

Development of Mobility-as-a-Service (MaaS) services in Poland – an example of Polish Y generation travel choices

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Abstract

New Mobility Services (NMS) are more popular every year. Large-scale deployment of so-called 'New Mobility Services' is part of facing today's biggest mobility challenges. Sharing economy solutions acquire the demand for travel services, especially for short distances. The evolution of business models on the mobility market has an impact on mobility choices of all urban residents, especially the younger ones, described as the Y generation. Therefore, the study aims at indicating the level of popularity of Mobility-as-a-Service (MaaS) and differences between the sub cohorts of the Y generation in Poland.

Keywords: mobility, maas, urban residents, y generation, urban transport.

1 Introduction

Mobility of people is one of the most popular research areas in contemporary logistics research. The complexity of this topic results from the complicated nature of the stakeholders' needs, local authorities' goals, global trends (e.g. sustainable development, suburbanization) and changing market offer (especially in the automotive industry). The growing market power are individual bidders within new forms of service providers, being a competition to the traditional models of public- and private-owned organizations. The power of the crowd can be a future scenario for developing the offer for the whole economy, not only mobility or transport sector.

One part of the sharing economy trend in the field of terrestrial mobility is the development of new mobility services, including Mobility-as-a-Service group, a response to growing restrictions in car-related mobility within city centers, especially in European countries. The car culture, grown into the developed economies and peaking in the developing ones, will last for many years. That is why the new solutions in this respect are worth to be analyzed and improved. What is more, they correspond with the existing elements of urban logistics, including urban transport, like Sustainable Urban Mobility Plans (SUMP), implemented in many cities worldwide.

The paper aims to present the level of MaaS brand awareness of Polish young adults, the level of using those solutions for everyday mobility and the differences in those fields regarding the chosen differentiation criteria, like gender, age, family status etc. The main research questions in this paper are:

RQ1: What is the level of MaaS brands awareness among young adults in Poland?

RQ2: What are the differences between young adults subgroups in the area of using MaaS?

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The answers to these questions address the problems of the development of such solutions and launching them on the new markets. It can provide valuable information for the MaaS providers, focusing their marketing activities in countries of Central and Eastern Europe.

The paper is organized as follows. The first part contains the literature review results, according to the chosen procedure and search criteria. The second part of the paper presents the methodology of the main research, namely the characteristics of the survey carried out between March and May 2018. It gives details about the data analysis method. The third section contains research results divided into general results and results for the specified subgroups of respondents. The last part concludes the paper, presents its limitations and points areas for future research.

2 Literature review

2.1 Procedure

To obtain reliable results of the literature review, the chosen procedure for defining the publication base should have been used. This analysis was also aimed at identifying critical areas of knowledge on the use of MaaS.

The planned procedure of the literature review should be clear and possible to reproduce for the next researchers. In this study, this was the Denyer and Tranfield procedure, dedicated for socio-economic research, possible to replicate. The primary procedure was modified to address the results to the aim of the study (Pieriegud et al., 2018).

The obstacle in the procedure implementation was the dispersed character of the literature on the chosen topic. However, the literature base had to correspond directly with MaaS development, not the new mobility solutions or urban mobility as a whole. For this reason, Boolean logic was used (“mobility-as-a-service” or “mobility on demand” in title or abstract), as was only the one search engine (EBSCOhost multi-source engine). There was no need to implement additional criteria because of the small size of the primary literature base. Only full-text records were analyzed. Finally, 15 papers were confirmed as corresponding to the studied topic.

2.2 Results

Travel choices. MaaS solutions should be designed with the use of the information gathered from different stakeholders. Market needs are identified within different groups of users (differentiated by age, gender, family status, life-stage, drivers and non-drivers, etc.), sustainable urban mobility plans, other documents stating the urban logistics policy and virtual reality, where big data analysis is needed (Chmiel et al., 2023).

