, analyzing generations (X, Y, Z), and what other factors are important	Quantitative through questionnaire to 694 persons	(Pelech, 2024)
Accessibility of the car, price, comfort, driving distance, ecological footprint	Analyzed the most significant factors, influencing the choice for carsharing service, by Gen Z, X and Y	Quantitative through questionnaire to 364 persons in Latvia	(Mavlutova et al., 2021)

2.3.1 Theory of Planned Behavior

The theory of planned behavior (TPB) was used in this study to support the prediction of consumers' intention to use carsharing or carpool. This theory was originally developed by Ajzen, (1991) and consists of a social and psychological model for predicting individuals' intention to engage in a certain behavior. According to this theory, the behavioral intention is formed by a combination of three primary variables: attitude, subjective norms, and perceived behavioral control.

In summary, according to (Ajzen, 1991), the combination of positive/favorable attitude of an individual and higher subjective norms, with a better perceived behavioral control, creates a stronger intention feeling on the individual to perform certain behavior.

Figure 1. The Theory of Planned Behavior model adapted from Ajzen (2005).



The research developed by Zhang & Li (2020), focused on the determinants of Chinese college students' intention to purchase a carsharing service, used the TPB as a base. This study concluded that subjective norm and the perceived behavioral control are directly and positively associated with Chinese college students' intention, to use carsharing. However, they also concluded that attitude and environmental concern have no direct correlation with the intention. By other side, environmental concern only impact indirectly their intention to use carsharing services, (through attitude, subjective norm and perceived behavioral control) (Zhang & Li, 2020).

The same authors, developed a new study in 2021, however using a multi-group analysis of different sociodemographic characteristics. According to this most recent study,

attitude, subjective norm, and perceived behavior control has influence on intention to use carsharing.

According to Jain et al. (2021) studies, revealed on the qualitative side of the research that cost, convenience and environmental concerns are important motivators for carshare adoption, however, factors like community sharing mindset, reducing/avoiding hassles related to car ownership (e.g. maintenance, insurance) and a desire to own fewer material possessions are also factors that encourage carshare adoption. Also, this study reveals that attitude, social norms and perceived behavioral control has positive and direct influence, on intention to use carsharing.

On the studies of Mattia et al. (2019), they concluded that attitude, perceived behavioral control, and subjective norm have a direct influence on the future intention to re-use carsharing service. By another hand, Attitude has also indirect influence on intention to re-use carsharing, through environmental aspects, social aspects and economic aspects.

Regarding carpooling, there were also studies developed by Bachmann et al. (2018) which investigate on what are the drivers to adopt carpool. They concluded that descriptive and personal norms, in combination with perceived behavioral control has direct and positive influence on carpooling intention. At the same time, trust has indirect influence on intention, through attitude, descriptive norm and perceived behavioral control (Bachmann et al., 2018).

Analyzing the literature available about the Theory of Planned Behavior and the determinants to use carsharing and carpooling, we can see that there is a lack of studies combining carshare and carpool in the same paper, focusing on generation Z and studying frugality as determinant.

Also, there is no studies which combine the determinants Attitude, Subjective Norm, Perceived Behavior Control, Price, Convenience, Ecological Awareness and Frugality, in the same paper.

Having said that and taking in consideration the importance of generation Z as current and future consumers, our research purpose will focus on understanding what are the individual motivations/drivers to choose carsharing or carpool, and how can we expand the TPB to predict the purchase of carsharing or carpool service.

To achieve our research target, we will use as support the three basic variables of the TPB model, Subjective norm, Attitude and Perceived behavioral control.

Looking at the reasons, that motivates to choose TPB for this research was because emphasizes the roles of attitudes toward the behavior intentions, when it comes to carsharing and carpooling, individuals' attitudes toward these practices can significantly influence their likelihood of adopting them. At the same time TPB considers subjective norms, which involve perceptions of social pressure and approval from significant others. In the context of carsharing and carpooling, understanding how social influences impact individual decisions is essential, so this point was also important to decide on choosing TPB for this research.

By another hand, TPB incorporates the concept of perceived behavioral control, reflecting an individual's belief in their ability to perform the behavior. For carsharing and carpooling, factors such as convenience, accessibility, and perceived ease of use can influence perceived behavioral control, so for that reason we decided to choose this theory.

Taking in consideration the characteristics of generation Z, highlighted above, like strong sense of frugality, interesting about sustainability and green products, we found interesting to add "Frugality" and "Ecological Awareness" to the variables to be researched.

Taking in consideration the current world economic situation, inflation and in some cases lower salaries, for the people who are now on the career beginning, we though "Price" could be as well a good variable to de studied on this paper.

Regarding the "Convenience" variable, we believed this would be interesting to be studied because current society, and specifically new generations live by the second, and are changing the future of shopping where convenience and faster delivery hold prominence in choosing their online shopping destinations (Digital, 2023).

Also, new generations value the easy access to shopping, mainly using digital platforms, at comfort zone of their houses (Balchandani et al., 2023).

Attitude

Attitude is the first determinant of behavioral intention in the TPB model. It refers to an individual's evaluation of certain behavior, here the individual will evaluate if agrees or disagrees with certain behavior. If an individual has a more favorable attitude about a certain behavior, the more likely the individual will engage in that behavior (Ajzen, 1991).

From the literature review (table 1), we can see that there are authors affirming that attitude has no direct correlation with the intention to use carsharing or carpool (Zhang & Li, 2020; Bachmann et al. 2018). However, (Li & Zhang, 2021; Mattia et al., 2019; Jain et al. 2021) affirms that Attitude has direct impact on intention to use carsharing.

By another hand, the studies developed by Gangakhedkar et al. (2023), which analyzed the carpooling intentions of Generation Z, in India, they concluded that attitude has positive influence on intention to use carpool.

The different opinions and visions, but also the lack of investigation about carshare and carpool in the same paper, about generation Z, turns further investigation crucial.

H1: Attitude has a positive influence on intention to use carpool or carsharing service, by generation Z.

Subjective norms

The subjective norm is the second determinant of behavioral intention in the TPB model. According to (Ajzen, 1991), this determinant reflects the impact of social influence on consumer behavior. Inside this determinant, includes all the social pressure experienced by an individual to behave in a specific manner. This social pressure can be from many sources, from friends, family, work colleagues or even by social networking apps.

From investigations of Zhang & Li (2020), Li & Zhang (2021) and Mattia et al. (2019), subjective norm is directly and positively associated with intention to use carsharing services. On carpool side, from studies of Bachmann et al. (2018) subjective norms impact on intention to use it.

In terms of generation Z studies, Gangakhedkar et al. (2023), concluded that subjective norm doesn´t have direct influence, on intention to use carpool, by generation Z, in India.

H2: Subjective norms has a positive influence on intention to use carpool or carsharing service, by generation Z.

Perceived behavioral control

The third determinant of the TPB model is the "Perceived Behavioral Control" and in summary is the perceived ability of individuals to perform a behavior. Inside this determinant is included the availability of the necessary resources and opportunities to perform a specific behavior (Ajzen, 1991).

Has from investigations presented above, Perceived Behavioral Control is directly and positively associated with intention to use carsharing services (Zhang & Li, 2020; Li & Zhang, 2021; Jain et al., 2021; Mattia et al., 2019) and carpooling (Bachmann et al., 2018).

On the studies about generation Z, the studies of Gangakhedkar et al. (2023), about carpooling adoption by generation Z in India, concluded that perceived behavioral control influence on intention to use it.

All the studies above are considering both business models in separate, once we intend to study both business models in the same research, we consider interesting to proceed with further investigation.

H3: Perceived Behavioral Control directly influence intention to use carpool or carsharing service, by generation Z.

The theory of planned behavior can be extended by adding other variables, to better understand the determinants that influence the intention, to use carsharing or carpool, by generation Z. Then, we added price, convenience, ecological awareness, and frugality.

2.3.2 Other variables that influence the intention to use carsharing or carpool

For the extension of theory of planned behavior, we selected the price, convenience, ecological awareness and frugality, because these determinants belong to some of generation Z characteristics. So, it makes sense to develop the studies analyzing determinants that characterize the specific generation we are focusing on.

Price

In the current economic situation, with fuel costs going up and in consequence a high inflation rate all over the world, the price of transportation is clearly a point which users really care about. On car share business model, users only pay for booked hours, and kilometers driven, and so this reflects in significant cost savings compared to private vehicle ownership (e.g. capital cost, fuel, maintenance, insurance, parking) (Duncan, 2011).

According to the 2019 literature review of car share motivations, over 60 per cent of the users identify cost savings as key determinant to use car share (Munzel et al., 2019).

Also, studies of Mattia et al. (2019) on the qualitative side of the research, indicated that users consider carsharing as cost effective.

On the studies of Pelech (2024) focused on three generations (X,Y,Z), to determine whether preferences for car-sharing attributes would differ. They found that for all the three generations (including the generation Z), the price is one of the attributes that are considered as important.

As far as we know, there is no research which studied the influence of price on intention to purchase a carpool or a carshare service, in the same research, about generation Z, so we built the following hypothesis:

H4: Price has a positive influence on the intention to use carpool or carsharing service, by generation Z.

Convenience

Convenience can be a significant factor on the purchase of a transportation service using car. Customers who value convenience, may be more likely to choose a car sharing service because it allows them to have access to a vehicle, when needed without the hassle of owning and maintaining a personal vehicle.

Studies developed in 2019, revealed that convenience is one of the main motivators to purchase a car share service (Munzel et al., 2019). However, convenience is a complex term and can have multiple interpretations depending on the user. While some relate convenience to time-efficiency, others relate it to single versus multi-modal trips, distance or purpose of the journey (Buys & Miller, 2011).

Rosa (2018) has concluded that for users and non-users, both consider convenience as a determinant to choose carsharing, as transportation option.

There are no studies that combine carsharing or carpool in the same study, with the determinant convenience, for generation Z. But there are studies that concluded that convenience is one of the determinants, that influence the impulsive buying behavior, by Generation Z (Lina et al., 2022).

With the introduction of this variable on the re-search, we aim to go deeper on the convenience definition, for customers of carsharing or carpool. Also, we aim to analyze the influence of the convenience, on the intention to purchase a service of this type. Looking at the car sharing example, and trying to extrapolate for both business models, we suggest the following hypothesis:

H5: Convenience has a positive influence on the intention to use carpool or carsharing service, by generation Z.

Ecological awareness

With the automobile transport servitization migration, the number of vehicles needed, reduces significantly, mainly because of business models like car sharing or carpooling once typically involve a fleet of vehicles shared among a multiple user.

According to Martin et al. (2010) researches, in 2010, which focused on car sharing, a single car shared replaces nine to thirteen privately owned cars. However, from the studies developed by Kanatli & Karaer (2022) they warn that the servitization over selling a car is environmental better only in case a target population stays in equilibrium. If a population begins to migrate from public transport services, like bus and train, the scenario may change.

