Contemporary Passenger – Use of Modern Information Technologies in Public Transport (Polish Example)

Grażyna Barbara Rosa

Institute of Spatial Management and Socio-Economic Geography, University of Szczecin

Szczecin, Poland   *grazyna.rosa@usz.edu.pl*

Abstract

The aim of the article is to learn about travelers' behavior in the use of modern technologies in transport in the context of changes taking place in the environment. The research adopted a hypothesis: the "digital" development of passenger behavior coincided with the unexpectedly rapid development of modern technologies and their "forced" use during the COVID-19 pandemic. The article presents the results of four original studies conducted in 2020-2023 using the CAWI method on representative nationwide samples: N = 674 (2020), 890 (2021), 364 (2022), 929 (2023). Respondents were asked whether they use modern technologies to obtain information, purchase tickets and check the route or timetable in passenger transport. In 2020, 53% answered affirmatively and 47% declared not to use modern technologies. In 2023, the group of users increased to 78% and the group of non-users decreased to 22%.

Keywords : modern technologies, passenger transport, digital traveler

1. Introduction

In the years 2019-2021, as a result of restrictions introduced due to the development of the coronavirus, there was a decrease in the mobility of Poles caused by pandemic restrictions (Fig. 1). This was a trend noticed all over the world [9] that forced the implementation of digital mobility [3] [5] [7]. Modern technologies are a concept most often identified with the Internet, applications in phones, smart boards in vehicles and at bus stops [6]. In public transport, the following subsystems can be distinguished: visual and voice information inside the vehicle, ticketing, information for passengers on the Internet, applications in phones, at bus and railway stops, counting passenger flows, video monitoring, assigning priorities at intersections for public transport vehicles. Passenger transport in 2011-2022 is presented in Figure 1.
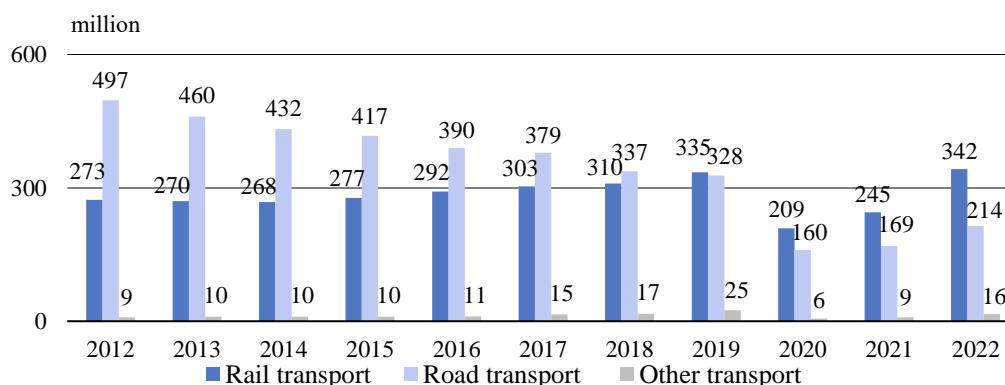

Fig. 1. Carriage of passengers by mode of transport (source: [10])

The aim of the article is to learn about passengers' behavior in the use of modern technologies in public transport in the context of changes taking place in the environment. The research adopted a hypothesis: "digital" changes in passenger behavior were combined with the unexpectedly rapid development of modern technologies and the "forced" scope of their use in

