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Mobility as a Service for university communities, Case study

TESI DI LAUREA MAGISTRALE IN
MOBILITY ENGINEERING

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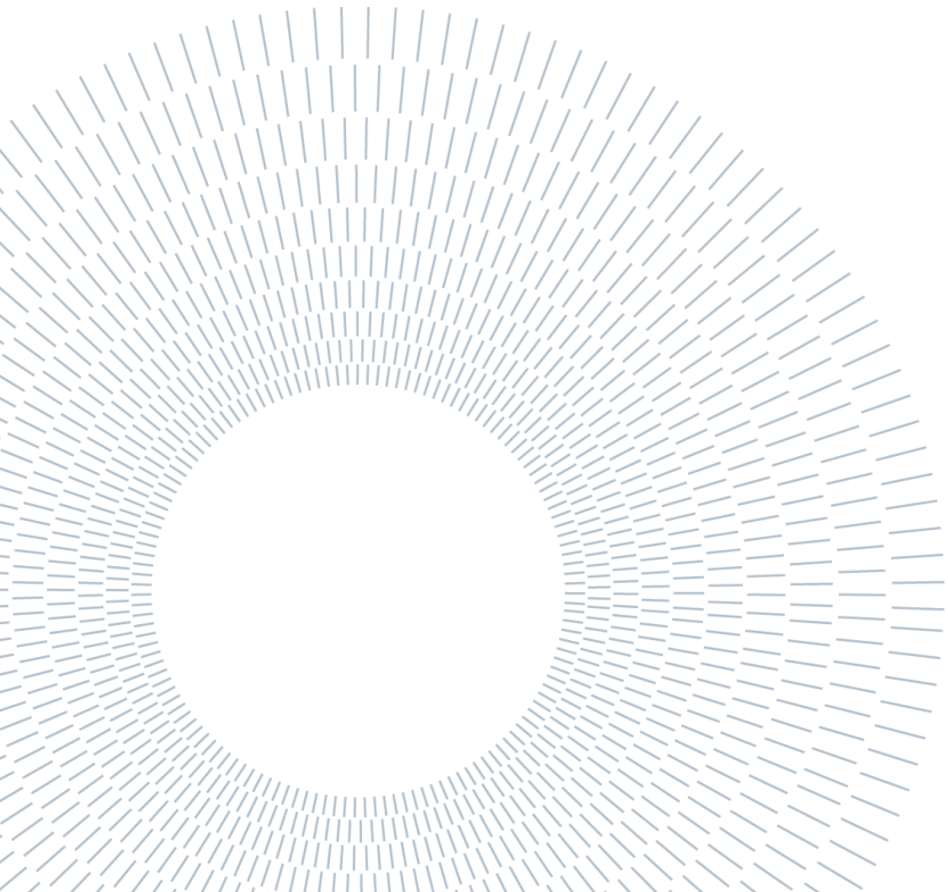


Abstract

Mobility as a Service (MaaS) is a concept that integrates various transportation modes into a single, accessible, and user-centric platform, allowing individuals to plan, book, and pay for their journeys seamlessly. It aims to provide convenient, sustainable, and personalized mobility options, reducing the reliance on private car ownership while promoting efficient and eco-friendly transportation solutions.

This research begins by providing an overview of Mobility as a Service and delves into its potential users, relevant social trends, implementation factors, and future market prospects, drawing from a comprehensive literature review. It then shifts focus to the examination of challenges and opportunities associated with MaaS implementation within university settings, accompanied by a review of relevant studies in this context.

Furthermore, the research includes insights from an academic survey involving 1949 participants, comprising students and employees of Polytechnic Milan University between May and July 2023. This survey offers valuable insights into the actual mobility needs of these individuals and their preferences for the presented mobility packages. Additionally, it measures their willingness to pay for each package.

Ultimately, the findings underscore a prevalent dissatisfaction among public transportation users, primarily students, and those combining public transport with private vehicles. These groups are identified as the target demand. The survey highlights that the most favored MaaS package is the combination of public transport with bike and scooter shared service, with respondents willing to pay between 100 to 200 euros annually or accept a 10% to 20% increase in the annual transport card cost for this package.

Key-words: Mobility as a Service, MaaS, Willingness to pay, Target demand, University community.

Abstract in lingua italiana

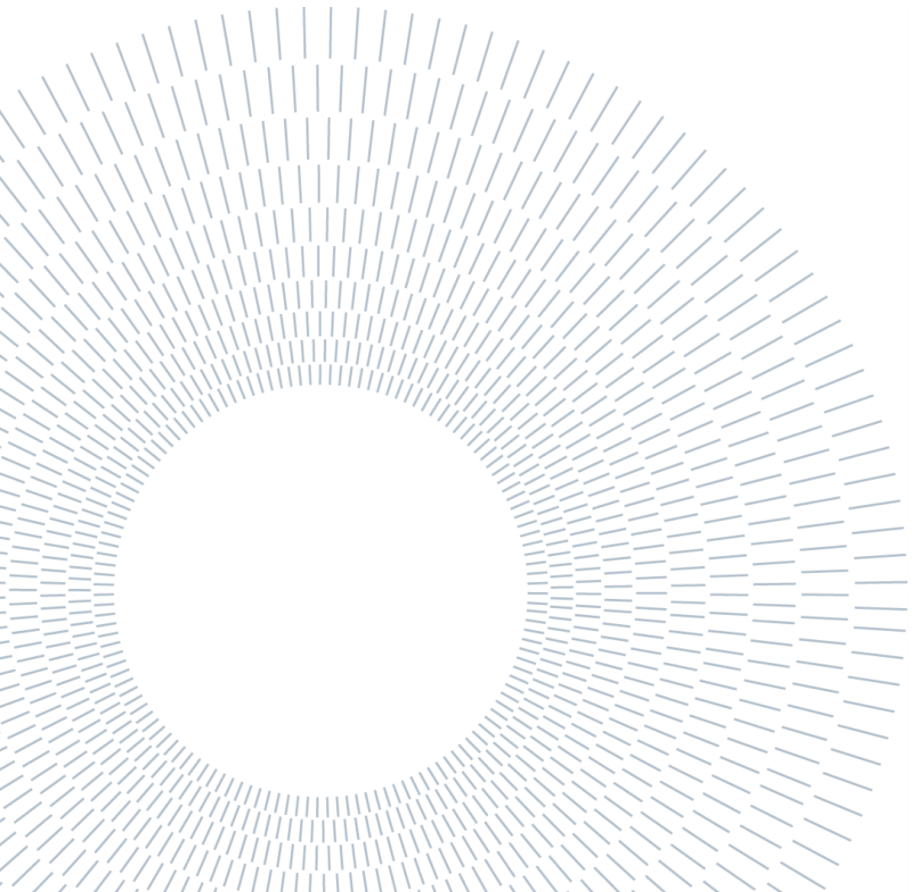
La Mobilità come Servizio (MaaS) è un concetto che integra vari modi di trasporto in una piattaforma unica, accessibile e incentrata sull'utente, consentendo alle persone di pianificare, prenotare e pagare i loro viaggi in modo semplice. Mirando a fornire opzioni di mobilità comode, sostenibili e personalizzate, riduce la dipendenza dalla proprietà di auto private, promuovendo nel contempo soluzioni di trasporto efficienti ed ecologiche.

Questa ricerca inizia fornendo una panoramica della Mobilità come Servizio e approfondisce le prospettive degli utenti, le tendenze sociali rilevanti, i fattori di implementazione e le prospettive future del mercato, basandosi su una revisione completa della letteratura. Si concentra poi sull'esame delle sfide e delle opportunità legate all'implementazione della MaaS all'interno degli ambienti universitari, accompagnato da una revisione degli studi rilevanti in questo contesto.

Inoltre, la ricerca include approfondimenti da un sondaggio accademico che coinvolge 1949 partecipanti, tra studenti e dipendenti della Polytechnic Milan University tra maggio e luglio 2023. Questo sondaggio offre preziose informazioni sulle effettive esigenze di mobilità di queste persone e sulle loro preferenze per i pacchetti di mobilità presentati. Inoltre, misura la loro disponibilità a pagare per ciascun pacchetto.

In definitiva, i risultati mettono in luce una diffusa insoddisfazione tra gli utenti dei mezzi pubblici, principalmente studenti, e coloro che combinano il trasporto pubblico con veicoli privati. Questi gruppi sono identificati come la domanda target. Il sondaggio evidenzia che il pacchetto MaaS più preferito è la combinazione di trasporto pubblico con servizi di condivisione di biciclette e monopattini, con i partecipanti disposti a pagare tra 100 e 200 euro all'anno o ad accettare un aumento del 10% al 20% del costo annuale della carta trasporti per questo pacchetto.

Parole chiave: Mobilità come servizio, MaaS, disponibilità a pagare, domanda target, comunità universitaria.



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Introduction

Background

As per the data provided by the United Nations population report, the global population is predicted to surpass 10.5 billion individuals by the year 2075, a significant increase from the 4.2 billion recorded in 2018. Projections indicate that by 2030, there will be approximately 43 megacities, each hosting more than 10 million residents. Moreover, by the year 2050, over two-thirds of the global populace will find their homes in urban settings.[1]

Since the private car, widely regarded as the symbol of comfort in transportation, embodies flexibility, freedom, and convenience, these sprawling metropolises wrestle with severe congestion, which contributes to significant time losses. This vehicular congestion, often characterized by solo occupants, intensifies pollution and urban congestion, while traffic's environmental toll extends to substantial CO2 emissions. Although private transport is not singularly culpable for climate change, it undoubtedly exerts a pronounced impact on the transportation area.

Considering these factors, the prevailing car-centric transportation paradigm necessitates substantive recalibration. Meeting this evolving need for transportation and mobility will emerge as a vital challenge for the cities of tomorrow, necessitating innovative solutions to ensure urban mobility keeps pace with growing populations while maintaining the desired standards of service.

When it comes to traditional transportation systems, they often involve fragmented and disconnected modes of travel, such as private cars, public transit, ridesharing, biking, and walking. These fragmented systems can lead to inefficiencies, congestion, environmental concerns, and a lack of convenient options for individuals to plan and execute their journeys. MAAS addresses these challenges by leveraging technological advancements to create a comprehensive and personalized mobility ecosystem.

The central focus of this study is directed towards an exploration of the Mobility as a Service concept. Within this chapter, various aspects of MAAS are investigated.

Mobility as a Service represents a transformative concept in transportation and urban mobility that aims to revolutionize the way people access and utilize various modes of transportation within cities and regions. It is an umbrella term for services that assist people to plan, book, and pay for multiple types of mobility services through a joint digital channel. [2] Rooted in the digital age and the increasing need for sustainable and efficient transportation solutions, MAAS seeks to provide a seamless, integrated, and user-centric approach to mobility by combining different transportation services into a unified, on-demand platform.

Figure 0.1: This image illustrates a schematic of MaaS model[3]

As urban populations grow and cities become more interconnected, the challenges of congestion, air pollution, and limited transportation infrastructure become increasingly evident. Traditional car-centric models of mobility contribute to these issues, and there is a pressing need for innovative solutions that can offer a more efficient, flexible, and environmentally-friendly approach to urban transportation.

MAAS holds the promise of not only enhancing the quality of urban living but also contributing to broader societal goals. By promoting the use of shared transportation options and reducing reliance on private cars, MAAS can help alleviate traffic congestion, lower carbon emissions, and create more livable urban environments. Additionally, the data generated by MAAS platforms can offer valuable insights for urban planners and policymakers to make informed decisions about transportation infrastructure and land use.

Mobility as a Service represents a paradigm shift that aligns with the evolving needs and preferences of modern urban populations. The rise of smartphones, the expansion of data analytics, and the growing emphasis on sustainability have converged to create an opportune environment for the widespread adoption of MAAS solutions.

At its core, Mobility as a Service offers users a single point of access for planning, booking, and paying for various transportation options. This might include buses, trains, taxis, rideshare services, bike-sharing, scooter-sharing, and even future modes like autonomous vehicles. Through a user-friendly mobile application or web platform, individuals can seamlessly navigate their journeys, choosing the most suitable modes of transportation based on factors such as cost, time, convenience, and environmental impact. [2]

The success of MAAS depends on collaboration between public and private stakeholders. Public transportation agencies, rideshare companies, bike-sharing programs, and other mobility service providers need to come together to create an integrated ecosystem that seamlessly connects various modes of transport. Government support, regulatory frameworks, and investment in digital infrastructure also play a crucial role in enabling the growth of MAAS platforms.

However, the path to full-scale MAAS implementation is not without its challenges. Overcoming technological, regulatory, and cultural barriers is essential for realizing the full potential of MAAS. Privacy concerns, data security, interoperability between different service providers, and ensuring equitable access to transportation options are all complex issues that require careful consideration.

It is worth mentioning that Mobility as a Service represents a visionary approach to urban transportation that has the potential to reshape how people navigate cities. By offering a comprehensive, interconnected, and user-centric mobility experience, MAAS has the capacity to improve urban living conditions, reduce environmental impact, and promote more sustainable transportation practices. As the world continues to urbanize and societies seek innovative solutions to urban mobility challenges, MAAS stands as a beacon of progress, guiding us towards a future where transportation is not just a means of getting from point A to point B, but a seamless and integrated part of urban life.

Motivation and Objective of this thesis

The central objective of this thesis is to conduct a comprehensive exploration of potential solutions aimed at improving the commuting experience for staff and students travelling to Politecnico di Milano University. To achieve this objective, the results of a survey are employed, with a focus on capturing the perspectives of the university's commuting community. The survey aims to gather crucial data regarding the current commuting patterns of Polimi attendees and gauge their perceptions of Mobility as a Service as a potential solution. By examining these perspectives, the study seeks to contribute to the development of strategies that address the unique challenges faced by Polimi commuters in order to enhance the overall efficiency and convenience of their transportation choices in the future.

Within the scope of this study, several key questions are addressed. Firstly, a comprehensive investigation into the state-of-the-art MaaS solutions is undertaken. This entails a detailed review of the MaaS concept, focusing on factors such as various users, societal trends impact and key elements for implementation.

Additionally, the study delves into the future prospects of implementing a practical MaaS framework for Polytechnic Milan University commuters. Considering the findings from the survey, the research aims to outline potential scenarios that can offer viable and reasonable packages for improving the commuting experience of individuals associated with Politecnico di Milano University.

1. State of the art

1.1 Literature review

Within the literature review, a comprehensive exploration awaits, delving into the concept of Mobility as a Service.

1.1.1 MaaS concept and expected users

The concept of Mobility as a Service has gained significant traction as a promising solution for addressing urban mobility challenges and transforming the way people navigate cities. MaaS envisions an integrated and user-centric approach to transportation, where various modes of travel are seamlessly combined into a unified mobility service. This literature review seeks to explore and analyze the potential scenarios for the implementation of MaaS, shedding light on the diverse perspectives, challenges, and implications associated with its future paths.

The background on the emerging mobility ecosystem refers to the major transition that urban transport is currently experiencing, which has considerable potential to foster sustainable mobility. This transition is being triggered by technological trends, such as digitalization and electrification, as well as by societal and market changes, such as decarbonization and the rise of digital platforms. These changes have led to the development of new approaches to mobility. [4]

MaaS can improve transit accessibility by offering users a range of transportation options, such as public transit, ride-sharing, bike-sharing, and car-sharing, that are tailored to their specific needs and preferences.[4] This can help to reduce the reliance on private cars and increase the use of sustainable modes of transportation, which can improve transit accessibility for all users, including those with limited mobility or access to private vehicles.[4]

The user of Mobility as a Service encompasses a diverse spectrum of individuals with varying travel needs and preferences. MaaS revolutionizes the way people move from one place to another by seamlessly integrating various transportation modes, such as public transit, shared mobility services, and alternative mobility solutions, all

under one unified platform. This innovative concept aims to cater to users by providing a spectrum of travel options customized to their unique requirements, simplifying the planning, booking, and payment processes through a single user-friendly app or platform. MaaS is exceptionally valuable for those who either do not own a personal vehicle or opt not to rely on one for their daily commute. It empowers them with sustainable, cost-efficient, and convenient alternatives. However, MaaS is not exclusive to non-car owners; even car owners can benefit by supplementing their private vehicle use with these versatile mobility options. Additionally, MaaS serves as a valuable resource for tourists and visitors exploring unfamiliar locales, offering them a streamlined way to navigate and utilize local transportation networks. Whether an individual is a daily commuter, an occasional traveler, a car owner seeking flexibility, or a tourist discovering new destinations, MaaS opens up a world of mobility possibilities tailored to their specific needs. [5]

1.1.2 Impacts of societal trends on MaaS

Enoch and Potter investigate societal trends that could impact the development of MaaS, including increasing demand for mobility services, increased choice of transport options, more productive travel time, changes in the geography of destinations, and the appearance of self-driving vehicles.[6]

The findings of McIlroy can inform the development of MaaS systems that are more equitable for all genders by highlighting the current gaps and opportunities for improvement in the MaaS literature.[7] For example, the review found that gender is not consistently considered in MaaS research, and that there is a need for more targeted research on the gendered impacts of MaaS. The review also identified potential areas where MaaS could address gender inequities, such as providing safety information and easy access to ride-hailing services. By addressing these gaps and opportunities, MaaS systems can be designed to better cater to the needs of all genders and reduce the transport gender gap.[7]

Narayanan and Antoniou reveal the influence of socio-demographic characteristics (age, gender, education, household car-ownership and possession of public transport pass and license), trip-related variables (trip distance and travel time), and supply parameter (fleet size) on the demand for these services.[5] The estimation results show that bike-sharing systems are more likely to be used for trips with distances up to 5 km, while car-sharing and ride-hailing systems are expected to be used for a longer distance range of 2 to 15 km. However, there is a lower probability to use the three services for travel times beyond 30 min. The model also indicates that cost and travel time are important factors that influence the probability of using ride-sharing and ride-hailing services, along with travel distance.[5]

1.1.3 Key factors for MaaS implementation

It is worth mentioning that the insights from this study can be used to improve the design and implementation of MaaS services in the future in several ways. Firstly, MaaS services should be made compatible with the needs and preferences of potential adopters by targeting groups that have previously indicated interest in the sharing economy and/or sustainability-branded innovations and by making the services flexible enough to enable adopters to customize them to fit with their current travel needs and habits. Secondly, the complexity of MaaS should be reduced by minimizing the volume of new digital systems and apps, practical procedures, and pricing models the adopters have to learn and manage. Thirdly, the trialability of MaaS should be improved by making the onboarding process quick and simple, and through promotional discounts. Fourthly, the reduced parking opportunities played a key role in making the residents interested in alternatives to private car ownership and use, so the implementation of MaaS services should be synchronized with the implementation of policies aimed at reducing car use. Finally, the study emphasizes the significance of design decisions related to, for instance, the installation process, instructions for use, user responsibilities, support functions, and even physical and practical solutions.[2]

To ensure that MaaS is accessible to all, including those in developing countries, policymakers need to implement both facilitating and regulatory policies.[4] Facilitating policies can include investments in infrastructure, such as dedicated active mobility lanes and bus rapid transit (BRT) systems, as well as the introduction of cashless payment systems and service contracting of public transport. Regulatory policies can include measures to ensure that MaaS providers are meeting certain standards of service quality and accessibility, as well as measures to protect the rights of informal and semi-formal transport services (paratransit) and micro-mobility providers. Additionally, policymakers should establish a vision and a desired outcome for MaaS at the national level, embedded in the national transport strategy, while taking into account local specificities. [4]

1.1.4 Future market

They present four future MaaS market scenarios as follows: [6]

1. The Dominance of Private Mobility
2. The Rise of Public Mobility
3. The Emergence of a Multi-Modal Mobility Market

4. The Disruption of the Mobility Market

The study identifies a range of implications for each of the four future MaaS market scenarios.[6] These implications relate to the design of the 'public' transport service, the operational, regulatory and planning mindset, the potential impacts on individuals, operations and society more generally, and the potential for MaaS to contribute to a paradigm shift from transport being fundamentally provider-led to being a more user-led system. [6]

The future market for MaaS holds the promise of significant advantages for both users and service providers. As outlined by Hensher et al., a competitive MaaS market has the potential to provide a host of benefits. For users, this competitive landscape could translate into more affordable and convenient travel choices, offering a broader spectrum of services and tempting discounts on various products and amenities. Such a dynamic market can empower users with greater control over their mobility preferences and spending. [8]

On the provider side, a competitive MaaS market can serve as a fertile ground for innovation and expansion. Service providers may explore novel revenue streams and cultivate strategic partnerships to enhance their offerings. The competition can also stimulate operational efficiency and drive providers to continually improve their services to stay ahead in the market. [8]

One critical aspect highlighted by the authors is the potential of a competitive MaaS market to play a pivotal role in reducing car usage and promoting sustainable modes of transportation. By offering a persuading array of alternative options and incentives, MaaS can actively contribute to addressing transportation challenges, including congestion and environmental concerns. [8]

However, it's important to recognize that the success of the competitive MaaS market is not guaranteed. If the competitive tendering process fails to attract bids from potential providers, it could convey a significant message about the challenges and uncertainties surrounding the future of MaaS. Therefore, fostering an environment conducive to competition, innovation, and collaboration will be essential in shaping the future market of MaaS, ultimately benefiting both users and providers while advancing the cause of sustainable and efficient transportation. [8]

1.1.5 Design of MaaS Plans

The expanding integration of transportation modes has led to the concept of mobility plans or MaaS bundles. [9] MaaS bundling refers to the practice of offering packages

of mobility services to customers as subscriptions. MaaS bundles typically include a variety of transportation options, such as public transportation, car-sharing, bike-sharing, and ride-hailing services. The benefits of MaaS bundling include the potential to promote sustainable travel behavior by increasing the share of intermodal alternatives compared to private car use and ultimately reducing car ownership. MaaS bundling can also provide benefits to providers by enabling price discrimination and reducing transaction and information costs. Additionally, some people prefer a subscription even though they would pay less under a pay-per-use scheme. MaaS brokers might differ from original service providers, and societal benefits are a driving factor for bundling in transportation. Research on MaaS bundle configuration has primarily focused on consumer preferences through surveys and choice modeling. [9]

Necessary design dimensions encompass the essential core of a MaaS bundle, lacking which the bundle would be insufficiently defined. These aspects encompass transportation modes, measurement units determining service entitlement, geographical coverage, target market segments, and subscription intervals. [9]

This table presents an overview of academic studies on MaaS bundles in point of necessary design dimensions in order to enhance comprehension of these factors.

Study	Modes	Metrics	Geography	Market segment	Subscription cycle
Caiati et al. (2020)	PT	trips/flat rate	Regional (Amsterdam/Eindhoven) or national	Individual	Month
	e-Bikeshare	hours			
	e-Carshare	minutes			
	Taxi	km			
	Car rental	days			
	Rideshare	km			
	On demand bus	trips			
Feneri et al. -2020	PT	trips/flat rate	Rotterdam, Amsterdam, Utrecht	Individual	Month
	Carshare	trips			
	Taxi	trips			

	e-Bikeshare	NA (flat rate)			
Guidon et al.(2020)	PT	NA (flat rate)	Zurich	Individual	Month
	Carshare	km			
	Bikeshare	hours			
	e-Bikeshare	hours			
	Taxi	minutes			
Ho et al. (2018)	PT	days	Sydney	Individual	fortnight
	Carshare	hours			
	Taxi	trips			
	Uber	trips			
Ho et al.(2020a,b)	PT	days	Tyneside	Individual	Month
	Carshare	hours			
	Bikeshare	hours			
	Taxi	trips			
Matyas and Kamargianni (2019a)	PT	NA (flat rate)	London	Individual	Month
	Taxi	miles			
	Carshare	hours			
	Bikeshare	hours			
Mulley et al.-2020	Shopping bus	trips	New South Wales, Queensland	Individual	Month
	Social outings				
	Medical transport				
	Emergency taxi service				

Table 1.1: Academic studies on MaaS Solutions, focusing on design dimensions

By considering these design dimensions and their potential benefits, designers can create MaaS bundles and solutions that are more attractive to customers and more effective in promoting sustainable travel behavior.

1.1.6 MaaS for university communities: opportunities and challenges

MaaS for university communities presents a unique set of challenges and opportunities, tailored to the specific needs and dynamics of these academic environments.