The special users' group are young adults, represented by the Y generation (people born between 1981 and 1999) and the oldest sub cohorts of the Z generation (people born in 2000 or later). In many well-developed countries, they declare different attitudes towards car driving (and mobility as a whole) in comparison with older cohorts (Gharachorloo et al., 2021, Nozari et al., 2012). The main characteristics of their travel choices are lower car-dependency level and higher environmental awareness than for older generations. Therefore, they are more willing to be users of multimodal urban mobility solutions. What is more, they are “digital natives” and therefore, most likely to first adopt the newest market solutions those two tendencies make them the best group to use MaaS solutions in everyday life. However, despite their general consistency of travel choices and mobility demands, as a group, they are internally diverse. Examining the real level of those internal differences was the main goal of this study.

Mobility-as-a-Service. First of all, new mobility services are the response to growing demand for non-restricted, flexible mobility. This, in turn, is the effect of changing lifestyles. The route from the starting point to the destination point can be overcome by using different means of transport. The means is not so important here, the higher priority has the final result – being in the destination point at the required time (or earlier). High priority is also given to travel comfort – availability of seat and door-to-door transport. Some researchers point the intramodality (or multimodality) as one of the features of today’s mobility, but in fact, it is discussable. The lack of means shifts during the journey correlates positively with travel comfort. Of course, it is not so important for the youngest travelers, more for the older ones, but still, the lack of transport means shift should be regarded as one of the potentially important variables in the field of mobility patterns (Barreto et al., 2018 , Nozari , 2024).

The demand for people terrestrial mobility can be met by mobility services. Those are divided into traditional services (taxi, public transport, car or bike rentals) or new ones (e.g. e-hailing, B2C car sharing, B2C bike-sharing, ride splitting). Within the group of the new mobility services, some can be provided as one trip using one mode or means of transport, some – as a wider plan for the journey, including the various options (scenarios) of this journey, enabling one application and – in many cases – one payment. The second mentioned group brings the most significant value for the user and is called as Mobility-as-a-Service . They can be delivered by different providers – public and private (including profit, non-profit organizations or individuals). Usually, what is obvious in the digital era, they are available through mobile applications (Matowicki et al., 2022).

The most valuable feature of the MaaS is the integration of offers of different transport services providers, but in practice, few levels of this integration can occur. The basic one is partial integration - the check and analysis of possible journey options for the chosen route, taking into consideration offers of different providers. The advance integration provides the additional options – pre-purchasing of services (from different market players), benefits systems, integration of short- and long-distance journeys, integration of public and private offers. The most advanced level, presented by a few solutions, enables purchasing mobility packages, including the special offers for the socio-economical groups (unemployed people, retired people, students, big families etc.).

The mentioned specifics of the MaaS solutions require hardware and software. The hardware part contains the means of transport (cars, bikes, motorbikes, scooters) and the equipment needed to manage the whole MaaS system (main stations, servers, cables, ticket machines, stations etc.). The software is more complex and can be differentiated in MaaS solutions. It includes all the options of route planning, analysis, importing data from different sources, virtual bumper, booking system, payment system). It is a core of the MaaS solution. Big Data analytics should be improved to collect the data about the community and user – the profile, preferences, history of transactions, searching routes, data from other applications and accounts (Johansson, 2017). The remaining elements important for designing MaaS solution are being environmental-friendly, meeting the law requirements, being secure and scalable, possible to implement in many cities in different countries etc. It helps to build the brand value, market position and performance in the launch period, and also can be a basis for the next solutions, for example in the area of crowd logistics for freight transport in urban and suburban zones (Amaral et al., 2021).

3 Research method

3.1 Survey

The main research method was an online survey examining the opinions and attitudes of the Y generation. A part of this survey was focused on characteristics of MaaS brand awareness and their use. The survey was preceded by the pilot study (n=42, born in 1996) and questions’ adjustments according to the pilot group comments. The respondents’ group was recruited with the use of purposive strategy (Patton, 2002) with the inclusion criteria (born between 1981 and 1999, Polish citizens). The survey was held from March to May 2018 with snowball sampling method (Hensher, 2017). Finally, 312 full questionnaires were collected. Characteristics of the research group are presented in Table 1. The research was made in 2022 and will be replicated in 2024 to observe the level of development of the MaaS market in Poland.

