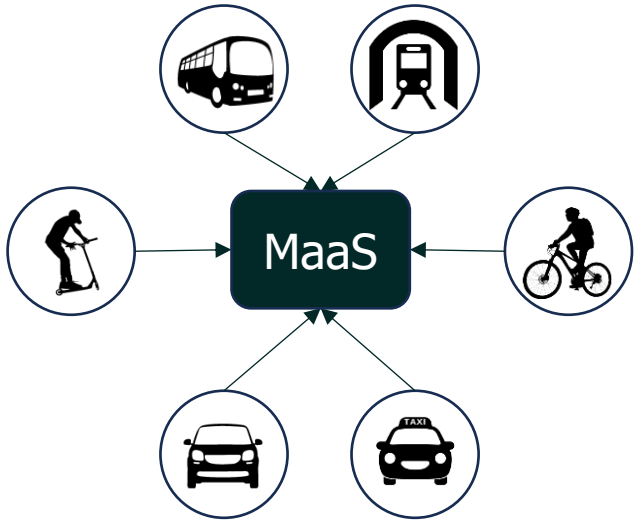
| THNS2024 |

6th Nov 2025

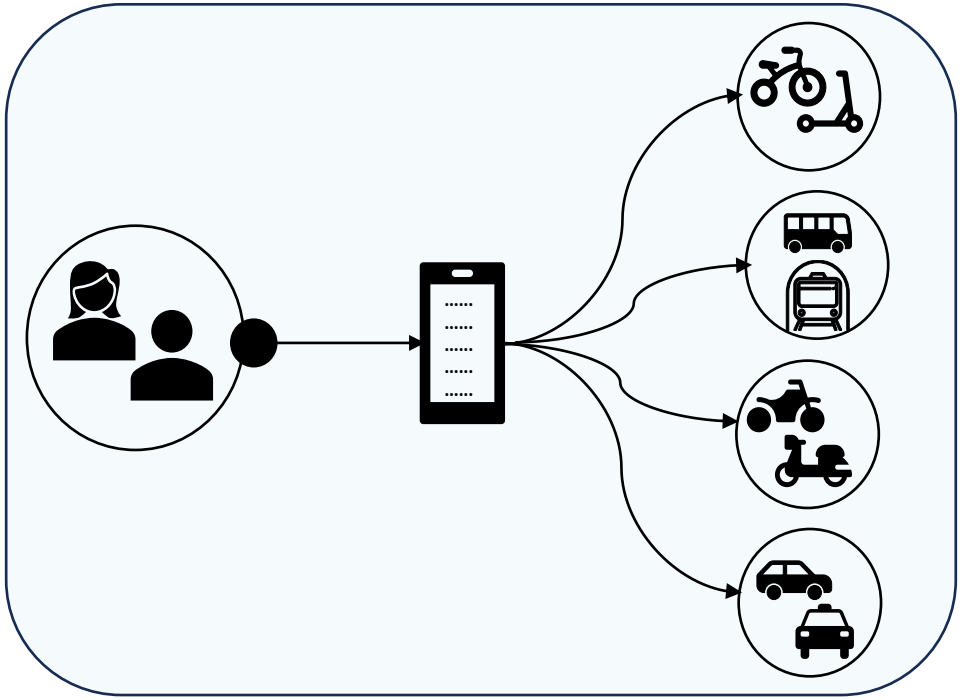
Session 4 Mobility services: economics and organization

IDENTIFYING THE FACTORS AFFECTING CITIZENS' WILLINGNESS TO USE MOBILITY AS A SERVICE.

