

Factors influencing Tunisian student's intentions to carpool

Fatma TURKI

Department of Economic and Transport Planning
Higher Institute of transport and Logistics - ISTL
University of Sousse, Tunisia
fatmatorki750@gmail.com

Aymen GHÉDIRA

Department of Economic and Transport Planning
Higher Institute of transport and Logistics - ISTL
University of Sousse, Tunisia
a.ghedira@gmail.com

Abstract

Carpooling is a strong strategy that various countries have used. Its development necessitates firsthand knowledge of how commuters who travel alone and those who share a journey to a desired location perceive it. This technique is knowledge-based, and it can help to reduce unfavorable perceptions about security, privacy, and usability. Although this phenomena has a number of advantages (lower travel expenses, time savings, less congestion), it has been hampered by a number of obstacles. The phenomena of carpooling in Tunisia are the subject of this research. This paper aims to identify significant factors influencing the student's intentions toward carpooling in Tunisia. A questionnaire was designed consisting of respondent's socioeconomic demographics, interests in carpooling, and factors that encourage and discourage carpooling. A self-reported approach was used and 269 usable samples were obtained. The outcomes show that ladies are the most worried about accessibility with regards to carpooling (61% versus 39% for men). As far as attitudes and perceptions, the results acquired from our data show that 47% of men favor carpooling to public vehicle for three basic reasons: reliability, convenience, and poor quality of public transport. Moreover, solo driving and public transport are less safe and uncomfortable than this mode.

1. Introduction

Since current public transportation facilities are inadequate to meet the public's needs, the transportation system requires owners to own private vehicles.

Despite a high rate of urbanization, the low density development and long distances between agglomerations have resulted in a high reliance on private vehicles in Tunisia; car ownership has changed but at a very slow rate; in 2014, 27.2 percent of households had at least one car, compared to 21 percent in 2004 and 15.7 percent in 1994 [1].

However, there are still differences between the east and west of the country, as well as between coastal and interior governorates.

In road traffic, the number of regular commuters on public transportation reached 512977 in 2019, with school and university transportation accounting for 53% [2]. In this context, road traffic congestion is generally caused by an increase in urban population, as well as private vehicle ownership and use. Traffic management issues also contribute to traffic congestion, which exacerbates during the morning rush hour [3]. Increased traffic flow raises social costs by increasing pollution, fuel consumption, and travel delays at intersections and links.

According to the World Bank, Tunisian road transport emissions account for about 26% of all CO₂ emissions. Currently, private car use accounts for the majority of kilometers traveled, making it one of the most significant contributors to air pollution.

In Tunisia, access to public transportation is difficult at times for some community. Socio-cultural and environmental concerns are major impediments to the development and marketing of public transportation services. It is reported that the local people have realized the need for better travel alternatives, but people's awareness and use of different transportation modes are limited [4].

The prices of various fuel categories in Tunisia are changed on a monthly basis based on the market price of crude oil. Fuel price increases have resulted in higher travel costs for taxis, private vehicles, public transportation, and educational bus services. Many people have begun to share vehicles with colleagues/friends, particularly in areas where origins and destinations are common. It enables them to share travel expenses and reduce driving time.

The issue of traffic congestion and rising travel costs requires the attention of policymakers and decision-makers. Travel Demand Management (TDM) measures must be considered and implemented. Local economic, social, and cultural factors influence the implementation and effectiveness of TDM measures [5] [6]. TDM measures aim to reduce travel demand by changing individual travel behavior and spreading travel demand across space and time [7]. It incorporates programs that are intended to change individual conduct through some motivation and additionally disincentive plans. It includes techniques like High Occupancy Vehicle (HOV) lanes, improvement in public transport, parking and land use management, road taxes or toll schemes, vehicle ownership and fuel taxes, and carpooling [8].

Carpooling is a TDM measure used to reduce the number of private vehicles on the road by increasing vehicle occupancy. Carpooling is the sharing of rides among people who have the same origin and destination.

It reduces car use and travel costs for riders. Carsharing, on the other hand, is defined as becoming a customer of a car share company, which allows you to access many cars throughout the city for a set period of time.

Congestion affects people's travel behavior as well as the social and economic aspects of society.

To address the congestion issue, alternative measures must be considered in addition to a supply-side solution.