3.2 Data collection and analysis

The data collected while conducting the survey was mainly qualitative, two- or multi-level data. Variables were described on nominal and ordinal scales. For this reason, as the first, descriptive statistics were used to characterize the surveyed group and present some general results for young adults as one group. Then, for testing the correlation in all surveyed sample, because of the ordinal scale of the variables, Kendall's tau correlations coefficients were calculated. Finally, to verify the possible differences between groups of people, the test for two independent groups, a nonparametric test, namely the Mann-Whitney U test was held. An auxiliary tool for data analysis were tables of cardinality expanded by percentage indicators in order to identify the types of responses of particular subgroups in the research sample. All the data were analyzed with the use of the Statistica 13 software.

Table 1. Characteristics of the research sample.

Category	Result
Year of birth	1981-1990 10,58%; 1991-1999 88,79%
Sex	Female 62,50%; Male 37,50%
Student status	Bachelor students 71,47%; Master students 13,46%; Doctoral students 0,64%; Graduate 13,78%, Non-student 0,64%
Personal status	Single 41,03%, in a relationship; 52,56%; married 6,41%
Place of residence	City 500.000p or more 17,95%; City 200.000-500.000p 38,46%; City 100.000-200.000p 7,05%; City, 50.000-100.000p 8,97%; City less than 50.000p 17,31%; Countryside, suburban zone 6,09%; Countryside 4,17%
Housing status	Own flat/house (without mortgage) 6,09%, Own flat/house (mortgage) 4,49%, Flat/house owned by family 34,62%, Rented flat 48,08%, Dormitory 6,73%
Household size	One person 6,73%; Two persons 40,71%; Three, four or five persons 48,40%; More than 5 4,17%
Children (0-16)	Yes 10,26%; No 89,74%
Monthly income per person	500 PLN or less 3,85%; 500-1000 PLN 11,54%; 1000-1500 PLN 19,23%; 1500-2000 PLN 22,44%; 2000-3000 PLN 19,55%; 3000-5000 PLN 16,35%; more than 5000 7,05%

4 Research results

4.1 General results

The first step in the analysis was to identify the level of MaaS brands awareness among young adults. This level has to be defined as high (see Table 2), especially in the case of the main market players like Uber, BlaBlaCar and myTaxi (taxi and parataxi). The first MaaS on the Polish market appeared in 2013, so the score of brand awareness shows a quick spread of information about such solutions among young Poles. Those best-known solutions are car-related, although the launch of bike-sharing solutions in a few Polish cities (e.g. Verturilo, Mevo) may disrupt this result in a future study in two or three years. An exceptional case of the free-floating carsharing system in Poland is Traficar, currently operating in 6 locations (Tricity, Warsaw, Wroclaw, Poznan, Cracow, Silesian agglomeration), launched in October 2016, and fast-developing in the area of people and freight transport in urban traffic zones.

Within the part of the survey focused specifically on the MaaS group, 9 variables were established - 1 about the facts (frequency of use the mobile application for mobility purposes) and 8 about opinions about the MaaS solutions (see Table 3). The next step was to examine the correlation between variables (see Table 4). Then, for checking the subgroups differences, Mann-Whitney U test was held to examine the differences (or lack of them) between the specified subgroups of the respondents (see Table 5).

Correlation analysis of the indicated variables provides interesting conclusions (see Appendix A). Most variables are correlated with others. People who use mobile applications more often to order a means of transport

(probably most of all related to the car without or with a driver) do not rate the introduction of parataxis highly as a good solution. The less often someone uses a similar solution, the better the person assesses the very concept of such a service and its impact city area development, in addition, would like to use a public car rented for hours and would even be able to give up driving his or her own car. In turn, people often using MaaS evaluate highly other solutions, such as multimodal urban and suburban transport and would prefer to use a public car, rather than a tram or bus, if private-owned cars were excluded from traffic in cities. People who positively perceive the introduction of Uber and similar solutions are open to various possibilities in the field of MaaS, although they admit that in Poland this model will not work.