Mavrogenidou Panagiota and Apostolos Papagiannakis



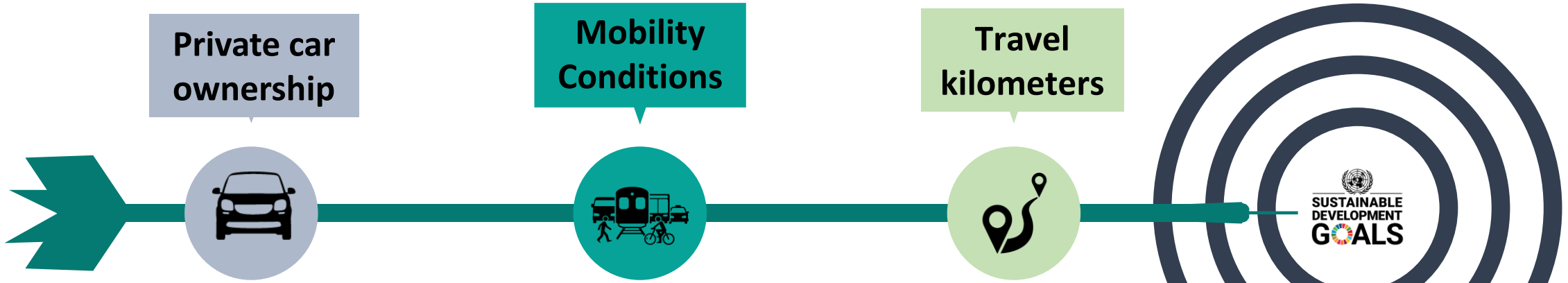
Background



MaaS **Convenient | Cost-effective| Eco-friendly**

Increases opportunities' access
Increases equity
Reduces journey times
Reduces car dependency
Increases transit ridership
Improves quality of life
Increases productivity
Reduces vehicles miles per person
Leverages infrastructure

Background



Improving the sustainability of cities by reducing or even eliminating car ownership

Improving the sustainability of cities by improving mobility conditions for people with disabilities (risk of social isolation)

Improving the sustainability of cities by reducing daily kilometers traveled on road networks by promoting ride-sharing

Background

Management
Services and resources

Connectivity
Modes of transportation

Integration of data and elements
Urban network ↑

Public authorities
Public authority benefits

Competition
Modes of transportation

Cost
Cost reduction

Quality of service
Service improvement

Time
Time reduction

Use of Public Transport
More efficient

Innovations
Promoting innovations

Background

People who are most likely to use a MaaS system are:

- Public transport users
- Users of active means of transport
- Younger aged people
- Mobile phone users who plan their journeys through them
- People with a high educational level





Background

Thessaloniki City

Population is estimated at 1,091,424 million inhabitants *(Hellenic Statistical Authority)*

To the south, the city is surrounded by the **sea**
The north of the city is characterized by a **hilly** and **mountainous** area with urban **forest**

Intense **mix of land uses** → increased traffic congestion levels, overexploitation of public space, and environmental degradation of the city

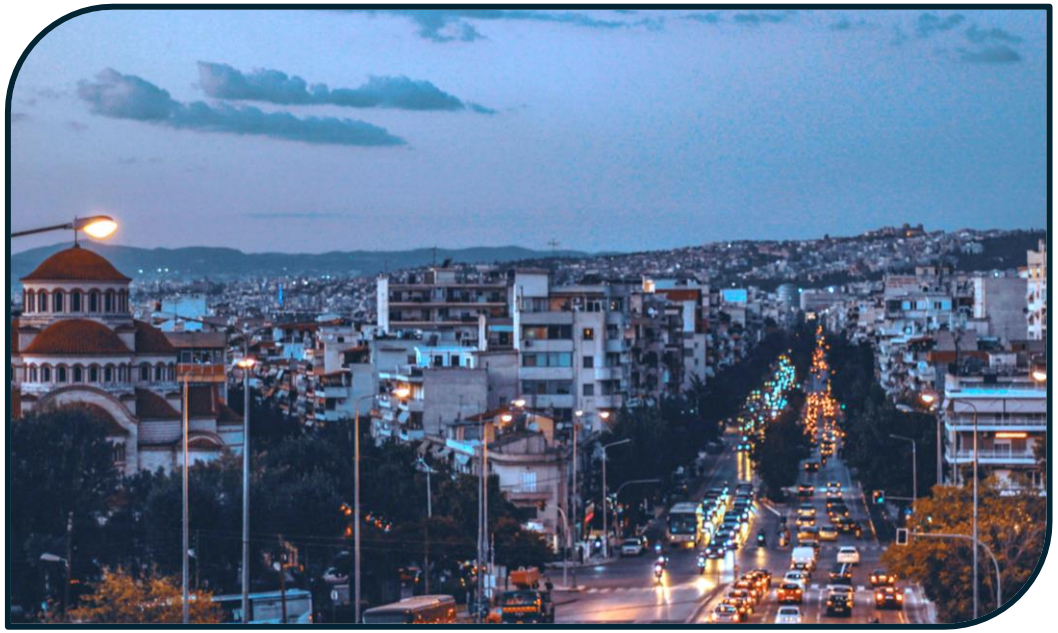
Modal split: 44% private car, 27% public transport, 11% motorcycles, 4% taxi, 3% bicycles, 11% on foot