Looking at the literature presented on table 1, the studies of Zhang & Li, (2020), Li & Zhang, (2021), defines environmental concerns as impacting indirectly the intention to use a carsharing service. Also, studies of Mattia et al. (2019) and Munzel et al. (2019) highlights that attitude over environmental aspects, influence indirectly the intention to use carsharing.

The studies developed by Hartl et al., (2018) pointed out that sustainability is perceived by the customers as a bonus or benefit, and not a key motivator to buy a carsharing service.

Looking at what was developed about the relation of carsharing or carpool, with ecological ways of life, and generation Z, the study developed by Madalina et al., (2023), confirmed that there is substantive effect of environmental consciousness on smart mobility, however less powerful effect of the latter on electric car sharing adoption.

Having as base, the literature presented above regarding car sharing, we consider interesting to further investigate about carshare and carpool inside the same research.

With this we have created the following hypothesis:

H6: Ecological awareness has a positive influence on the intention to use carpool or carsharing service, by generation Z.

Frugality

Frugality is deeply implicit in some religions, since American Indian, Buddhism, Christian or for example Hindu. As concept, frugality is a lifestyle trait reflecting disciplined acquisition and resource fulness in product and service use. The ones who have the frugal lifestyle, doesn´t intend to spend more than they have. They sacrifice a series of short-term purchases to achieve a certain long-term goal. However this is not necessarily related to environmental concerns (Lastovicka et al., 1999).

Observing generation Z, there are no studies about this generation and the relation of frugality as determinant to use carsharing or carpool, however through the studies of Fromm & Read, (2018), frugality sense was developed on this generation, after the exposed to financial crashes and the multiple global recessions.

From our investigation, frugality have never been studied as determinant to use carsharing or carpool, and so we consider interesting add this variable to our research:

H7: Frugality has a positive influence on the intention to use carpool or carsharing service, by generation Z.

Summarizing, there is no developed studies about generation Z yet, using theory of planned behavior, focusing on carsharing neither combining both business models, carsharing and carpool. Also, there are no studies combining the influence of price, convenience, ecological awareness and frugality in the same paper.

The study has as main objective understand the influence of the different factors, on the intention to use carsharing or carpool.

Studying the literature review, it was verified the role of the different determinants and the lack of consensus about the influence of each one, on the intention to use carsharing or carpool. With the identified necessity to further investigate on this theme, it was developed the conceptual model (figure 2) and the following investigation hypothesis (table 2).

Table 2 – Investigation Hypothesis

Hypothesis	Description
H1	Attitude has a positive influence on intention to use carpool or carsharing service, by generation Z
H2	Subjective norms has a positive influence on intention to use carpool or carsharing service, by generation Z
H3	Perceived Behavioral Control has a positive influence on intention to use carpool or carsharing service, by generation Z
H4	Price has a positive influence on the intention to use carpool or carsharing service, by generation Z
H5	Convenience has a positive influence on the intention to use carpool or carsharing service by generation Z
H6	Ecological awareness has a positive influence on the intention to use carpool or carsharing service, by generation Z
H7	Frugality has a positive influence on the intention to use carpool or carsharing service, by generation Z

3. Methodology

The aim of this study is to understand the influence of different factors on the intention to use carsharing or carpool, exploring the direct effects of each one, using the theory of planned behavior as base, and extending it to price, convenience, ecological awareness and frugality determinants.

On this chapter we will present the conceptual model to be used on this research, taking in consideration the hypothesis developed on the last chapter.

Following the hypothesis presented, the conceptual model of figure 2 was developed, using as base the research and literature review.

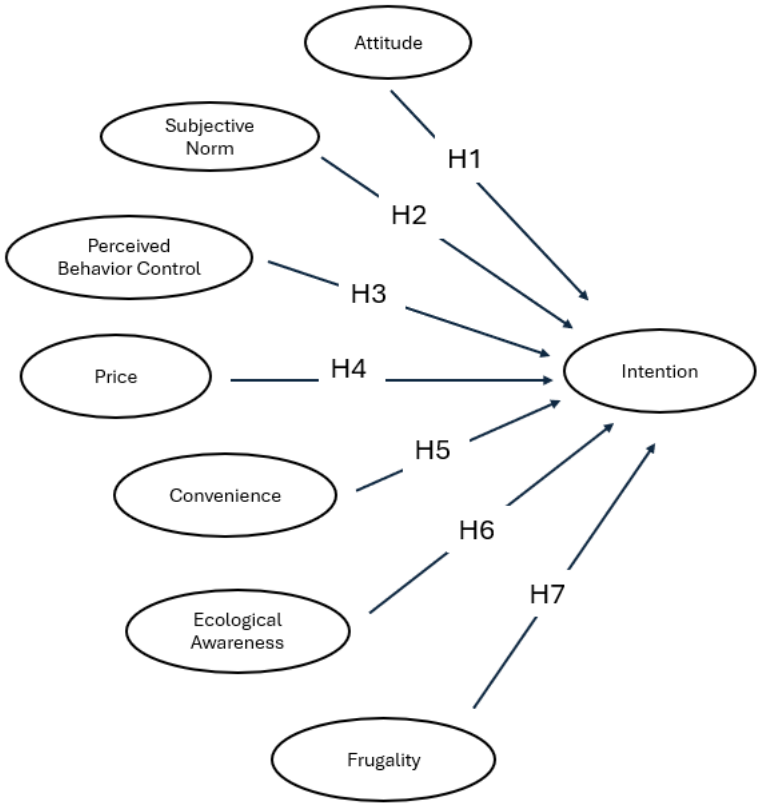


Figure 2: Conceptual Model

To test the research hypothesis and answer the study questions, stated on introduction, a quantitative approach will be followed. Our study focus is to understand the main

motivations to use car sharing and carpool, specifically by generation Z, so because of that will concentrate on persons born between 1996 and 2010.

The quantitative research was the one selected because is a more objectivist one, it emphasizes the measurement and analysis of causal relationships between isolated variables, within a framework which is value-free, logical, reductionistic, and deterministic, based on a priori theories. At the same time, qualitative measurement is more focused on inductive rational, search for patterns, makes minor use of numerical indices and is less objective (Yilmaz, 2013). Several authors that also studied carsharing and carpool business models, Zhang & Li (2020), Li & Zhang (2021), Bachmann et al (2018), Munzel et al (2019), Lowe (2023), Rosa (2018) and Gangakhedkar et al (2023) has used the same methodology. Therefore, a survey was used to collect the data.

For this purpose, a survey was launched (see attachment 7). Before of the survey publishment, we performed a pre-test, through 10 different persons. However, the perception of the questions was clear, so it was not performed any change.

The data were collected using Amazon Mturk platform but also on Portuguese high schools and universities.

MTurk is a crowdsourcing platform used to recruit persons to participate in research. The constructs developed were adapted and based on the research studies, presented on the literature review.

There were two types of questionaries, one for people belonging to generation Z, which is under-age, translated to Portuguese and launched on Portuguese high schools. Then, there was another one, also for people belonging to generation Z but adults, however in English and launched on the Mturk platform, on several countries, and on Portuguese universities. Both questionaries had the same content and questions, only differing on the language, Portuguese or English.

The survey is divided into 3 main parts: the first one, where it was questioned to select one of the services, carpool or carsharing, once all the answers will be linked to the service selected; the second part evaluate the influence of the determinants into the intention to use carsharing or carpool; and a third one where it was collected the sociodemographic characteristics of the sample.

All items were measured using a 5-point Linkert scale, where (1) = I totally disagree and (5) = I totally agree.

Table 3: Constructs

Variable	Item	Authors
Attitude (AT)	AT1: I think that carsharing/carpool is convenient	(Zhang & Li, 2020)
	AT2: I think that carsharing/carpool is economic	
	AT3: I think that carsharing/carpool is flexible	
	AT4: I think that carsharing/carpool is safe and comfortable	
	AT5: I think that carsharing/carpool benefits the environment	
Subjective Norm (SN)	SN1. My friends or family (who are important to me) support me if I consider carsharing/carpool as an option	(Zhang & Li, 2020)
	SN2. My friends or family (who are important to me) think i should use carsharing/carpool	
	SN3. My friends or family (who are important to me) all use or know carsharing/ carpool	
	SN4. I will make the same choice as my friends and family (who are important to me), regarding whether they use carsharing/carpool, or not	
Perceived Behavioral Control (PBC)	PBC1. I think my driving skills make me fully competent to use carsharing/carpool	(Zhang & Li, 2020)
	PBC2. I can find the vehicles easily if i want to use carsharing/carpool	
	PBC3. The process to access carsharing/carpool is easy and uncomplicated to accomplish	
Price (Pr)	PR1. I like carsharing/carpool because I think the users pay less	(Guiot & Roux, 2010; (Padmavathy et al., 2019)
	PR2. I feel that the users of carsharing/carpool spend less money	
	PR3. I would use carsharing/carpool because this way, I think I can use car by a lower cost	
	PR4. I would use carsharing/carpool because allows me to buy more things, once I pay less	

Convenience (Cv)	Cv1. Using carsharing/carpool is/would be easy to book and access a car	(Rosa, 2018)
	Cv2. Using carsharing/carpool I have/would always have a car available near me	
	Cv3. Using carsharing/carpool I do not/would not waste much time reaching my destination	
	Cv4. Using carsharing/carpool, I can/could choose the car that best meets my travel needs	
	Cv5. Using carsharing/carpool I have/would have privacy	
	Cv6. Using carsharing/carpool I travel/would travel comfortably	
Ecological Awareness (EA)	EA1. I consider the influence of my actions on the environment when i make decisions	(Zhang & Li, 2020)
	EA2. I worry about the environmental destruction and waste of natural resources	
	EA3. I am willing to bear some inconveniences for the sake of environment	
	EA4. Current environmental protections are insufficient	
Frugality (Fr)	Fr1. If we correctly manage our resources, we for sure will save money in the long run	(Lastovicka et al., 1999)
	Fr2. There is some car travels that could be shared by several persons	
	FR3. Making better use of my resources makes me feel good	
	FR4. If i can share a car with someone else, there's no sense in buying just one for me	
	Fr5. I believe in being careful about how i spend my money	
	Fr6. I discipline myself to get the most output of my money	
	Fr7. I'm willing to postpone a purchase I want, to save money.	
	Fr8. There are things I resist to buy today, so I can save for tomorrow	
Intention (Int)	INT1: I am willing to use carsharing/carpool	(Zhang & Li, 2020)
	INT2: I plan to use carsharing/carpool	
	INT3: I´m not going to buy private cars but use carsharing/carpool	

The data were collected through survey published between 14-Feb-2024 and 02-June-2024, on 3 different high schools and universities, but as well on the Mturk platform. We collected 462 valid answers and used 275 for the analysis, because those ones were related to generation Z age range, once our study is focused on this generation.