As a result, carpooling has been chosen for this study to assess its potential in the Tunisian socioeconomic and cultural context. The goal of this paper is to uncover important characteristics that influence student's desire to carpool in Tunisia.

In the same vein, our study aims to highlight the main motivations behind why individuals decide to carpool as a mode of transport. Considering this perspective, we will endeavor to respond to the accompanying inquiries: why do students seek to use carpool for their travels? For what reasons did the people polled choose this mode of transportation above public transportation and solo driving?

The significant factors concerning the promotion of carpooling have been identified using the results of a questionnaire survey. The balance of this paper has been organized in the following manner. Section 2 presents the relevant literature and research methods have been discussed in Section 3. Results have been presented in Section 4. Discussion on results and policy implications are presented in Section 5. Key findings are summarized in the last section of the conclusion;

2. Literature review

TDM is concerned with policy initiatives aimed at increasing the efficiency of the existing urban transportation system. [8] Identified three types of TDM measures: (a) creating and promoting alternative travel options to increase vehicle occupancy, (b) changing the amount of travel, particularly during peak hours, through the use of incentives, and (c) eliminating the need for physical travel.

Carpooling is connected with the first kind of TDM. It is an organized methodology that can offer commuters trust in their driving. More research is required to understand the impacts of carpool programs on infrastructure development, traffic congestion, climate change, and emissions [9].

Especially, this concept will play a major role in preserving the environment, improving network road and traffic flow, and improving the economy as well as providing an effective solution to several problems and challenges.

To this end, sharing is an aspect of sustainable development that creates a participatory element, and also reduces externality (ecological, economic, and social). In comparison to every other mode of displacement, it has its own unique economic, social, and environmental characteristics. Following this logic, carpooling is a type of sharing economy in which people share their vehicles with commuters to save money on transport.

Generally, carpooling is an operation in which several people who have similar or common schedules and itineraries share a privately owned car for a trip. In return, the passengers share in the driver's expenses during the trip. The term is defined by Bulteau et al. (2019) as "the use of a private or community-owned vehicle."

Meanings of carpooling differ as per whether or not the members who carpool have a place with a stable carpooling bunch. When carpool individuals structure a steady gathering, for example similar people carpool together for different sorts of excursions, terms, for example, ride sharing or vehicle sharing are regularly utilized reciprocally.

In the broadest sense, ride-sharing alludes to having a similar vehicle for at least one trip [8] (Morency, 2007). Carpool can take many structures, yet it very well may be considered as the sharing of a private vehicle with someone else (explorers, understudies...) for transport purposes (travel, study, shopping, leisure...). The thought behind this idea is that at least two individuals residing in discrete families can share the utilization of a private vehicle for a little charge, assuming they follow a comparable topic of movement [30].

It has been promoted in recent decades as a viable alternative to car ownership that has the potential to relieve traffic congestion, parking demand, and environmental issues. For sure, this mode enjoys a few benefits, including decreased transport expenses and travel time, disposal of traffic bottlenecks and further developed stream effectiveness, and fuel savings [10] [9]. Due to this, Carpooling may become more popular among travelers, resulting in lower annual fuel consumption [11].

Besides, this training expects to lessen leaving costs, driving pressure for vehicle travelers [27] [12], and driver weariness now and again [28] [13]. Moreover, the National Energy Agency assessed in 2005 that this could diminish the quantity of kilometers went by 19 percent [14]. Furthermore, this mode of transport may benefit commuters' social networks and increase their satisfaction by expanding their social networks. Similarly, carpooling introduces barriers and inconvenient that hinder the system's improvement, like the inflexibility of commuters' work schedules, the lack of trust between participants, and the difficulty of obtaining access to this service.

At this level, cultural exchange activities and mobility patterns differ in developing countries than in industrialized countries due to unstable economic conditions, cultural norms, and a lack of infrastructure. The rapid growth of shared mobility has transformed traveler behavior, necessitating urgent research into commuter travel patterns in developing countries' megacities.

Carpooling requires strong support from the business community and planning organizations. Three primary gatherings of variables require exceptional consideration in carrying out carpooling programs [8] : individual

socioeconomic demographics (SEDs), spatial factors (e.g. accessibility, location) and temporal factors (schedule and time constraints).

Researchers identified cost savings, time savings, convenient locations of carpooling opportunities, accessibility characteristics, and guaranteed parking as motivating factors for car sharing [12][13][14].