Approximately 1,600,000 **daily trips**, of which 25% start or end at the city's historical center, and 55% are carried out during peak hours

A 3.4% increase of **private car usage** was observed between 2000 and 2018

Background

Thessaloniki City



Public transport system is based on public busses → lack of frequent service, spatial accessibility, intermodality, and interoperability

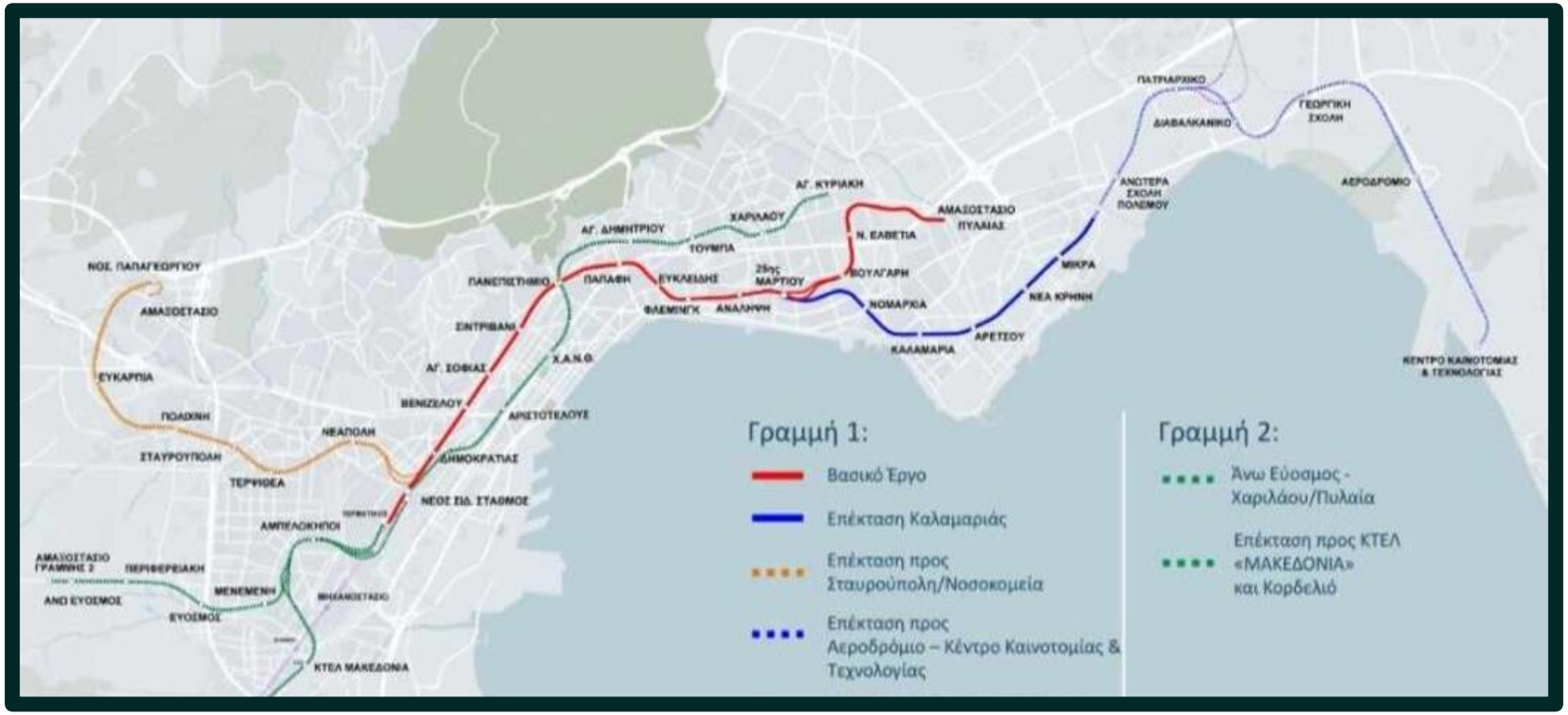
Thessaloniki Metro is under construction and is estimated to start operating at the end of 2024 (1/2 lines).