There exist numerous opportunities associated with mobility management within university settings: [10], [11]

1. The opportunity to reduce greenhouse gas emissions and mitigate air pollution through the promotion of eco-friendly transportation modes.
2. The potential to enhance the health and well-being of both students and faculty by encouraging active forms of commuting, such as walking and biking.
3. The chance to diminish traffic congestion and alleviate parking demand on campus by supporting sustainable transportation options.
4. The possibility of cost savings in transportation expenditures by adopting sustainable modes like public transit, walking, and cycling.
5. The prospect of improving the campus environment, making it more appealing and conducive to living.
6. The opportunity to foster a sense of community and social interaction among students and staff by endorsing sustainable commuting practices such as carpooling and car-sharing.
7. The potential to contribute to the attainment of Sustainable Development Goals (SDGs) by advancing sustainable transportation and mitigating transportation's adverse impact on the environment and society.

Considering the challenges in university mobility management, the study outlines several obstacles, including: [10], [12]

1. The need to promote eco-friendly transportation options among both students and faculty.
2. The necessity to diminish the reliance on private automobiles while encouraging the utilization of public transit, walking, and cycling.
3. The requirement to enhance the infrastructure and amenities supporting sustainable modes of transportation, such as bike lanes, bicycle parking facilities, and electric vehicle charging stations.

4. The essential task of raising awareness among students and staff regarding the advantages of sustainable transportation and the detrimental effects of private car usage on the environment and well-being.
5. The challenge of overcoming resistance to change and the absence of incentives for adopting sustainable transportation methods.
6. The obligation to address safety concerns pertaining to cycling and walking, particularly within urban areas.
7. The vital need to seamlessly integrate mobility management into the overarching campus planning and administration.

1.2 Current initiatives

Enabling MaaS services necessitates the incorporation of fundamental elements like shared transportation, booking and ticketing systems, and comprehensive multimodal traveller data. This involves blending various transportation modes and offerings, encompassing public transit, taxis, shared mobility programs, vehicle rentals, and more. This combination can be streamlined through the advancement of information and communication technologies (ICTs) and the availability of smartphone or web-based applications. [13]

1.2.1 MaaS Ecosystem

The MaaS ecosystem counts on the active involvement of various participants: [13]

1) customers, including both private and business clients who are offered MaaS products,
2) transport operators responsible for providing transportation assets and services such as public and private transport, roadways, and intelligent transportation systems,
3) the MaaS operator (which could be a public transport authority, a private transport authority, or a private company), responsible for designing and offering the MaaS concept,
4) data providers who offer the necessary data and information-sharing capabilities, and
5) other entities like insurance companies, regulatory bodies, technical backend providers, and more.

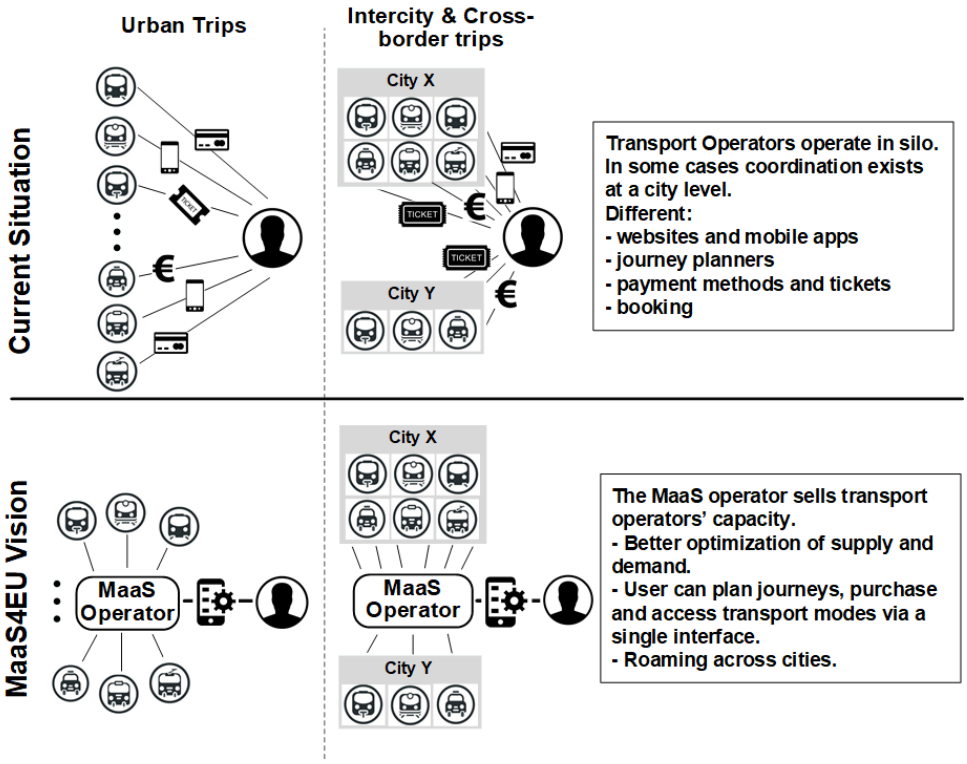


Figure 1.1: Comparison between current situation and future of MaaS [13]

This signifies that the MaaS operator must effectively manage a complex environment involving multiple stakeholders. However, this novel collaboration among MaaS participants (providers, transport operators, MaaS operators, etc.) presents a notable challenge to the success of the MaaS business ecosystem. Moreover, within the MaaS business ecosystem, multiple stakeholders who were previously competitors, like different transport operators serving the same market, now must cooperate to create value through MaaS offerings. Additionally, the MaaS operator introduces the potential for competition among various transport operators, aiming to enhance the quality of mobility services and capture the value of the products.

1.2.2 Recent MaaS university projects

This chapter offers an examination of evolving MaaS initiatives, including the modes of transportation and other relevant features.

Papantoniou *et al.* introduce an Action Plan designed to simplify the adoption of sustainable urban mobility measures for university decision-makers and planners. This strategic guide outlines a step-by-step approach that planners are encouraged to

follow to create a sustainable mobility plan for universities, whether they are located within urban areas or in outlying campuses. The Action Plan provides recommendations to address the specific needs of students and university staff while considering technical, economic, social, and environmental sustainability aspects of mobility solutions. Additionally, it recognizes that university campuses are part of a broader mobility context, where other end-users share infrastructures and services with the university. The Action Plan, presented in the article, follows four primary steps: Study, Plan, Do, and Act and Check, each containing subsections to define the context, operationalize plan development, implement measures, and monitor progress.[12]

Section	Activity	Duration
1 - Study societal trends and urban mobility scenario	1.1 Decarbonisation and air quality	1
	1.2 Local geographical area dynamics	3
	1.3 Demographic challenges	2
	1.4 Digital society	2
	1.5 Sharing economy	2
	total	**10**
2 - Plan of sustainable university mobility	2.1 Stakeholder identification and involvement 2	2
	2.2 Definition of goals, KPIs, action prioritising 3	3
	2.3 Community communication and involvement	Approximatively the whole duration of the plan implementation as it constitutes a monitoring and information activity
	2.4 Feedbacks on plan's actions 3	3
	total	**8**
3- Implementation of planned solution	**total**	**4**
4 - Monitor implemented sustainable university mobility solutions	4.1 KPIs evaluation	Its duration is comprehensive of the whole duration of the plan's implementation.
	4.2 Corrective actions	The duration depends from the monitoring plan. It is strongly dependent from the type of corrective action to plan
	4.3 Dissemination of results	This phase takes the whole plan duration and activities related to stakeholder communication
	total	Its duration is comprehensive of the whole duration of the action plan
ACTION PLAN	**Total**	**22**

Figure 1.2: This table represent the details of proposed action plan to create a MaaS plan for university communities [12]

De Lotto *et al.* provide a strategic plan for Pavia's soft mobility. It focuses on addressing various critical aspects of the current soft mobility system, with a primary emphasis on key destinations such as university and hospital areas and the historic city center, as well as the origins of flows, including the city's rail and bus stations and residential districts. The project aims to create an extensive soft mobility network encompassing the entire urbanized territory of Pavia. This entails the construction of new bicycle paths, the introduction of bicycle-friendly road crossings with traffic

lights, and the establishment of pedestrian crossings. Additionally, the plan proposes the implementation of 30 km/h zones in areas where it is not feasible to create separate bicycle paths, emphasizing safety and accessibility for pedestrians and cyclists. Importantly, the plan maintains the existing directions of travel and bus stops, with minimal impact on parking spaces, except for the addition of a new public parking area near the station. The execution of the project involves both ordinary and extraordinary maintenance of the municipal infrastructure, with various actions designed to enhance the soft mobility experience in the city, making it more efficient and sustainable.[14]

2. Materials and Methods

2.1 Survey design and administration

A survey has been conducted to collect data on how commuters move to different campuses of Polytechnic Milan University. The purpose of this analysis is to investigate the potential behavior of users in the presence of MaaS. The intended users of this research were students and employees of different campuses between May and June 2023. This survey was carried out using the CAWI method. The details of this method are as follows.

Computer-Assisted Web Interviewing (CAWI) is an online survey method where questionnaires are administered through the internet using devices like computers and smartphones. It offers advantages like cost-effectiveness, quick data collection, and global reach, while also facing challenges such as the digital divide and self-selection bias. Researchers design and implement surveys using online platforms, benefiting from features like skip logic and branching, and collect data electronically for analysis. CAWI's success depends on addressing technical issues, ensuring data security, and considering its potential impact on sample representation and data quality.[15]

One of the methods consists in the execution of surveys aimed to observe current trip's choices using Revealed Preferences (RP) approach and simulate trip's attitudes to use MaaS using Stated Preferences (RP) approach.

2.1.1 Revealed Preference (RP) section: socioeconomic characteristics and travel habits

Revealed Preference is the concept of examining and analyzing the choices individuals make through their real-life behaviors and actions. This involves observing decisions made in practical scenarios, like their transportation modes. Through the analysis of revealed preferences, researchers can derive what individuals actually prefer based on their observed actions. This concept is rooted in

the belief that people's original preferences are demonstrated by the choices they opt for when faced with alternatives.[16]

In this section, the RP technique is used to investigate socio-economic characteristics and travel habits. In the first part, questions are asked about the person's status (students/staff), point of origin, main destination, number of trips, vehicle used, gender, age, household conditions, education level and working conditions which reveals the socio-economic characteristics of people.

2.1.2 Stated Intention (SI) section: perceptions and expectations

Stated Intention pertains to querying individuals regarding their planned or intended actions within a given context. This method relies on individuals expressing their future intentions, even if they have not translated these intentions into actions yet. Stated intention data can offer an understanding of people's anticipated actions and plans. However, it is crucial to note that actual behavior might deviate from stated intentions due to factors like altering situations, external influences, or biases in responses.[17]

In this section, the focus is on getting the perception and expectations of the participants. Based on this, questions have been asked about the level of user satisfaction with the current modes of transportation, the reasons for dissatisfaction, the main problems, the usage of application for commuting, their expectations about the level of integration and functionality of a MaaS app.

2.1.3 Stated Preference (SP) section: proposed mobility bundles and choice situations

Stated Preference involves collecting information about individuals' preferences by directly inquiring about their choices. This usually occurs in a controlled survey or interview environment. This technique entails presenting individuals with hypothetical situations or sets of choices and requesting them to indicate their preferences by selecting from the available options. Stated preference data assists researchers in comprehending how individuals assess and rank various attributes or characteristics while making decisions. [16]

In this questionnaire, three packages are defined to determine the respondents' understanding of MaaS. In the first package, people are asked if they want to buy a MaaS subscription with the feature of combining public transportation and scooter and bicycle sharing services. The second package allows people to get to university by combining public transportation and car and moped sharing services. In the third

package, people's willingness to buy a combination of public transport and dedicated parking spaces for their cars/bicycles near the stations is investigated.

Packages	Suggestions
Package 1	combining public transport and scooter and bike sharing services
Package 2	combining public transport and car-sharing and moped-sharing services
Package 3	combining public transport and reserved pay parking spaces for your car/bike near stations/stops

Table 2.1: Introduction of packages

For people who currently have a public transport subscription card, packages are offered with different price increases. Similarly, for people who do not have a subscription card, suggested packages are offered at different prices.

Category	Questions	X
Public transport cardholders	If your public transport pass included this package, would you be willing to buy it for X% more than it would currently cost you?	10% 20% 30% 40% 50% 60% 80%
Non cardholders	If your public transport pass included this package, would you be willing to buy it for X euros per year?	100 euros 200 euros 300 euros 400 euros 500 euros 600 euros 800 euros

Table 2.2: Introduction of options suggested for each package within two group of users

The proposed packages have different prices and include different transportation services to understand the acceptance threshold of the interviewees. Therefore, by showing different options to the user they were asked if they accept the purchase of one or more subscription packages and how much they prefer?

3. Results analysis and key findings

3.1 Sample descriptive statistics

A robust participation of 1949 individuals, comprising both students and employees, contributed their responses to the questionnaire. Presented below is a concise overview of the demographic attributes of the survey participants.

Sex		**Role**	
Female	39%	Staff	49.7%
Male	58%	Student	50.3%
Non mi identifico in nessun genere	1%		
Preferisco non dichiarare	3%		
Age		**Highest educational level**	
I am less than 26 years old	44%	Bachelor degree	13.1%
26-35 years old	21%	Doctor of Philosophy	21.5%
36-45 years old	10%	High school diploma	35.7%
46-55 years old	14%	Master degree	29.3%
56-65 years old	9%	Secondary school certificate	0.3%
I am more than 65 years old	2%		

Table 3.1: Demographic attributes of the survey participants

The following graph distinctly outlines the transportation methods utilized by both students and personnel members. Notably, public transportation emerges as the most prominent choice for both groups. Among students, the subsequent preferences include a blend of public and private transportation, along with walking. Conversely, within the employee subgroup, personal vehicle commuting holds the second position, followed by the combination of public and private transportation modes.

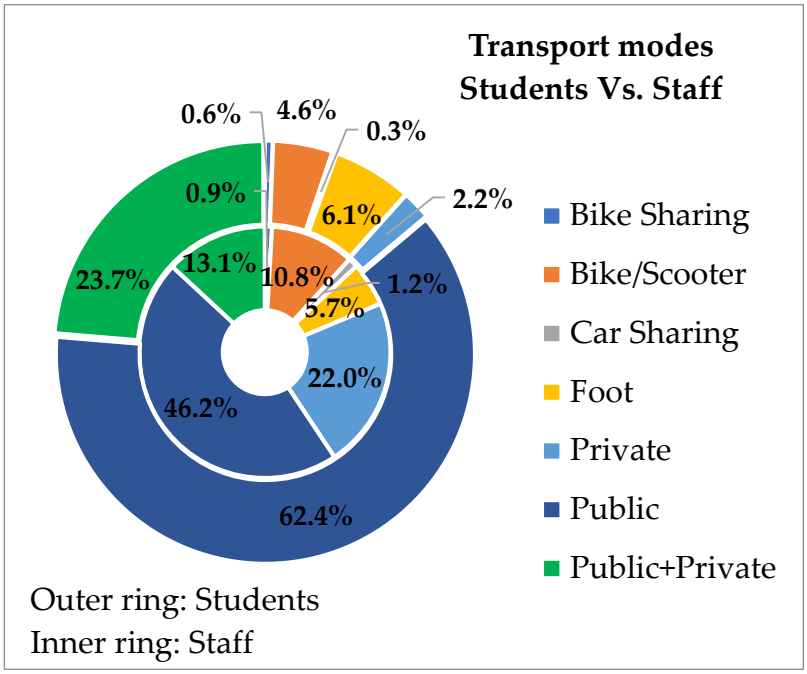


Figure 3.1: Comparison of transportation modes between Students and staff

Analysis of the gathered data reveals interesting insights about the respondents' living patterns and commuting habits. The majority, 46%, reside within the city of Milan, while 17% have their homes in the Milan province. The remaining 37% have chosen to establish their residence outside this province.

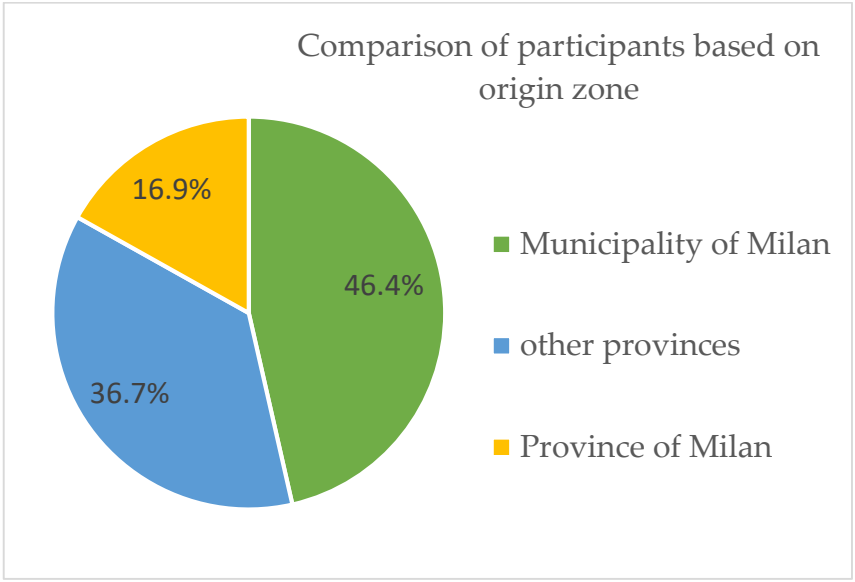


Figure 3.2: Comparison of participants based on origin zone

Considering the origin zone, a significant proportion of inhabitants in Milan opt for public transportation. Within the province of Milan, there is a rising trend in individuals utilizing private cars as well as a mix of both public and private transportation, although public transport remains predominant. This trend is also observable outside the Milan province, with the distinction that a greater number of individuals are switching to employing a combination of public and private transportation.

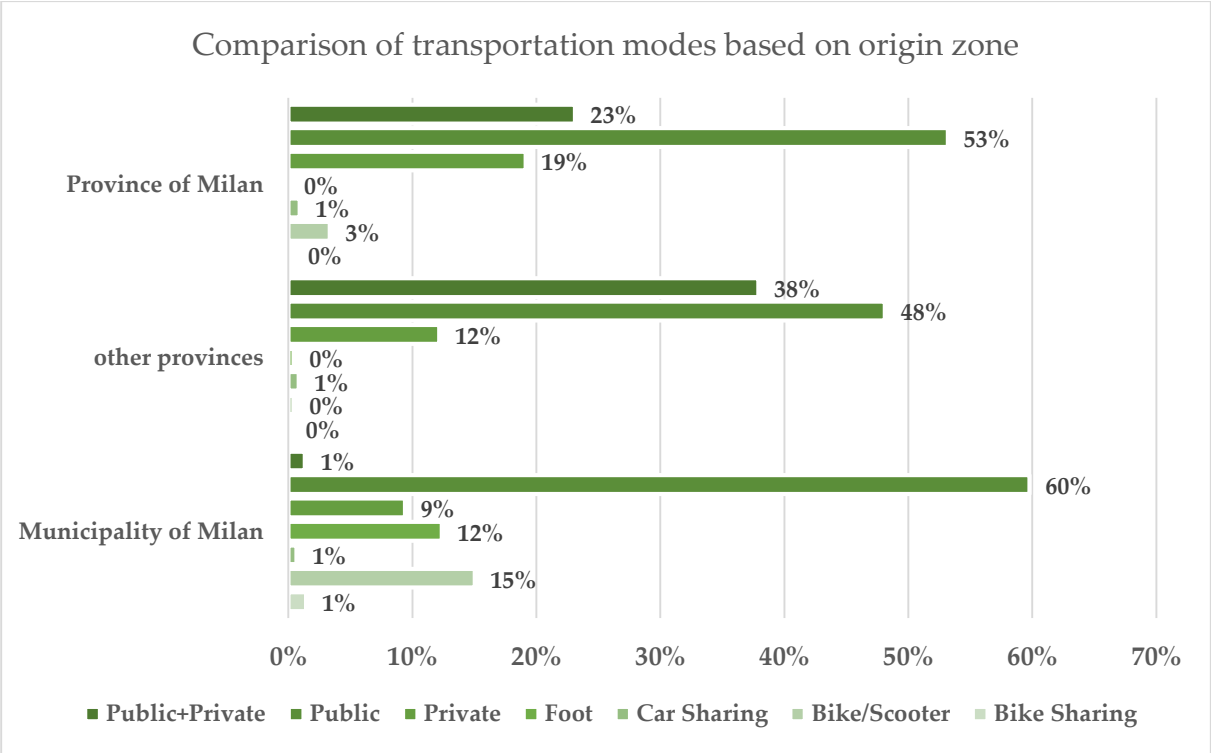


Figure 3.3: Comparison of transportation modes based on origin zone

In terms of weekly university commutes, a significant 43% of individuals undertake the journey more than 5 times, indicating a substantial commitment to their studies. Meanwhile, 29% opt for a regular schedule of 4 commutes, with the remaining 28% accounting for various commuting frequencies.

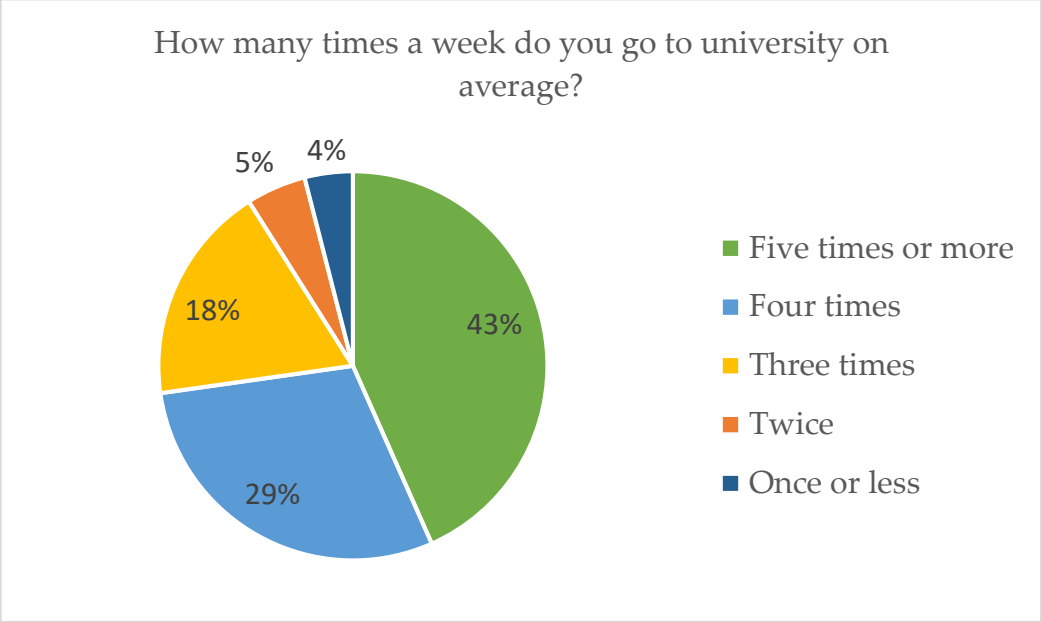


Figure 3.4: How many times a week do you go to university on average?

The data also shows that 63% of respondents mainly travel to the Leonardo campus and 35% mostly to the Bovisa campus.

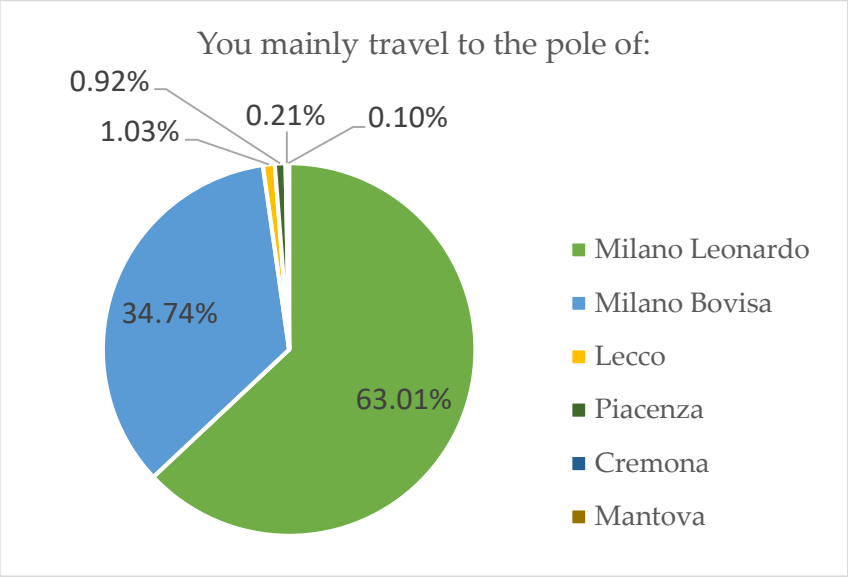


Figure 3.5: Comparison of participants based on main pole to travel

The diagram below illustrates the transportation mods employed by individuals traveling to the two major campuses, Leonardo and Bovisa campuses. Similarly to the previous one, a notable portion of individuals opt for public transportation.