To analyze the data were used the PLS-SEM method through Smart PLS 4.0 software.

This methodology has been used in several studies, once it allows to study complex models, measuring direct relations between different variables (Hair et al., 2014; Nitz et al., 2016). Due to this, the PLS model was the one selected for this study (Hair, 2014; Nitz, 2016).

4. Results

On this chapter, we will characterize the sample and the data collected will be analyzed.

We did validity and reliability tests, and then hypothesis was tested through the PLS model. After that, a multi-group analysis was performed, to increase knowledge about possible differences between carpool and carsharing responders.

4.1. Sample Characterization

The sociodemographic characteristics of the sample are shown in Table 4. The same number of male and female persons has answered to this survey, male (N=134, 49%), female (N=134, 49%) and the rest did not specify (N=7, 3%).

Regarding the years which the respondents were born, once this analysis is focusing on generation Z, 100% of our answers are from people born between 1996 and 2010 (N=275, 100%).

In terms of academic qualifications, the largest number of respondents has a bachelor's degree (N=141, 51%), then high school education (N=100, 36%), and then Master/Postgraduate education (N=22, 8%).

Regarding net monthly income, the majority answered that they had no income (N=100, 36%), which can be justified by the fact that young people represent a high portion of the sample, once we launched this survey on public high schools and universities. However, many participants reported an income between €1400 - €2099 (N=42, 15%), and others €2100 - €2799 (N=29, 11%).

The main origin country of the respondents is from United States of América (N=120, 44%), through the survey launched on Mturk. However, we have also big % of answers from Portugal (N=108, 39%), since the questionnaire in Portuguese, was shared in Portuguese high schools and universities.

Looking at the other countries that also answered the survey through the MTurk platform, we obtained responses from several countries, such as UK (N=31, 11%), Brazil (N=5, 2%) and Germany (N=4, 1%).

Also, is important to highlight that this survey was divided between Carpool service and Carsharing service, we have received 93 answers and 182 answers respectively.

Table 4 – Sociodemographic characteristics of the sample

Characteristics (N=275)	n	%
Gender		
Female	134	49%
Male	134	49%
Prefer not to say	7	3%
Age Range		
1996 - 2010	275	100%
Academic Level		
PHD	2	1%
Master/Post-Graduate	22	8%
Degree	141	51%
High School	100	36%
Middle School	9	3%
Primary School	1	0%
Monthly Income		
More than 3499€	37	13%
2800€ - 3499€	23	8%
2100€ - 2799€	29	11%
1400€ - 2099€	42	15%
800€ - 1399€	28	10%
up to 800€	16	6%
I do not have a salary	100	36%

Nationality		
Angola	3	1%
Brazil	5	2%
British/ United Kingdon	31	11%
Cabo-Verde	1	0%
Germany	4	1%
Guinee	1	0%
Morocco	1	0%
Portugal	108	39%
Spain	1	0%
United States of America	120	44%

4.2. Reliability and validation of the measurements

To verify the reliability and validity of the constructs were used several indicators: the individual reliability of the items, compound reliability (FC), Cronbach's alpha α (AC) and the AVE (Average Variance Extracted) criterion (Hair et al, 2014, 2020).

The results obtained by the PLS-SEM, represented in Table 5, reveal the individual reliability of the construct indicators, and all the items reached values elevated to 0.5 (Hair et al, 2014, 2020), then none of the items were removed.

Considering 0.7 the minimum acceptable value for Cronbach's α, the reliability of the constructs is confirmed (Nunnally, 1967). The values are between 0.763 and 0.888.

Composite reliability has been achieved, as the values are between 0.774 and 0.892, all higher than the recommended 0.7 (Bagozzi & Yi, 1988).

To Measure Convergent Validity, the stroke criterion was used, which should be greater than 0.5 (Fornell & Larcker, 1981). Validity was achieved, for all constructs except Frugality, as the AVE of all constructs exceeded 0.5, except Frugality with only 0.493.

Table 5 – Model Reliability and Validity (first analysis)

Variable	Item	Individual Reliability (Factor Loading)	Mean	Standard Deviation	Cronback´s Alfa	Composite Reliability (rho_a)	AVE
Attitude (AT)	AT1	0.804	4.204	0.792	0.784	0.795	0.538
	AT2	0.696	4.116	0.879			
	AT3	0.719	4.058	0.864			
	AT4	0.776	3.924	0.960			
	AT5	0.662	4.084	0.944			
Subjective Norm (SN)	SN1	0.760	3.938	0.894	0.828	0.839	0.660
	SN2	0.850	3.705	1.074			
	SN3	0.850	3.415	1.423			
	SN4	0.786	3.618	1.234			
Perceived Behavior Control (PBC)	PBC1	0.745	3.720	1.202	0.763	0.774	0.680
	PBC2	0.865	3.749	1.058			
	PBC3	0.857	3.709	1.046			
Price (Pr)	Pr1	0.799	3.789	0.976	0.833	0.838	0.666
	Pr2	0.795	3.775	1.023			
	Pr3	0.835	3.869	0.956			
	Pr4	0.832	3.745	1.048			
Convenience (Cv)	Cv1	0.818	3.818	0.978	0.888	0.892	0.643
	Cv2	0.793	3.753	1.081			
	Cv3	0.777	3.833	1.017			
	Cv4	0.735	3.920	0.977			
	Cv5	0.845	3.749	1.163			

	Cv6	0.848	3.895	1.034			
Ecological Awareness (EA)	EA1	0.857	3.927	1.003	0.792	0.820	0.617
	EA2	0.800	4.000	0.984			
	EA3	0.823	3.836	1.023			
	EA4	0.646	3.935	1.000			
Frugality (Fr)	Fr1	0.630	4.084	0.855	0.854	0.865	0.493
	Fr2	0.619	4.113	0.929			
	Fr3	0.742	4.069	0.914			
	Fr4	0.655	3.538	1.216			
	Fr5	0.667	4.131	0.877			
	Fr6	0.700	3.949	1.074			
	Fr7	0.798	3.949	0.952			
	Fr8	0.784	4.011	0.959			
Intention (Int)	INT1	0.857	3.876	1.058	0.827	0.830	0.744
	INT2	0.896	3.720	1.205			
	INT3	0.833	3.324	1.308			

To solve the issue of the AVE below 0.5, for construct frugality, the item Fr2 were removed from the model (one was the one with lower individual reliability value), and the analysis was re-runed. The results are presented on the table 6 below.

Table 6 – Model Reliability and Validity (2nd analysis without item Fr2)

Variable	Item	Individual Reliability (Factor Loading)	Mean	Standard Deviation	Cronback´s Alfa	Composite Reliability (rho_a)	AVE
	AT1	0.804	4.204	0.792	0.784	0.795	0.538
	AT2	0.696	4.116	0.879			
Attitude (AT)	AT3	0.719	4.058	0.864			
	AT4	0.776	3.924	0.960			
	AT5	0.662	4.084	0.944			
Subjective Norm (SN)	SN1	0.760	3.938	0.894	0.828	0.839	0.660
	SN2	0.850	3.705	1.074			
	SN3	0.850	3.415	1.423			
	SN4	0.786	3.618	1.234			
Perceived Behavior Control (PBC)	PBC1	0.745	3.720	1.202	0.763	0.774	0.680
	PBC2	0.865	3.749	1.058			
	PBC3	0.857	3.709	1.046			
Price (Pr)	Pr1	0.799	3.789	0.976	0.833	0.839	0.666
	Pr2	0.795	3.775	1.023			
	Pr3	0.835	3.869	0.956			
	Pr4	0.832	3.745	1.048			
Convenience (Cv)	Cv1	0.818	3.818	0.978	0.888	0.892	0.643
	Cv2	0.783	3.753	1.081			
	Cv3	0.777	3.833	1.017			
	Cv4	0.735	3.920	0.977			
	Cv5	0.845	3.749	1.163			
	Cv6	0.848	3.895	1.034			

Ecological Awareness (EA)	EA1	0.857	3.927	1.003	0.792	0.820	0.617
	EA2	0.800	4.000	0.984			
	EA3	0.823	3.836	1.023			
	EA4	0.646	3.935	1.000			
	Fr1	0.637	4.084	0.855	0.847	0.857	0.518
	Fr2	-	-	-			
	Fr3	0.747	4.069	0.914			
	Fr4	0.653	3.538	1.216			
Frugality (Fr)	Fr5	0.672	4.131	0.877			
	Fr6	0.715	3.949	1.074			
	Fr7	0.803	3.949	0.952			
	Fr8	0.792	4.011	0.959			
Intention (Int)	INT1	0.857	3.876	1.058	0.827	0.830	0.744
	INT2	0.896	3.720	1.205			
	INT3	0.833	3.324	1.308			

The validity has been reached, since the AVE of all constructs exceed the appropriate value, ranging from 0.518 and 0.744.

To evaluate discriminant validity, the Fornell and Larcker criterion was used, which. confirms its validity if the square root of the AVE is greater than the correlations of the constructs (Fornell & Larcker, 1981). As depicted in Table 7, the square root of the AVE for each variable (indicated in bold) is greater than the correlations between the others constructs, however this do not happen for Frugality and Subjective Norm constructs. Thus, according to this, we will need to perform changes in the model to understand why the reason this.

Table 7 – Fornell and Larcker Criterium (without item Fr2)

	AT	Cv	EA	Fr	INT	PBC	Pr	SN
AT	**0.733**							
Cv	0.679	**0.802**						
EA	0.590	0.595	**0.786**					
Fr	0.647	0.655	0.743	**0.720**				
INT	0.632	0.760	0.622	0.701	**0.862**			
PBC	0.597	0.775	0.509	0.595	0.708	**0.824**		
Pr	0.648	0.658	0.673	0.632	0.630	0.597	**0.816**	
SN	0.684	0.763	0.579	0.644	0.817	0.744	0.645	**0.812**

To solve this problem, several tests were developed. It was noticed, through cross loadings check in PLS 4, that item Fr4 it was loading more on Intention construct than on frugality, then this item was removed. On Subjective norm, all items were loading properly into the own construct, so we decided to remove the item with lower individual reliability, the SN1.

After removing those items, the square root of the AVE for each variable (indicated in bold) is greater than the correlations between the others constructs, as can be seen on Table 8 below. Thus, according to this criterion, there is discriminant validity.