Cycling Infrastructure: Approximately 5km of bike lanes along the city's coastal front. Total, 11.7km bike lanes in the city center

Most residents do not feel comfortable and safe to travel **on foot** → inadequate infrastructure, insufficient ramps for people with disabilities, rich in obstacles, and poor in cleanliness and environment.

Background

Thessaloniki Metro System



It’s estimated that by **2040** the city's metro system is expected to have 44 stations in a length of 48 kilometers, and to transport 680,000 passengers daily.

Methodology

Systematic Literature Review

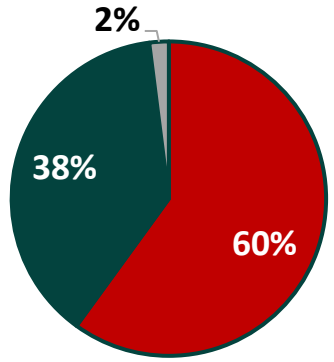
Online Questionnaire
Revealed (RP) preferences

Data collection:
395 individuals

Descriptive and Inferential analysis
Binary logistic regression model

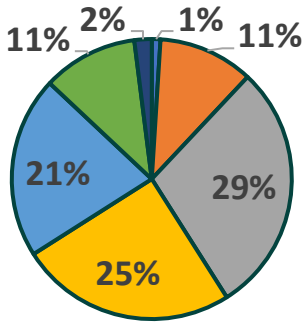
Results | Descriptives

Gender



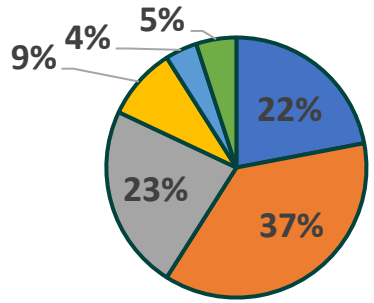
Women Men Other

Age



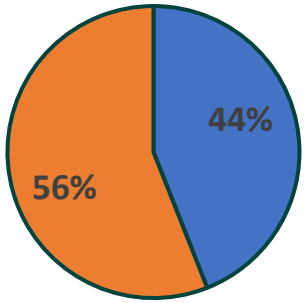
<64 18-24 25-34 35-44 45-54 55-64 >64

Income



0-500 501-1000 1001-1500 1501-2000 2001-2500 >2500

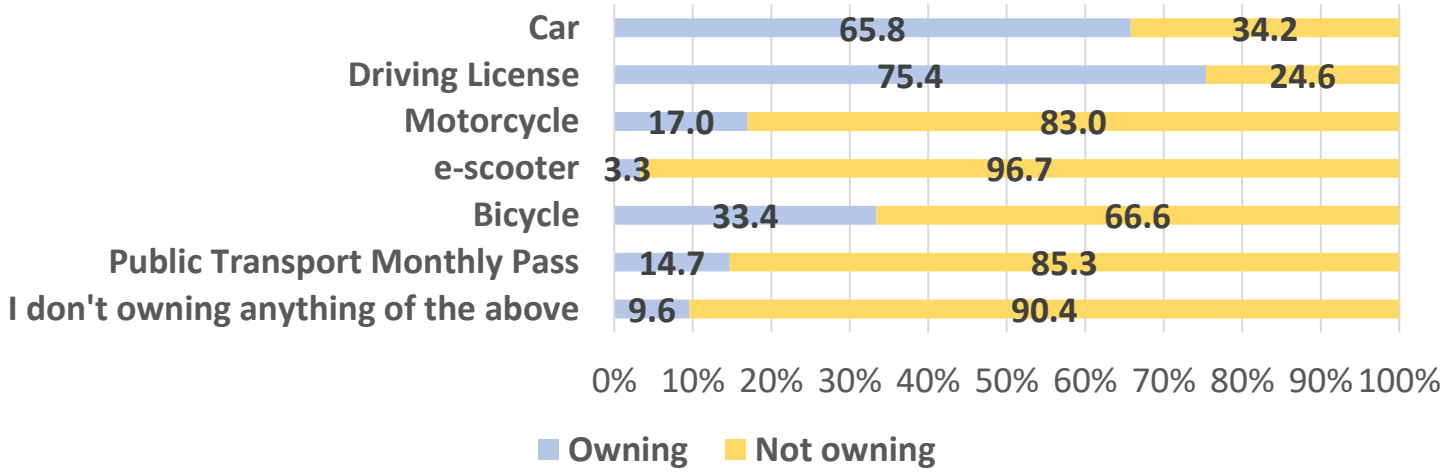