Subsequently, there are individuals who utilize a combination of public and private means, while the third category comprises those who rely on private cars for commuting. The noteworthy aspect is this pattern is the same across both campuses.

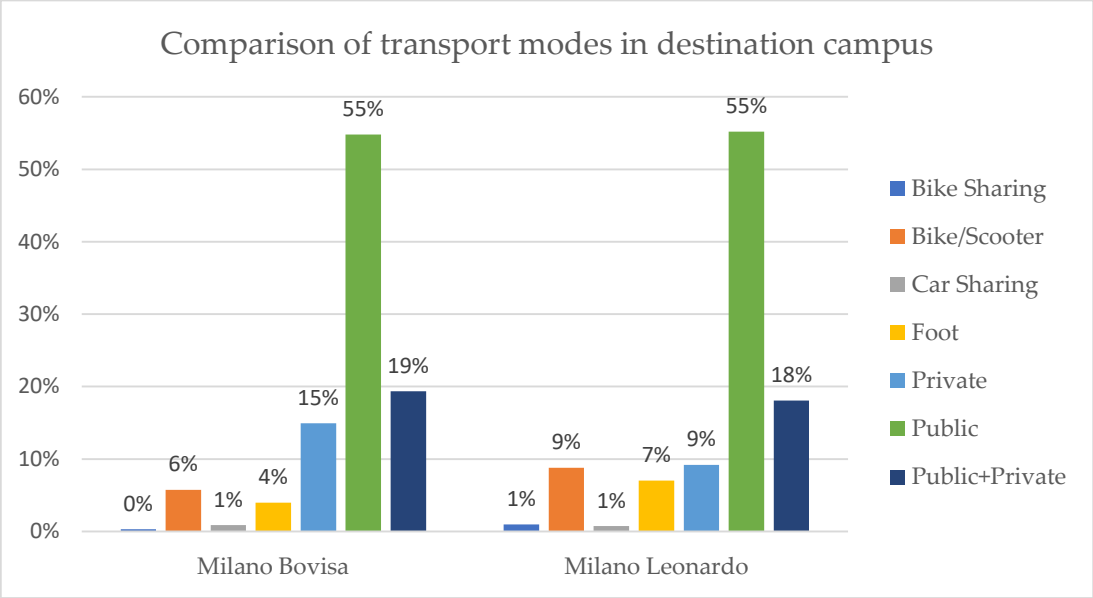


Figure 3.6: Comparison of transport modes in destination campus

Considering household conditions, the data indicates that 37% of individuals share their living space with their partners, while 33% reside with their parents. A smaller percentage, 16%, have chosen to live independently, and a group of 15% share accommodation with friends or colleagues.

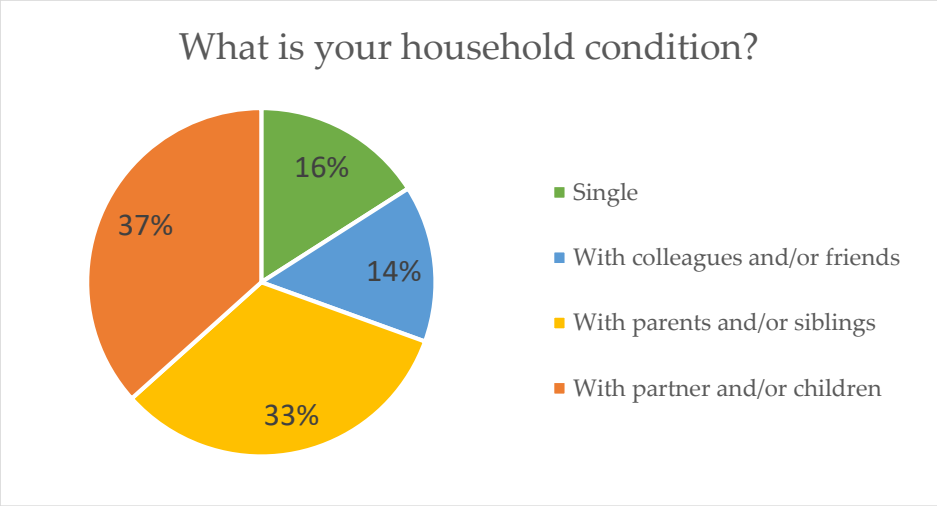


Figure 3.7: Comparison of household conditions of participants

3.2 Mobility needs and issues

The preliminary survey assessing individuals' satisfaction with their chosen modes of transportation to the university reveals that slightly over 50% of respondents express some level of dissatisfaction with their current commuting methods. Notably, the three modes of transportation with the highest dissatisfaction rates are as follows:

Transfer mode	Percentage
Public	57%
Public & Private	27%
Private	9%

Table 3.2: Comparison of dissatisfaction between transportation modes

Further investigations unveil a distinct pattern: the discontent with transportation options is predominantly concentrated within the student group, while the staff group reports a higher level of contentment with their chosen modes of transport. In light of this evidence, there exists an opportunity to absorb the student group through the implementation of an efficient Mobility as a Service (MaaS) solution, with the goal of mitigating this dissatisfaction.

Occupancy	Percentage
Staff	40%
Student	60%

Table 3.3: Comparison of dissatisfaction between Staff and Students

Notably, the most pronounced dissatisfaction among students has relevance to the following modes of transportation:

Transfer mode	Percentage
Public	61%
Public & Private	32%
Bike/Scooter	3%

Table 3.4: Comparison dissatisfaction between transportation modes for Students

Regarding the staff, as previously mentioned, their satisfaction levels are predominantly positive. However, a noteworthy observation emerges from the data: a substantial portion (51%) of users who utilize public transport express dissatisfaction. This demographic presents a promising opportunity for targeting with an appealing MaaS package, aimed at alleviating this dissatisfaction and drawing them towards the MaaS solution.

Transfer mode	Percentage
Public	51%
Private	20%
Public & Private	20%

Table 3.5: Comparison dissatisfaction between transportation modes for Staff

An analysis based on the origin zones reveals a noteworthy trend: the satisfaction level associated with transportation options within the city of Milan has surpassed the dissatisfaction. However, as one moves away from the city of Milan, a notable decline in satisfaction becomes apparent. This variation becomes particularly pronounced when examining individuals residing other provinces. In this case, the number of individuals expressing satisfaction with their transportation experiences drops to less than half, particularly within the two primary groups of Public transport and combination of Public and Private transport modes.

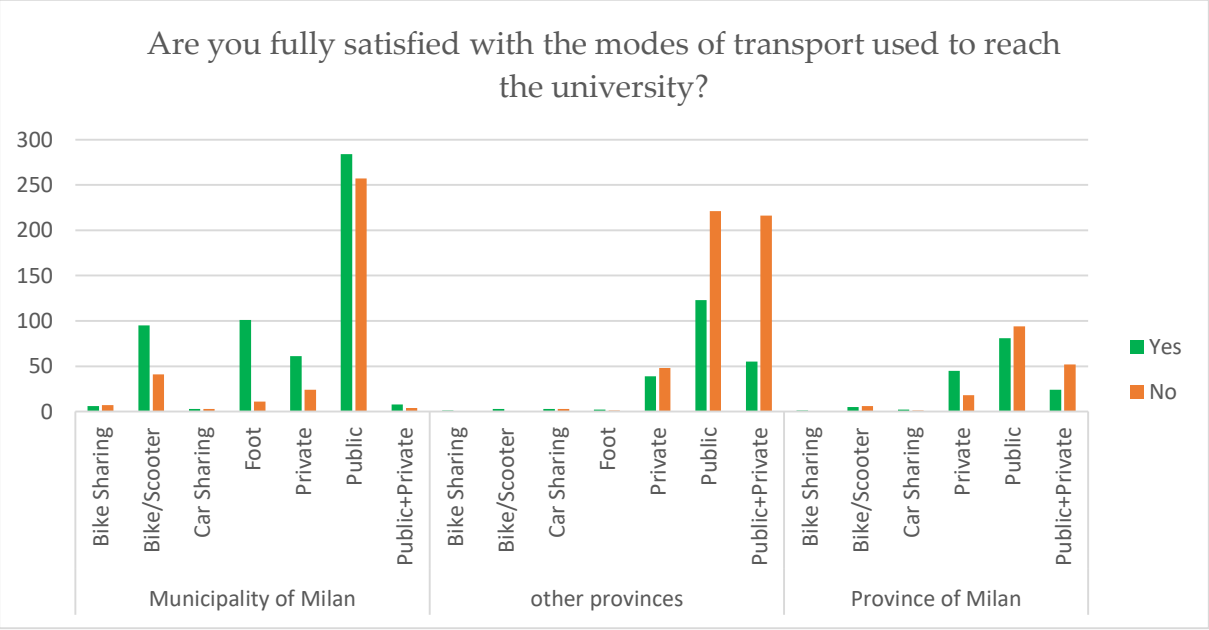


Figure 3.8: Comparison of Satisfaction among origin zone based on transport modes

Conducting a more in-depth examination of students and employees reveals a prevailing sense of contentment with their transportation experiences within Milan City. However, a notable variation arises in the Milan province. While staff members predominantly report satisfaction, the population of dissatisfied students exhibits an upward trend. Beyond the province's borders, this trend intensifies, with the level of student dissatisfaction escalating to fivefold. Notably, employees also showcase a prevailing sentiment of discontent in this scenario.

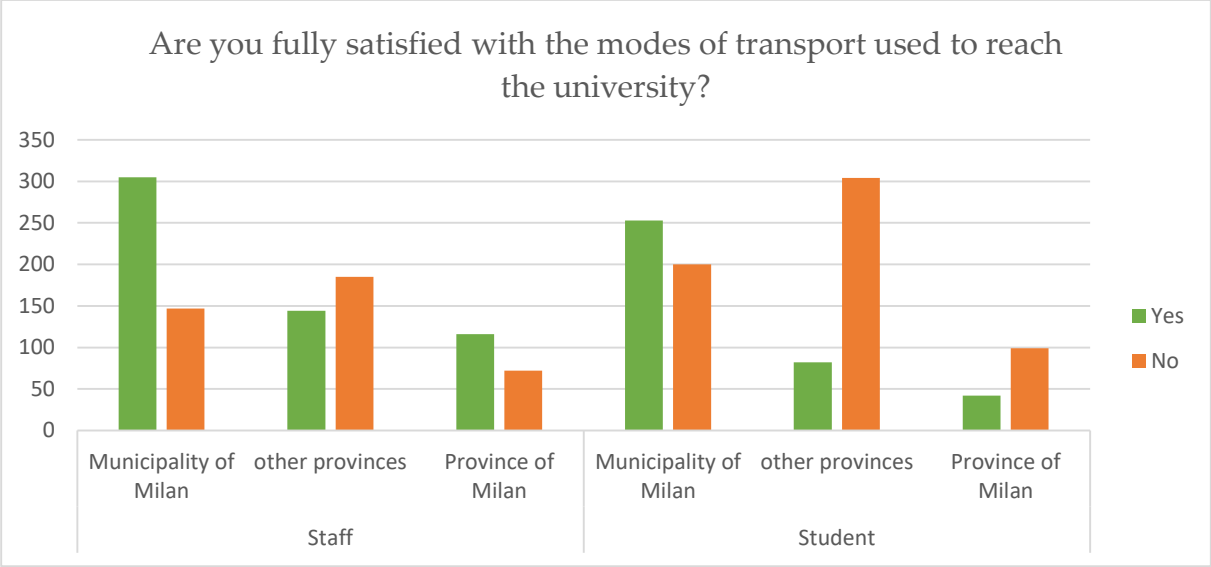


Figure 3.9: Comparison of Satisfaction among origin zone based on occupancy

Evidently, there exists a promising opportunity to capture the attention of these groups by introducing a viable and convenient Mobility as a Service plan.

The assessments within this section concentrate on the Main Pole of commuters, largely on the Bovisa and Leonardo campuses. Due to a lack of information, it should be mentioned that an exhaustive analysis of other campuses could not be undertaken. The data analysis underscores a notable trend: commuters heading to the Bovisa campus express significant dissatisfaction with both the public transportation mode and the combination of public and private modes. Accessing this particular campus appears to be an unappealing prospect for a substantial portion of users. It, as a result, can be a focal point for persuading people to apply for a MaaS Package.

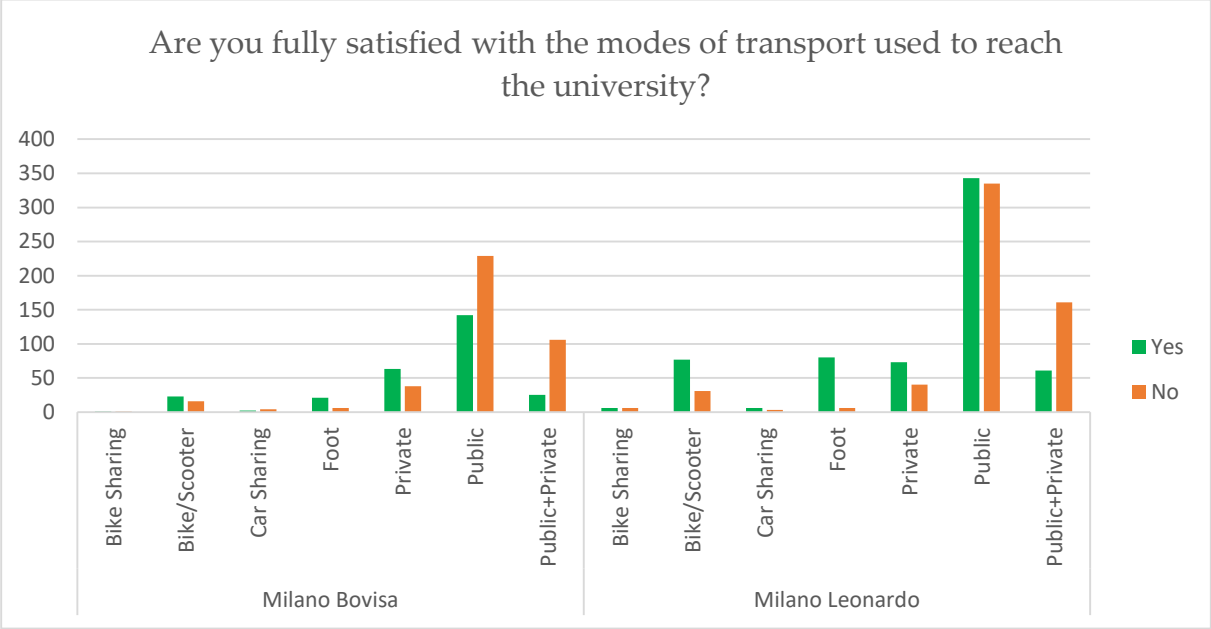


Figure 3.10: Comparison of Satisfaction among origin zone based on transport modes

Subsequent analysis delves into the preferences of individuals who own cars and scooters. Interestingly, a high level of satisfaction is observed with the Private mode, while a contrasting pattern of substantial dissatisfaction emerges with the combination of Public and Private transport modes. This difference signals a potential path for meeting demand by implementing a practical MaaS that optimally combines public and private transport options.

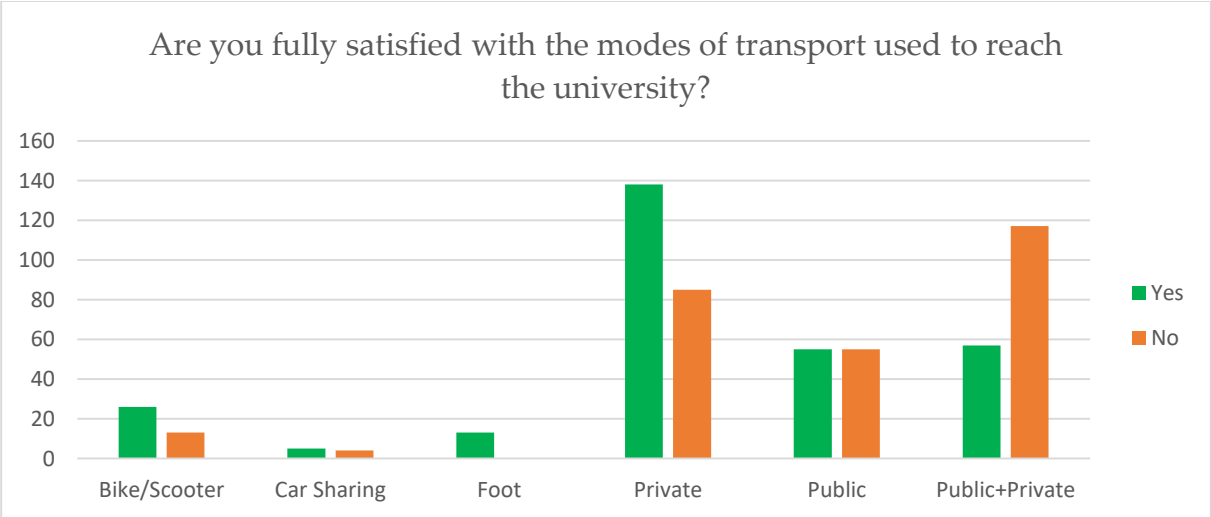


Figure 3.11: Comparison of Satisfaction among car/scooter based owners on transport modes

It should be mentioned that the age group emerges as another influential factor impacting individuals' satisfaction levels. Those under 45 years old, and notably those aged under 26, tend to exhibit lower levels of contentment.

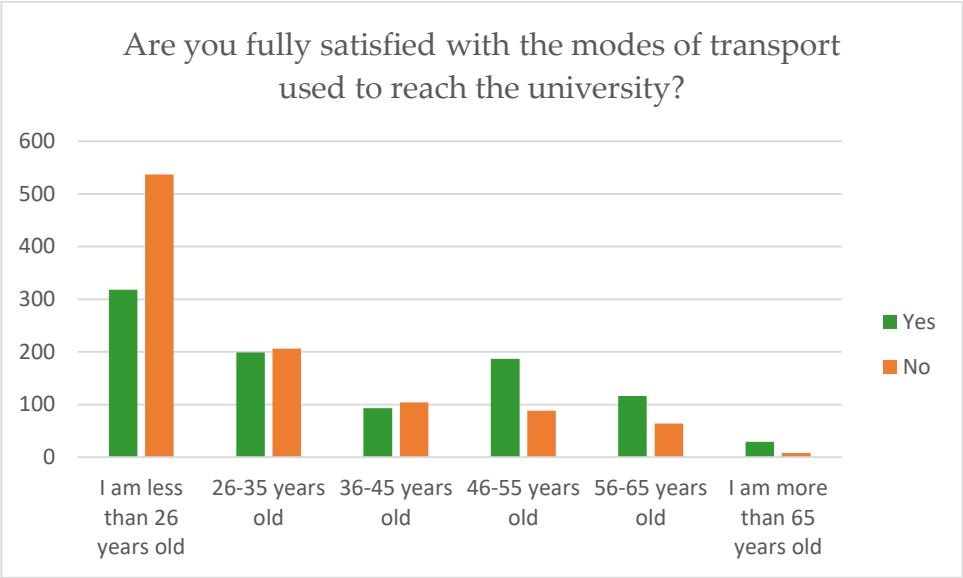


Figure 3.12: Comparison of Satisfaction among various age groups

Turning the focus to subscription willingness, the investigation reveals a significant insight. Notably, 59% of individuals considering subscription purchases express discontent with their current university commuting experiences. This dissatisfaction revolves around two categories: public transportation, and the public and private transport combination.

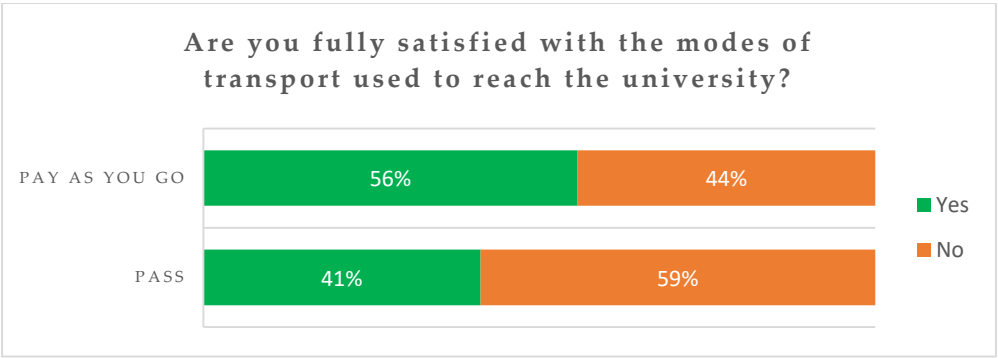


Figure 3.13: Comparison of Satisfaction between people with tendency to the subscription and others

In this question, it is clear that students are more willing to subscribe than employees. While the employees prefer the method of pay-as-you-go. Also, considering the origin zone, the residents of Milan mainly preferred the pay-as-you-go method, but the other two groups mainly considered subscriptions. Examining the mode of transportation in this part shows that the main choice of public transportation users, and users of public and private combination is the payment method through subscription. But users of other vehicles are more willing to pay per trip.

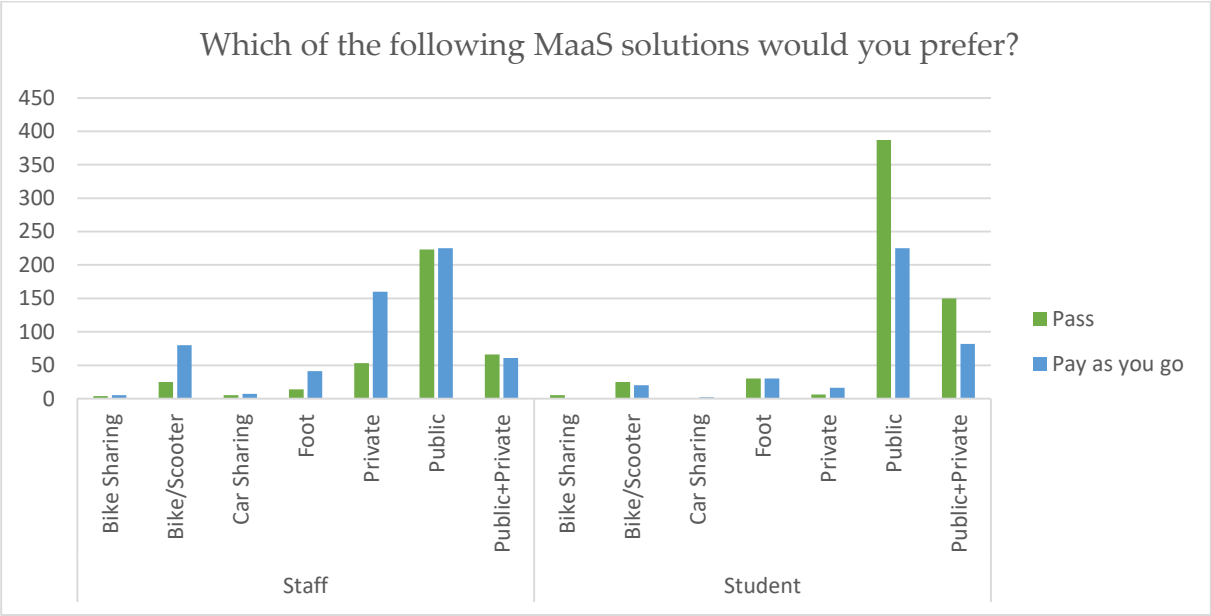


Figure 3.14: Comparison of people's tendency to purchase subscription

Common problems

This section analyzes the sources of dissatisfaction within people commuting to the university. The dissatisfaction stems from five primary reasons, as indicated by the recorded data. Notably, the first three reasons exhibit considerable variation from the remaining factors.