Table 2. The awareness of MaaS brands in Poland among young adults

Knowing the MaaS brand	no. of people	% of people	Use of MaaS	no. of people	% of people
Generally	310	99,36%	Generally	203	65,06%
Uber	309	99,04%	Uber	146	46,79%
BlaBlaCar	309	99,04%	BlaBlaCar	65	20,83%
Ecocar	190	60,90%	Ecocar	7	2,24%
iTaxi	177	56,73%	iTaxi	18	5,77%
myTaxi	276	88,46%	myTaxi	96	30,77%
Traficar	197	63,14%	Traficar	31	9,94%
Taxify	62	19,87%	Taxify	6	1,92%
Blinkee	49	15,71%	Blinkee	4	1,28%
Scroot	26	8,33%	Scroot	3	0,96%
JedenŚlad	32	10,26%	JedenŚlad	1	0,32%
4Mobility	34	10,90%	4Mobility	1	0,32%
Other	62	19,87%	Other	23	7,37%

Table 3. The set of variables used in the study

Variable	Description	Scale	Specifics
1	The frequency of use the mobile application to call a taxi or para-taxi, car-sharing	1 (everyday)-6 (not at all)	Facts
2	The introduction of Uber and similar MaaS solutions is good.		
3	I like the concept of shared cars or car rentals for hours.		
4	If a public transport company proposed a car for hours as one of the means of transport, I would use such a solution.		
5	An urban car (public, rented for hours) is a good solution for modern cities.		
6	A city bike combined with a high-speed train is beneficial for urban transport customers.		
7	I think that in Poland public urban cars would not work.		
8	If there was an urban car in the public transport offer, I would give up driving my own car.		
9	If the city center was forbidden to enter for private cars, I would prefer to use a city car rather than a bus or a tram.	1 (completely disagree) -5 (fully agree)	Opinions

Table 4. Correlation coefficients (Kendall's tau)*

	1	2	3	4	5	6	7	8	9
1	1,000	0,531	0,217	0,366	0,239	-0,103	-0,049	0,078	-0,254
2		1,000	0,332	0,512	0,283	-0,198	0,099	0,149	-0,220
3			1,000	0,430	0,100	-0,113	0,340	0,235	-0,265
4				1,000	0,282	-0,283	0,183	0,181	-0,157
5					1,000	-0,091	0,095	-0,059	-0,027
6						1,000	0,005	0,047	-0,002
7							1,000	0,149	-0,048
8								1,000	-0,046
9									1,000

* results in bold indicate statistically significant results at 0.05

There are two areas where negative correlation can be seen. People generally open to new MaaS solutions and new mobility services do not positively perceive multimodal urban and suburban transport, and are not willing to use a public car in the city while banned entry to the city center while they positively perceive the idea of such a solution. Many people, despite the good attitude towards new mobility solutions, think that they will not work good in Poland.

4.2 Groups differences

Differences between older and younger people. The results of the Mann-Whitney U test showed, for most variables, statistically insignificant differences between the facts and opinions of older and younger people of the studied generation (groups of people born in 1981-90 and 1991-98).

Table 5. Mann-Whitney U test results*

Grouping variable	No. of variable	p-value	Grouping variable	No. of variable	p-value	Grouping variable	No. of variable	p-value
birth year interval	1	0,148	Driver status	1	0,392		1	0,001
	2	0,039		2	0,922		2	0,051

(1981-1990; 1991-1999)	3	0,130	(driver, non- driver)	3	0,209	place of living (city and suburbs, countryside)	3	0,034			
	4	0,434		4	0,432		4	0,330			
	5	0,110		5	0,232		5	0,826			
	6	0,128		6	0,948		6	0,739			
	7	0,816		7	0,081		7	0,161			
	8	0,304		8	0,029		8	0,452			
	9	0,291		9	0,548		9	0,574			
	gender (female, male)	1		0,302	Student status (student, non- student)		1	0,869	income level (lower, higher)	1	0,001
		2		0,221			2	0,233		2	0,205
3		0,100	3	0,644		3	0,010				
4		0,385	4	0,923		4	0,265				
5		0,671	5	0,185		5	0,498				
6		0,595	6	0,345		6	0,191				
7		0,482	7	0,758		7	0,864				
8		0,928	8	0,163		8	0,896				
9		0,273	9	0,096		9	0,953				
parental status(parents, non-parents)	1	0,065									
	2	0,812									
	3	0,525									
	4	0,205									
	5	0,909									
	6	0,187									
	7	0,677									
	8	0,032									
	9	0,772									

* results in bold indicate statistically significant results at 0.05

The only factor that statistically significantly differs between those subgroups is the opinion on the introduction of MaaS services. Older respondents assessed the usefulness of these solutions higher than younger ones, who, in turn, in other questions of the questionnaire showed a much stronger attachment to public transport than people born in 1981-90. It can be related to the life stage of both subcohorts because the older ones are mostly employed and have higher purchasing power than younger ones.