Carpooling is strongly predicted by factors such as the number of employees at a workplace, matching programs with partners, and fixed work schedules [15]. A study found that normative and personal norms, as well as perceived behavioral control, are good predictors of carpooling intention for both passengers and drivers [16].

Carpooling may be discouraged by factors such as a lack of flexibility and schedule constraints, inconvenience, problems with being unable to travel during the workday, and more commuting time [17][18]. Carpooling also has a significant impact on spontaneity, privacy, and personal freedom [19].

Socioeconomic demographics (SEDs) of travelers such as gender, job and income, and service characteristics of travel modes such as travel time and cost, registration fees, and capital costs are found to have a significant correlation with carpooling [20][21]. Traveling with others, saving time, and helping the environment and society are all important reasons to carpool, whereas carpool partner matching programs, working at the same company, and vehicle parking at work are less important [22]. Convenience, low cost, time savings, and maintenance services are characteristics of effective carpooling services [23].

High fuel costs, expensive and limited parking spaces, user awareness of the operational mechanism, benefits, availability of supporting technologies, and high public demand for private vehicle access are the main challenges in designing carpooling programs in developing countries [12] [24].

Service attributes, spatial and accessibility characteristics, individual attitudes, and demographic characteristics all influence a traveler's decision to carpool.

In some countries, the inclusion of carpooling as a mode of transport remains a challenge. In Tunisia in particular, car sharing remains a conscious choice of a group of people as a mode of transport in order to reduce travel costs and travel time. Due to this reflexion, this practice as a means of transport is not defined based on Tunisia's experience. No law text currently exists that defines or analyses carpooling as a mode of human transport. The government does support transportation restructuring projects in Tunisian cities as part of a long-term, cohesive, and demand-driven urban mobility strategy.

3. Research methods

3.1. Questionnaire design

A self-reported questionnaire was used to collect data. This questionnaire was divided into three sections. The first section included the respondents' socioeconomic demographics (SEDs), such as age, gender, driving license, car ownership, and preferred mode of transportation. This part aims to determine the way of life and social level, as well as mobility conditions and transportation and transportation needs.

It has been used to identify participants, either as drivers or passengers.

The second part of the survey asked commuters to participate in ride-sharing programs as drivers, which determines their modal choice habits and is divided into two sections (one on Quality of Service Attributes and Post-COVID behaviors' and one on Movement Attributes).

The third section included specific questions aimed solely at the passengers, which will determine their attitudes and perceptions toward this choice. It's also divided into two sections: one on the characteristics of transportation choice, the quality of service after COVID-19, and passenger behavior, and the other on their movements.

3.2. Sample size and survey location

The generated survey is intended for a diverse group of carpoolers. Between 2020 and 2021, a survey of Tunisian carpoolers was conducted across 24 governorates. It was designed to collect data on this practice and should only take participants ten minutes to complete

A questionnaire was completed by various ride-sharing users, whether drivers or passengers.

We conducted this survey through Facebook groups because the topics were so diverse.

Originally released on November 30, 2020, it was used for a test aimed at detecting potential survey errors and determining current error rates in light of the entire study history of a clear sample. From that date, this survey was distributed online via Facebook bundles from December 2020 to February 2021. To gather information about this training, the study should target the member for just ten minutes. A questionnaire was developed that included respondents' socioeconomic demographics, interests in carpooling, and factors that encourage and discourage carpooling. A self-reported approach was used, and 269 usable samples were obtained.

3.3. Analysis specifications

Exploratory Factor Analysis (EFA) and the SEM technique were used to analyze the collected data. The SEM allows for the inclusion of a large number of observed and latent variables in a single model.

It is also possible to elicit the direct and indirect effects of variables using SEM.

The goal of factor analysis is to reduce or explain observed variable variance in terms of underlying latent factors [25].

The EFA calculates the optimal number of factors needed to represent the data set. The Maximum Likelihood (ML) method and varimax rotation with Kaiser Normalization were used to conduct the factor analyses.

A factor loading of 0.4 was used as a cut-off value for factor extraction [26]. The extracted factors were combined to create an integrated structural model of the student's willingness to consider carpooling. The structural model's dependability was assessed using goodness of fit parameters.

4. Results and discussion

4.1. Descriptive statistics of SEDs

The distribution of respondent's SEDS is shown in Table 1.