Table 8 – Fornell and Larcker Criterium (without item Fr2, Fr4 and SN1)

	AT	Cv	EA	Fr	INT	PBC	Pr	SN
AT	**0.733**							
Cv	0.679	**0.802**						
EA	0.590	0.595	**0.786**					
Fr	0.610	0.594	0.697	**0.758**				
INT	0.632	0.760	0.622	0.607	**0.862**			
PBC	0.597	0.775	0.509	0.507	0.708	**0.824**		
Pr	0.648	0.658	0.673	0.579	0.630	0.597	**0.816**	
SN	0.645	0.750	0.562	0.523	0.819	0.749	0.633	**0.847**

Once more items were removed from the model, find below on table 9, an update to table 6, but now removing items Fr2, Fr4 and SN1.

Table 9 – Model Reliability and Validity (3rd analysis without item Fr2, Fr4 and SN1)

Variable	Item	Individual Reliability (Factor Loading)	Mean	Standard Deviation	Cronback´s Alfa	Composite Reliability (rho_a)	AVE
Attitude (AT)	AT1	0.804	4.204	0.792	0.784	0.795	0.538
	AT2	0.696	4.116	0.879			
	AT3	0.719	4.058	0.864			
	AT4	0.776	3.924	0.960			
	AT5	0.662	4.084	0.944			
Subjective Norm (SN)	SN1	-	-	-	0.804	0.810	0.718
	SN2	0.854	3.705	1.074			
	SN3	0.872	3.415	1.423			
	SN4	0.815	3.618	1.234			
Perceived Behavior Control (PBC)	PBC1	0.745	3.720	1.202	0.763	0.774	0.680
	PBC2	0.865	3.749	1.058			
	PBC3	0.857	3.709	1.046			
Price (Pr)	Pr1	0.799	3.789	0.976	0.833	0.838	0.666
	Pr2	0.796	3.775	1.023			
	Pr3	0.835	3.869	0.956			
	Pr4	0.832	3.745	1.048			
Convenience (Cv)	Cv1	0.818	3.818	0.978	0.888	0.892	0.643
	Cv2	0.783	3.753	1.081			
	Cv3	0.777	3.833	1.017			
	Cv4	0.735	3.920	0.977			
	Cv5	0.845	3.749	1.163			

Ecological Awareness (EA)	Cv6	0.848	3.895	1.034			
	EA1	0.857	3.927	1.003	0.792	0.820	0.617
	EA2	0.800	4.000	0.984			
	EA3	0.823	3.836	1.023			
	EA4	0.646	3.935	1.000			
Frugality (Fr)	Fr1	0.693	4.084	0.855	0.852	0.862	0.574
	Fr2	-	-	-			
	Fr3	0.788	4.069	0.914			
	Fr4	-	-	-			
	Fr5	0.734	4.131	0.877			
	Fr6	0.693	3.949	1.074			
	Fr7	0.817	3.949	0.952			
	Fr8	0.813	4.011	0.959			
Intention (Int)	INT1	0.857	3.876	1.058	0.827	0.830	0.744
	INT2	0.896	3.720	1.205			
	INT3	0.833	3.324	1.308			

The individual reliability of the construct indicators, and all the items reached values elevated to 0.5 (Hair et al., 2014, 2020). then none of the items were removed. The Cronbach's α values are all above 0.7, then reliability of the constructs is confirmed (Nunnally, 1967).

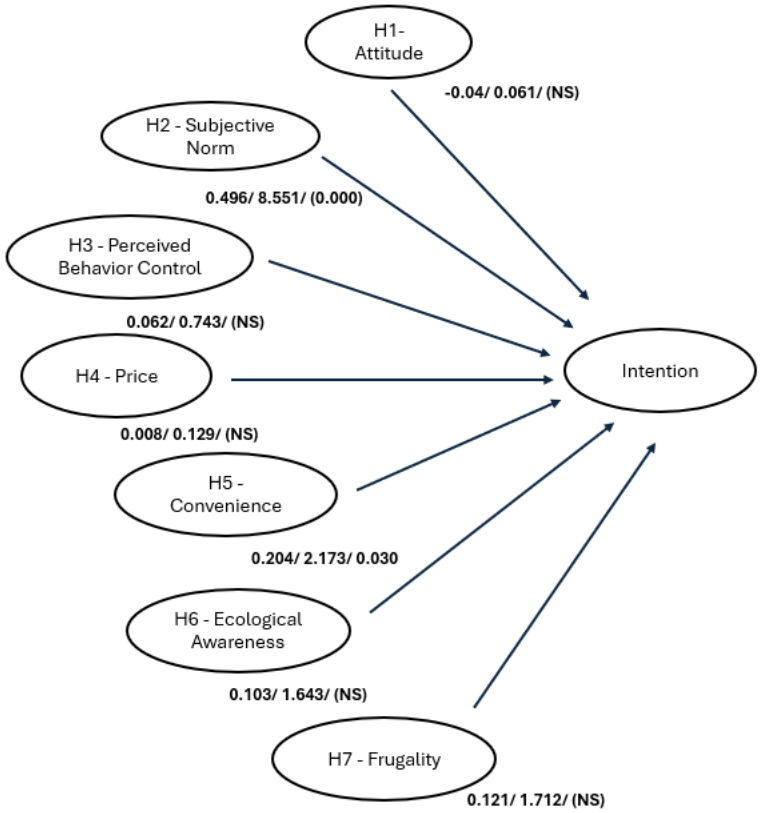
Composite reliability has been achieved, as the values are all above the recommended 0.7 (Bagozzi & Yi, 1988). Validity was achieved, for all construct as the AVE of all constructs exceeded 0.5 (Fornell & Larcker, 1981).

4.3. Hypothesis test

After verifying the validity of the items, the hypothesis test was carried out using the bootstrapping procedure with 5000 samples.

The figure below, and the table 10, show us the results for the coefficients, the values for t and p. The coefficients are between -1 and +1, and this indicates if the behavior between variables is positive or negative. The relationship between the variables will be as strong, as the Beta coefficients are closer to -1 and +1.

Figure 3: Results of the conceptual model (Beta coefficient/ t value/ p value)



Note: Beta Coefficients | T value | P value

The results of the determination coefficient show us that the constructs, attitude, subjective norm, perceived behavioral control, price, convenience, ecological awareness and frugality explains 74.6% of the variance of intention to use carpool or carsharing (R square).

The hypothesis H1 proposed that attitude influence in a positive way, the intention to use carsharing/carpool, by generation Z. The results don´t confirm that positive relation, with the coef=-0.04 and p = 0.951, so higher than 0.05, meaning not significant, the hypothesis was rejected.

The hypothesis H2 proposed that subjective norm influence in a positive way, the intention to use carsharing/carpool, by generation Z. The results confirm that positive relation, with the coef=0.496 and p = 0.000 (meaning significant), the hypothesis was confirmed.

The hypothesis H3 proposed that perceived behavior control influence in a positive way, the intention to use carsharing/carpool, by generation Z. The results confirm that positive relation, with the coef=0.062, but the p = 0.458, so higher than 0.05. meaning not significant, the hypothesis was rejected.

The hypothesis H4 proposed that price influence in a positive way, the intention to use carsharing/carpool, by generation Z. The results confirm that positive relation, with the coef=0.008, but the p = 0.897, so higher than 0.05, meaning not significant, the hypothesis was rejected.

The hypothesis H5 proposed that convenience influence in a positive way, the intention to use carsharing/carpool, by generation Z. The results confirm that positive relation, with the coef=0.204 and p = 0.030 (meaning significant), the hypothesis was confirmed.

The hypothesis H6 proposed that ecological awareness influence in a positive way, the intention to use carsharing/carpool, by generation Z. The results confirm that positive relation, with the coef=0.103, but the p = 0.100, so higher than 0.05, meaning not significant, the hypothesis was rejected.

The hypothesis H7 proposed that frugality influence in a positive way, the intention to use carsharing/carpool, by generation Z. The results confirm that positive relation, with the coef=0.121, but the p = 0.087, so higher than 0.05, meaning not significant, the hypothesis was rejected.

Table 10. Hypothesis test

Hypothesis	Coefficient	T value	P value
H1 - AT->INT	-0.004	0.061	0.951
H2 – SN>INT	0.496	8.551	0.000
H3 – PBC>INT	0.062	0.743	0.458
H4 – Pr> INT	0.008	0.129	0.897
H5 – Cv>INT	0.204	2.173	0.030
H6 – EA>INT	0.103	1.643	0.100
H7 – Fr>INT	0.121	1.712	0.087

R square Intention = 0.746

4.4. Multi-Group Analysis

To test the results of different groups, a multigroup analysis (MGA) was conducted. Although the comparison between groups was not the main target of this study, this was carried out to complete the research.

The data is split between carpool and carsharing, meaning, the persons that has chosen the service carpool to answer the survey (93 responders) and the ones who has chosen carsharing (182 responders). This analysis was carried out, to verify possible differences between the two services, and understand what the determinants with bigger influence, in the intention to use carpool and carsharing, separately.

The coefficients per service and the differences are stated on the table 11 below.

Table 11 – Multi-Group Analysis PLS

Hypothesis	Carpool Coefficient	Carpool p value	Carsharing Coefficient	Carsharing p value	Both Groups Coefficient	Both Groups p value
H1: Attitude -> Intention	0.063	0.463	-0.018	0.825	-0.004	0.951
H2: Subjective Norm -> Intention	0.386	0.000	0.518	0.000	0.496	0.000
H3: Perceived Behavioral Control -> Intention	-0.003	0.973	0.104	0.364	0.062	0.458
H4: Price -> Intention	0.04	0.586	-0.021	0.811	0.008	0.897
H5: Convenience -> Intention	0.322	0.009	0.152	0.193	0.204	0.030
H6: Ecological Awareness -> Intention	0.069	0.510	0.152	0.042	0.103	0.100
H7: Frugality -> Intention	0.127	0.266	0.096	0.27	0.121	0.087

Table 12: Coefficient Difference

Hypothesis	Carpool Coefficient	Carsharing Coefficient	Coefficient Difference	P value (Significance)
H1: Attitude -> Intention	0.063	-0.018	0.081	0.951
H2: Subjective Norm -> Intention	0.386	0.518	-0.132	0.000
H3: Perceived Behavioral Control -> Intention	-0.003	0.104	-0.107	0.458
H4: Price -> Intention	0.04	-0.021	0.061	0.897
H5: Convenience -> Intention	0.322	0.152	0.17	0.030
H6: Ecological Awareness -> Intention	0.069	0.152	-0.083	0.100
H7: Frugality -> Intention	0.127	0.096	0.031	0.087

The results suggest some differences between the coefficients and determinants of both groups. When looking at carpool group, this one is in line with both groups analysis, subjective norm and convenience has a positive influence on intention to use the service.

However, the carpool group considers subjective norm with less influence on intention to use the service, carpool coefficient = 0.386, while on both group analysis, the coefficient it was stronger with a value of 0.496.

Looking at the convenience construct, the carpool group consider this determinant with more influence on intention, once the carpool group coefficient is equal to 0.322, while on both group analysis, the coefficient was only 0.204, 0.118 lower.