the conditions shaped by the COVID-19 pandemic. The main reason for undertaking the research is to obtain an answer whether travelers use modern technologies in passenger transport, and if not, whether they intend to use them, and whether external phenomena, such as the COVID-19 pandemic, affect the digital behavior of travelers? For this purpose, surveys of public transport passengers in Poland were carried out using the CAWI method. The implications of the conducted research are particularly important for carriers and public transport organizers. Contemporary authors notice changes in the digital behavior of passengers and new directions in shaping their preferences . They became particularly visible during and after the COVID-19 pandemic [2], [5], [8], [9]. Tests these phenomena are conducted by various authors [6, 7, 8]. in terms of the passenger service process, from ticket purchase to arrival at commercial sales points and the journey itself (an example is the ExtenSive project , aimed at developing both passenger applications and software for carriers. Understanding the psychosocial factors that influence public transportation usage behavior can provide important implications for transport policies aimed at managing travelers ' mobility behavior [2, 3]. railway in 2021 indicated that the most frequently used ways to check the timetable, ticket prices or purchase a ticket include: [1] searching for connections (75%), carriers' websites (64.1%) and applications for mobile devices (51.6 % Mobile applications are the most common[4]. Most of them enable the purchase of tickets and payments for parking in the city (MoBI LET, MPay, Skycash). Information is made available to passengers: [7] on passenger information boards at bus stops and stations, on the website and in a mobile application prepared for smartphones, on electronic information boards in buses and trains. The analysis of available works and research, to the author's knowledge, has shown that there are no cyclical studies of public transport passengers in Poland regarding changes in the use of digital information technologies during the COVID 19 pandemic and immediately after it. The article aims to fill the resulting research gap. The poster contains an introduction, discussion of research methods and research results, and conclusions.

2.   Methodology and research method

Original research on the use of modern technologies by public transport passengers was conducted in 2020-2023 using the CAWI method on representative samples: in 2020 **N=1012, in 2021 N=1129, in 2022 N=1067**, in 2023 **N=1117** adult residents of Poland by using the Opinion Research consumer panel (https://www.badanie-opinii.pl/_) and the Poznaj.to panel. The study population consisted of people aged 18 or over living in Poland. According to the Central Statistical Office, in 2021, over 31 million people over 18 years of age lived in Poland. Before starting the analyses, the iterative weighting methodology (RIM) was used using the following features: gender, age and place of residence. In order to analyze the significance of differences in the responses of individual groups of respondents, statistical analyzes were performed using the IBM SPSS Statistics 26 package. The level of significance was $\alpha = 0.05$. Bonferroni correction was also used to adjust the significance value. In order to increase the accuracy of the analysis of quantitative data, the presence of a level of statistical significance of the relationship between the variables was examined. For this purpose, the following were used, among others: Kruskal-Wallis test , Mann-Whitney U test , chi square test (*chi2*) and Spearman's correlation coefficient (*rho*). Additionally, for variables measured on quantitative scales, the Kolmogorov-Smirnov (*KS*) test was performed to check whether the distribution of results deviated from normal. The quantitative method and sampling used in the study allow the results to be generalized to the entire adult population with an estimation error of +/- 3.0% (95% confidence level). This method also has limitations - only people who use mobile devices can take part in the study. Purpose research carried out in 2020-2023 was to collect information on the use of digital technologies by public transport passengers.

3.   The use of modern technologies in public transport – research results

Figure 2 summarizes the regularly conducted research, which shows that the use of modern technologies by passengers is increasing.
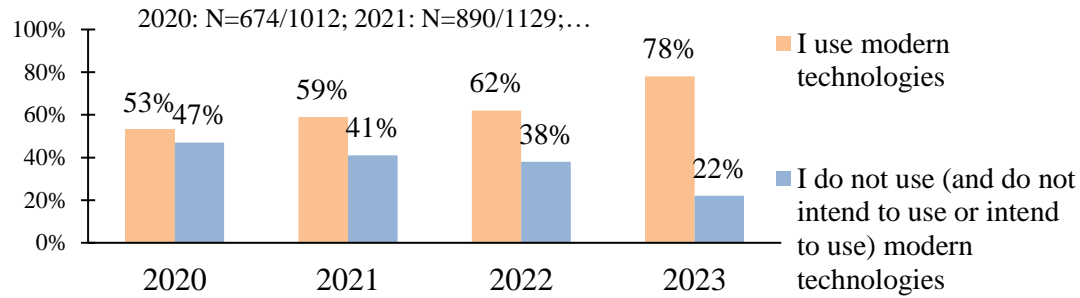
Fig. 2. Using modern technologies to obtain information, purchase a ticket, check the route or timetable and location (source: own research)