The results showed that 16 percent of the students were interested in carpooling as drivers and 84 percent as passengers. According to the first gap in our study, the ridesharing sample consisted of 269 Tunisian students; almost 54% of the students are female.

Most of the respondents (94%) are under the age of [20-29] years as the target population only consisted of students. The respondents were on average 24.39 years old.

Just over 43% of the respondents own a car, while the remaining 57% do not own a car but have access to at least one car in their household that they could use occasionally if available and around 60% possess a driving license. The sample was extracted from a larger database that included both drivers and passengers. Almost all students (84 percent) are more likely to be passengers than drivers. For this reason, possession of a driver's license for the 269 is expected to be optional; they are on average 2 years old. Student carpoolers had an average monthly income of 282.20 DT, while their monthly commuting expenses averaged 118.42 DNT.

All the respondents have trip frequency two or three days a week.

Table 1. Distribution of respondent's socioeconomic demographics

Characteristics	Distribution (%)	
Gender	Male (46%); Female (54%)	
Age	[15-19] (41%); [20-29] (94%); [30-39] (1%)	
Income	Yes (46%); No (54%)	
Car ownership	Yes (43%); No (57%)	
Have a driving license	Yes (60%); No (40%)	
Practice	Driver (16%)	Passenger (84%)
Average Travel time (minutes)	<90km(59);[90-150km](97);>150km(179)	<90km(64);[90-150km](39);>150km(123)
Average Trip distance (km)	156	121
Average Trip travel cost (dnt/km)	0.54	0.33

Most of the students have travel time between 1h-3h. The distributions of travel costs and distance from home to campus are shown in table1. Table 1 also shows a comparison of travel costs and time between driver's and passenger's for a typical carpool.

4.2. Distribution of responses on carpooling interests

Figure 1(a) depicts the students' perceptions of their interests in carpooling as a driver and a passenger, as well as their preference for public transportation and drive alone over carpooling.

Around 16% of respondents expressed interest in carpooling as drivers, and 84% expressed interest in carpooling as passengers, which is a promising result for promoting carpooling. Figure 1(b) shows that 19% would carpool with two person, 40% with three persons, and 41% with four or more persons, respectively.

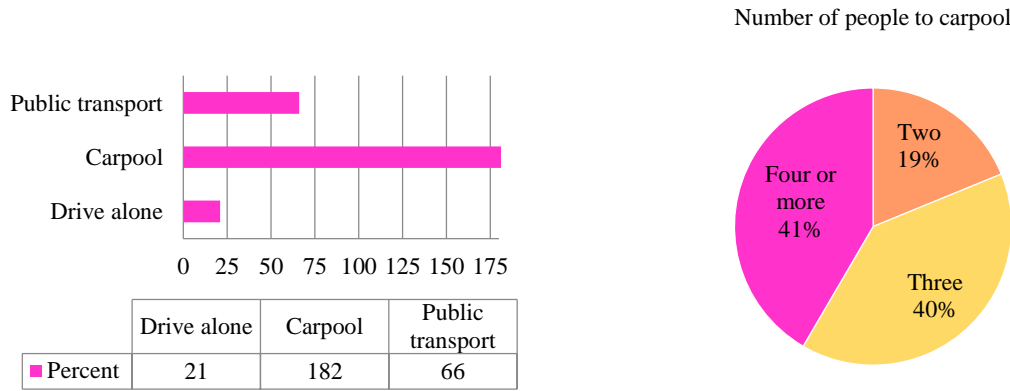


Figure 1. Distribution of student's interests in carpooling: (a) interests in carpooling (b) number of people to carpool

4.3. Average responses and factor analysis

Factor analysis identified three factors in students' interest in ridesharing: cost, perception and attitude, and safety. Regardless of the reason for travel, data shows that safety, convenience, time savings and significant cost savings are among the top reasons for carpooling. Environmental motives are classified as secondary, while family perceptions and pressures come first. The recognizable proof of the changeability in the practice of carpooling is inextricably linked to the findings, perspectives, circumstances, and choice of transport of the second occupations in the urban climate. To better understand why students carpool, this study is based on these 1192 observations. The combination of the factors causing the displacement resulted in three combined cluster formations (Table 2).

Cronbach's alpha values are more than 0.5 for all three factors, which shows the significant reliability of these factors. The percent of variance explained by attitude, accessibility and cost are 49%, 44%, and 43%, respectively.