Living Area



Living at the City Center

Not Living at the City Center

Ownership

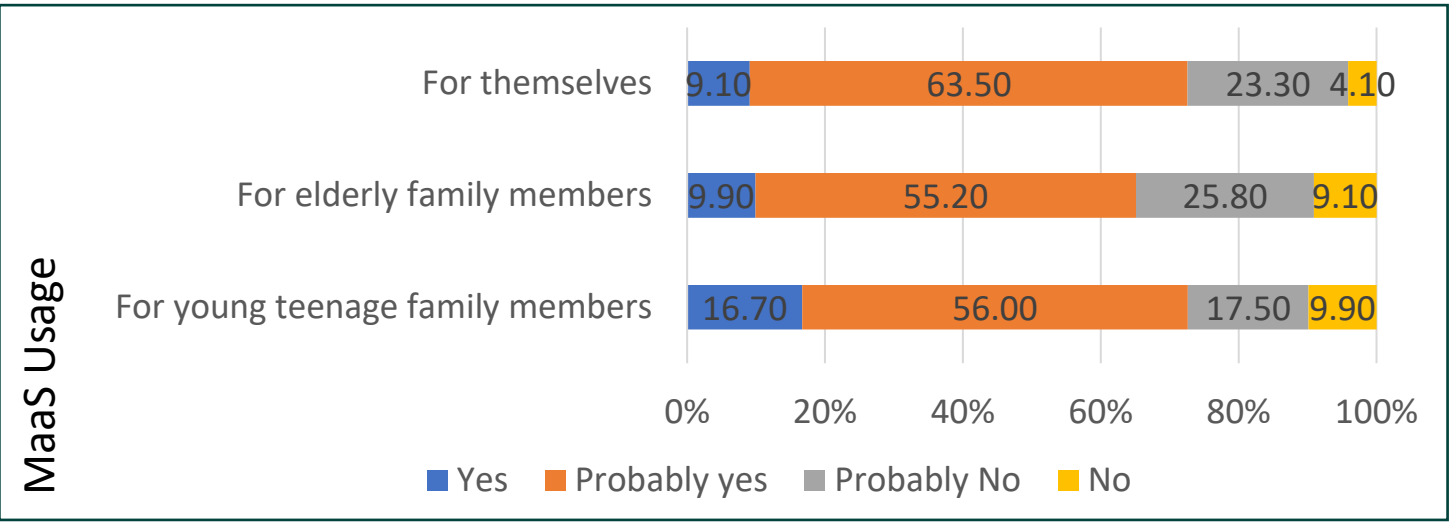


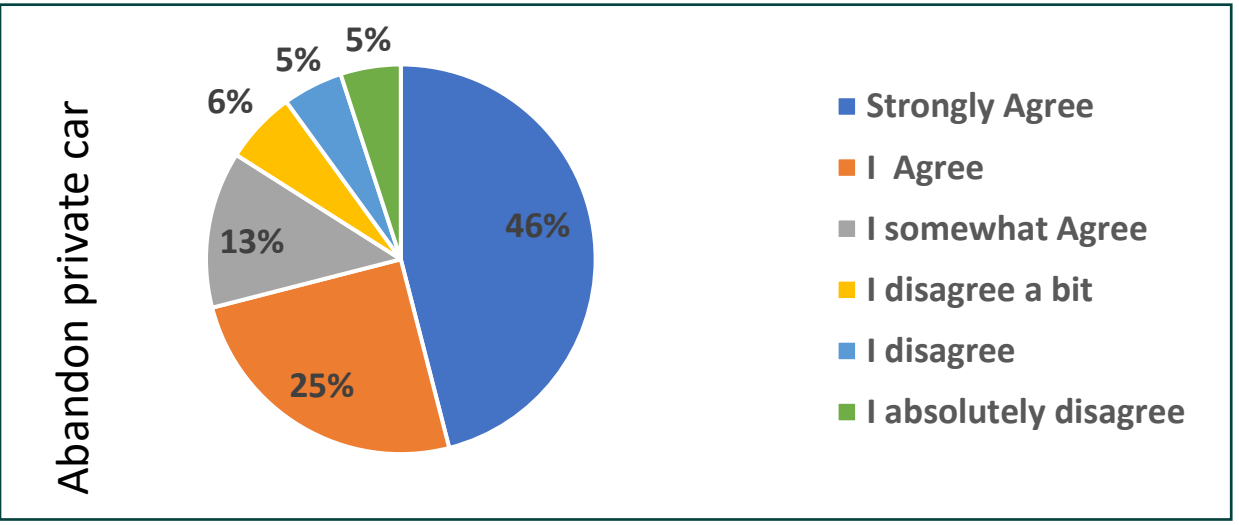
Results |Descriptives

Variables	M	Median	SD	IQR
How often do you commute for work?	3,93	5	1,63	2
How often do you travel for shopping?	2,66	3	1,16	1
How often do you travel for entertainment?	2,47	2	1,12	1
How often do you travel for family care issues?	2,41	2	1,39	2
How often do you move for other purposes?	2,1	2	1,33	2
How often do you travel for training?	1,88	1	1,38	2
How often do you travel for medical appointments?	1,27	1	0,73	0

Variables	M	Median	SD	IQR
Frequency of trips on foot	4.81	5	1.21	2
Frequency of trips by car as a driver	3.97	5	2.17	5
Frequency of trips by car as a passenger	3.78	4	1.44	3
Frequency of trips by buses	3.06	3	1.71	2
Frequency of trips by taxis	2.58	2	1.27	1
Frequency of trips by motorbike	1.81	1	1.48	1
Frequency of trips by bicycle	1.7	1	1.31	1
Frequency of trips by e-scooters	1.21	1	0.71	0

Results | Descriptives





Variable	% Respondents
Cost	27.80%
Trial	11.40%
Nothing could make me use a MaaS system	11.00%