Analyzing now the carsharing group, we can see that this group, also select subjective norm with having influence on intention, however instead of convenience (as on both group analysis and carpool analysis), this group selected ecological awareness.

Looking at the subjective norm, in carsharing group, this group has considered subjective norm with more influence, comparing to both group analysis and the carpool analysis. The carsharing group coefficient is 0.518, 0.132 stronger than carpool coefficient (0.386) and 0.022 stronger than both groups analysis (0.496).

Looking at the ecological awareness, the carsharing group consider this determinant with influence on intention to use carsharing, with a coefficient of 0.152 and a p value of 0.042.

On table 13 below, we can see the hypothesis validation summary as outcome of this research.

Table 13 – Hypothesis validation

Hypothesis	Carpool or Carsharing Service
H1	Rejected
H2	Confirmed
H3	Rejected
H4	Rejected
H5	Confirmed
H6	Rejected
H7	Rejected

5. Discussion

Previous studies have identified various motivational factors to use carsharing or carpool services, ranging from economic to environmental or convenience (Zhang & Li, 2020; Li & Zhang, 2021; Munzel et al., 2019, Rosa, 2018).

This study has tried to extend the theory of planned behavior and combine it with other factors, analyzing the direct influence of those factors, in the intention to use carsharing or carpool, by generation Z.

In opposition to what has been defended by Li & Zhang (2021), Jain et al. (2021), Mattia et al. (2019) or Rosa (2018), our study doesn´t confirm the role of attitude on the prediction of intention to use carsharing or carpool, by generation Z. This may be because our study focused on generation Z, and this is a generation with some particularities. Also, our study has answers from several countries, but the studies above were focused on specific countries, and not on specific generations.

By another hand, the subjective norm factor was confirmed as having direct and positive influence on intention, to use carsharing or carpool, by generation Z. According to our results, we can conclude that the beliefs of the people that surround us, has influence in the decision of choose carsharing or carpool, which is in line with most studies that we used as base (Zhang & Li, 2020; Li & Zhang, 2021; Jain et al., 2021; Mattia et al. 2019; Bachmann et al., 2018; Lowe et al., 2023).

Moreover, in the multi-group analysis, when we split the responses related to carpool and carsharing, in both analysis we can see that subjective norm continues to have a direct and positive influence, on the intention to use the service. However, the carsharing coefficient is bigger than the carpool one, and as well bigger than the complete group analysis.
In the carsharing service, the subjective norm has even bigger influence on the intention to use it, compared to carpool.

Regarding the perceived behavioral control, our results are showing positive influence of this factor, however with no significant *p* value, so this hypothesis was rejected, in opposition to the studies of Zhang & Li (2020), Li & Zhang (2021), Jain et al. (2021), Mattia et al. (2019), Bachmann et al. (2018). This may be because our study focused on generation Z, and it has a considerable number of answers from Portuguese students,

including underage students, which possibly don´t have yet knowledge, confidence or freedom to use these kind of services.

Looking now for the constructs that don´t belong to the TPB, and in first place to the price, even that some studies have evidence of cost savings and economic benefits (Munzel et al., 2019; Matia et al. 2019), we though that the hypothesis for the price would be based on studies of Guiot & Roux, (2010), Hristova, (2019) and Yan et al., (2015) about motivations to buy second-hand products and adapted to our study, once were more explored by these authors. However, even if we can see a slight positive coefficient of influence in the intention to use carsharing and carpool, the results are not significant, so the hypothesis was rejected.

The reason for the different results, on the price determinant, between our study and the studies developed by Munzel et al. (2019) and Matia et al. (2019), could possibly be because of different economic context in 2024 compared to 2019. However, this difference can also be justified by current higher prices on carsharing/carpool services. It can happen, that customers don´t consider carsharing/carpool anymore, as an economic/cheaper solution. This output can be interesting for carsharing/carpool operators, to adjust their fees on these services.

When we split the two groups, carpool and carsharing, in the multi-group analysis, this remains not statistically significant, so was also here rejected.

Furthermore, focusing on the convenience factor, our results show that indeed this determinant has direct and positive influence on intention to use both services, however in the multi-group analysis, only carpool responses are significant, even that both services have positive influence.

These conclusions are interesting because the studies we used as base of Munzel et al. (2019) and Rosa (2018), concluded that this factor had positive influence on the intention to use carsharing. However, we adapted the hypothesis to consider carpool as well, reflecting in an output only significant for carpool. The reason for that could possibly be because that previous studies were developed several years ago, pre-covid and in a different context. Also, our study is focused on generation Z, differently to the others.

About the Ecological awareness factor, our results shows that this factor has positive influence, however the results are not significant for the total group analysis. This result is against the results achieved by other authors, probably because our study collected responses from several countries, but also because aggregate answers from carsharing and carpool services together.

On the multi-group analysis, the carsharing group reports positive influence and significancy. These results are in line with the studies developed by Rosa (2018) and indirectly in line with the studies of Zhang & Li (2020), Li & Zhang (2021) and Mattia et al. (2019), once those studies concluded indirect influence of ecological factors.

These results confirms that effectively, the consumers more aware of ecological factors, look for more green transportation alternatives, and in specific the carsharing users. From another perspective, it´s interesting to split the two groups analysis, carsharing and carpooling responders, because this allow us to understand that this is not a determinant for carpool users, but it is for carsharing users.

In terms of the Frugality factor, which was never studied before by other authors applied to the carpool or carsharing, our results show us that in the complete group analysis and in the multi-group analysis, this factor has positive influence in the intention to use these services, however with no significant *p* value, so this hypothesis was rejected. This can be because our analysis does not focus on any specific country, but also because of some responders are under-age, and still on high school, with less maturity and still not sensible to frugal topics.

This let us to conclude as well, that even some authors affirms that generation Z is characterized by being frugal, maybe that is because were focused on specific regions, and if we analyze in a wide list of countries, this may be different.

In ton of conclusion, of this discussion section, we can say that, for generation Z, subjective norms and convenience are considered as determinants that influences the intention to use carpool or carsharing. Also, ecological awareness influences the intention of carsharing users specifically, while convenience can´t be considered as determinant for carsharing users, but only for carpool users.

6. Conclusion and contributions

Our results shed light on generation Z consumers' intentions, to make new habits on car utilization, specifically the intention to buy services of carsharing or carpool.

In terms of literature, the TPB has been consistently used around carsharing, carpooling or other sustainable behaviors.

However, from our knowledge, this is the first study that simultaneously combine carsharing and carpooling, with focus on generation Z. Using the TPB focusing on generation Z and extending it to other variables, the study contributes with new results, discussed on the previous section.

We believe that this paper adds value to this issue and may help understand better its dynamics. Some previous studies were corroborated and other rejected. It was confirmed the relevancy of subjective norm, the only one confirmed from the three behavioral variables. Concomitantly, it was confirmed the influence of convenience. Furthermore, in the multi-group analysis, where carsharing and carpooling responders were split in two groups, the convenience was confirmed as factor that influenced only carpooling responders, while the ecological awareness was confirmed as factor that influenced only the carsharing responders.

With the understanding of individuals motivations, brands can adopt strategies, implement initiatives, develop new products and services adapted to the consumers' needs.

Currently the carpool apps operate on an online exclusive basis, so the unknowledge about other people users, which they would share the ride, can be a barrier to this service adoption.

Promotion of carpool operators inside universities and companies, could increase the knowledge, sense of easy accessibility and confidence, about this transportation option. By another hand, carsharing operated inside big cities, it´s perceived to be a big solution to avoid car ownership in the cities. The easy access to the cars through the mobile app, and the fact that the cars are already parked in the cities, close to the potential customers location, is a big plus.

Carsharing attract users that can have budget constrains to buy a car but are interested on this service, because it allows to pay only hours/minutes used.
At the same time, carpool enables that car owners do car travels more often, because they

share the travel costs with others, and by another hand, the other users can enjoy the travel without the necessity to buy a car.

This study has several contributions for the literature and for management, once it focuses on generation Z and their own motivations to use carsharing and carpool, these individuals are now transitioning from universities to work careers, and so are creating new demand trends, interesting to research and be analyzed by a management perspective.

The contributions for the literature are mainly the knowledge increase, about the determinants to use car-share business models, combining carsharing and carpool in the same analysis, and focusing on generation Z.

As contributions for management, is quite interesting to understand that for generation Z, subjective norm, convenience and ecological awareness (in the multi-group analysis) are determinants important for users of carsharing or carpool services.

With these outputs, companies can adapt the communication to these group of users, highlighting the determinants that are important, for every specific service. At the same time, the companies, and promoters of these kind of business models, can adjust the operation strategy, to deliver more added value, focusing on the important determinants to the users, for every specific service.

7. Limitations and future research's

Although the present study adds contributions to the literature and to management, it is important to point out some limitations that should be eliminated in future research.

Firstly, due to the fact that we collected data, from Portuguese high-schools and universities, but at the same time collected responses through the Mturk platform mainly in UK and USA. Because of this, the responses can be significantly different, once are different cultures and because of the carsharing/carpool operations can also be different.

Another limitation that we would like to highlight is that the collection of data trough surveys in Spain, France, Germany or Belgium is very difficult for students of another countries, so because of that, the responses from those countries are just a few or even zero. We tried to collect survey responses on those countries through Mturk platform, however this is a tool not so much used on those countries.

In the TCP extension, we decided to focus on intent factors to better recognize consumers' motivations. In the future, it may apply to TCP or others introducing risks/barriers that reduce intention to use carsharing or carpool by generation Z.

Another limitation that we found, is that there is a lack of studies around frugality characteristic of generation Z.

As future research, we think would be good to concentrate the research on only central Europe countries, still focusing on generation Z and as well analyzing both business models together, once these countries have more similarities between them and has a strong car culture.

For the study, a quantitative methodology was used, with the dissemination of an online questionnaire for data collection, which, of course, has its limitations. In this sense, other methodologies can be used in future research

8. References

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179-211. https://doi.org/https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. (2005). The Influence of Attitudes on Behavior. The handbook of attitudes, 173.

Amberblog. (2023). *Gen Z And Technology: How The Future Of Tech Is Changing*. Retrieved 24-06-2024 from https://amberstudent.com/blog/post/how-gen-z-is-shaping-the-future-of-technology

Amirkiaee, S. Y., & Evangelopoulos, N. (2018). Why do people rideshare? An experimental study. *Transportation Research Part F-Traffic Psychology and Behaviour*, *55*, 9-24. https://doi.org/10.1016/j.trf.2018.02.025

Bachmann, F., Hanimann, A., Artho, J., & Jonas, K. (2018). What drives people to carpool? Explaining carpooling intention from the perspectives of carpooling passengers and drivers. *Transportation Research Part F-Traffic Psychology and Behaviour*, *59*, 260-268. https://doi.org/10.1016/j.trf.2018.08.022

Bagozzi, R. P., & Yi, Y. (1988). On the Evaluation of Structural Equation Models. *Journal of the Academy of Marketing Science*, *16*, 74-94. https://doi.org/doi.org/10.1007/BF02723327

Baines, T. L., H. (2013). Made to serve " Understanding what it takes for a manufacturer to compete through servitization and product-service systems". *Wiley*.