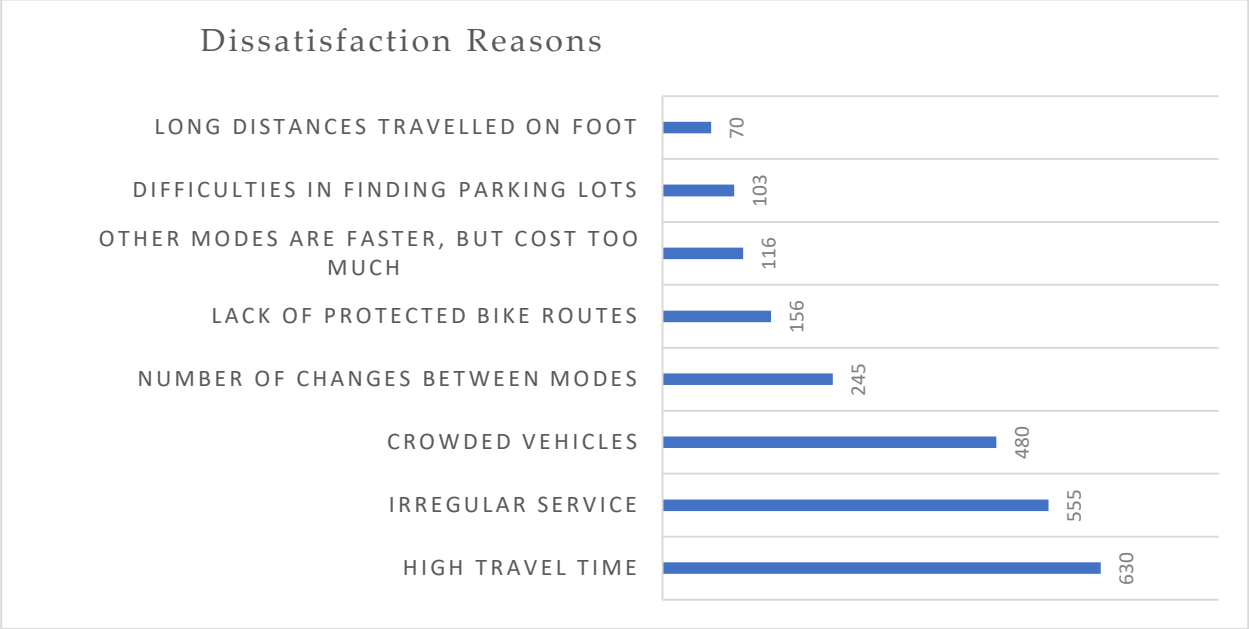


Figure 3.15: Comparison of dissatisfaction reasons according to participants

Considering modes of transport, for the public transit and public and private transit groups, significant contributors to discontent are irregular service, high travel times, and crowded vehicles. Conversely, within the private sector, high travel times, parking difficulties, and crowded vehicles are the main drivers of dissatisfaction.

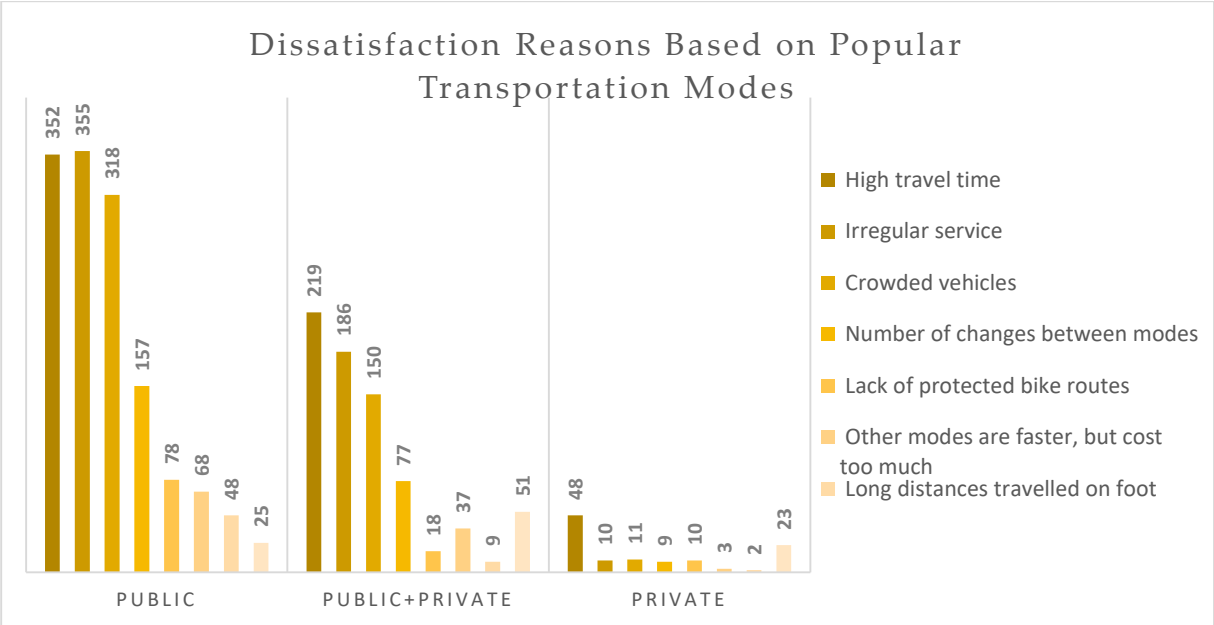


Figure 3.16: Comparison of dissatisfaction reasons based on popular transportation modes

As highlighted, long travel times stand out as a consistent cause for dissatisfaction across the board. Addressing this issue can be seen as a key mobility need that a well-designed MaaS package could fulfill effectively. Moreover, the potential to draw these dissatisfied individuals to MaaS packages lies in the creation of effective offerings. These could combine public transportation with shared services, providing alternative solutions during scenarios such as public transportation delays or crowded vehicles. This approach could significantly enhance user contentment by offering versatile options.

By elevating user satisfaction through the provision of robust and high-quality MaaS packages that cater to their mobility requirements, potential users are more likely to transition into active users. This integrated approach, coupled with responsive solutions, paves the way for a comprehensive MaaS strategy.

3.3 Identified potential MaaS users

Identifying Mobility-as-a-Service target users within a university community is essential for creating a transportation solution that meets the unique needs and challenges of this specific environment. A university community presents distinct travel patterns and requirements that can benefit from tailored MaaS offerings.

One of the highlighted target demands consists of individuals who frequently commute to and from the university throughout the week, displaying a strong affinity for the academic environment and a preference for spending extended hours on campus. As indicated in the graphical representation, the majority of both students and staff commute to the university at least five times a week, with the majority of these individuals residing in Milan. The second level in the graph are people who commute four times a week, with most employees in this category residing in Milan, while the majority of students live outside the Milan province.

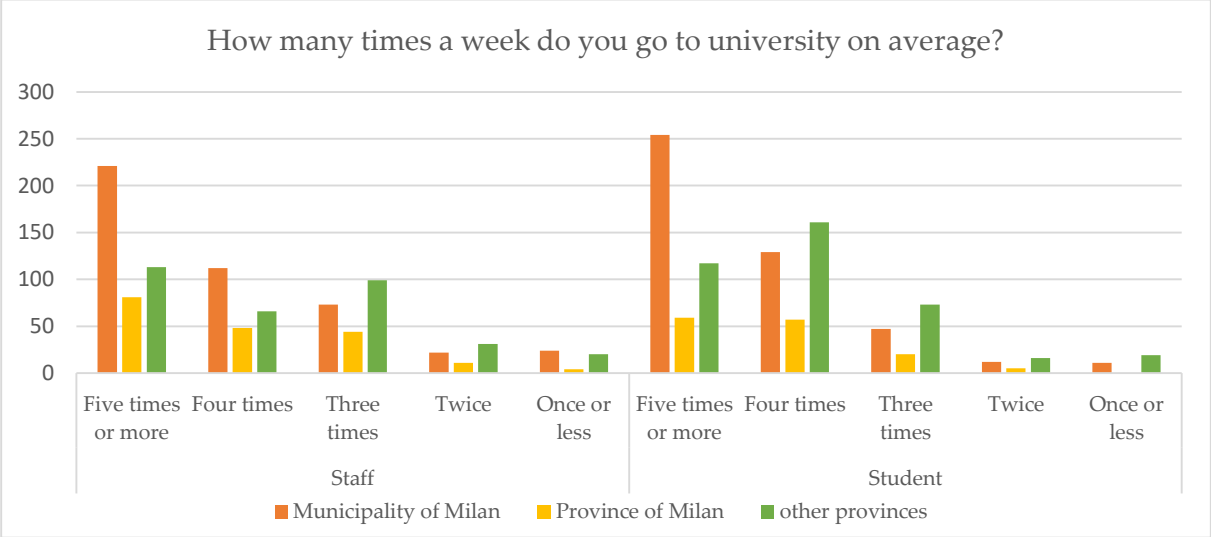


Figure 3.17: Comparison of frequent trips based on origin zone

Additionally, the graph underscores that a significant proportion of university commuters rely on public transportation.

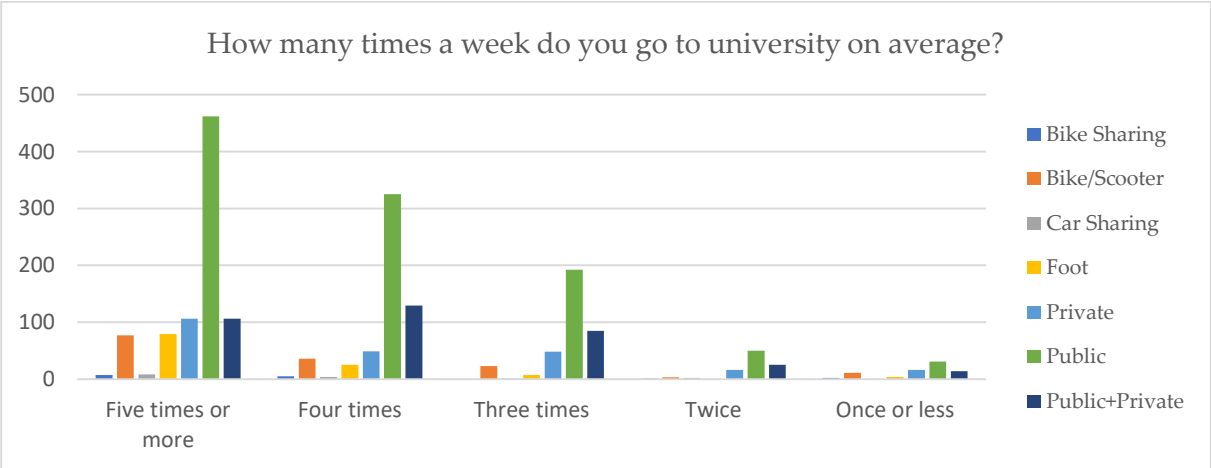


Figure 3.18: Comparison of frequent trips based on transportation modes

Furthermore, among the university commuters, those who engage in multimodal transportation may represent a prime target demand for Mobility as a Service (MaaS) offerings, as they appear more inclined to embrace MaaS solutions. For instance, individuals who utilize a combination of public transport and private cars are more likely to opt for shared services instead of exclusively using their private vehicles.

Encouraging bicycle and scooter owners to embrace shared services is also a promising way.

The data shows that most individuals who use a combination of public and private transportation live outside the Milan province, whereas bicycle and scooter owners are primarily based in Milan.

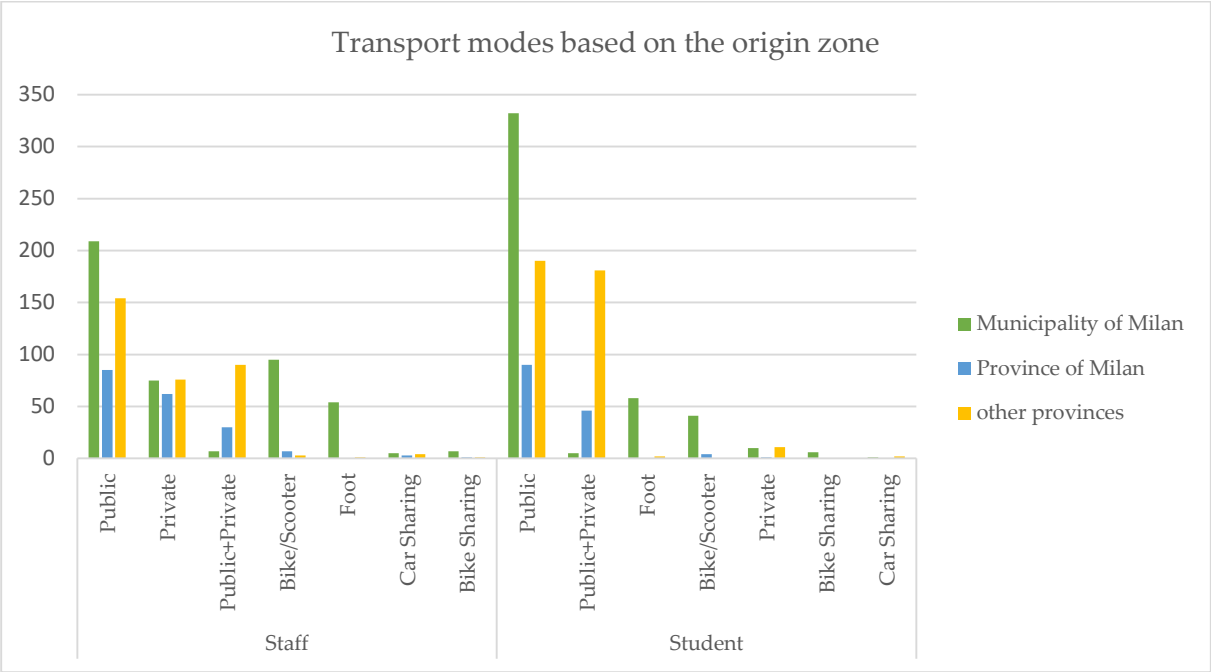


Figure 3.19: Comparison of multimodal transportation commuters based on the origin zone

Notably, individuals who express dissatisfaction with their current transportation options can constitute a substantial portion of the target audience. These individuals possess the motivation to switch to alternative and more efficient services that better align with their mobility needs. According to the graph, the majority of dissatisfied students in Milan rely on public transportation, while students living in other provinces predominantly use a combination of public transport and private cars. The trend is similar among staff members.

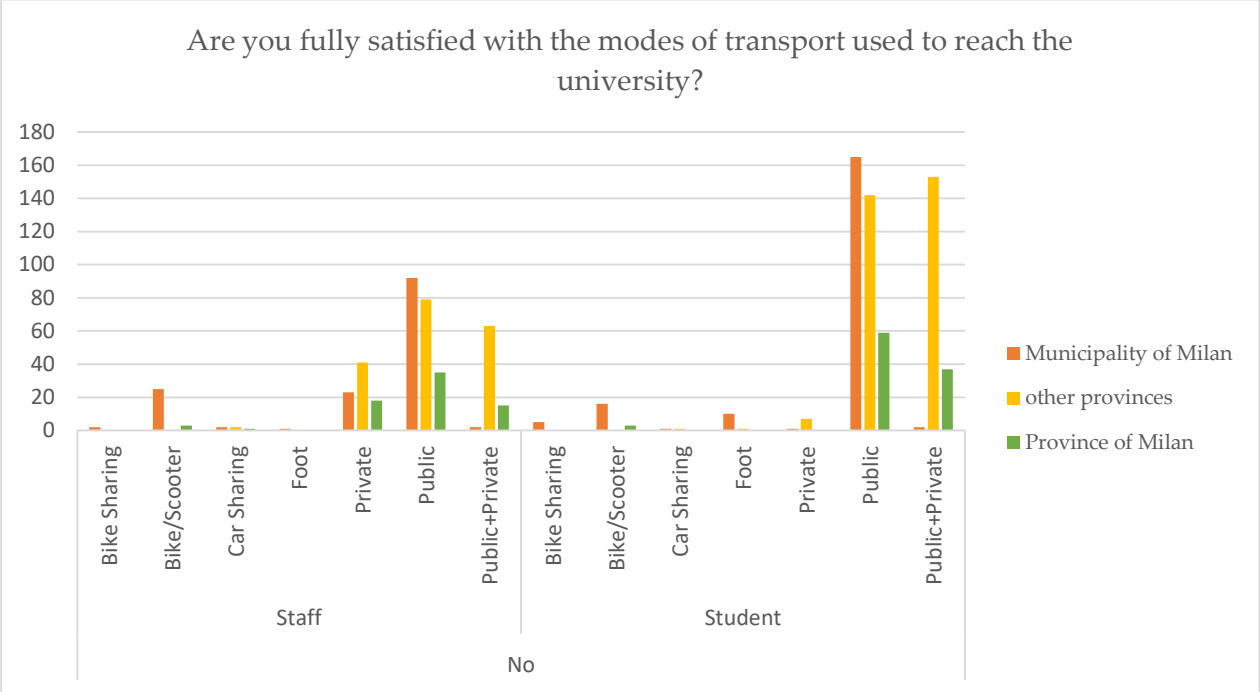


Figure 3.20: Comparison of dissatisfaction people based on origin zone

In addition to the aforementioned factors, one of the key advantages of MaaS is the integration of various transportation services. Consequently, individuals who prioritize the integration of transportation options can undoubtedly be considered part of the target demand, since they would greatly benefit from a functional MaaS app. According to the table below, students in Milan express a strong interest in the integration of different transportation modes.

Category	Municipality of Milan	other provinces	Province of Milan
Staff	1513	511	910
Student	1650	474	1100

Table 3.6: Individuals interested in the integration of different transportation modes

To summarize, it appears that the focal demographic primarily utilizing public transportation or adopting a hybrid approach with private vehicles can be termed as the target demand. This deduction is drawn from the insights obtained in the previous analysis.

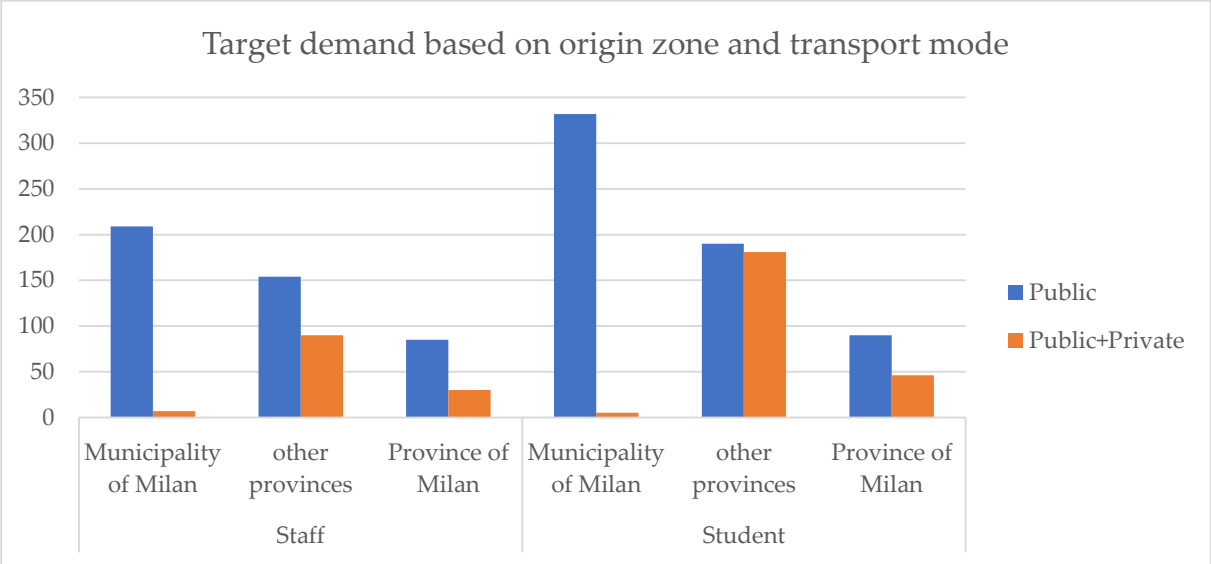


Figure 3.21: Target demand based on origin zone and transport mode

Based on the chart provided, this particular subset of respondents predominantly comprises students and employed individuals residing in Milan. The total number of this subgroup is 1419, encompassing approximately 73% of the overall sample.

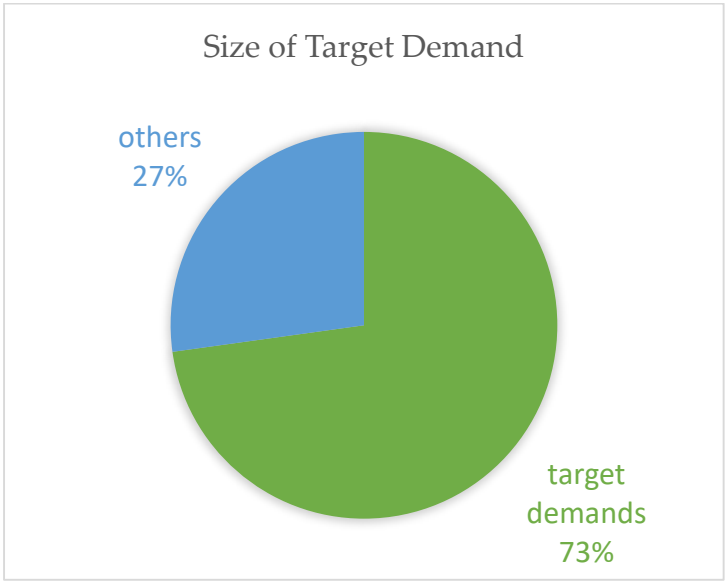


Figure 3.22: This graph illustrates the size of target demand

3.4 Most desired MaaS features

In this segment, we will delve into the stated intentions, aiming to discover the desired transport modes and functionalities that a robust MaaS platform should encompass.

One of the survey questions pertained to the significance of various factors influencing the selection of transportation modes for commuting between home and university. The hierarchy of these factors, based on the recorded responses categorizing them as important or very important, aligns as follows:

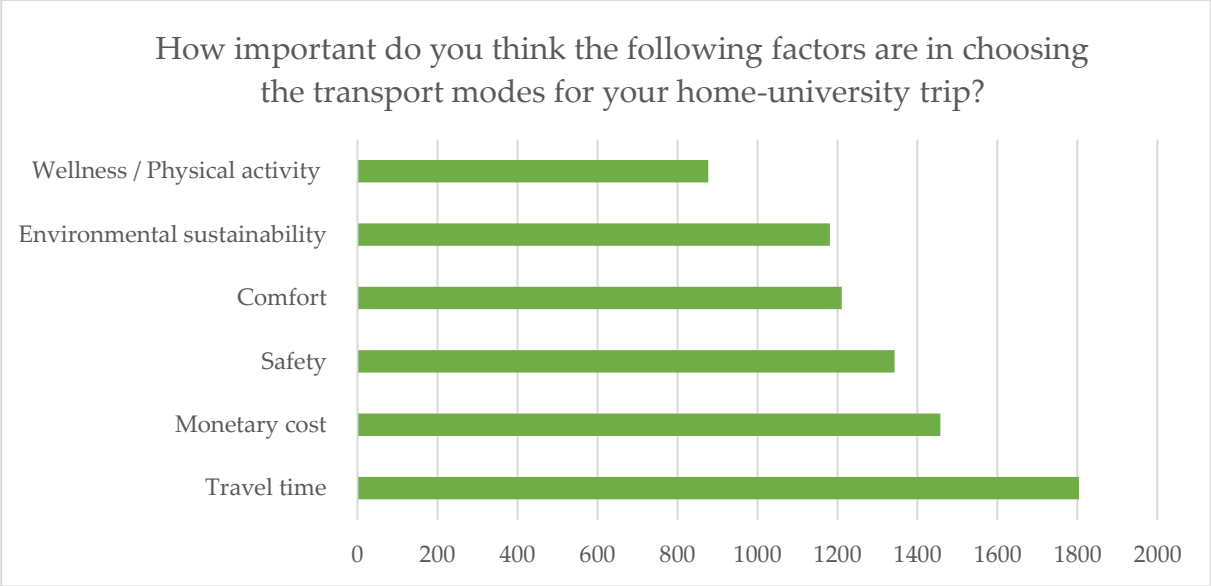


Figure 3.23: Comparison of important factors in choosing transport modes

Remarkably, this prioritization persists even among individuals dissatisfied with their current transportation method.

Further differentiations arise when investigating the preferences of students and employees. In this distinction, Comfort overtakes Safety in importance among employees.