Unlimited trips with simultaneous access to multiple modes	10.10%
Comfort	7.80%
Environmental Benefits	4.60%
Flexibility	3.80%
Time saving	3.30%
Additional Amenities	3.30%
Absence of alternatives	2.30%
Easiness of trips	2.00%
Independence	1.80%
Innovation	1.80%
Safety	1.50%
Accessibility	1.50%
Reliability	1.30%
Reduction of car use	1.30%
Other	3.60%

Results | Inferential

Variables		Peoples' Willingness to Use a MaaS System			
		Mean Rank	N	Chi-Square	p-Value
Transport mode for work commuting	Car driver	184.46	189	20.361	0.02
	Car as passenger	**248.08**	43		
	Public Bus	216.32	77		
	Taxi	222.29	7		
	Motorcycle	171.28	20		
	Bicycle	187.63	8		
	Walking	187.07	51		
Transport mode for educational trips	Car driver	180.68	164	22.906	0.001
	Car as passenger	**246.91**	29		
	Public Bus	225.43	79		
	Taxi	190.45	11		
	Motorcycle	150.12	17		
	Bicycle	196.9	10		
	Walking	199.92	85		
Transport mode for leisure trips	Car driver	177.88	165	28.962	0
	Car as passenger	225.93	70		
	Public Bus	226.05	46		
	Taxi	**252.17**	24		
	Motorcycle	162.94	16		
	Bicycle	145.45	10		
	Walking	195.81	64		