Table 2. Reasons carpool

Reasons	
Attitude	Fiability, security, convenience, comfort, friends and coworkers that use it, poor transportation quality, communication and experience sharing
Accessibility	Availability of transport, difficulties in access to transport, contributes to congestion, contributes to environmental pollution, incompatible working hours, flexibility
Cost	Time savings, prices, and costs

Table 3. Estimation factors

	Mean	Std.dev	Crombach's alpha
Attitude	0.47	0.49	0.54
Accessibility	0.27	0.44	0.72
Cost	0.24	0.43	0.68

4.4. Development of a carpooling structural model

Using factor analysis results, a hypothetical structural model was developed for students' carpooling interests. Some variables based on the student's personal and travel characteristics were defined and incorporated into the model.

Only significant variables are shown in table 4. Gender, age, driving license, car ownership and trip distance were among the significant observed variables.

These variables were coded as: if students own a car = 1, otherwise is 0, and if the trip distance is less than 90 km is 1, otherwise is 0. A latent variable consisting of students' interests in carpooling as a passenger was introduced to develop the structural model. The measurement equations of this latent variable are highly significant and positive.

It illustrates that the students' positive beliefs in ensured safety and friendly, cheap, and relaxed traveling nature have a positive relationship with the formation of their attitude to consider carpooling as a commuting mode for reducing traffic congestion, air pollution, and energy consumption.

The structural equation coefficient of reasons with variables is positive and significant at a 5% level of significance, indicating that students have high accessibility obligations to use carpooling despite schedule, flexibility, and commitment constraints.

The commitment issues reduce students' proclivity to carpool. When students are with other students, they tend to see carpooling as positive. They can travel with their friends and share travel costs by carpooling. Similarly, a trip distance of more than 150 km correlates positively with the student's interest in carpooling, as longer trips increase the driving load and travel costs. Carpooling, on the other hand, tends to reduce both travel costs and the load of driving tasks.

Table 4. Integrated structural model of student's interests in carpooling

	Gender	Age	Trip Distance	Own a car	Driving license
Perception /attitude	-0.99	-0.04	-0.07	0.004	0.001
Cost	0.62	-0.77	0.01	0.003	0.0001
Accessibility	0.50	0.86	0.06	-0.004	-0.001

The main advantages of carpooling are relaxed travel and companionship with friends while traveling. Longer trips of more than 150 kilometers and owning a personal vehicle have positive implications for developing carpooling programs. Longer trips usually result in higher travel costs and more driving.

Traveling with other students allows you to make new friends and interact with them.

This can make their travel safer because traveling alone can be dangerous because someone may fall asleep while driving.

However, the presence of other passengers in the vehicle may cause the driver to become distracted, which could lead to a dangerous situation.

When considering carpooling, the driver's distraction must be considered.

Social interaction norms and personality traits are usually beneficial in encouraging green travel behavior among travelers.

The same travel route, fixed schedule, and same place of living, study, and work are important factors that encourage students to carpool. Our main research also revealed the importance of accessibility

In this light, pull factors are those measures or associated benefits that help to attract travelers to carpooling, whereas push factors are those measures that push travelers to carpooling.

Travel time and cost savings, relaxed travel, sharing the driving load, companionship and interaction with others, preferential parking treatment with carpooling vehicles, availability of HOV lanes, sharing the same origins and destinations, the same traveling route, and the same work and study schedule are all pull factors.

High fuel prices, limited and paid parking at destinations or workplaces are the primary push factors or measures.

There is also a need to develop and implement education and awareness programs to promote green travel initiatives among road users.

Due to this, mode switching would aid in the reduction of traffic congestion, air pollution, energy consumption, and the economic and social costs associated with travel delays.

Information technologies, such as the development of mobile applications and websites, should be used to provide necessary information about the protocol and use of carpooling.

The awareness and readiness of the traveler are critical in the promotion and success of carpooling.

5. Conclusions

This study identified the significant factors of student's interests in the carpooling program.

The results show that women are the most concerned about accessibility when it comes to carpooling (61 percent vs. 39 percent for men). In terms of attitudes and perceptions, the results obtained from our data show that 47% of men prefer carpooling to public transport for three simple reasons: reliability, convenience, and poor quality of public transport. In addition, solo driving and public transport are less safe and uncomfortable than this mode. As part of the average distance traveled per trip, the perceptions and attitudes (43%) presented in Table 1 (e.g. safety, reliability, comfort) have a strong impact on roads less than 90 km away. The results indicate that each increase in a unit's travel time translates into a cost reduction. This is illustrated by the fact that for longer distances of more than 150 kilometers, students choose to carpool to reduce their travel costs, gain time and save their time on their trips to a base.