Balchandani, A., Coe, E., Enomoto, K., Francis, T., & Schmidt, J. (2023). *What is Gen Z?* Retrieved 24-06-2024 from https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-gen-z

Bocken, N., Jonca, A., Sodergren, K., & Palm, J. (2020). Emergence of Carsharing Business Models and Sustainability Impacts in Swedish Cities. *Sustainability*, *12*(4). https://doi.org/https://doi.org/10.3390/su12041594

Brady, P. (2021). *The Top 5 Car-rental Companies*. Retrieved 10.06.2024 from https://www.travelandleisure.com/worlds-best/car-rental-agencies

Buys, L., & Miller, E. (2011). Conceptualising convenience: Transportation practices and perceptions of inner-urban high density residents in Brisbane, Australia. *Transport Policy*, *18*(1), 289-297. https://doi.org/10.1016/j.tranpol.2010.08.012

Callaghan, S. D., H. Medalsy, J. Pionne, A. Teichner, W. (2024). *The trends defining the $1.8 trillion global wellness market in 2024*. Retrieved 24-06-2024 from https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/the-trends-defining-the-1-point-8-trillion-dollar-global-wellness-market-in-2024?cid=other-eml-mtg-mip-mck&hlkid=54939dab49524181828382c3803a1e29&hctky=1926&hdpid=a91cc4a1-cb5d-48e8-9020-050490cd48c6

Caterpillar Rental Services. (2022). Retrieved 31 December 2022 from https://www.catrentalstore.com/en_US/home.html

Cetelem, O. (2018). *Reasons not to be*. Retrieved 10/07/2024 from https://observatoirecetelem.com/en/lobservatoire-cetelem-de-lautomobile-en/loyalty-warning-fragile/reasons-not-to-be

Cilliers, E. J. (2017). The challenge of teaching generation Z. *People: International Journal of Social Sciences*, *3*, 188-198. https://doi.org/10.20319/pijss.2017.31.188198

Coreynen, W., Matthyssens, P., & Van Bockhaven, W. (2017). Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers. *Industrial Marketing Management*, *60*, 42-53. https://doi.org/10.1016/j.indmarman.2016.04.012

Correia, G. H. D., Jorge, D. R., & Antunes, D. M. (2014). The Added Value of Accounting For Users' Flexibility and Information on the Potential of a Station-Based One-Way Car-Sharing System: An Application in Lisbon, Portugal. *Journal of Intelligent Transportation Systems*, *18*(3), 299-308. https://doi.org/10.1080/15472450.2013.836928

Costa, B., & Gardner, N. (2021). *How Gen Z shops and pays*. Retrieved 24-06-2024 from

Cozza, J. (2012). *The History of Carpooling, from Jitneys to Ridesharing*. Retrieved 14/Jan/2023 from https://www.shareable.net/the-history-of-carpooling-from-jitneys-to-ridesharing/

Dabija, D. C., & Bejan, B. (2017). Behavioral Antecedents for Enhancing Green Customer Loyalty in Retail. *Basiq International Conference: New Trends in Sustainable Business and Consumption 2017*, 183-191. <Go to ISI>://WOS:000426833400020

Desjardins, J. (2018). *Why Generation Z has a totally different approach to money*. Retrieved 24-06-2024 from https://www.weforum.org/agenda/2018/11/why-gen-z-is-approaching-money-differently-than-other-generations-95032cb6-6046-4269-a38a-0763bd7909ff/

Digital, A. (2023). *Understanding the Gen Z and Millenial Consumers*. Retrieved 24-06-2024 from https://advesa.com/featured-articles/understanding-the-gen-z-and-millenial-consumers/#:~:text=Gen%20Z%20prioritize%20convenience%20and,comes%20to%20making%20purchase%20decisions.

Doherty, M. J., Sparrow, F. T., & Sinha, K. C. (1987). Public Use of Autos - Mobility Enterprise Project. *Journal of Transportation Engineering-Asce*, *113*(1), 84-94. https://doi.org/Doi 10.1061/(Asce)0733-947x(1987)113:1(84)

Dolot, A. (2018). The Characteristics of Generation Z. E-mentor. https://doi.org/10.15219/em74.1351

Donovan, S. (2024). *Changing the Game: Influencer Marketing for Generation Z*. Retrieved 24-06-2024 from https://influencermarketinghub.com/influencer-marketing-for-generation-z/

Duncan, M. (2011). The cost saving potential of carsharing in a US context. *Transportation*, *38*(2), 363-382. https://doi.org/10.1007/s11116-010-9304-y

Eurostat. (2023). EMPLOYMENT AND GROSS VALUE ADDED BY BROAD ACTIVITY. (2023). Retrieved 21-Jan-2023 from https://ec.europa.eu/eurostat/cache/digpub/european_economy/bloc-3a.html?lang=en

Fee, M. N., Senser, M., & Lunsford, R. (2016). Differentiation in the United States Rental Car Industry. *International Business & Education Conferences*.

Finneman, B., & Spagnuolo, E. (2020). *Meet Generation Z: Shaping the future of shopping*. Retrieved 24-06-2024 from https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/meet-generation-z-shaping-the-future-of-shopping

Fornell, C., & Larcker, D. F. (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Jornal of Marketing Research*, *18*, 39-50.

Francis, T., & Hoefel, F. (2018). *True Gen: Generation Z and its implications for companies*. McKinsey&Company. from https://www.mckinsey.com/industries/consumer-packaged-goods/our-insights/true-gen-generation-z-and-its-implications-for-companies

Fromm, J., & Read, A. (2018). Marketing to Gen Z: The Rules for Reaching This Vast-and Very Different-Generation of Influencers, Amacom. *Amacom, American Management Association, New York*.

Gangakhedkar, R., Khan, M., & Karthik, M. (2023). Understanding carpooling intentions of Generation Z of India: a structural equation modeling approach. *Transportation Planning and Technology*. https://doi.org/https://doi.org/10.1080/03081060.2023.2294342

Genzlinger, F., Zejnilovic, L., & Bustinza, O. F. (2020). Servitization in the automotive industry: How car manufacturers become mobility service providers. *Strategic Change-Briefings in Entrepreneurial Finance*, *29*(2), 215-226. https://doi.org/10.1002/jsc.2322

Guiot, D., & Roux, D. (2010). A second-hand shoppers motivation scale: Antecedents, consequences, and implications for retailers. *Journal of Retailing and Consumer Services*, *4*, 355-371. https://doi.org/https://doi.org/10.1016/j.retail.2010.08.002

Gutfreund, J. (2016). Move over, Millennials: Generation Z is changing the consumer landscape. *Journal of Brand Strategy*, *5*, 245-249.

Hair, J. F. S., M. Hopkins, L. Kuppelwieser, V. (2014). Partial Least Squares structural equation modeling (PLS-SEM): An Emerging tool in business research. *European Business Review*. https://doi.org/doi.org/10.1108/EBR-10-2013-0128

Hair, J. F. H., M. C. Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research*, *109*, 101-110. https://doi.org/doi.org/10.1016/j.jbusres.2019.11.069

Hartl, B., Sabitzer, T., Hofmann, E., & Penz, E. (2018). "Sustainability is a nice bonus" the role of sustainability in carsharing from a consumer perspective. *Journal of Cleaner Production*, *202*, 88-100. https://doi.org/10.1016/j.jclepro.2018.08.138

Hristova, Y. (2019). The Second-Hand Goods Market: Trends and Challenges. *Izvestia Journal of thee Union of Scientists - Varna*, *3*, 62-71. https://doi.org/https://doi.org/10.36997/ijusv-ess/2019.8.3.62

Jaffe, E. (2015). *Carpooling Tries for a Comeback*. Retrieved 14/Jan/2023 from https://www.bloomberg.com/news/articles/2015-03-17/several-start-ups-are-betting-that-carpooling-can-make-a-comeback

Jain, T., Rose, G., & Johnson, M. (2021). "Don't you want the dream?": Psycho-social determinants of car share adoption. *Transportation Research Part F-Traffic Psychology and Behaviour*, *78*, 226-245. https://doi.org/10.1016/j.trf.2021.02.008

Johnson, J. P., & Waldman, M. (2010). Leasing, Lemons, and Moral Hazard. *Journal of Law & Economics*, *53*(2), 307-328. https://doi.org/Doi 10.1086/648384
Kamp, B. (2019). Restructuring for service business development: insights from a machine tool manufacturer. *International Journal of Business Environment*, *10*(4), 281-305. https://doi.org/Doi 10.1504/Ijbe.2019.10023229
Kanatli, M. A., & Karaer, O. (2022). Servitization as an alternative business model and its implications on product durability, profitability & environmental impact. *European Journal of Operational Research*, *301*(2), 546-560. https://doi.org/10.1016/j.ejor.2021.10.052
Ke, H., Chai, S. W., & Cheng, R. (2019). Does car sharing help reduce the total number of vehicles? *Soft Computing*, *23*(23), 12461-12474. https://doi.org/10.1007/s00500-019-03791-0
Kuzminov, M. (2023). What should you know about Gen Z to drive your business. What Should You Know About Gen Z To Drive Your Business? (forbes.com)
Lastovicka, J. L., Bettencourt, L. A., Hughner, R. S., & Kuntze, R. J. (1999). Lifestyle of the tight and frugal: Theory and measurement. *Journal of Consumer Research*, *26*(1), 85-98. https://doi.org/Doi 10.1086/209552
Lezotte, C. (2021). McCANN & ME - One Woman´s Experience in Detroit Automotive Advertising. *Automotive History Review*, *62*.
Li, L. M., & Zhang, Y. (2021). An extended theory of planned behavior to explain the intention to use carsharing: a multi-group analysis of different sociodemographic characteristics. *Transportation*. https://doi.org/10.1007/s11116-021-10240-1
Lina, Y., Hou, D., & Ali, S. (2022). Impact of online convenience on generation Z online impulsive buying behavior: The moderating role of social media celebrity. *Front. Psychol*. https://doi.org/https://doi.org/10.3389/fpsyg.2022.951249
Lowe, W. U. A. P., M. (2023). Investigation of Behavioral Influences of carpool adoption for educational trips - A case study of Thammasat University, Thailand. *Case Studies on Transport Policy*, *12*. https://doi.org/https://doi.org/10.1016/j.cstp.2023.100970
Madalina, V. E., Nicolescu, L., Gazzola, P., & Amelio, S. (2023). Integrating smart mobility and electric car sharing adoption in a common framework: Antecedents and mediators. *Journal of Cleaner Production*. https://doi.org/https://doi.org/10.1016/j.jclepro.2023.138254
Martin, E., Shaheen, S. A., & Lidicker, J. (2010). Impact of Carsharing on Household Vehicle Holdings Results from North American Shared-Use Vehicle Survey. *Transportation Research Record*(2143), 150-158. https://doi.org/10.3141/2143-19
Martin, J. (2023). *Carpooling Vs CarSharing*. https://www.share-now.com/de/en/blog-car-sharing-vs-car-pooling/
Mattia, G., Mugion, R. G., & Principato, L. (2019). Shared mobility as a driver for sustainable consumptions: The intention to re-use free-floating car sharing. *Journal of Cleaner Production*, *237*. https://doi.org/https://doi.org/10.1016/j.jclepro.2019.06.235
Mavlutova, I., Kuzmina, J., Uvarova, I., Atstaja, D., Lesinskis, K., Mikelsone, E., & Brizga, J. (2021). Does Car Sharing Contribute to Urban Sustainability from User-