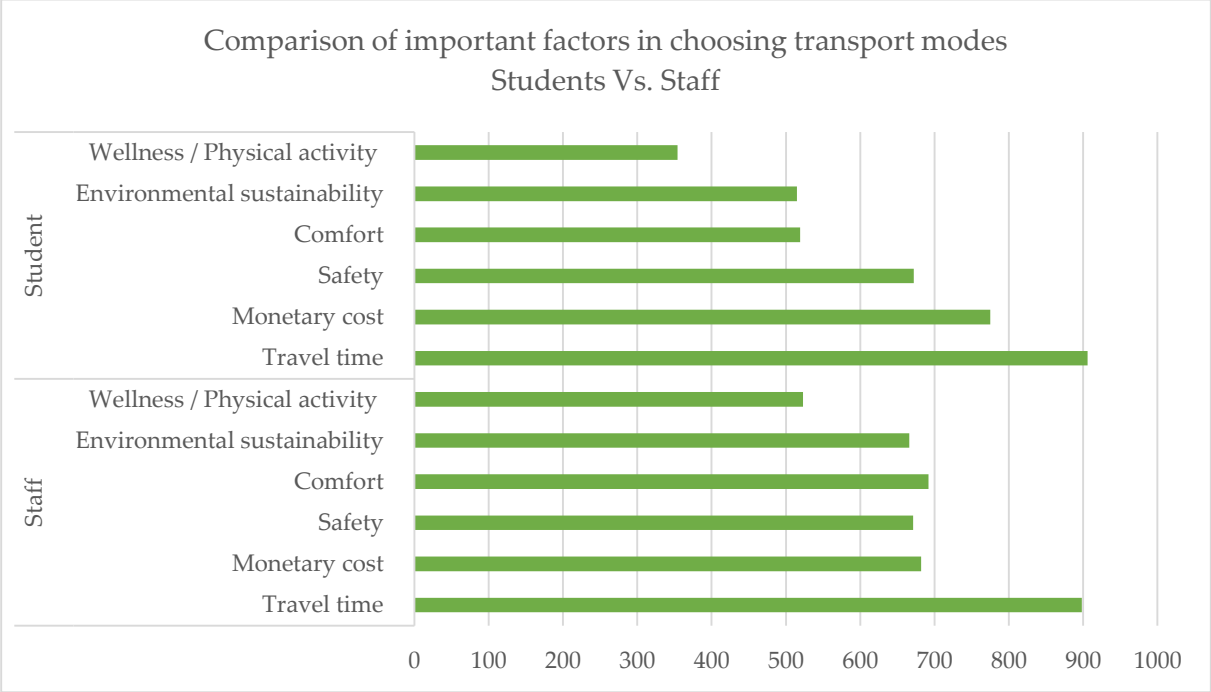


Figure 3.24: Comparison of important factors in choosing transport modes between Students and Staff

Upon exploring the three principal transportation modes, a slight difference emerges. For users of public transportation and those employing a combination of public and private means, three pivotal factors remain consistent. However, among private car users, the prioritization of these factors takes on a distinct arrangement:

- Travel Time
- Comfort
- Safety

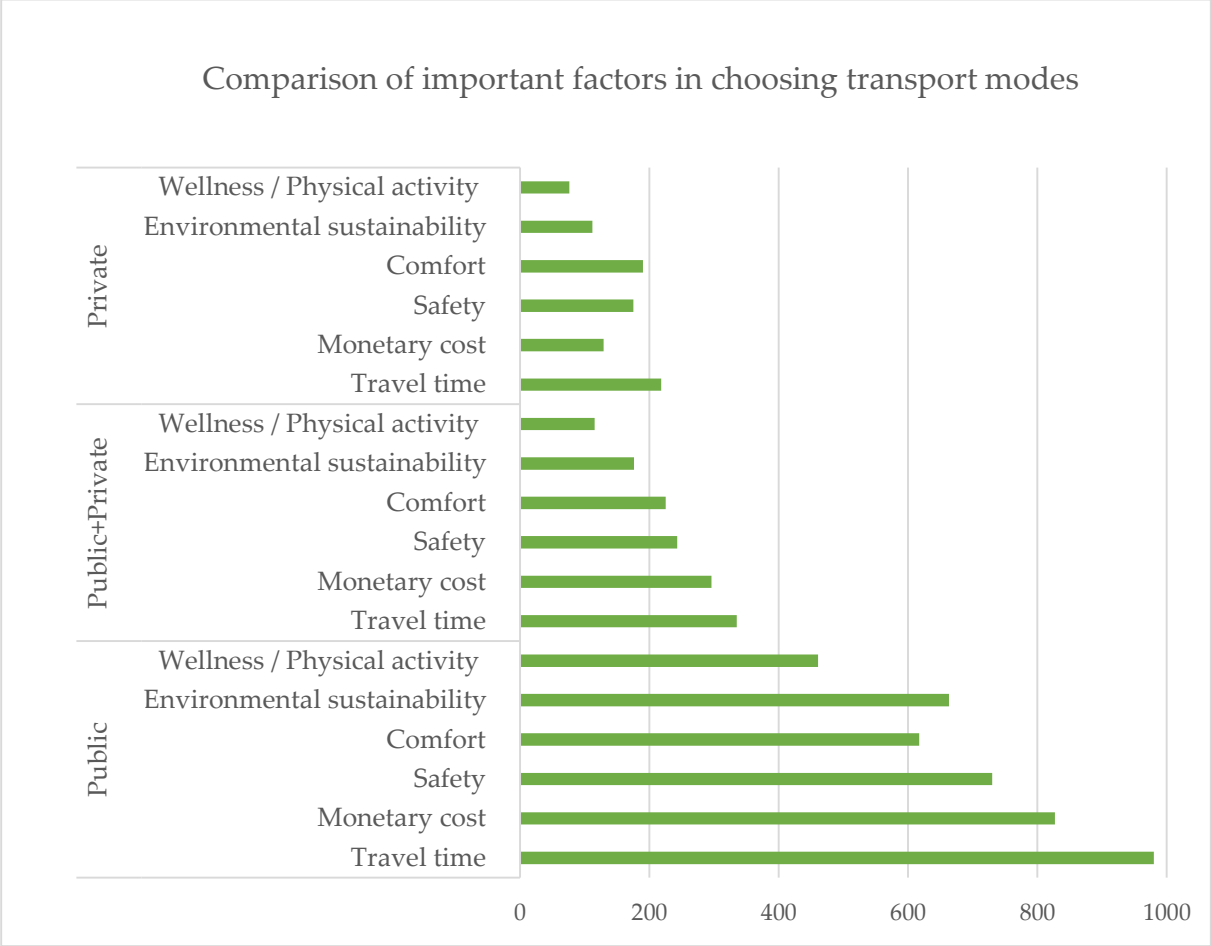


Figure 3.25: Comparison of important factors in choosing transport modes

Considering these factors in the design of the desired future MaaS holds the potential for substantial effectiveness.

Regarding smartphone application usage during journeys, a noteworthy pattern emerges. Most individuals, particularly those utilizing mass transit and private and public integration modes, rely on their smartphones to gather information about traffic and potential delays. In contrast, private transit mode users predominantly leverage their phones to dynamically re-plan and alter their routes.

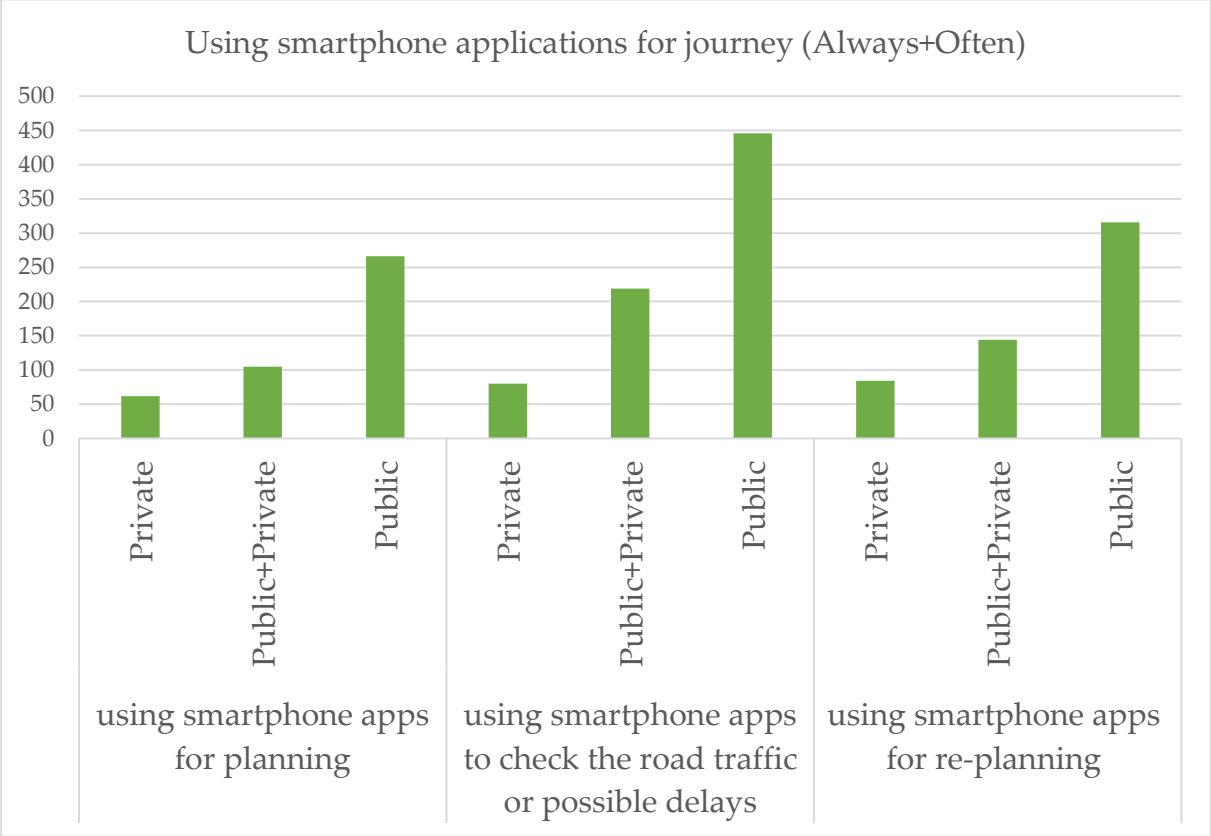


Figure 3.26: Comparison of using smartphone applications for journey based on transfer modes

The significance of integrating diverse transport services within a MaaS application is discussed below. A thorough analysis of the data illuminates that the top three preferences for both staff and student groups align as follows:

1. Public Transportation
2. Bike Sharing
3. Car Sharing

However, in the continuation of the analysis, the priorities of the two groups are different. For employees, the following levels of importance are revealed:

- Carpooling
- Moped Sharing

Contrastingly, for students, the subsequent items capture their attention:

- Scooter Sharing
- Moped Sharing

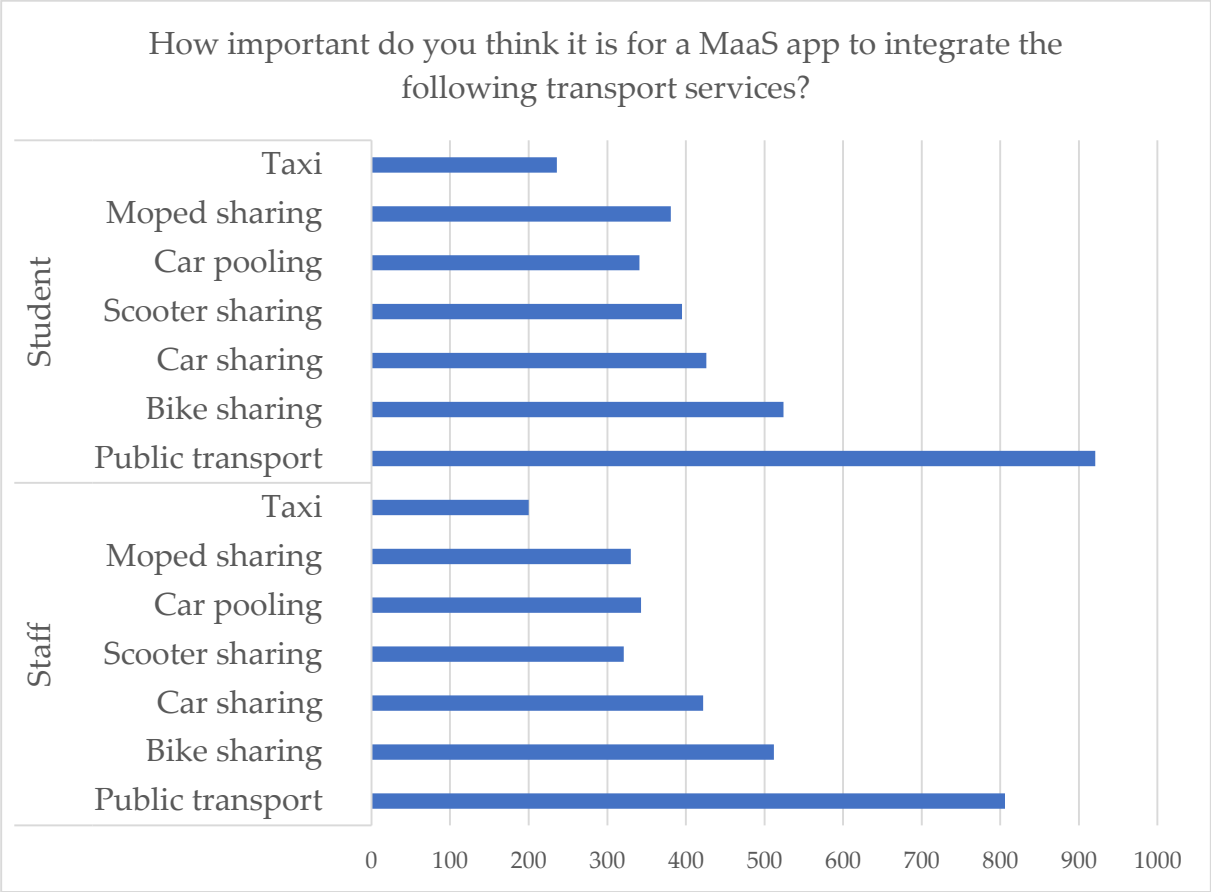


Figure 3.27: Comparison of importance of integrating transport services between students and staff

In the other question, individuals have been inquired about the significance attributed to the essential functionalities within a MaaS application. An analysis of the data indicates a clear order of functionalities, showcasing no difference across students and employees.

1. Real-time updates of traffic and public transport timetables
2. Time- and cost-optimised route search (also including several modes of transport)
3. Discounts for the use of more sustainable modes of transport Registration of a single account for access to services offered by several operators:
4. Electronic payment in a single transaction of the services used
5. Booking and actual availability of shared means of transport

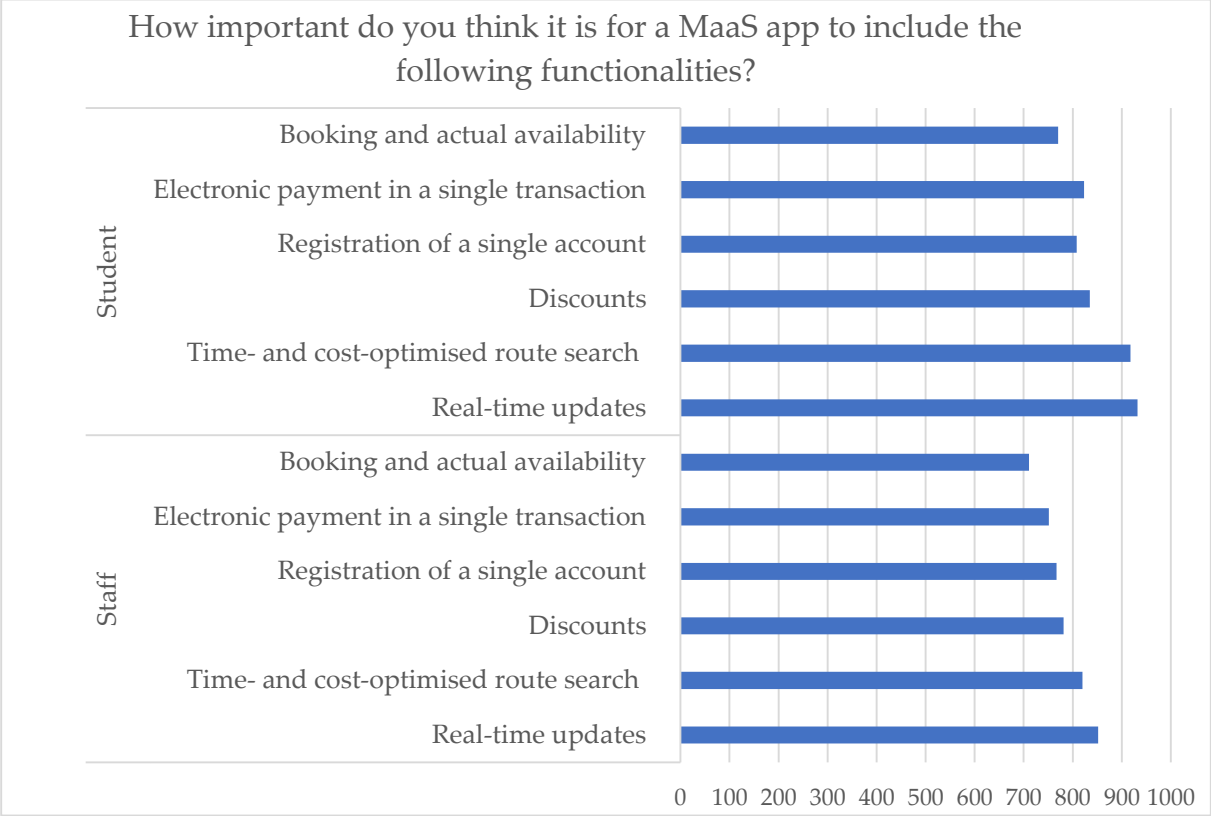


Figure 3.28: Comparison of importance of MaaS app functionalities between students and staff

Additional inquiries reveal that individuals holding public transport cards, who have indicated their interest in the MaaS packages outlined in the survey, perceive three crucial functionalities as indispensable, as follows:

- Real-time Traffic and Public Transport Updates
- Time- and Cost-Optimized Route Exploration
- Discounts for Sustainable Transport Modes

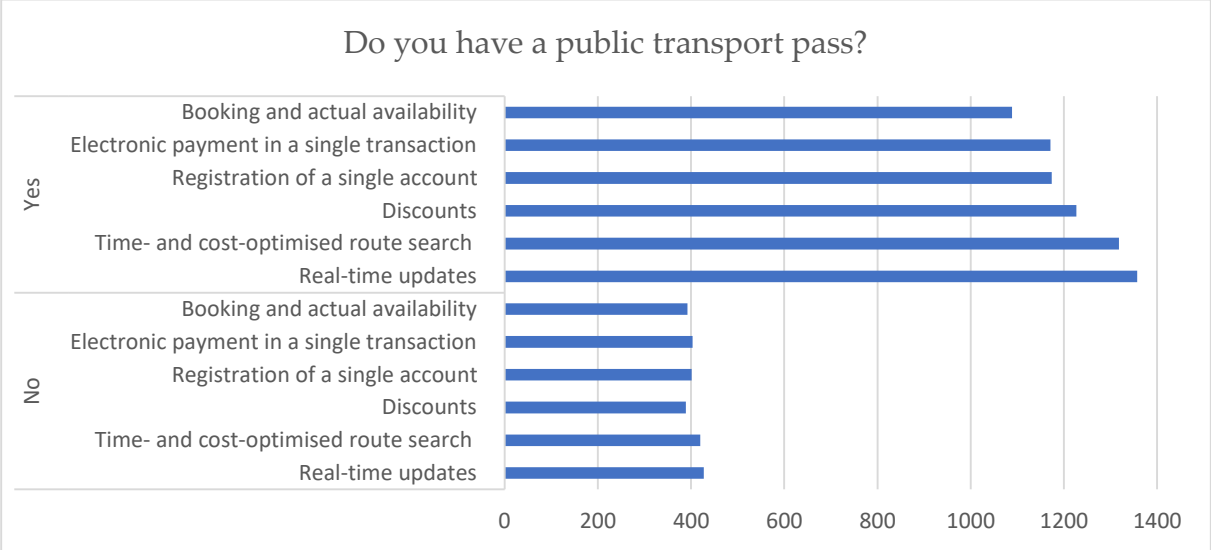


Figure 3.29: Comparison of importance of MaaS app functionalities between pass owners and others

However, the hierarchy of factors' significance exhibits a slight deviation for individuals who do not possess cards. For those who have conveyed their interest in the first scenario, the subsequent aspects held importance for them:

- Discounts for Sustainable Transport Modes
- Time- and Cost-Optimized Route Exploration
- Registration of a single account for access to services

For prospects of the second package, the order of emphasis shifts once more:

- Registration of a single account for access to services
- Discounts for Sustainable Transport Modes
- Real-time Traffic and Public Transport Updates

And finally, those eyeing the third package reveal their prioritization:

- Real-time Traffic and Public Transport Updates
- Time- and Cost-Optimized Route Exploration
- Registration of a single account for access to services

Functionality	Package 1	Package 2	Package 3
Discounts	133	112	97
Registration of a single account	131	112	108
Time- and cost-optimized route search	131	108	110
Real-time updates	130	110	112
Electronic payment in a single transaction	129	108	108
Booking and actual availability	127	108	104

Table 3.7: Comparison of important MaaS app functionalities based on people without pass card and interested in MaaS packages

With this detailed understanding of user preferences, a clear path emerges for developing a MaaS app that seamlessly combines practicality, inclusivity, and customization. This thoughtful approach guarantees that the app aligns perfectly with the diverse mobility needs of its users.

In the subsequent phase of the study, participants were queried regarding their potential adoption of a comprehensive MaaS app, one that encompasses all the functionalities detailed earlier. They were asked if they would use it to travel to the university or undertake other trips (leisure, shopping).

The collected responses provide a revealing insight: a substantial 61% of the participants express a strong inclination to employ such an integrated MaaS application for their university commutes. Delving deeper into this segment, it emerges that among these potential users, an impressive 57% represent the student body, with the remaining fraction comprising university employees.

Option	interested people	percentage of whole	Staff	Student
travel to the university	1192	61%	43%	57%
undertake other travels (leisure,shopping)	1419	73%	46%	54%

Table 3.8: Comparison of people's tendency to use MaaS app

By delving further into the demographics, a fascinating dynamic unfolds. When considering the geographical origin of these potential users, it's evident that both Milan residents and those who commute from other provinces hold an equal stake, each contributing 41% of this collective desire to adopt the comprehensive MaaS application.

option	Municipality of Milan	other provinces	Province of Milan
travel to the university	41%	41%	18%
undertake other travels (leisure,shopping)	51%	33%	16%

Table 3.9: Comparison of people's tendency to use MaaS app based on origin zone

3.5 Most preferred MaaS bundles

To explore potential strategies for the future implementation of a comprehensive and integrated Mobility as a Service system, three distinct packages have been developed:

1. public transport pass included one hour per day of shared bike and scooter rental (Package 1)
2. public transport pass included 30 minutes of car/moped sharing per day (Package 2)
3. public transport pass included parking for 10 hours a day for your car/motorbike at a station/stop (Package 3)

Within the survey participants who currently possess a transportation pass card, an interesting breakdown of preferences emerges: 46% lean towards the first solution, 26% express a preference for the second, and 28% align with the third alternative.

Packages	percentage
Package 1	46%
Package 2	26%
Package 3	28%

Table 3.10: Percentage of people with pass interested in each package

Shifting our focus to those without a transportation card, a distinct ratio takes shape:

Packages	percentage
Package 1	38%
Package 2	31%
Package 3	31%

Table 3.11: Percentage of people without pass interested in each package

Referring to the provided table, it is evident that individuals currently possessing a pass card and displaying an intent to purchase one of the MaaS packages predominantly consist of public transportation customers, alongside those who combine public transportation with personal vehicles. It is worth highlighting that the strongest tendency is observed among users of public transportation.

Transportation mode	Package 1	Package 2	Package 3
Public transport	71%	67%	49%
A combination of public and private	17%	18%	40%

Table 3.12: Percentage of people with pass interested to each package according to their transportation mode

Subsequently, the following table outlines the information concerning individuals attracted by MaaS packages while currently lacking a public transport card. Notably, a majority of these individuals predominantly rely on personal vehicles for their travel. Additionally, the table reveals the presence of public transport users and individuals with bicycles or scooters in the next levels.