In 2020, during the pandemic, research results indicated a decline in both the mobility of travelers and the low use of modern technologies in public transport. In 2023, after the end of the COVID-19 pandemic, an increase in both transport and the use of modern technologies by travelers can be observed (Figures 3, 4, 5). The variables that differentiate travelers include age, sex and place of residence (respondents from large and medium-sized cities use or intend to use them more often).
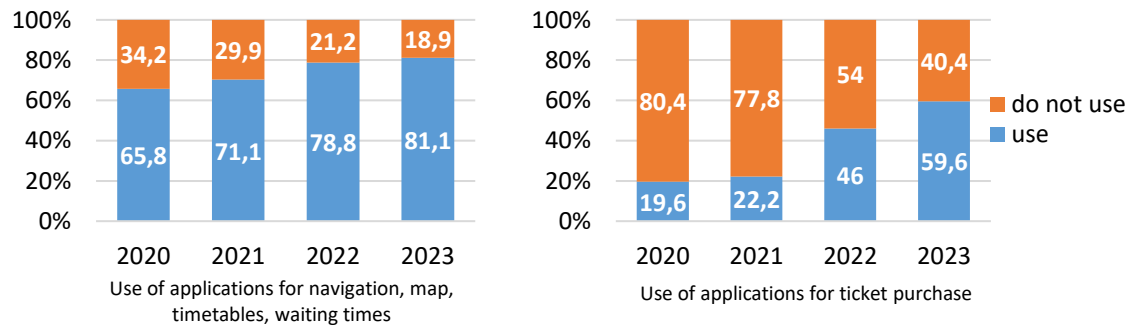

Fig. 3. Use of applications for navigation, map, timetables, waiting times, and ticket purchase - total (source: own research, 2020-2023).
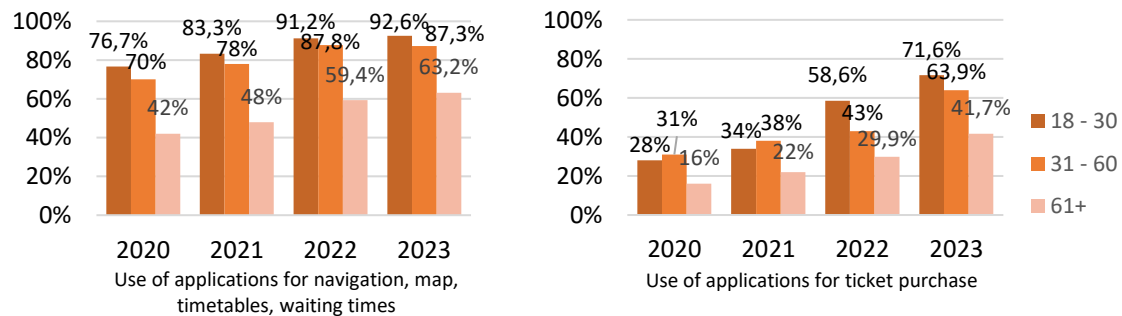

Fig. 4. Use of applications for navigation, map, timetables, waiting times, and ticket purchase - by age (source: own research, 2020-2023).
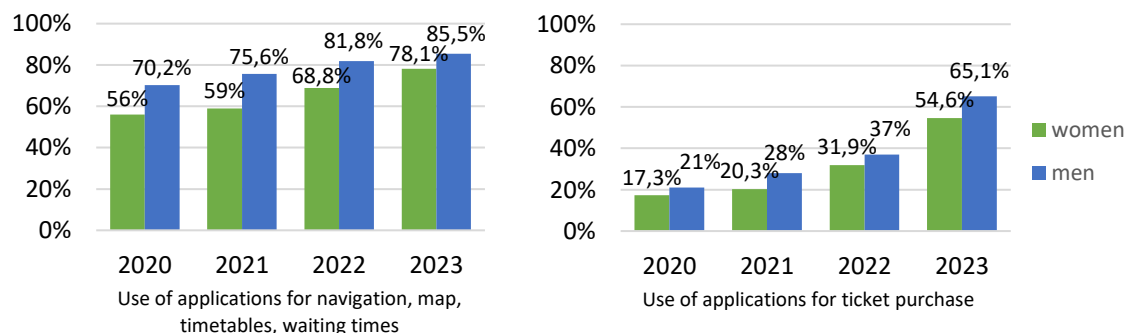

Fig. 5. Use of applications for navigation, map, timetables, waiting times, and ticket purchase - by sex (source: own research, 2020-2023).