Motivation Perspectives? *Sustainability*. https://doi.org/https://doi.org/10.3390/su131910588
Mindur, L., Sierpinski, G., & Turon, K. (2018). Car-Sharing Development - Current State and Perspective. *Logistics and Trasnport, 39*. https://doi.org/10.26411/83-1734-2015-3-39-1-18
Mitropoulos, L., Kortsari, A., & Ayfantopoulou, G. (2021). A systematic literature review of ride-sharing platforms, user factors and barriers. *European Transport Research Review*. https://doi.org/https://doi.org/10.1186/s12544-021-00522-1
Munzel, K., Piscicelli, L., Boon, W., & Frenken, K. (2019). Different business models - different users? Uncovering the motives and characteristics of business-to-consumer and peer-to-peer carsharing adopters in The Netherlands. *Transportation Research Part D-Transport and Environment, 73*, 276-306. https://doi.org/10.1016/j.trd.2019.07.001
Nitz, C. C.-c., m G. A. Róldan, J.L. (2016). Mediation Analyis in Partial Least Squares Path Modeling: Helping Researchers Discuss More Sophisticated Models. *Industrial Management & Data Systems*. https://doi.org/doi.org/10.1108/IMDS-07-2015-0302
Number of carpooling vehicles worldwide from 2015 to 2025. (2022). Retrieved 21-Jan-2023 from https://www.statista.com/statistics/867668/carpooling-vehicles-worldwide/
Nunnally, J. C. (1967). Psychometric Theory *New York: McGraw Hill*.
Padmavathy, C., Swapana, M., & Paul, J. (2019). Online second-hand shopping motivation - conceptualization, scale development, and validation. *Journal of Retailing and Consumer Services, 51*, 19-32. https://doi.org/https://doi.org/10.1016/j.jretconser.2019.05.014
Paribas, B. (2022a). *A brief history of responsible credit 2/3: the organisation of consumer credit*. Retrieved 1 January 2023 from https://histoire.bnpparibas/en/a-brief-history-of-responsible-credit-23-the-organisation-of-consumer-credit/
Paribas, B. (2022b). *A brief history of responsible credit 2/3: the organisation of consumer credit*. Retrieved 4/Jan/2023 from https://histoire.bnpparibas/en/a-brief-history-of-responsible-credit-23-the-organisation-of-consumer-credit/
Pelech, P. (2024). Marketing Communications in the Sharing Economy: Is the Brand of the Car Important to Car-Sharing Users? *New Perspectives and Paradigms in Applied Economics and Business*. https://doi.org/https://doi.org/10.1007/978-3-031-49951-7_8
Pelech, P., & Holendová, J. (2022). Generation X, Y, and Z Preferences for Car-Sharing in Different Situations. *ACC Journal*. https://doi.org/https://doi.org/10.15240/tul/004/2022-2-007
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*. https://doi.org/https://doi.org/10.1016/j.tra.2017.05.012
Revenue. (2023). Retrieved 21-Jan-2023 from https://www.statista.com/outlook/mmo/shared-mobility/shared-rides/car-rentals/worldwide#revenue

Rodriguez, A. *Supporting the Diversity (and Diversity Values) of Gen Z*. Retrieved 24-06-2024 from https://www.generations.com/insights/supporting-the-diversity-and-diversity-values-of-gen-z

Rosa, R. M. (2018). *Attitude and Intention to use carsharing in Portugal: Users and Non-Users* ISCTE Business School].

Shaheen, S., & Cohen, A. (2016). Innovative Mobility Carsharing Outlook – Winter 2016. *Transportation Sustainability Research Center*.

Shaw, J. (2023). *The Role of Social Media in Gen Z's Purchasing Decisions*. Retrieved 24-06-2024 from https://kadence.com/the-role-of-social-media-in-gen-zs-purchasing-decisions/

Singh, A. P., Dangmei, J. (2016). Understanding the generation Z: the future workforce. South-Asian Journal of Multidisciplinary Studies, 3, 1-5.

Spitznagel, E. (2020). *Generation Z is bigger than millenials*. Retrieved 14/Jan/2023 from https://nypost.com/2020/01/25/generation-z-is-bigger-than-millennials-and-theyre-out-to-change-the-world/

staff, P. e. (2023). *Gen Z and the future of payment preferences*. Retrieved 24-06-2024 from https://www.paypal.com/us/brc/article/gen-z-payment-preferences#:~:text=Gen%20Z%20is%20at%20the,payment%20apps%2C%20and%20digital%20wallets.&text=With%20many%20of%20these%20payment,digital%20payments%20in%20the%20future.

Statista. (2022). *Number of Vehicles in carsharing programs worlwide between 2010 and 2021*. Retrieved 14/Jan/2023 from https://www.statista.com/statistics/649459/carsharing-fleet-worlwide/

Tate, R. (2017). *The Early Days of Automobile Maintenance and Repair*. Retrieved 14/Jan/2023 from https://www.motorcities.org/story-of-the-week/2017/the-early-days-of-automobile-maintenance-and-repair#:~:text=During%20the%20early%20days%2C%20older,the%20underbelly%20of%20the%20vehicle.

Transport&Environment. (2017). *Does car sharing really reduce car use?* Retrieved 10.06.2024 from https://www.transportenvironment.org/discover/does-car-sharing-really-reduce-car-use/

Uniplanet. (2018). *Qual a diferença entre carpooling e carsharing?* https://www.theuniplanet.com/2018/03/qual-diferenca-entre-carpooling-e-carsharing/

Why Gen Z Values Diversity. (2021). Retrieved 24-06-2024 from https://izea.com/resources/gen-z-values-diversity/#:~:text=Almost%20half%20of%20all%20Gen,to%20the%20Gen%20Z%20ethics.

Wise, R., & Baumgartner, P. (2000). Go downstream: The new profit imperative in manufacturing - Richard Wise and Peter Baumgartner respond. *Harvard Business Review, 78*(1), 168-168. <Go to ISI>://WOS:000087886100030

WorldBankGroup. (2023a). Manufacturing, value added (% of GDP) - European Union. (2023). Retrieved 21-Jan-2023 from https://data.worldbank.org/indicator/NV.IND.MANF.ZS?locations=EU

WorldBankGroup. (2023b). Services, value added (% of GDP) - European Union. (2023). Retrieved 21-Jan-2023 from https://data.worldbank.org/indicator/NV.SRV.TOTL.ZS?locations=EU

Xerox print services. (2022). Retrieved 31 December 2022 from https://www.xerox.com/pt-pt/empresa-de-servicos/managed-print

Yan, R. N., Bae, S. Y., & CXu, H. (2015). Second-hand clothing shopping among college students: The role of psycographic characteristics. *Young Consumers*, 85-98. https://doi.org/https://doi.org/10.1108/YC-02-2014-00429

Yilmaz, K. (2013). Comparison of Quantitative and Qualitative Research Traditions: epistemological, theoretical, and methodological differences. *European Journal of Education*. https://doi.org/ https://doi.org/10.1111/ejed.12014

Zhang, Y., & Li, L. M. (2020). Intention of Chinese college students to use carsharing: An application of the theory of planned behavior. *Transportation Research Part F-Traffic Psychology and Behaviour, 75*, 106-119. https://doi.org/10.1016/j.trf.2020.09.021

9. Attachments

Attachment 1



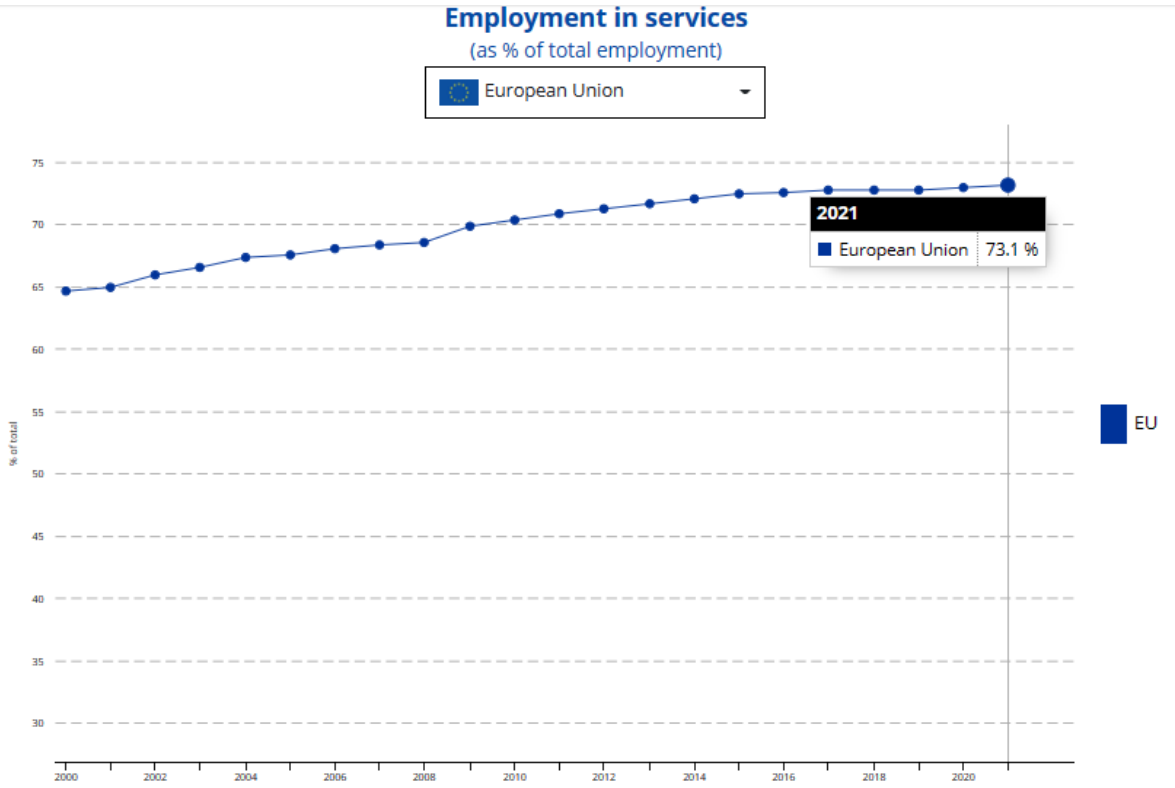
(WorldBankGroup, 2023b)