Transportation mode	Package 1	Package 2	Package 3
Private car or moped	35%	48%	54%
Public transport	23%	17%	15%
Private bike or scooter	23%	18%	11%

Table 3.13: Percentage of people without pass interested to each package according to their transportation mode

Significantly, there is a distinct preference among personal vehicle users for the third package, given its inherent attributes. Conversely, public transportation users exhibit a relatively lesser degree of interest in this specific package.

The preceding information provides a panoramic view of individuals' preferences pertaining to the various MaaS packages. Recognizing the critical importance of identifying the appropriate user base for each distinct MaaS package, our investigation now delves into a more comprehensive examination.

It is worth highlighting that individuals who presently find satisfaction in their existing travel arrangements might not exhibit a keen interest in altering their service. As a result, our investigation is concentrated on those who have openly voiced their dissatisfaction. This strategic focus ensures that the evaluations are effectively channeled towards those who have stated a need for potential change and enhancement.

Within this segment, individuals holding a pass card – both students and employees – who have clearly expressed an interest in any of the three MaaS packages, are subjected to an examination based on their chosen modes of transportation.

Transportation mode	Package 1	Package 2	Package 3
Public transport	67%	69%	48%
A combination of public and private	22%	14%	43%
Private car or moped	7%	12%	7%

Table 3.14: Percentage of staff with pass interested to each package according to their transportation mode

Transportation mode	Package 1	Package 2	Package 3
Public transport	67%	64%	45%
A combination of public and private	24%	28%	50%
Foot	3%	5%	3%

Table 3.15: Percentage of student with pass interested to each package according to their transportation mode

As depicted in the table, the primary inclination towards adopting MaaS packages originates from customers of public transportation, followed by those who combine

public transport with personal vehicles. Consequently, when assessing the potential user base for MaaS packages, these two groups emerge as pivotal focal points.

However, it is significant to note that within the context of the third package, public transportation users find themselves in the secondary category, subsequent to individuals who navigate their commutes using a combination of personal vehicles and public transport.

In the subsequent phase, we delve into the analysis of individuals who lack a card, experience dissatisfaction, and seek to acquire MaaS packages. Referring to the table provided, it becomes apparent that a majority of these individuals fall under the category of university staff.

Group	Package 1	Package 2	Package 3
Staff	70%	77%	77%
Students	30%	23%	23%

Table 3.16: Percentage of Students and staff without card interested in each package

When considering the subset of discontented employees, an evident pattern emerges. It is notable that among those who have expressed interest in the first and second MaaS packages, the prominent user groups encompass private car users, customers of public transportation, and individuals who own bicycles and scooters. However, the dynamics shift slightly in the context of the third package. Here, users who adeptly combine public transport with private vehicles manifest a greater inclination, surpassing the enthusiasm exhibited by bicycle and scooter owners. This variance is likely attributed to the distinct nature of the third package, which strategically addresses the issue of parking constraints.

Transportation mode	Package 1	Package 2	Package 3
Public transport	24%	14%	11%
Private car or moped	45%	60%	63%
Private bike or scooter	16%	14%	
A combination of public and private			11%

Table 3.17: Percentage of staff without card to each package based on transport modes

Contrastingly, among discontented students, the classification experiences a shift, leading to the removal of personal device users from this categorization. Consequently, the new order surfaces as follows:

Transportation mode	Package 1	Package 2	Package 3
Public transport	36%	38%	36%
Private bike or scooter	27%	31%	21%
A combination of public and private	18%	19%	29%

Table 3.18: Percentage of student without card interested in each package based on transport modes

This precise categorization underscores the preferences of discontented students, further outlining their priorities when considering MaaS packages.

In terms of dissatisfactio reasons, when delving into the preferences of those lacking a public transport pass yet interested in acquiring MaaS packages, a slight difference emerges. Those drawn to the first and second package offerings express dissatisfaction primarily due to:

- High travel time: Once again, the extended time taken to reach destinations remains a central cause of dissatisfaction.
- Lack of protected bike routes: A noteworthy concern for this group is the shortage of secure paths for cycling.
- Irregular service: As with the previous groups, inconsistent service provision remains a key factor in their dissatisfaction.

Evidently, a significant mobility need for these individuals is the availability of safe and suitable cycling routes.

Another subgroup seeking the third package expresses their dissatisfaction based on:

- High travel time: Long travel times persist as a central issue.
- Difficulties in finding parking: The challenge of locating parking spaces poses a significant problem.
- Irregular service: Once again, irregular service schedules contribute to their discontent.

In this section, the aim is to reevaluate the analysis conducted on the whole population, with a specific focus on the target demand: those who use public transportation or combine it with a personal vehicle.

For individuals possessing a pass card, the distinction is relatively negligible. However, within the subset of individuals lacking a card, there is an approximately 8% increase in inclination towards the first package.

Packages	percentage
Package 1	43%
Package 2	29%
Package 3	28%

Table 3.19: Percentage of target demand without pass interested in each package

Furthermore, when we shift our attention from the entire sample to the target demand, we observe minimal alterations in the preferences for MaaS packages among cardholders. This outcome aligns with expectations since a substantial proportion of cardholders are already included within the target demographic.

Conversely, when investigating those without cards, a significant shift is apparent. As indicated in the graph below, the number of employees showing an interest in MaaS packages diminishes, resulting in a raised participation share among students.

Group	Package 1	Package 2	Package 3
Staff	56%	59%	46%
Students	44%	41%	54%

Table 3.20: Percentage of target demand without card interested in each package

3.6 Willingness to Pay: students vs. employees

Willingness to Pay (WTP) in the context of a Mobility as a Service project refers to the amount of money that users are willing to spend in order to access and utilize the integrated transportation services offered by the MaaS platform. Understanding

users' WTP is crucial for designing pricing models that are attractive to users while also ensuring the financial sustainability of the MaaS service.

In essence, understanding users' willingness to pay is a critical aspect of MaaS project planning and management. It involves striking a balance between offering an attractive and affordable service for users while ensuring the financial viability of the project for sustainable operations and growth.[18]

In this section, we delve into respondents' attitudes towards the following questions:

If your public transport pass included one of the mentioned MaaS packages, would you be willing to buy it for X% more than it would currently cost you?

The aim is to explore the WTP of individuals holding public transport cards. The graph below illustrates their preferences for the available MaaS options.

This cumulative graph below provides insights into people's willingness to pay more for a package combining public transport, scooter, and bike-sharing services. The x-axis represents the percentage increase they are willing to accept, while the y-axis shows the share of the sample population interested in each level of increase.

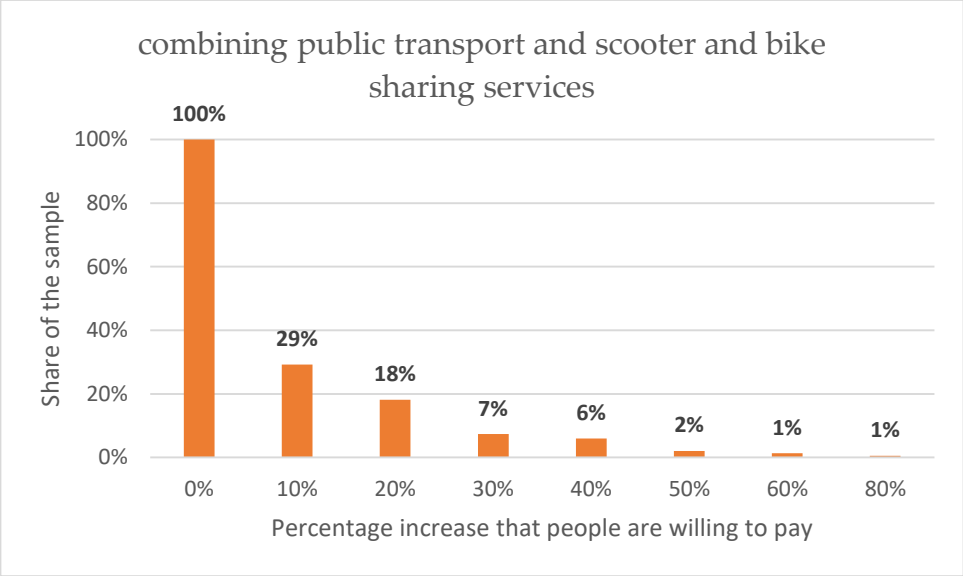


Figure 3.30: Comparison of willingness to pay to package 1 for whom with pass

The graph demonstrates that a significant portion of the sample is interested in modest price hikes, with 29% willing to accept a 10% cost increase and 18% willing to accept a 20% increase. However, as the cost increases beyond this range, interest

diminishes. This data suggests that there is perceived value in Package 1 at lower price increments but highlights a potential threshold (20%) beyond which potential users may reconsider. These insights can guide pricing strategies and the development of Mobility as a Service (MaaS) packages, considering user preferences and price sensitivity.

The following cumulative chart illustrates the willingness of potential users to invest more in the second package, which combines public transport with car-sharing and moped-sharing services.

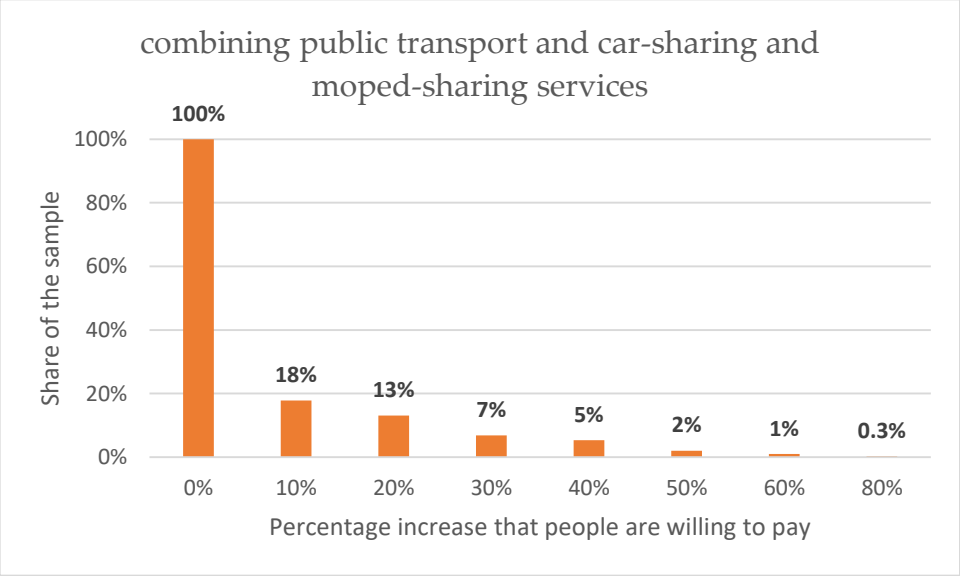


Figure 3.31: Comparison of willingness to pay to package 2 for whom with pass

Analyzing the data, it becomes evident that lower percentage increases, particularly at 10% and 20%, capture a significant level of interest among respondents. Approximately 18% of individuals are amenable to a 10% cost increase, while 13% are willing to accept a 20% hike. However, as the cost increment rises beyond 20%, the percentage of interested individuals declines. These findings suggest that there is a perceived value in the package at these price points, reflecting an attractive proposition for users seeking integrated MaaS solutions.

The graph presented here sheds light on the willingness of individuals to embrace the third package, which combines public transport with reserved pay parking spaces for cars and bikes near stations and stops. As observed in line with the

patterns seen in other packages, it becomes evident that lower percentage increases are more appealing to participants. Specifically, approximately 19% of participants express interest in a 10% increase in the MaaS card cost, while 13% are drawn to the idea of a 20% increase. However, the attractiveness of other cost increment options appears to be significantly lower among respondents.

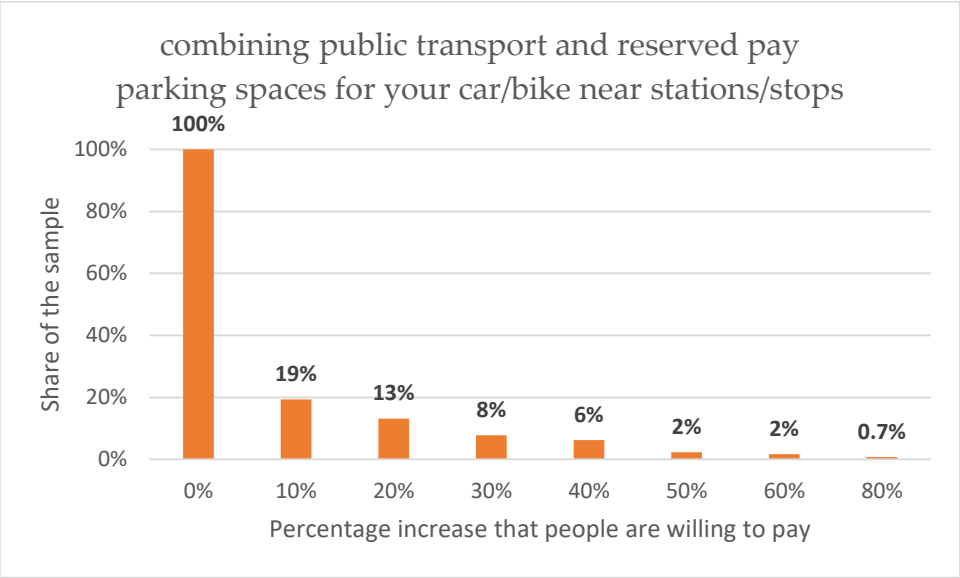


Figure 3.32: Comparison of willingness to pay to package 3 for whom with pass

The next section is dedicated to the analysis of the answers to the following question, considering the people without public transport cards.

If your public transport pass included one of the mentioned MaaS packages, would you be willing to buy it for X euros per year?

The chart provided reveals the willingness of individuals to pay annual costs for combining public transport and scooter and bike sharing services.

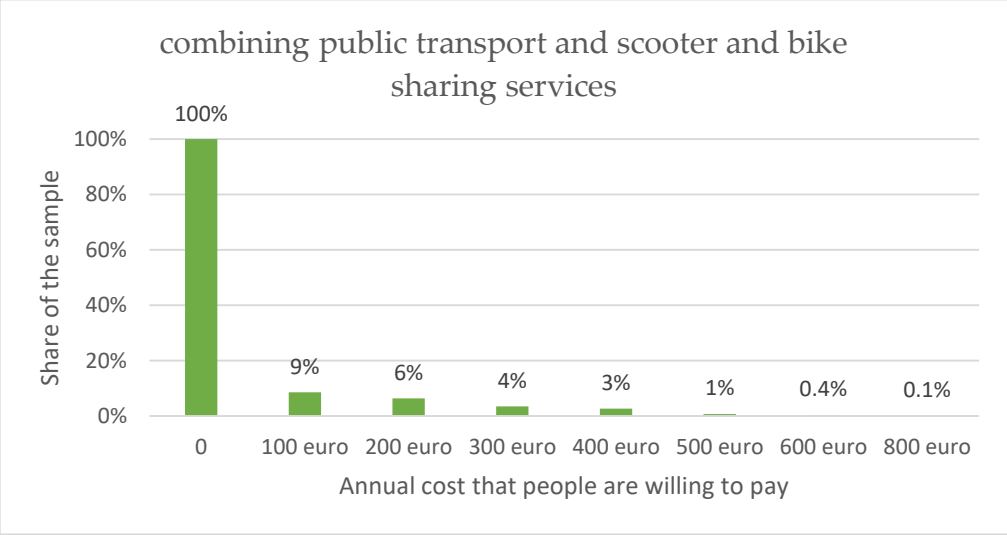


Figure 3.33: Comparison of willingness to pay to package 1 for whom without pass

As we examine the data, it becomes apparent that at lower annual costs, particularly 100 euros and 200 euros, there is a relatively higher level of interest among participants. About 9% of the sample population is inclined to accept a 100-euro cost for a year, while 6% express interest in a 200-euro MaaS card. However, as the cost climbs, the percentage of individuals interested in these higher price points progressively decreases. For instance, only 0.1% of respondents are willing to accept an 800-euro MaaS card.

Comparatively, when examining the second and third packages, it becomes apparent that the level of interest among potential users is lower than that observed in the first package. At the annual 100-euro cost, approximately 7% of participants express their interest, and for the 200-euro card, approximately 6% indicate their willingness. Additionally, the 400-euro card option stands out as relatively appealing to a segment of the population, with 3% of the entire sample population expressing their interest.

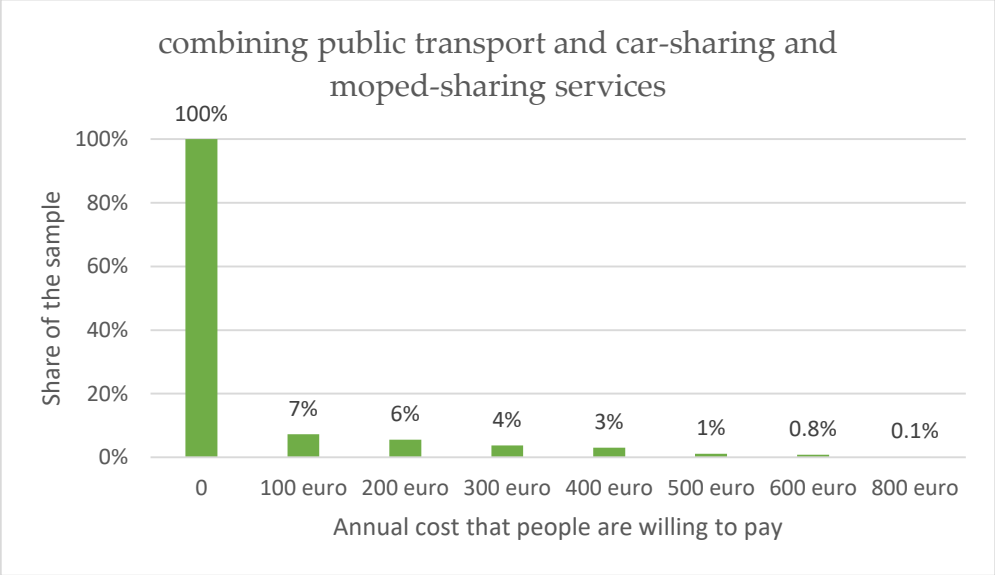


Figure 3.34: Comparison of willingness to pay to package 2 for whom without pass

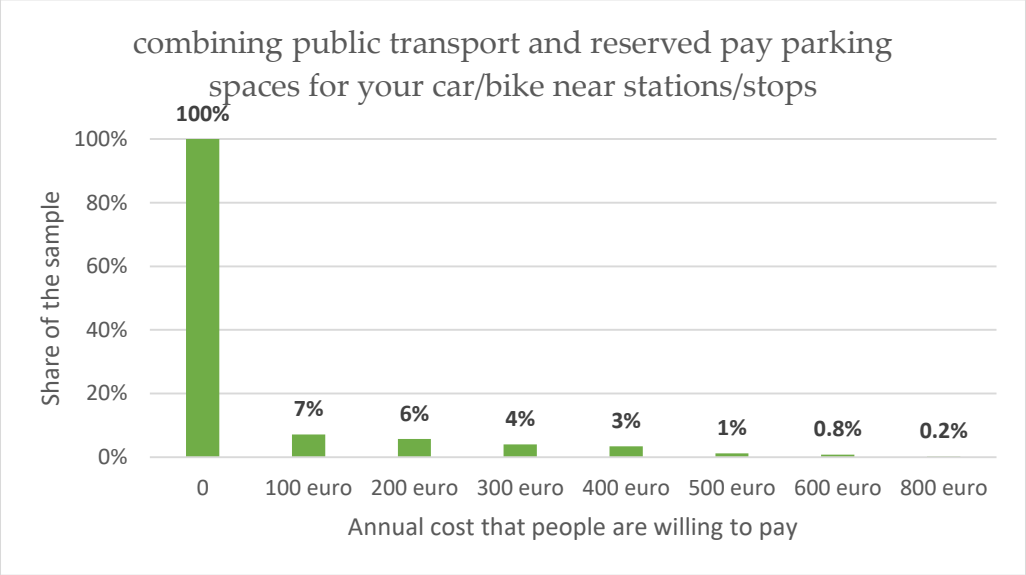


Figure 3.35: Comparison of willingness to pay to package 3 for whom without pass

These insights highlight a pricing sensitivity trend across these packages. While the first package seems to have garnered more enthusiasm, there remains a modest level of interest in the second and third packages.

With respect to the first package, a more detailed analysis reveals that a substantial portion of those showing interest in the offered options consists of students residing in Milan who rely on public transport. A similar trend is observed among staff.

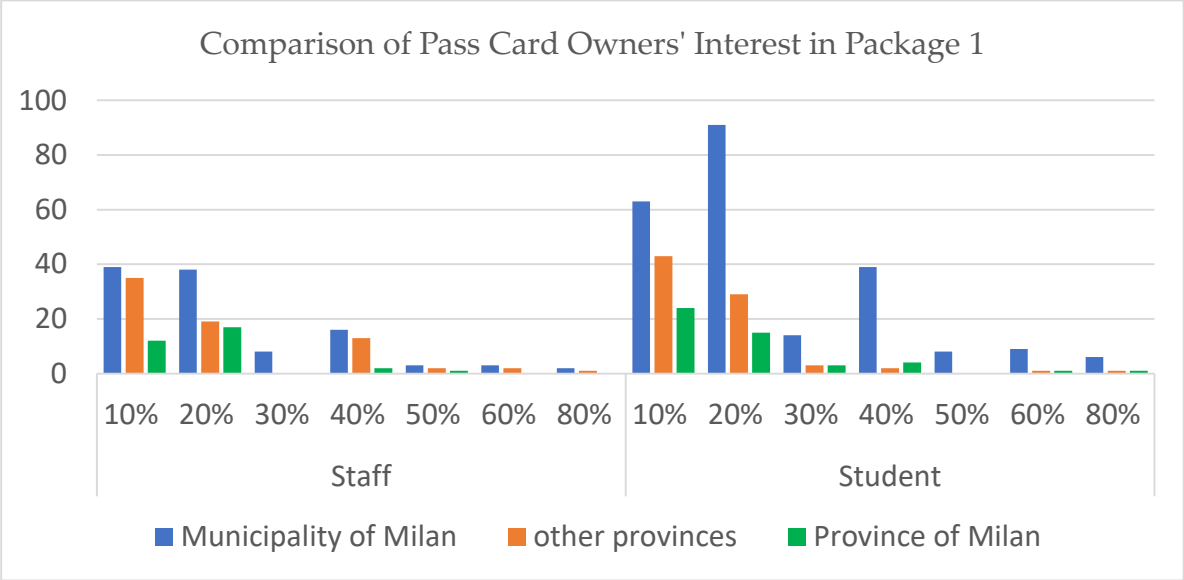


Figure 3.36: Comparison of Pass Card Owners' Interest in Package 1 based on occupancy and origin zone

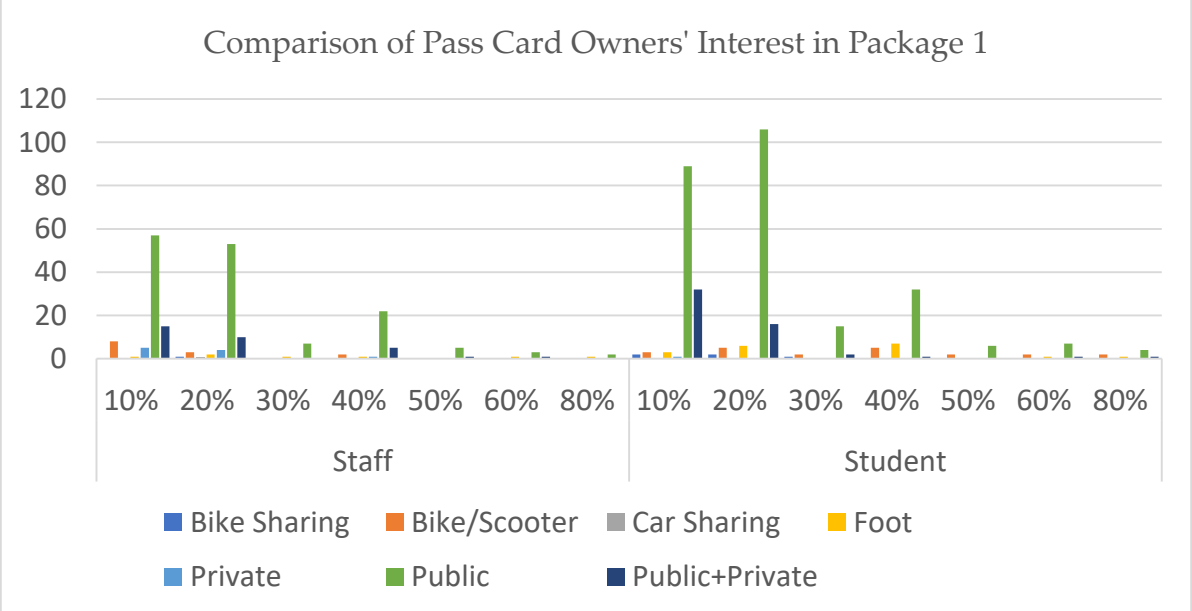


Figure 3.37: Comparison of Pass Card Owners' Interest in Package 1 based on transfer modes

Concerning the second package, Milan residents who utilize public transport continue to comprise the majority of respondents.

