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Digital Traveler: The Use of Modern Information Technologies in Passenger Transport

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Abstract:

Purpose: *The aim of the article is to learn about the behavior of travelers in the use of modern technologies in transport in the context of changes in the environment. The answer was sought whether travelers use modern technologies in passenger transport, and if not, do they intend to use them?*

Design/Methodology/Approach: *The study was conducted in January 2022 using the CAWI method on a representative nationwide, random-quota sample of N = 1,129 adult residents of Poland aged 15 to 60, where the total amounts were selected according to the representation in the population of Poles for the variables sex, age, size place of residence. In other words, the sample was divided into 50 strata resulting from the intersection of categories within variables 2 (gender), 5 (age), 5 (size of town) and the respondents were randomized for each of them. The data for quoting the sample comes from the National Census of Population and Housing 2011, which was conducted by the President of the Central Statistical Office on the basis of the Act of 2010. It was run on the territory of the Republic of Poland from April 1 to June 30, 2011.*

Findings: *More than half of the respondents answered in the affirmative, and about a quarter said that although they have not yet used these technologies, they intend to do so. Only about 15% of the respondents admitted that they have not used and do not intend to use modern technologies. Detailed results are presented for urban transport. The "digital" changes in the behavior of travelers coincided with the unexpectedly rapid development of modern technologies "forced" by the need to function in new environmental conditions shaped by the COVID-19 pandemic.*

Practical Implications: *Modern technologies in urban transport are generally used by young and professionally active people. This group will grow over time, so carriers should develop comprehensive services related to the use of modern technologies and make them more appealing. The fact that older people make the least use of modern technologies in urban transport and, at the same time often choose public transport is an important information for carriers to take action to activate this group - educate, develop simplified applications, information and distribution systems. Carriers should also develop action scenarios for residents of smaller towns who use modern information technologies in public transport to a lesser extent. The results of in-depth research may show what is the reason behind it.*

Originality/Value: *The article presents the results of own research conducted using the CAWI method in January 2022 on a representative nationwide random-quota sample of N = 1129 adult inhabitants of Poland.*

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1. Introduction

The coronavirus pandemic has shown that the current paradigms regarding the identification of sources of transport needs and their impact on the load on the transport system and the challenges generated in terms of shaping mobility do not have to be as obvious as it seemed so far.

The situation on the transport market changed in 2019-2020 as a result of the economic slowdown, introduced restrictions and restrictions caused by the development of the coronavirus. During the lockdown period, in April 2020, the mobility of Poles decreased by more than half (55%).

In the second wave of the pandemic, in autumn 2020, there was another reduction in the mobility of Poles caused by pandemic restrictions (http://mobilne-miasto.org/stress-test-zacznie-mikromobilność-w-polsce-2020) (Figure 1). It was a trend noticed all over the world (Hörcher, Singh, and Graham, 2022).

The commonly introduced mobility restrictions, aimed at reducing physical contacts between people due to the need to limit virus transmission, forced the implementation of digital mobility allowing for the fulfillment of obligatory and optional needs without the need to physically move (Kos, Krawczyk, Mercik, and Tomanek, 2022). Substitutive in nature in relation to transport services, to a large extent began to be provided by telecommunications services, enabling remote "reaching" to work, shop or school (Budziewicz-Guźlecka and Drab-Kurowska, 2017).