Gender differences. For all variables, there are no differences between the two genders regarding the use of MaaS services and opinions about these services. No results in this area were statistically significant.

Differences between students and non-students. For all variables, the differences between students and non-students turned out to be statistically insignificant. These groups do not differ both in terms of using MaaS and opinions about such services, which is quite surprising taking into account the significant differences between older and younger Y's mentioned above.

Differences between (sub)urban and country residents. Although the survey gave respondents a choice of several options to choose a place of residence, the analysis took into consideration cumulated results for (sub)urban (with access to urban public transport) and for the countryside (without such access). As a result, two groups were obtained, and the responses of people in these groups were compared. The results of the U test indicate statistically significant differences in the frequency of use of MaaS, which is evident and natural because they are less available in rural areas and there are fewer solutions based on long-distance car sharing. Another area was the opinion on the concept of car-sharing and time-based car rental. Residents of cities and suburban zones rated them higher in relation to inhabitants of rural areas for similar reasons.

Differences between parents and non-parents. Only one variable turned out to be statistically significant in this respect. It was a tendency to give up driving own car in favor of using a public car. In this regard, people with children were much less flexible compared to people without children. This result is not very surprising

considering the number of child-related items that need to be taken away from home, while going out (stroller, bicycle, cosmetics, etc.).

Differences between drivers and non-drivers. In the case of most variables, there were no differences between the two groups, in this case, people with and without a driving license. However, in the case of one variable (the tendency to resign from own car for a public, rented per hour), these differences turned out to be statistically significant. The question was addressed to all respondents, even those who did not have a driving license during the survey research. It turned out that these people are much more flexible and likely to give up their own car to the public than those who have a driving license, even if they declared using not own car but belonging to partner or family.

Differences between people with lower and higher income. Significant differences could be seen in the responses of people with lower (up to PLN 3000 / person) and higher (PLN 3,000 / person) income per one person in the household. People with higher income were less likely to use MaaS solutions. They rated lower the usefulness of these solutions, and in general, shared cars and rented for hours.

5 Conclusions

This research showed the attitudes of Polish young adults to use Mobility-as-a-Service solutions. Their travel behavior characteristics can be the basic assumptions for mobility services development, including MaaS. The group of young adults is not so diverse as it is assumed in the literature [2,17,21], considering different characteristics of the respondents (gender, place of living, having children, studying etc.).

This analysis can contribute to the knowledge about the Polish MaaS market and be helpful to adjust the offer to the characteristics of demand declared by the chosen cohort. The best of the researcher's knowledge, there are still a few similar reports on the studied topic.

However, it should be noted that this research has one strong limitation. No random sampling method was used to carry out the survey and then. In addition, non-parametric tests were held to verify correlations between variables and differences between subgroups. They have lower power than parametric tests, so are less reliable. Consequently, the results of this survey cannot be extrapolated to the whole young adults' population in Poland. This leads to the conclusion that in the future, random sampling and testing should be carried out to confirm the results presented in this research.

Nevertheless, the research results are promising and they form the basis for drawing some conclusions about the Polish MaaS market according to the group of young users. According to the Author's knowledge, there were no research results about MaaS for Polish society, and this research filled this gap in some way. The Author plans to continue the research in this field, as also about the crowd logistics solutions [21], similar to MaaS, but in the area of freight transport in cities. Additionally, the future research should be focused on other cohorts of the society (Baby Boomers, generation X) to identify their mobility patterns, travel choices, needs and attitudes toward the use of mobility-related solutions, including MaaS.

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