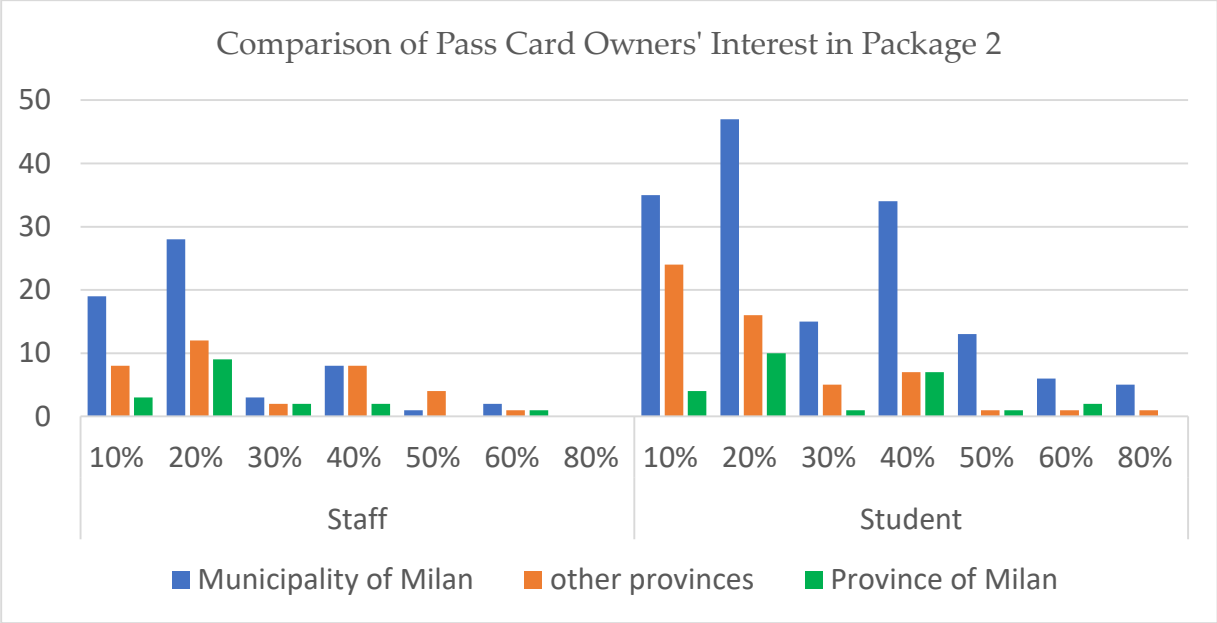


Figure 3.38: Comparison of Pass Card Owners' Interest in Package 2 based on occupancy and origin zone

For the third package, among students, those from outside Milan province who use public transportation and private car predominantly favor the 10% and 20% options. However, for the 40% increment, Milan residents who commute via public transport still constitute the majority. These findings suggest that raising the price of this package by more than 20% may not be appealing to residents of other provinces.

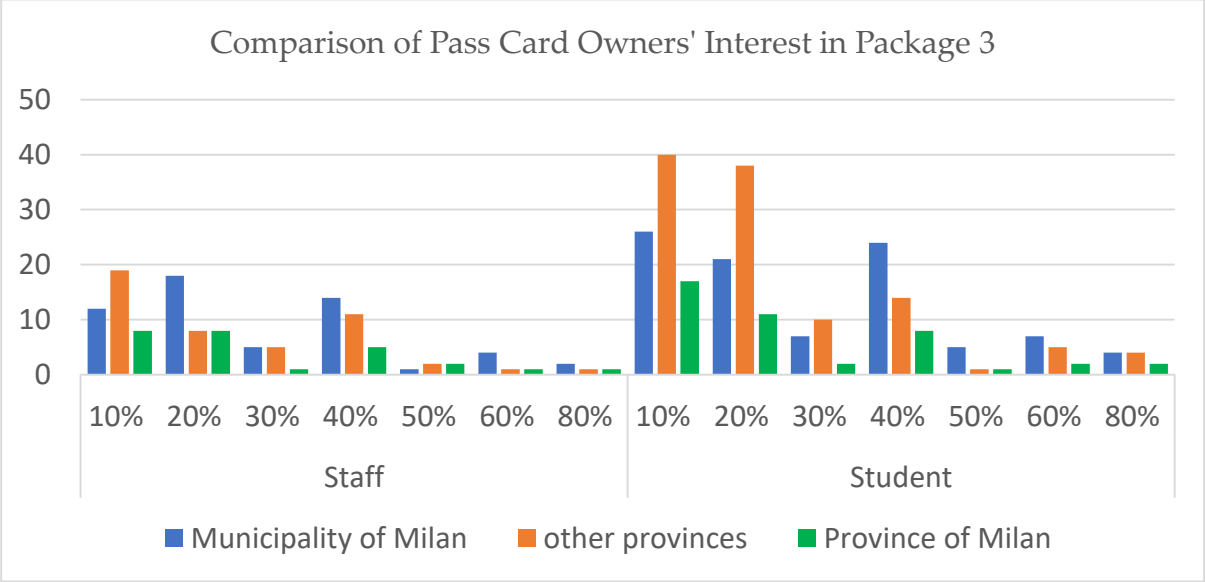


Figure 3.39: Comparison of Pass Card Owners' Interest in Package 3 based on occupancy and origin zone

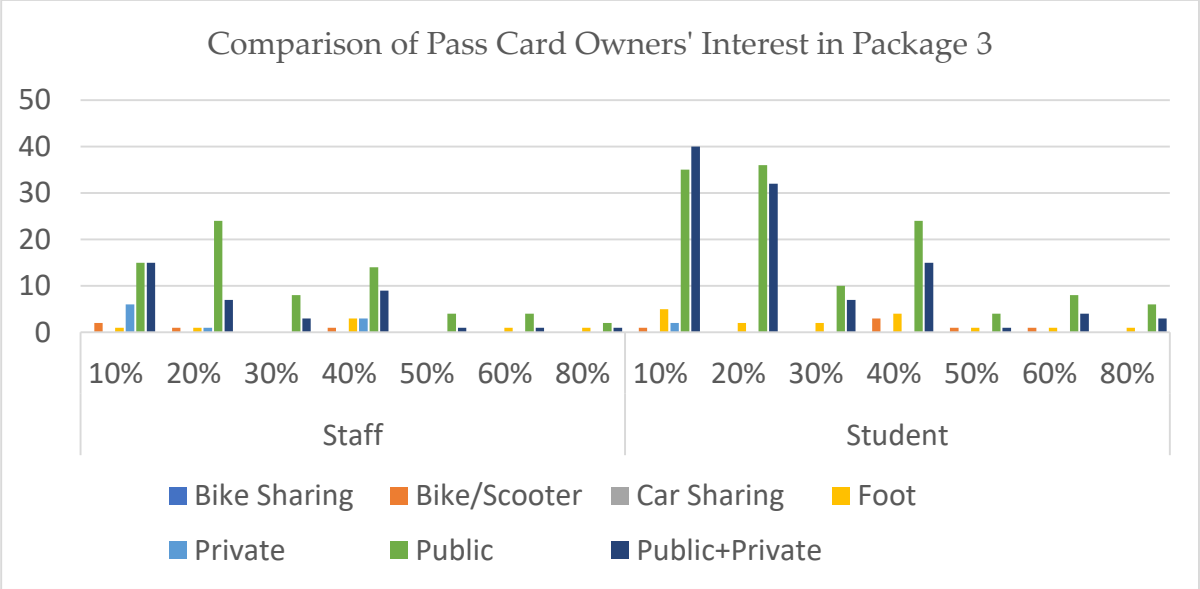


Figure 3.40: Comparison of Pass Card Owners' Interest in Package 3 based on transfer modes

This section investigates the willingness to pay of individuals who do not possess a card.

For the first package, employees residing in Milan who commute via personal bike or scooter exhibit the highest participation rate, expressing their willingness to pay a maximum of 400 euros annually. In both Milan province and other provinces, a significant number of employees who rely on personal vehicles have shown interest in these packages.

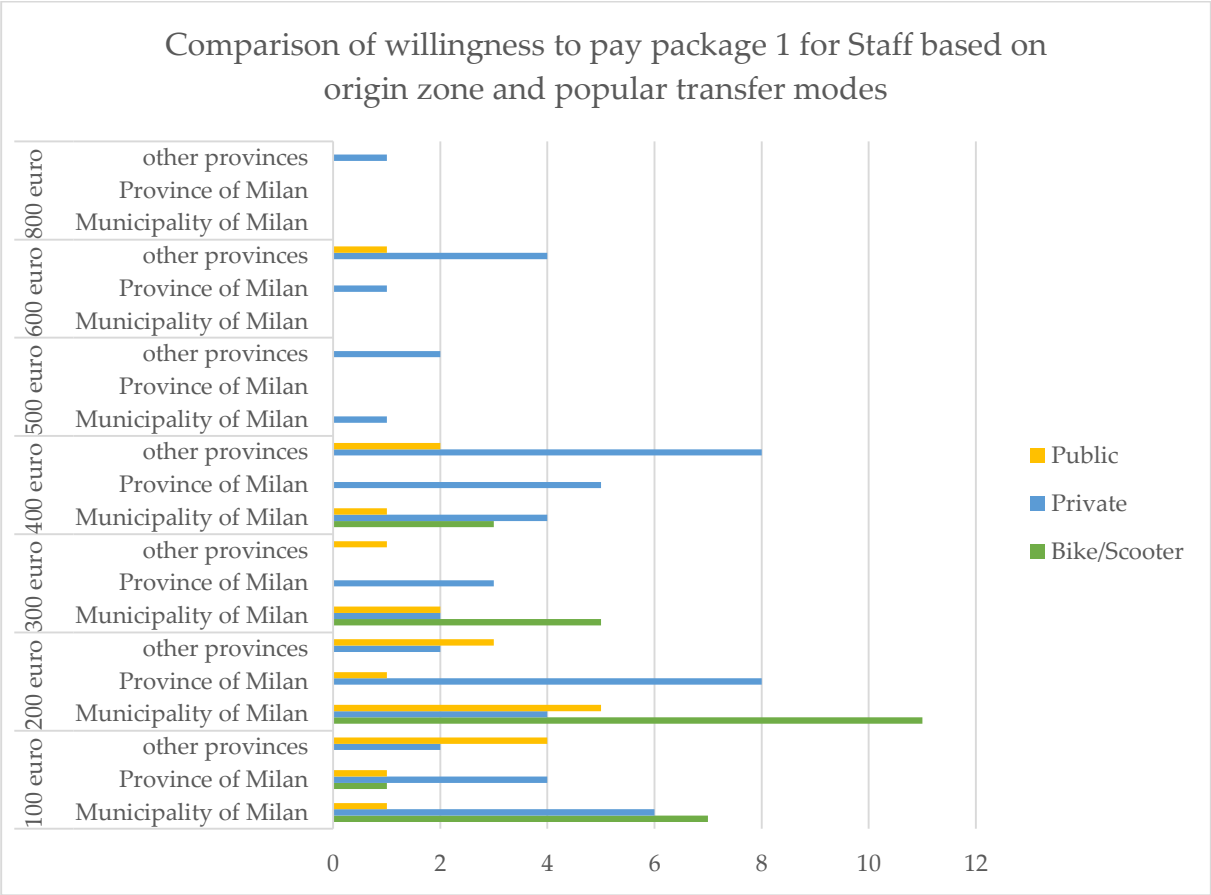


Figure 3.41: Comparison of willingness to pay package 1 for Staff based on origin zone and popular transfer modes

Among students, residents of Milan who utilize personal bicycles, personal scooters, or public transportation have also expressed interest in this package.

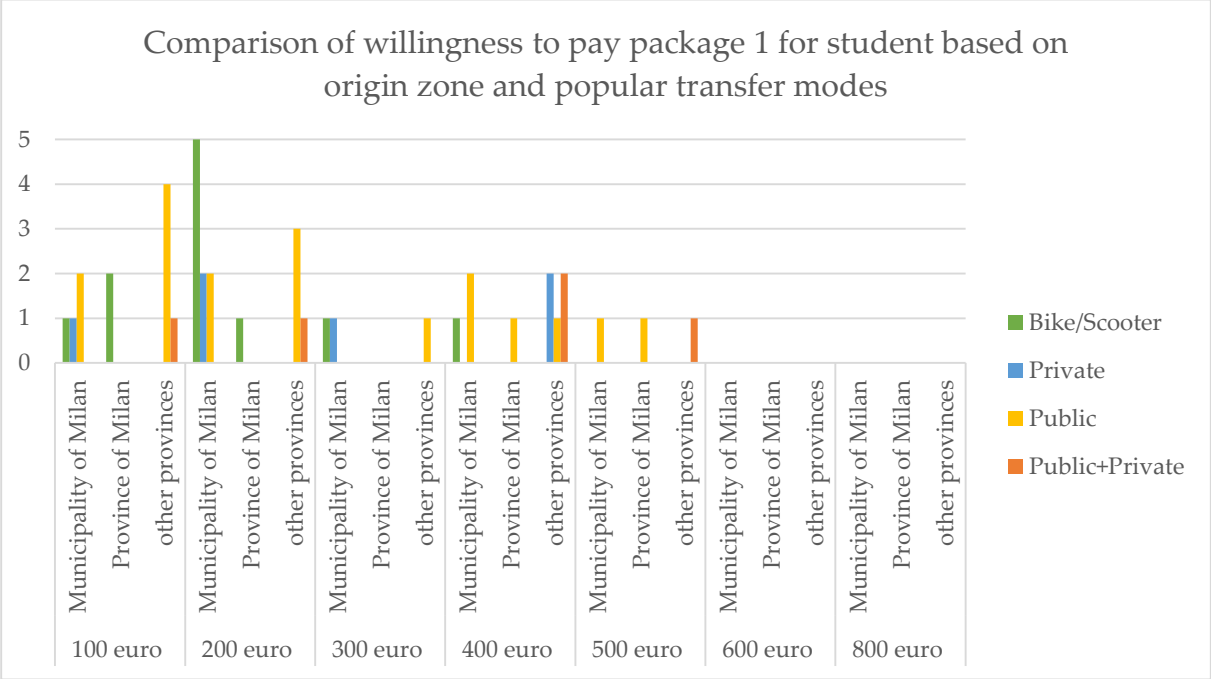


Figure 3.42: Comparison of willingness to pay package 1 for student based on origin zone and popular transfer modes

Moving on to the second package, the majority of interested parties are staff living in Milan who use personal bikes and scooters. Conversely, individuals residing outside Milan who favor this package predominantly rely on personal cars for transportation.

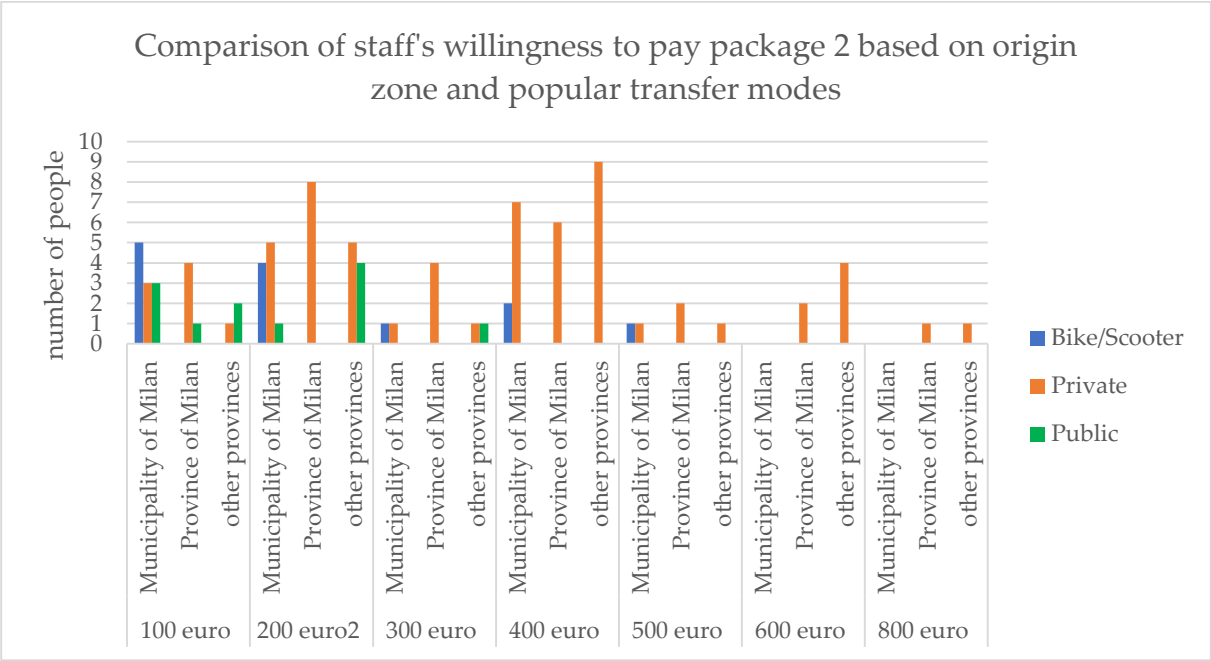


Figure 3.43: Comparison of staff's willingness to pay package 2 based on origin zone and popular transfer modes

Regarding students interested in this package, it is largely Milan residents who commute on foot, by personal bicycle or scooter, while those residing outside Milan and opting for this package frequently use public transportation for their daily commute.

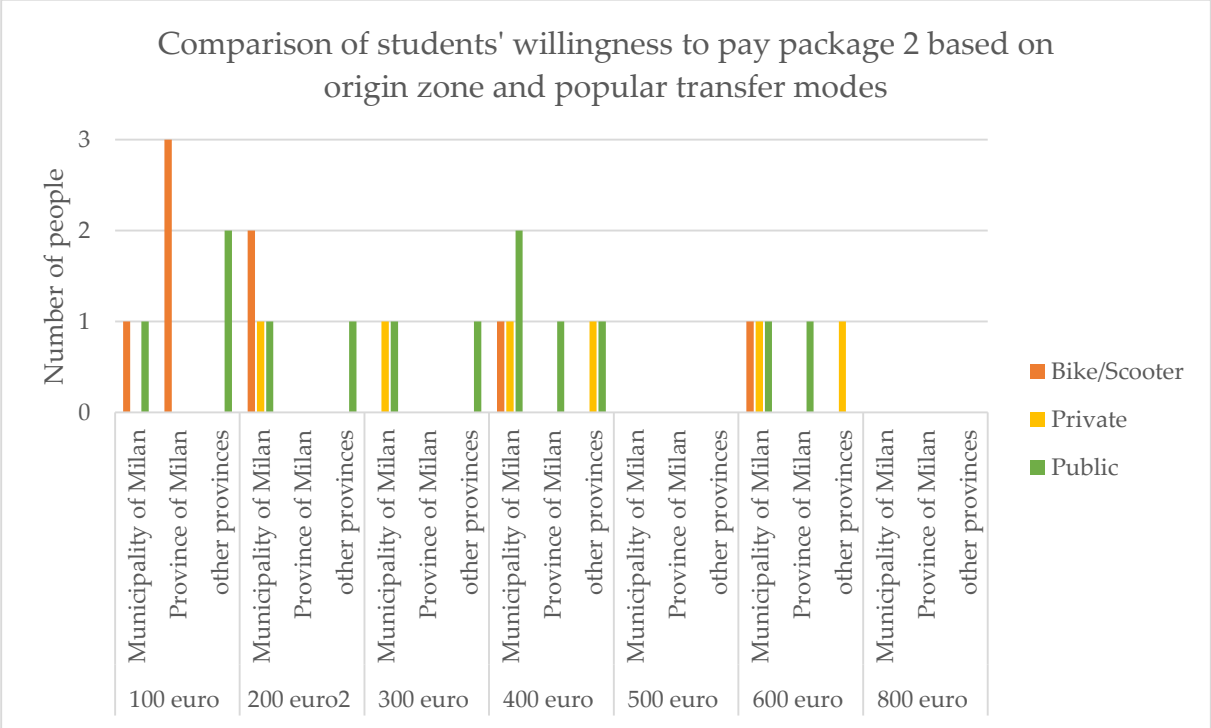


Figure 3.44: Comparison of students' willingness to pay package 2 based on origin zone and popular transfer modes

In the case of the third package, the primary stakeholders are employees who commute by private car. Notably, a larger number of individuals who expressed interest in the option of paying 400 euros reside in other provinces. For the 100 and 200-euro payment options, the regional distribution remains relatively consistent.

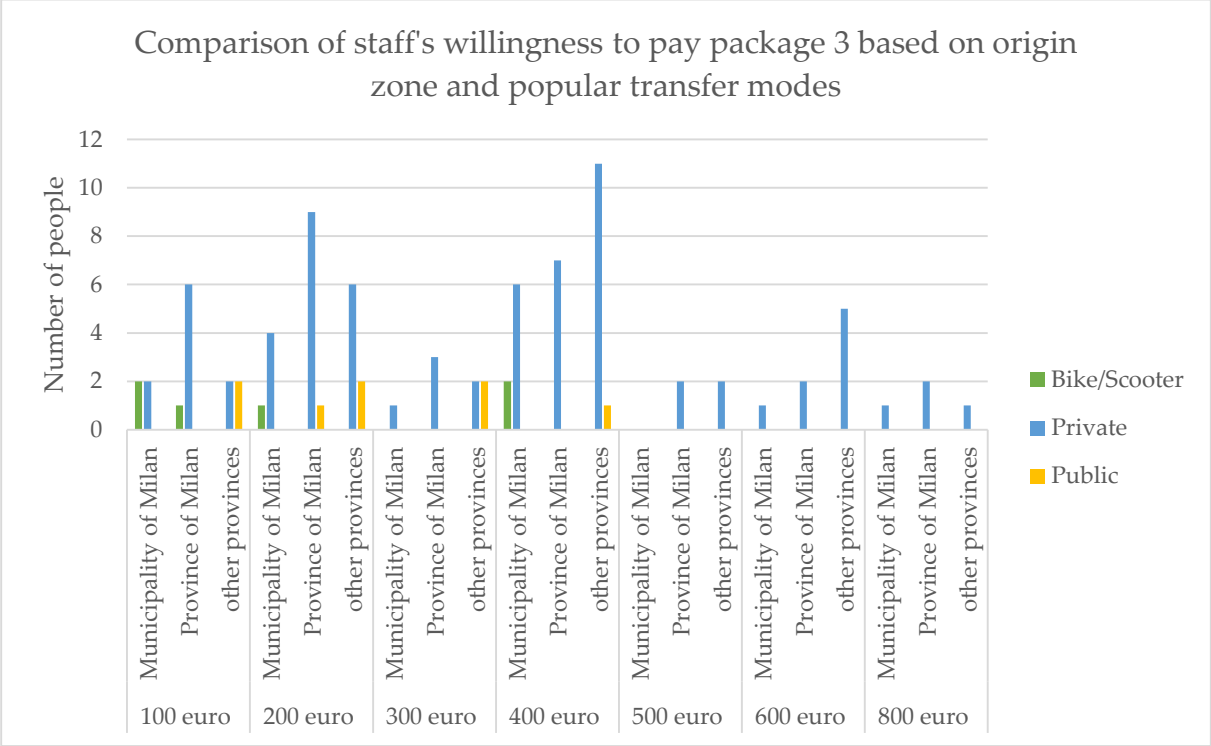


Figure 3.45: Comparison of staff's willingness to pay package 3 based on origin zone and popular transfer modes

Among students, the 100-euro option primarily attracts students residing in Milan who rely on public transportation. For the 200-euro option, residents outside of Milan, who mainly use public transport, are more prominent. Those inclined towards the 400-euro option are typically individuals residing outside the Milan province who utilize three modes of transportation: public transport, personal vehicles, and a mix of both.