When trying to quit, the results also show that the benefits of carpooling include safety, convenience, time savings, and significant financial savings for study participants. Perception and family pressures come first, with environmental incentives second.

At last, likewise with any field study, the advancement of our review has been frustrated by various hardships, for example, the time being spent get-together information, the COVID-19 stage, strategic issues emerging from the review's lead, and the spread of the exploration results by means of web-based entertainment.

Moreover, because of the absence of concentrates on this issue in Tunisia, it is challenging to attempt to analyze our discoveries.

The points of view of our examination spin around the investigation of the topic of carpool: the way of behaving of this versatility during the COVID-19 period by zeroing in on the portability of people and distinguishing the emissivity and allure of urban areas as far as carpooling using cartographic.

References

- [1] Boughzala, Mongi, et al. "Les inégalités en Tunisie." *Les inégalités en Tunisie*. Agence française de développement, 2020. 1-79 <https://doi.org/10.3917/afd.bough.2020.01.0001>
- [2] Tunisian transport portal 2019
http://www.transport.tn/uploads/Statistique/Transport_public_regulier_personnes_fr.pdf
- [3] Al-Maqbali, N., and M. Refeque. 2017. "Smart Transportation for Smart Oman: An Enquiry into Its Potentials and Implications." *Journal of Student Research* 6: 1–7. doi:10.47611/jsr.vi.582
- [4] Belwal, R., and S. Belwal. 2010. "Public Transportation Services in Oman: A Study of Public Perceptions." *Journal of Public Transportation* 13 (4): 1–21. doi:10.5038/2375-0901.13.4.1.
- [5] Javid, M. A., T. Okamura, F. Nakamura, S. Tanaka, and R. Wang. 2015. "Factors Influencing the Acceptability of Travel Demand Management Measures in Lahore: Application of Behavioral Theories." *Asian Transport Studies* 3 (4): 447–466. doi:10.11175/eastsats.3.447.
- [6] Eriksson, L., A. M. Nordlund, and J. Garvill. 2010. "Expected Car Use Reduction in Response to Structural Travel Demand Management Measures." *Transportation Research. Part F, Traffic Psychology and Behaviour* 13 (5): 329–342. doi:10.1016/j.trf.2010.06.001.
- [7] Ferguson, E. 1990. "Transportation Demand Management Planning, Development, and Implementation." *Journal of the American Planning Association* 56 (4): 442–456. doi:10.1080/01944369008975448.
- [8] Meyer, M. D. 1999. "Demand Management as an Element of Transportation Policy: Using Carrots and Sticks to Influence Travel Behavior." *Transportation Research Part A: Policy and Practice* 33 (7–8): 575–599. doi:10.1016/S0965-8564(99)00008-7
- [9] Chan, N. D., and S. A. Shaheen. 2012. "Ridesharing in North America: Past, Present, and Future." *Transport Reviews* 32 (1): 93–112. doi:10.1080/01441647.2011.621557.
- [10] Ferguson . (1997). The rise and fall of the American carpool: 1970–1990. *Transportation* 24, 349376. doi:https://doi.org/10.1023/A:1004928012320
- [11] Seyedabrishami, S., A. Mamdoohi, A. Barzegar, and S. Hasanpour. 2012. "Impact of Carpooling on Fuel Saving in Urban Transportation: Case Study of Tehran." *Procedia - Social and Behavioral Sciences* 54: 323–331. doi:10.1016/j.sbspro.2012.09.751.
- [12] Shaheen, S. A., and A. P. Cohen. 2007. "Growth in Worldwide Carsharing an International Comparison." *Transportation Research Record* 1992: 81–89. doi:10.3141/1992-10.
- [13] Shaheen, S. A., N. D. Chan, and T. Gaynor. 2016. "Casual Carpooling in the San Francisco Bay Area: Understanding User Characteristics, Behaviors, and Motivations." *Transport Policy* 51: 165–173. doi:10.1016/j.tranpol.2016.01.003.
- [14] Delhomme, P., and A. Gheorghiu. 2016. "Comparing French Carpoolers and Non-Carpoolers: Which Factors Contribute the Most to Carpooling?" *Transportation Research Part D: Transport and Environment* 42: 1–15. doi:10.1016/j.trd.2015.10.014.
- [15] Neoh, J. G., M. Chipulu, and A. Marshall. 2017. "What Encourages People to Carpool? An Evaluation of Factors with Meta-Analysis." *Transportation* 44: 423–447. doi:10.1007/s11116-015-9661-7.
- [16] Bachmann, F., A. Hanimann, J. Artho, and K. Jonas. 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 (Part A): 260–268. doi:10.1016/j.trf.2018.08.022.
- [17] Van Der Waerden, P., A. Lem, and W. Schaefer. 2015. "Investigation of Factors that Stimulate Car Drivers to Change from Car to Carpooling in City Center Oriented Work Trips." *Transportation Research Procedia* 10: 335–344. doi:10.1016/j.trpro.2015.09.083
- [18] Correia, G., and J. M. Viegas. 2011. "Carpooling and Carpool Clubs: Clarifying Concepts and Assessing Value Enhancement Possibilities through a Stated Preference Web Survey in Lisbon, Portugal." *Transportation Research Part A: Policy and Practice* 45 (2): 81–90. doi:10.1016/j.tra.2010.11.001.
- [19] Friginal, J., S. Gambs, J. Guiochet, and M. O. Killijian. 2014. "Towards Privacy-Driven Design of a Dynamic Carpooling System." *Pervasive and Mobile Computing* 14: 71–82. doi:10.1016/j.pmcj.2014.05.009
- [20] Ullah, I., K. Liu, and T. Vanduy. 2019. "Examining Travelers' Acceptance Towards Car-Sharing Systems—Peshawar City, Pakistan." *Sustainability* 11 (3): 808–823. doi:10.3390/su11030808
- [21] Zhou, B., K. M. Kockelman, and R. Gao. 2011. "Opportunities for and Impacts of Carsharing: A Survey of the Austin, Texas Market." *International Journal of Sustainable Transportation* 5 (3): 135–152. doi:10.1080/15568311003717181.