		Mean Rank	N	U	Z	p-Value
Variables		Peoples' Willingness to Use a MaaS System				
Gender	Woman	**202.37**	235	15,659.00	−2.293	0.02
	Man	179.7	151			
Driving License	Yes	**206.34**	298	11,967.00	−2.979	0.003
	No	172.37	97			
Prior Knowledge of MaaS	Yes	**227.35**	96	11,534.00	−3.389	0.001
	No	188.58	299			
Used MaaS in the past	Yes	**256.45**	41	4860.5	−4.053	0
	No	191.23	354			

Results | Inferential

Variables		Peoples' Willingness to Use a MaaS System			
		Mean Rank	N	Chi-Square	p-Value
Frequency of commuting my PT	Never	169.61	87	23.608	0
	<1 day/week	181.36	104		
	1–2 days/week	208.22	53		
	2–3 days/week	210.97	54		
	3–4 days/week	244.27	45		
Age	<18	199.7	5	14.277	0.027
	18–24	211.45	43		
	25–34	214.46	116		
	35–44	196.43	97		
	45–54	185.71	82		
	55–64	185.49	44		
	>64	99.81	8		

Variables		Peoples' Willingness to Use a MaaS System			
		Mean Rank	N	Chi-Square	p-Value
The weather affects my modal choice	Absolutely disagree	133	11	11.492	0.042
	Strongly disagree	185.98	25		
	Disagree a bit	185.16	25		
	Somewhat agree	177.48	66		
	Totally agree	209.18	134		
	Strongly Agree	206.9	134		

Results | Inferential

Variables		Mean Rank	N	Chi-Square	p-Value
Willingness to Create a MaaS Subscription for the Elderly					
Frequency of commuting as car passenger	Never	112.25	18	25.004	0
	<1 day/week	170.22	84		
	1–2 days/week	198.87	52		
	2–3 days/week	211.21	105		
	3–4 days/week	211.06	85		
	5+ days/week	224.17	51		
Frequency of commuting by bus	Never	170.33	87	11.316	0.45
	<1 day/week	200.38	104		
	1–2 days/week	197.06	53		
	2–3 days/week	204.26	54		
	3–4 days/week	230.4	45		
	5+ days/week	205.97	52		

Willingness to Create a MaaS Subscription for the Elderly						
Variables		Mean Rank	N	U	Z	p-Value
Gender	Woman	**202.77**	235	15563	−2.269	0.023
	Man	179.07	151			
Trip Cost	Yes	190.11	271	14663	−2.253	0.024
	No	**215.25**	124			

Variables		Mean Rank	N	U	Z	p-Value
Willingness to create a MaaS subscription for their young teenage family members						
Used MaaS in the past	Yes	230.98	41	5905	−2.165	0.03
	No	194.18	354			
PT commuters for shopping activities	Yes	217.69	68	9779	−1.733	0.083
	No	193.91	327			
Private car ownership	Yes	181.18	135	15,279.50	−2.338	0.019
	No	206.73	260			
The frequency of city buses routes is an inhibiting factor in using them	Yes	201.91	348	6819	−2.05	0.04
	No	169.09	47			

Results | Binary logistic regression model

The model

Logit(odds) = ln(p/1 − p) = b0 + b1X1 + b2X2 + … + bmXm

where:
b0 is the intercept coefficient.
bi are the coefficients to be estimated for each independent variable.
Xi are the independent variables describing the characteristics of the survey participants.