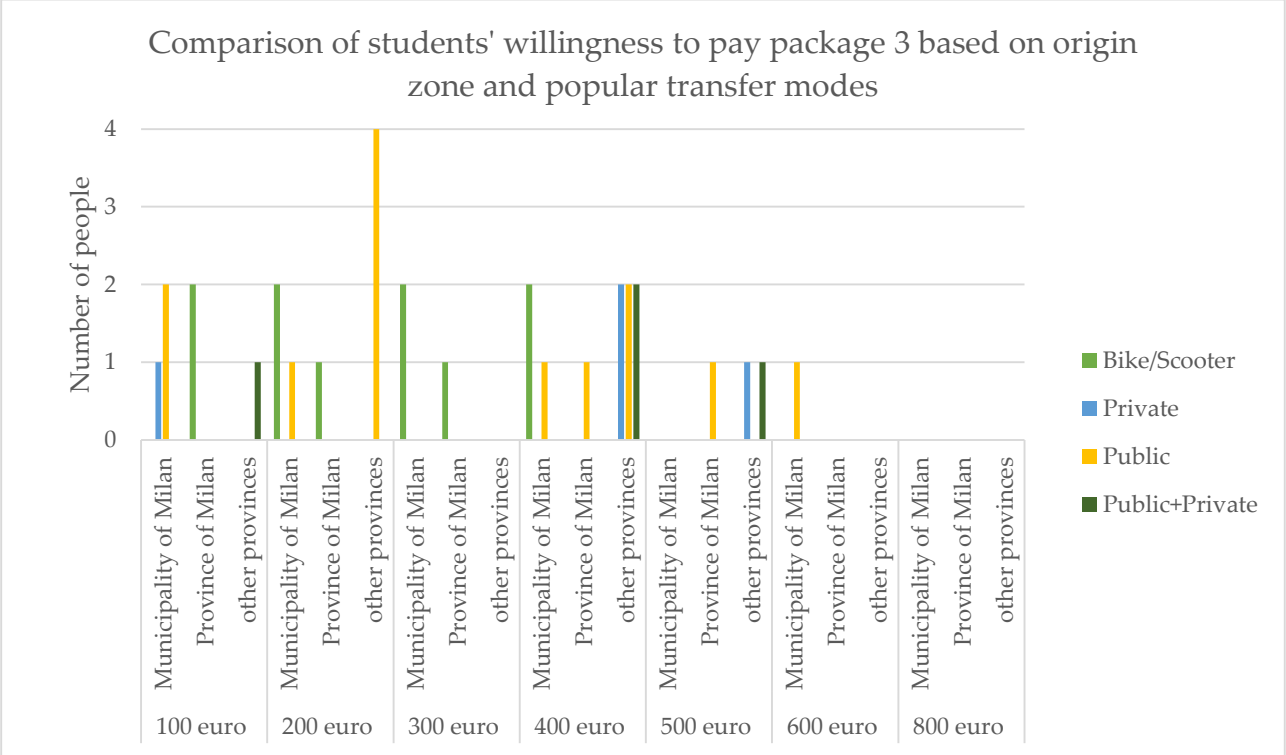


Figure 3.46: Comparison of students' willingness to pay package 3 based on origin zone and popular transfer modes

These insights emphasize the importance of pricing sensitivity when designing MaaS solutions. Service providers and planners should take these findings into careful consideration when crafting pricing strategies and refining Mobility as a Service packages. Providing the right balance between cost and convenience is crucial to aligning these offerings with user expectations and enhancing their appeal within the market.

4. Conclusion

Mobility as a Service endeavours to enhance our transportation systems by promoting environmental sustainability, minimizing emissions, congestion and resource consumption through the integration of various transportation modes. Achieving MaaS success necessitates concerted efforts from all stakeholders, including transport operators, MaaS providers, integrators, and, notably, users themselves. It is crucial to emphasize that the key to MaaS's success lies in the implementation of efficient and personalized solutions capable of meeting the diverse needs of users. This research investigated insight into the current perceptions of the MaaS concept within a university community.

A survey was conducted using the Computer-Assisted Web Interviewing (CAWI) method, involving 1949 participants, including students and staff at Polimi University campuses between May and June 2023. The survey aimed to investigate commuters' behavior in the presence of Mobility as a Service. It included Revealed Preference (RP) questions about socio-economic characteristics and travel habits, Stated Intention (SI) questions regarding perceptions and expectations, and Stated Preference (SP) questions about proposed mobility bundles and choice situations. The survey explored user preferences for MaaS packages that combine various transportation services and assessed their willingness to pay for these options.

The data indicates that public transportation is the preferred choice for both groups, with students also using a combination of public and private transport. Employees, on the other hand, tend to use personal vehicles as a second choice. The majority of respondents reside in Milan, with some in the Milan province and others outside the province.

The survey findings on mobility needs and issues highlight several key points. Firstly, over half of respondents express dissatisfaction with their current commuting methods, with students primarily driving this dissatisfaction. Dissatisfaction is particularly prominent among users of public transportation and the combination of public and private modes. The data also reveals geographical variations in

satisfaction levels, with residents of Milan generally more satisfied with their transportation options compared to those in other provinces.

Common problems leading to dissatisfaction include high travel times, irregular service, and crowded vehicles. Long travel times are a consistent source of discontent across different modes of transportation. To address these issues and attract dissatisfied individuals to Mobility as a Service packages, it is crucial to offer effective solutions that combine public transportation with shared services. This approach can provide alternatives during transportation delays or crowded situations, ultimately enhancing user satisfaction and promoting the adoption of MaaS packages.

Identifying potential users for Mobility as a Service within a university community is crucial for tailoring transportation solutions to their specific needs. The target demand includes students and employed individuals who primarily use public transportation or a hybrid approach of public transportation and private vehicles, totaling approximately 73% of the sample.

To be more exact, the identification of this target demand is rooted in the analysis of three key factors. Firstly, individuals who express dissatisfaction with their current transportation options represent a pivotal component of the target demand. This group's discontent, especially prominent among students relying on public transportation in Milan or those in other provinces resorting to a combination of public transport and private cars, indicates their readiness to seek alternative and more efficient mobility solutions. Secondly, the category of multimodal commuters is an integral part of this target audience. These individuals, who seamlessly blend public transport with private vehicles exhibit a natural inclination toward MaaS solutions. Lastly, the group of dedicated commuters who maintain a frequent presence at the university forms part of this demand.

From the point of view of desired features for a robust MaaS, respondents prioritize factors influencing transportation mode selection for commuting between home and university, with Travel Time, Monetary Cost, Safety, Comfort, Environmental Sustainability, and Wellness as top considerations. These priorities remain consistent, even among individuals dissatisfied with their current transportation. Differences in preferences are observed between students and employees, where Comfort surpasses Safety in importance among employees. When considering transportation modes, Travel Time, Comfort, and Safety are consistently prioritized for public transportation and combined public-private means users, while private car users emphasize Travel Time, Comfort, and Safety in a distinct order. Integration of transport services within a MaaS app is crucial, with Public Transportation, Bike Sharing, and Car Sharing being top preferences, although employees prioritize

Carpooling and Moped Sharing, while students prefer Scooter Sharing and Moped Sharing. Key functionalities within a MaaS app include Real-time updates, Time- and cost-optimized route search, Discounts for Sustainable Transport Modes, Single account access, Electronic payment, and Booking shared transport.

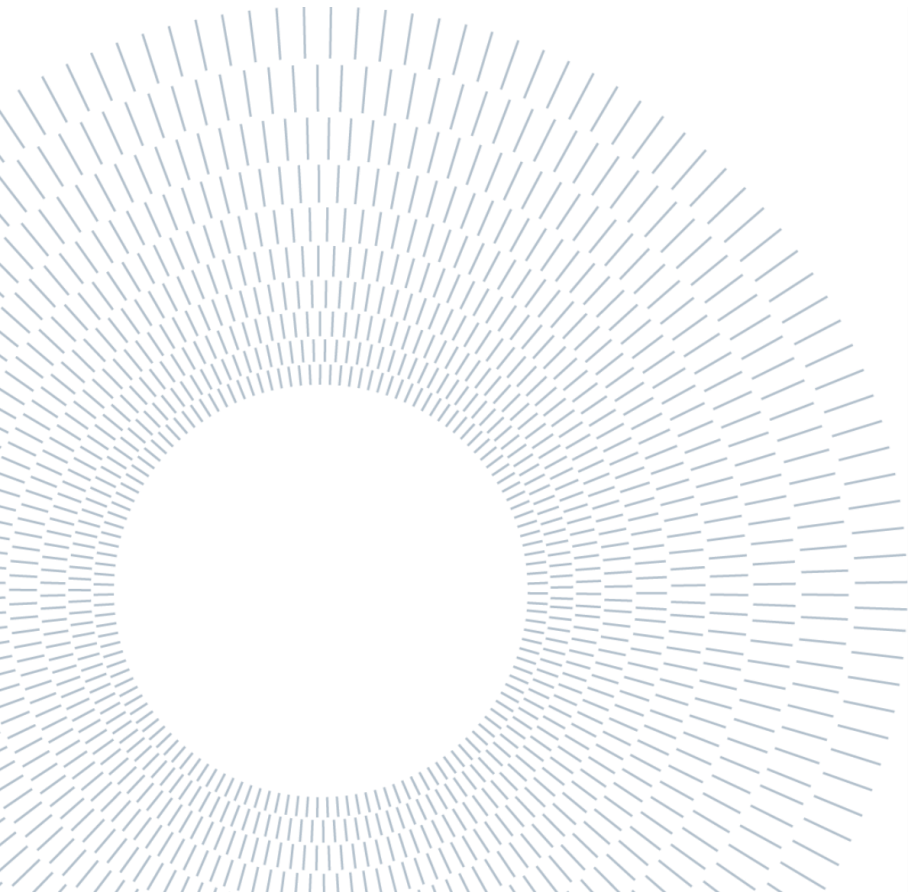
When considering the preferred MaaS bundles, the initial package stands out as a popular choice. Individuals holding pass cards overwhelmingly lean towards this first package, particularly those who rely on public transport, and this preference remains consistent among both students and employees. However, among those without pass cards, while the preference for the first package diminishes somewhat, it still maintains its status as the most preferred option. Notably, this group is primarily composed of staff, a majority of whom are private car users. In contrast, among the subgroup of students without cards, public transport users dominate across all package preferences.

From the angle of Willingness to Pay (WTP) for MaaS packages, individuals with pass cards are willing to pay more for MaaS packages, especially at lower price increments. Package 2 also garners interest at 10% and 20% price increases. Package 3 receives less interest at higher cost increments.

Among respondents without pass cards, there is less willingness to pay for MaaS packages. For Package 1, 9% are inclined to pay 100 euros annually, and 6% for 200 euros, but interest diminishes at higher costs. Package 2 and Package 3 have lower levels of interest compared to Package 1, with some respondents willing to pay for the 100 and 200 euro options.

Broadly speaking, it can be asserted that Package 1 is the most appealing, especially to students and staff residing in Milan who rely on public transport. Package 2 attracts those using personal vehicles and Package 3 appeals to employees who commute by private car, particularly those outside Milan.

These findings underscore the need to be price-sensitive when developing MaaS solutions. It is crucial for service providers and planners to carefully factor in these insights when shaping pricing strategies and improving MaaS packages. Balancing affordability and convenience is key to ensuring that these offerings meet user expectations and remain attractive in the market.



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A. Appendix A

Mobility as a Service (ENG)

MaaS *("mobility as a service")* is an innovative concept that **promotes integration between modes of transport** by providing users with access to public transport, bike sharing, car sharing and other services **through a single digital platform**. **A MaaS platform**, on the one hand, **suggests time- and cost-optimised travel solutions from origin to destination** by combining several modes of transport according to the user's needs and, on the other hand, **allows users to buy/book services offered by different operators** *(e.g., Trenord, ATM, Enjoy, ShareNow, BikeMi)* **with a single account and in a single transaction**.

This survey aims to collect the opinions and needs of Politecnico di Milano students and employees to assess the potential development of a MaaS for the university community.

The information collected will be useful for the updating of the Home and Work Displacement Plan (https://rb.gy/nlcg9) by the University Mobility Manager and may be used in academic publications. It will be possible to receive a summary of the research results by indicating your e-mail address at the end of the questionnaire.

At this link you can vision the information on the processing of personal data: https://rb.gy/cvpk9

* Obbligatoria

1. **Which is your role at Politecnico di Milano?** *

- ◯ Bachelor student
- ◯ Master Student
- ◯ PhD Student / Research Associate / Research Fellow
- ◯ Professor / Researcher
- ◯ Technical-Administrative Staff
- ◯ Altro

2. **How many times a week do you go to university on average?** *

- ◯ once or less
- ◯ twice
- ◯ three times
- ◯ four times
- ◯ five times or more

3. **Where do you generally start your journey to university?** *

- ◯ Municipality of Milan
- ◯ Province of Milan
- ◯ Bergamo (municipality or province)
- ◯ Brescia (municipality or province)
- ◯ Pavia (municipality or province)
- ◯ Como (municipality or province)
- ◯ Cremona (municipality or province)
- ◯ Lecco (municipality or province)
- ◯ Lodi (municipality or province)
- ◯ Monza (municipality or province of Monza Brianza)
- ◯ Novara (municipality or province)
- ◯ Piacenza (municipality or province)
- ◯ Varese (municipality or province)
- ◯ Altro

4. **You mainly travel to the pole of:** *

- ◯ Milano Bovisa
- ◯ Milano Leonardo
- ◯ Cremona
- ◯ Lecco
- ◯ Mantova
- ◯ Piacenza

5. **Do you have your own car/scooter to get to the university?** *

- ◯ Yes
- ◯ Sometimes, because I share it with family members or others
- ◯ No, never

6. **Starting from home, which of the following modes of transport do you mainly use during this period?**

Break down the home-university route into its different legs, if any, distinguishing between the means of transport used

	On foot	Bus, Tram or Metro	Train	Private car or moped	Shared car or moped	Private bike or scooter	Shared bike or scooter
1st leg / unique path	◯	◯	◯	◯	◯	◯	◯
2nd leg	◯	◯	◯	◯	◯	◯	◯
3rd leg	◯	◯	◯	◯	◯	◯	◯
4th leg	◯	◯	◯	◯	◯	◯	◯
5th leg	◯	◯	◯	◯	◯	◯	◯
6th leg	◯	◯	◯	◯	◯	◯	◯
7th leg	◯	◯	◯	◯	◯	◯	◯

7. **Does the choice of the used modes of transport change according to the season?** *

◯ Yes

◯ No

8. **How important do you think the following factors are in choosing the transport modes for your home-university trip?** *

Please express your opinion on a scale from 1 to 5, where 1 means "Not at all important" and 5 "Very important".

	1 - **Not at all important**	2 - **Slightly important**	3 - **Neutral**	4 - **Important**	5 - **Very important**
Monetary cost	◯	◯	◯	◯	◯
Travel time	◯	◯	◯	◯	◯
Comfort	◯	◯	◯	◯	◯
Safety	◯	◯	◯	◯	◯
Environmental sustainability	◯	◯	◯	◯	◯
Wellness / Physical activity	◯	◯	◯	◯	◯

9. **Are you fully satisfied with the modes of transport used to reach the university?** *

◯ Yes

◯ No

10. **For which of the following reasons are you not satisfied?** *

Please select one or more options

- [ ] High travel time
- [ ] Irregular service
- [ ] Number of changes between modes
- [ ] Crowded vehicles
- [ ] Other modes are faster, but cost too much
- [ ] Long distances travelled on foot
- [ ] Difficulties in finding parking lots
- [ ] Lack of protected bike routes
- [ ] Altro

11. Before going to the university, **do you plan your journey using smartphone applications?** *

(for example, using Google Maps to check in real time which is the best path)

- ◯ Never
- ◯ Rarely
- ◯ Sometimes
- ◯ Often
- ◯ Always

12. While travelling to the university, **do you use smartphone applications to check the road traffic or possible delays of public transport services?** *

- ◯ Never
- ◯ Rarely
- ◯ Sometimes
- ◯ Often
- ◯ Always

13. While travelling to the university, in case of traffic or delay, **do you use smartphone applications to re-plan and change your route?** *

- ◯ Never
- ◯ Rarely
- ◯ Sometimes
- ◯ Often
- ◯ Always

14. **How important do you think it is for a MaaS app to integrate the following transport services?** *

Please express your opinion on a scale from 1 to 5, where 1 means "Not at all important" and 5 "Very important".

	1 - **Not at all important**	2 - **Slightly important**	3 - **Neutral**	4 - **Important**	5 - **Very important**
Public transport (e.g., ATM, Trenord)	○	○	○	○	○
Bike sharing (e.g., BikeMi, Mobike)	○	○	○	○	○
Scooter sharing (e.g., Tier, Dott)	○	○	○	○	○
Car sharing (e.g., Enjoy, ShareNow)	○	○	○	○	○
Car pooling (e.g., BlaBlaCar)	○	○	○	○	○
Moped sharing (e.g., Cityscoot, Cooltra)	○	○	○	○	○
Taxi	○	○	○	○	○

15. **How important do you think it is for a MaaS app to include the following functionalities?**
*

Please express your opinion on a scale from 1 to 5, where 1 means "Not at all important" and 5 "Very important".

	1 - **Not at all important**	2 - **Slightly important**	3 - **Neutral**	4 - **Important**	5 - **Very important**
Time- and cost-optimised route search (also including several modes of transport)	◯	◯	◯	◯	◯
Real-time updates of traffic and public transport timetables	◯	◯	◯	◯	◯
Booking and actual availability of shared means of transport (cars, bikes, scooters)	◯	◯	◯	◯	◯
Registration of a single account for access to services offered by several operators	◯	◯	◯	◯	◯
Electronic payment in a single transaction of the services used	◯	◯	◯	◯	◯
Discounts for the use of more sustainable modes of transport	◯	◯	◯	◯	◯

16. **If there is a MaaS app that offer all the above-described functionality, would you use it to ...** *

	1 - **Very unlikely**	2 - **Unlikely**	3 - **Neutral**	4 - **Likely**	5 - **Very likely**
... travel to the university	◯	◯	◯	◯	◯
... undertake other travels (leisure, shopping)	◯	◯	◯	◯	◯

17. **Which of the following MaaS solutions would you prefer?** *

◯ **Pay as you go** – Payment per trip made, depending on duration/length and mobility services used

◯ **Pass** – Payment by subscription to a pre-defined package of services (e.g., public transport and bike-sharing, and/or other)

18. **Do you have a public transport pass?** *

◯ Yes, ATM

◯ Yes, Trenord

◯ Yes, ATM + Trenord

◯ Yes, other integrated pass

◯ No

19. Would you be interested in purchasing a MaaS pass that would allow you to get to university by combining public transport and **scooter and bike sharing services**? *

This would allow you, for example, to use bicycles and scooters to get to stations/stops and from there continue your journey by public transport

- ◯ Yes
- ◯ No

20. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **40% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

21. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **60% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

22. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **80% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

23. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **50% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

24. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **20% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

25. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **30% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

26. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **10% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

27. Would you be interested in purchasing a MaaS pass that would allow you to get to university by combining public transport and **car-sharing and moped-sharing services**? *

This would allow you, for example, to use the sharing service to reach stations/stops and from there continue your journey by public transport

- ◯ Yes
- ◯ No

28. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **40% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

29. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **60% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

30. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **80% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

31. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **50% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

32. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **20% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

33. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **30% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

34. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **10% more than it would currently cost you**? *

- ◯ Yes
- ◯ No

35. Would you be interested in purchasing a MaaS pass that would allow you to travel to university by combining public transport and **reserved pay parking spaces for your car/bike near stations/stops**? *

This would allow you, for example, to use your car/scooter to get to stations/stops and from there continue your journey by public transport

- ◯ Yes
- ◯ No

36. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **40% more than it would cost you at present**? *

- ◯ Yes
- ◯ No

37. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **60% more than it would cost you at present**? *

- ◯ Yes
- ◯ No

38. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **80% more than it would cost you at present**? *

- ◯ Yes
- ◯ No

39. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **50% more than it would cost you at present**? *

- ◯ Yes
- ◯ No

40. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **20% more than it would cost you at present**? *

- ◯ Yes
- ◯ No

41. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **30% more than it would cost you at present**? *

- ◯ Yes
- ◯ No

42. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **10% more than it would cost you at present**? *

- ◯ Yes
- ◯ No

43. Would you be interested in purchasing a MaaS pass that would allow you to get to university by combining public transport and **scooter and bike sharing services**? *

This would allow you, for example, to use bicycles and scooters to get to stations/stops and from there continue your journey by public transport

- ◯ Yes
- ◯ No

44. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **400 euros per year**? *

- ◯ Yes
- ◯ No

45. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **600 euros per year**? *

- ◯ Yes
- ◯ No

46. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **800 euros per year**? *

- ◯ Yes
- ◯ No

47. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **500 euros per year**? *

- ◯ Yes
- ◯ No

48. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **200 euros per year**? *

- ◯ Yes
- ◯ No

49. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **300 euros per year**? *

- ◯ Yes
- ◯ No

50. If your public transport pass included **one hour per day of shared bike and scooter rental**, would you be willing to buy it for **100 euros per year**? *

- ◯ Yes
- ◯ No

51. Would you be interested in purchasing a MaaS pass that would allow you to get to university by combining public transport and **car-sharing and moped-sharing services**? *

This would allow you, for example, to use the sharing service to reach stations/stops and from there continue your journey by public transport

- ◯ Yes
- ◯ No

52. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **400 euros per year**? *

- ◯ Yes
- ◯ No

53. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **600 euros per year**? *

- ◯ Yes
- ◯ No

54. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **800 euros per year**? *

- ◯ Yes
- ◯ No

55. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **500 euros per year**? *

- ◯ Yes
- ◯ No

56. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **200 euros per year**? *

- ◯ Yes
- ◯ No

57. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **300 euros per year**? *

- ◯ Yes
- ◯ No

58. If your public transport pass included **30 minutes of car/moped sharing per day**, would you be willing to buy it for **100 euros per year**? *

- ◯ Yes
- ◯ No

59. Would you be interested in purchasing a MaaS pass that would allow you to travel to university by combining public transport and **reserved pay parking spaces for your car/bike near stations/stops**? *

This would allow you, for example, to use your car/scooter to get to stations/stops and from there continue your journey by public transport

- ◯ Yes
- ◯ No

60. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **400 euros per year**? *

- ◯ Yes
- ◯ No

61. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **600 euros per year**? *

- ◯ Yes
- ◯ No

62. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **800 euros per year**? *

- ◯ Yes
- ◯ No

63. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **500 euros per year**? *

- ◯ Yes
- ◯ No

64. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **200 euros per year**? *

- ◯ Yes
- ◯ No

65. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **300 euros per year**? *

- ◯ Yes
- ◯ No

66. If your public transport pass included **parking for 10 hours a day for your car/motorbike at a station/stop**, would you be willing to buy it for **100 euros per year**? *

- ◯ Yes
- ◯ No

To conclude, we ask you to provide us with some personal data, reminding you that the questionnaire will remain anonymous.

67. **Which is your gender?** *

- ◯ Male
- ◯ Female
- ◯ Non-binary
- ◯ I prefer to not answer
- ◯ Altro

68. **Which age group do you belong to?** *

- ◯ I am less than 26 years old
- ◯ 26-35 years old
- ◯ 36-45 years old
- ◯ 46-55 years old
- ◯ 56-65 years old
- ◯ I am more than 65 years old

69. **What is your household condition?** *

- ◯ Single
- ◯ With parents and/or siblings
- ◯ With colleagues and/or friends
- ◯ With partner and/or children

70. **What is your highest educational level already acquired?** *

- ◯ None
- ◯ Primary school certificate
- ◯ Secondary school certificate
- ◯ High school diploma
- ◯ Bachelor degree
- ◯ Master degree
- ◯ Doctor of Philosophy

71. **What is your working condition?** *

Please select one or more options

- [ ] Student
- [ ] Part-time worker
- [ ] Full-time worker
- [ ] Unoccupied / Inactive
- [ ] Retired
- [ ] Altro

72. **If you would like to be informed of the results of this survey campaign, please leave a contact below.**

By answering this question, you consent to receive communications regarding the outcome of your search

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2. Acknowledgements

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