4.   Conclusions

According to the author's research conducted in 2020-2023. Passengers use their digital skills and take advantage of the opportunities offered by carriers more and more often and willingly. The presented results of the author's research are similar to the results presented in the report of the Office of Rail Transport for railway passengers [1] and in the studies of Kos et al. [7], Dolinayowa et al. [3], Rosy [8]. They show that modern technologies are generally used by young, professionally active people, mainly men. The presented research results may be useful for building scenarios of carriers' impact on travelers. The information that a large group of respondents declares the use of modern technologies and that this number is growing provides grounds for improving this area. On the other hand, the information obtained is a source of knowledge that carriers need to encourage those who do not use modern technologies. The research results may also be useful in improving carriers' direct sales and information channels for groups that are unable to use modern technologies. The presented research results concern a specific period - during the COVID-19 pandemic and immediately after it. In the future, they can be carried out again, developed and detailed in order to learn the directions of changes in the use of modern technologies by a modern passenger. It is worth paying special attention to the reasons for not using modern technologies and developing scenarios for overcoming the identified barriers. The next step and revolution in this area is the use of artificial intelligence (AI). The research is limited by digital exclusion and the lack of direct observation of respondents. It is worth delving deeper into the reasons for passenger behavior in this area.

References

1. Badanie satysfakcji pasażerów – edycja II, Urząd Transportu Kolejowego, Warszawa (2022),https://utk.gov.pl/pl/dokumenty-i-formularze/opracowania-urzedu-tran/19585,Badanie-satysfakcji-pasazerow-kolei-2021.html. Accessed: March 30, 2022

2. Borkowski, P., Jażdżewska-Gutta, M., Szmelter-Jarosz, A.: Lockdowned. Everyday Mobility Changes in Response to COVID-19. W: Journal of Transport Geography 90, https://doi.org/10.1016/j.jtrangeo.2020.102906 (2021)

3. Dolinayova, A., Masek, J., Kendra, M., Hamaj, J., Grandsart, D., Marlier, E., Colzani, P., Arena, M., Paragreen, J., Navaratnam, P., Brennan, M., Paleta, T.: Research of the Passenger's Preferences and Requirements for the Travel Companion Application. W: Innovative Technologies for Sustainable Passenger Transport. Journal of Advanced Transportation. Stopka O,. Ricci S., Marinov M., Abramović B., and Zitricky V. (Editors) pp. 1-11 (2019)

4. Górniak J.: Analysis of mobile applications supporting public transport passengers in selected cities. In: Prace Komisji Geografii Komunikacji PTG, 25(4), 48-58 (2022)

5. Hörcher, D., Singh, R. Graham, D.J.: Social distancing in public transport: mobilising new technologies for demand management under the Covid-19 crisis. In: Transportation (49), 735–764, https://doi.org/10.1007/s11116-021-10192-6. used 22.04 2024 (2022)

6. Ilciów A.: Technologie informacyjno-komunikacyjne (ICT); zrównoważony rozwój; inteligentne miasto; miasto przyszłości [In Polish]. Songdo, 2, 27-50, UAM, Poznań, (2023)

7. Kos, B., Krawczyk, G., Mercik, A., Tomanek, R.: Mobilność miast przyszłości [In Polish]. Wyd. Uniwersytetu Ekonomicznego w Katowicach, Katowice (2022)

8. Rosa, G.: Use of modern technologies by public transport passengers during the COVID-19 pandemic, Procedia Computer Science, 207, 3584-3593 DOI: 10.1016/j.procs.2022.09.418 (2022)

9. Stopka, O., Zitricky, V., Abramovic, B., Marinov, M., Ricci, S.: Innovative Technologies for Sustainable Passenger Transport. Journal of Advanced Transportation, Article ID 4197246 (2019)

10. https://stat.gov.pl/obszary-tematyczne/transport-i-lacznosc/transport/transport-wyniki-dzialalnosci-w-2022-roku,9,22.html