- [22] Li, J., P. Embry, S. P. Mattingly, K. F. Sadabadi, I. Rasmidatta, and M. W. Burris. 2007. "Who Chooses to Carpool and Why? Examination of Texas Carpoolers." *Transportation Research Record* 2021: 110–117. doi:10.3141/2021-13.
- [23] Malodia, S., and H. Singla. 2016. "A Study of Carpooling Behaviour Using A Stated Preference Web Survey in Selected Cities of India." *Transportation Planning and Technology* 39 (5): 538–550. doi:10.1080/03081060.2016.1174368.
- [24] Martin, E., S. Shaheen, and J. Lidicker. 2010. "Impact of Carsharing on Household Vehicle Holdings." *Transportation Research Record* 2143: 150–158. doi:10.3141/2143-19.
- [25] Habing, B. 2003. *Exploratory Factor Analysis*. (Accessed 26 July 2020). <https://people.stat.sc.edu/habing/courses/530EFA.pdf>
- [26] Guadagnoli, E., and W. F. Velicer. 1988. "Relation of Sample Size to the Stability of Component Patterns." *Psychological Bulletin* 103 (2): 265–275. doi:10.1037/0033-2909.103.2.265
- [27] Jamal, J., Montemanni, R., Huber, D., Derboni, M., & Rizzoli, A. E. (2017). A Multi-Modal and Multi-Objective Journey Planner for Integrating Carpooling and Public Transport. *Journal of Traffic and Logistics Engineering*, 68-72. doi:doi: 10.18178/jtle.5.2.68-72
- [28] Maif. (2009). Utilisation and attitudes of covoiturage.fr users. Récupéré sur <https://www.maif.fr/files/live/sites/maif-fr/files/pdf/particuliers/auto-moto/covoiturage/maif-etude-covoiturage-12-2009.pdf>
- [29] Bulteau, J. F. (2019). Carpooling and carsharing for commuting in the Paris region: A comprehensive exploration of the individual and contextual correlates of their uses. *Travel Behaviour and Society*, 77-87. doi:<https://doi.org/10.1016/j.tbs.2019.04.007>
- [30] Ciari, Francesco. (2012). Why do people carpool: Results from a Swiss survey. doi:<https://doi.org/10.3929/ethz-b-000041315>