Attachment 2



(WorldBankGroup, 2023a)

Attachment 3



(Eurostat, 2023)

Attachment 4



(*Revenue*, 2023)

Attachment 5: Car-Sharing in Europe, USA and Asia

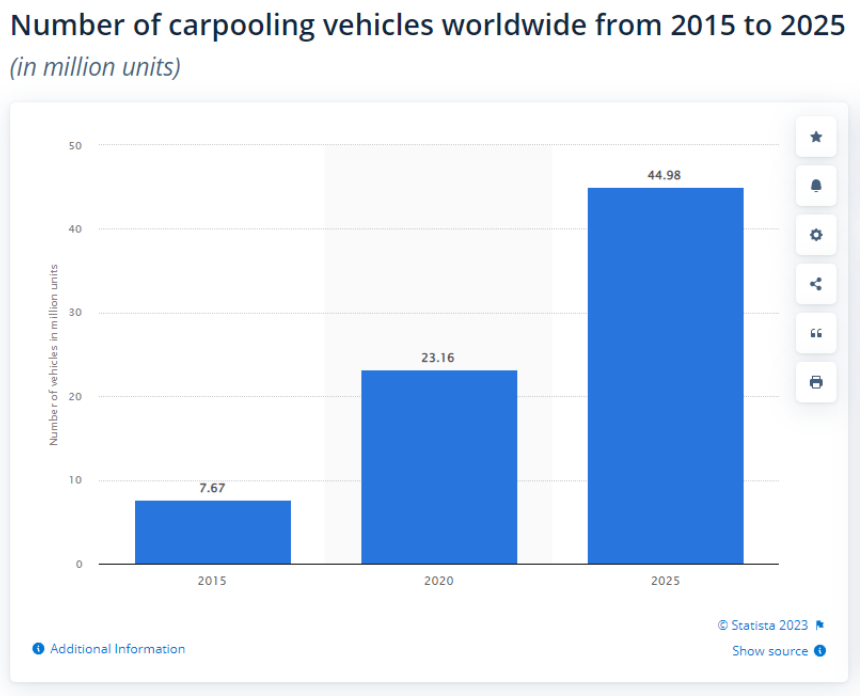
Established	Country, city	Car-sharing project's name	Fleet on establishing
1948	Switzerland, Zürich	Sefage	n.a.
1971	France, Montpellier	Procotip	35
1973	Holland, Amsterdam	Witkar	35
1976	Sweden, Lund	Bilpoolen	n.a.
1977	England, Suffolk	Share-a-Car Service	n.a.
1983	Sweden, Örebro	VivallaBil	5
1985	Sweden, Gothenburg	Bilkooperativ	n.a.
1987	Switzerland, Zürich	ATG Auto TeiletGenossenschaft	n.a.
1987	Switzerland	ShareCom	n.a.
1988	Germany, Berlin	StadtAuto Berlin	300
1993	Germany, Münich, Frankfurt	Lufthansa Airlines car-sharing	n.a.
1993	Switzerland, Zürich	CarShare – Swissair	n.a.
1997	Switzerland	Mobility Carsharing Switzerland	1200
1997	France	Praxitele	50
1997	Germany	Volkswagen car-sharing	n.a.
1999	France, La Rochelle	Liselec	50

Established	Country, State, city	The name of the car-sharing project	Fleet on establishing
1983	United States, Indiana, West Lafayette	Mobility Enterprise	n.a.
1983	United States, California, San Francisco	Short-Term Auto Rental (STAR)	n.a.
1994	Canada, Quebec City	Auto-Com	34
1995	Canada, Montreal	CommunAuto	32
1997	Canada, British Columbia	Cooperative Auto Network (CAN)	14
1997	San Francisco	City CarShare	8
1997	Canada, Victoria	Victoria Car-Share Co-Op	5
1997	United States, Missouri, Rutledge	Dancing Rabbit Vehicle Cooperative (DRVC)	3
1998	Canada, Toronto	AutoShare–Car Sharing Network	8
1998	United States, Colorado, Boulder	CarShare Cooperative	1
1998	United States, Oregon, Portland	CarSharing Portland	11
1998	United States, Washington, Olympia	Olympia Car Coop	1
1999	Oregon, Corvallis	Motor Pool Co-O	n.a.
1999	United States, Illinois, Chicago	ShareCarGo!	12-14

Year	Country, city	The name of the car-sharing project	Fleet
1997	Singapore, Upper Bukit Timah	NTUC INCOME Car cooperative	4
1998	Japan, Motegi	Intelligent Community Vehicle System (ICVS)	n.a.
1999	Japan	Crayon	35
1999	Japan	Inagi EV-Car Sharing	50

(Mindur et al., 2018)

Attachment 6:



(*Number of carpooling vehicles worldwide from 2015 to 2025*, 2022)

Attachment 7: Survey (English Version)

Carsharing and Carpool Services

This form is only for persons with 18 years old or more, so if you are still underage, please do not answer this form.
This form is related to carsharing or carpool services, depending on which option you choose on the first question, then all the following questions are only related to that service.
Carsharing
is a system where a person or group of individuals can rent and drive a car, for a limited period (even hours or minutes), generally through an mobile app or website, only paying for the time they use it.
Some of the most known mobile apps related to carsharing are Sixt, ShareNow, Zipcar or Getaround.

Carpool involves sharing a ride with others, who are going in the same direction, and in most of the times, the car is owned by one of the individuals, the remaining users are taking a ride, paying for it.
Some of the most known mobile apps related to carpool are BlaBlaCar, Boleias.net or Carpool.be.

* Indicates required question

1. What service do you choose to answer this form? *
   Please select the service you know better
   (depending on this answer, all the following questions will be only related to the service chosen here)

   Mark only one oval.

   - ◯ Carsharing
   - ◯ Carpool

2. I think that this service is convenient *

   Mark only one oval.

	1	2	3	4	5	
Com	◯	◯	◯	◯	◯	Completely agree

3. I think that this service is economic *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

4. I think that this service is flexible *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

5. I think that this service is safe and comfortable *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

6. I think that this service benefits the environment *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

7. My friends or family (who are important to me) support me if I consider this service as an option *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

8. My friends or family (who are important to me) think i should use this service *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

9. My friends or family (who are important to me) all use or know this service *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

10. I will make the same choice as my friends and family (who are important to me), regarding whether they use this service, or not *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

11. I think my driving skills make me fully competent to use this service *

Mark only one oval.

	1	2	3	4	5	
Con	◯	◯	◯	◯	◯	Completely agree

12. I can find the vehicles easily if i want to use this service *

Mark only one oval.

	1	2	3	4	5	
Con	◯	◯	◯	◯	◯	Completely agree

13. The process to access this service is easy and uncomplicated to accomplish *

Mark only one oval.

	1	2	3	4	5	
Con	◯	◯	◯	◯	◯	Completely agree

14. I like this service because I think the users pay less *

Mark only one oval.

	1	2	3	4	5	
Con	◯	◯	◯	◯	◯	Completely agree

15. I feel that the users of this service spend less money *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

16. I would use this service because this way, I think I can use car by a lower cost *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

17. I would use this service because allows me to buy more things, once I pay less *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

18. Using this service, is/would be easy to book and access a car *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

19. Using this service, I have/would always have a car available near me *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

20. Using this service, I do not/would not waste much time reaching my destination *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

21. Using this service, I can/could choose the car that best meets my travel needs *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

22. Using this service, I have/would have privacy *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

23. Using this service, I travel/would travel comfortably *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

24. I consider the impact of my actions on the environment when i make decisions *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

25. I worry about the environmental destruction and waste of natural resources *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

26. I am willing to bear some inconveniences for the sake of environment *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

27. Current environmental protections are insufficient *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

28. If we correctly manage our resources, we for sure will save money in the long run *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

29. There is some car travels that could be shared by several persons *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

30. Making better use of my resources makes me feel good *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

31. If i can share a car with someone else, there's no sense in buying just one for me *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

32. I believe in being careful about how i spend my money *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

33. I discipline myself to get the most output of my money *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

34. I'm willing to postpone a purchase I want to save money *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

35. There are things I resist to buy today, so i can save for tomorrow *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

36. I am willing to use this service *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

37. I plan to use this service *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

38. I´m not going to buy private cars but use this service *

Mark only one oval.

	1	2	3	4	5	
Corr	◯	◯	◯	◯	◯	Completely agree

39. In which year were you born? *

Mark only one oval.

- 1996 - 2005
- 1980 - 1995
- 1965 - 1979
- 1945 - 1965
- before 1945

40. Gender *

Mark only one oval.

- Male
- Female
- Prefer not to say

41. **Education Level** *

Mark only one oval.

- Primary School
- Middle School
- Secondary School
- Degree
- Master/ Postgraduate
- PhD
- Other

42. Nationality *

43. **Net salary (monthly)** *

Mark only one oval.

- I do not have a salary
- up to 800€
- 800€ - 1399€
- 1400€ - 2099€
- 2100€ - 2799€
- 2800€ - 3499€
- More than 3499€

Attachment 8: Example of parental authorization, for underage students answer on survey

Questionário no âmbito da dissertação de Mestrado em Gestão de Serviços, da Faculdade de Economia da Universidade do Porto.
Este questionário trata-se de um questionário anónimo, e destina-se apenas a fins estatisticos, focando a sua análise nos determinantes para a escolha dos serviços de carsharing ou carpool, por jovens pertencentes à geração Z.

Eu Nádia Bruna Rocha Tomais, encarregado de educação do aluno Fabiana Tomais, autorizo que o aluno responda a este questionário.

Assinatura: Nádia Bruna Tomais, 12 / 3 /2024

Questionário no âmbito da dissertação de Mestrado em Gestão de Serviços, da Faculdade de Economia da Universidade do Porto.
Este questionário trata-se de um questionário anónimo, e destina-se apenas a fins estatisticos, focando a sua análise nos determinantes para a escolha dos serviços de carsharing ou carpool, por jovens pertencentes à geração Z.

Eu Maria Vieira, encarregado de educação do aluno Daniela Ramos, autorizo que o aluno responda a este questionário.

Assinatura: Mariavieira, 18 / 3 /2024