The variables

Time Spend on Urban Commuting; Trip Frequency as car passenger; Avoiding using public busses compared to the past use due to COVID-19; Previous experience on MaaS system; Previous experience on MaaS system; Trusting the private sector for the operation of public transport; Age; Family members; Driving License

Model Statistics

Chi-square statistic, $X2(8,N=395)=103.753$X 2 (8,N=395)=103.753 | **p-value** of 0.000
Variation explanation: **Nagelkerke R^2** 33.4% | Correct classifications 78.2%
Model fit: **Hosmer and Lemeshow test**, **Chi-square** 9.758 | **p-value** of 0.282 > 0.05

Results | Binary logistic regression model

Variable	Reference Category	B	S.E.	Wald	df	Sig.	Exp(B)
Constant	1.031	1.517	0.462	1	0.497	2.804	
Time spent of urban trips.	More than 2 h			7.98	4	0.092	
Less than 10 min		1.343	0.763	3.1	1	0.078	3.83
10 to 30 min		1.282	0.757	2.869	1	0.09	3.602
30 to 60 min		1.42	0.74	3.686	1	0.055	4.139
1 to 2 h		2.16	0.805	7.2	1	0.007	8.675
Trip frequency as a car passenger	5+days/week			15.48	5	0.008	
Never		−2.246	0.77	8.515	1	0.004	0.106
<1 day/week		−1.664	0.584	8.105	1	0.004	0.189
1–2 days/week		−1.558	0.612	6.482	1	0.011	0.211
2–3 days/week		−1.219	0.568	4.611	1	0.032	0.296
3–4 days/week		−0.492	0.579	0.721	1	0.396	0.611
Avoiding using public busses compared to the past use due to COVID-19	I completely agree			14.273	5	0.014	
Completely disagree		−0.786	0.419	3.519	1	0.061	0.455
I disagree a lot		−0.256	0.474	0.292	1	0.589	0.774
I disagree a little		0.222	0.493	0.202	1	0.653	1.249
I agree a little		−0.535	0.392	1.862	1	0.172	0.586
I agree a lot		1.148	0.512	5.038	1	0.025	3.152
Previous experience on MaaS system (Yes)	No	1.541	0.728	4.485	1	0.034	4.668

Results | Binary logistic regression model

Variable	Reference Category	B	S.E.	Wald	df	Sig.	Exp(B)
Trusting the private sector for the operation of public transport	I completely agree			17.141	5	0.004	
Completely disagree		−3.044	1.165	6.828	1	0.009	0.048
I disagree a lot		−2.124	1.172	3.283	1	0.07	0.12
I disagree a little		−2.291	1.152	3.95	1	0.047	0.101
I agree a little		−2.222	1.149	3.742	1	0.053	0.108
I agree a lot		−0.997	1.207	0.683	1	0.409	0.369
Age	>55			7.773	5	0.169	
<18		0.592	1.337	0.196	1	0.658	1.807
from 18 to 24		1.154	0.573	4.053	1	0.044	3.171
from 25 to 34		1.23	0.487	6.385	1	0.012	3.422
from 35 to 44		1.067	0.456	5.478	1	0.019	2.906
from 45 to 54		1	0.467	4.585	1	0.032	2.718
Family members	5 and more members			6.313	4	0.177	
1 member		1.31	0.577	5.164	1	0.023	3.708
2 members		0.337	0.505	0.444	1	0.505	1.4
3 members		0.494	0.501	0.974	1	0.324	1.639
4 members		0.438	0.482	0.827	1	0.363	1.55
Driving License (Yes)	No	0.591	0.304	3.774	1	0.052	1.805

Conclusions

- Demographics significantly impact citizens' willingness to embrace a MaaS scheme.
  - Age, driving license, daily commuting time, commuting frequency as car passenger, commuting frequency by public transport (PT), household size, and MaaS familiarity are the most influential factors of citizens’ willingness to use MaaS.
    - Women, cost-conscious individuals and frequent PT commuters demonstrate a higher willingness to use MaaS for their eldest relatives.
  - People living alone are more likely to choose a MaaS scheme. MaaS stakeholders should take actions to increase the attractiveness of the service to larger households.
- People who were aware of the service or had used the service before taking the questionnaire were more willing to use the service. Actions should be taken to educate people about the system and the benefits it provides. A well-designed pilot project could be extremely useful in attracting new users of a MaaS scheme.

Thank you

Contact information

Panagiota Mavrogenidou

E-mail

pmavrogenidou@aegean.gr

Apostolos Papagiannakis

E-mail

apa@plandevel.auth.gr