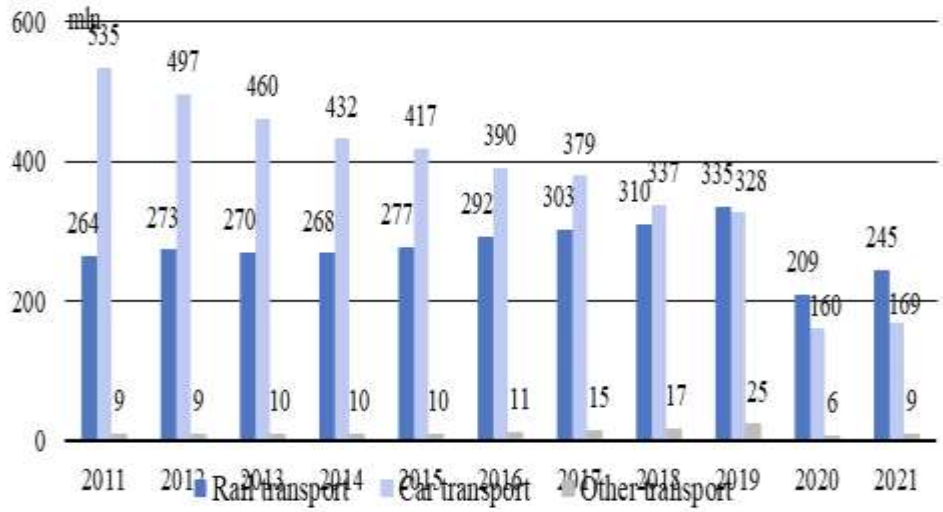
This has become especially noticeable during the COVID-19 pandemic. Online services have replaced many face-to-face activities and services. Passenger transport by type of transport in 2011-2021 is presented in Figure 1.

As a result of the evolution of the transport services market, there have been significant changes in customer expectations, which have resulted in the emergence of new preferences in addition to traditional expectations.

The importance of innovation in the field of transport services, technology, as well as customer relations is increasingly recognized (Kos, Krawczyk and Tomanek, 2018; Rosa, 2020). Progressing technical and technological development creates many opportunities for the efficient functioning of transport.

This promotes, among other things, a faster flow of information, facilitates the purchase of services, which may have a positive impact on travelers, whose expectations are also growing.

Figure 1. *Passenger transport by type of transport*



Source: *Transport - activity results in 2021, https://stat.gov.pl/files/gfx/portalinformacyjny/pl/defaultaktualnosci/5511/9/21/1/transport__wyniki_dzialalnosci_w_2021_r.pdf, p. 9 (04.01.2023).*

The aim of the article is to learn about the behavior of travelers in the use of modern technologies in transport in the context of changes in the environment. The answer was sought whether travelers use modern technologies in passenger transport, and if not, do they intend to use them?

The article contains an introduction, literature review, discussion of research methods and results, as well as discussion and conclusions. Detailed results are presented for urban transport.

2. Literature Review

Contemporary authors notice changes in the behavior of buyers of passenger

transport services and new directions in shaping their preferences (Antonowicz, Mirowski, and Abramowska, 2019). They were particularly noticeable during and after the COVID-19 pandemic (Kos, Krawczyk, Mercik, and Tomanek, 2022). It is important to constantly monitor these changes and flexibly adapt to them. The preferences of rail transport passengers result from the need to meet transport needs that reflect their expectations and personality (Rosa 2021).

Customers are more and more demanding with regard to, for example, the partnership approach adopted by the carrier, the quality of services offered (Kos, Krawczyk, and Tomanek, 2020), safety, provision of up-to-date information (Budziewicz-Guźlecka and Drab-Kurowska, 2020), customer service (Antonowicz and Bogucka, 2019), often even comprehensive logistics services on a national and international scale (Antonowicz and Bogucka, 2019; Bocheński and Wojtkiewicz, 2019; Krawiec and Ćwiek, 2019; Massel, 2019; Mężyk, 2019; Stopka, Zitricky, Abramovic, Marinov, and Ricci, 2019).

As a consequence of the increasing online availability of transport services and information, the "digital traveler" has ever-increasing demands and expects a personalized service (Nyurenberger, Luchina, Sewruikov, and Tikhomirova, 2019).

The research of the cited authors shows that customers assess which of the offers will provide, in their opinion - regardless of the motives - the greatest value perceived by them, and they decide on it. Whether the offer meets their expectations affects customer satisfaction and the likelihood that they will buy the product again (Abramovic and Sipus, 2019; Kotler and Keller, 2022).

The results of the analyzes show that passenger trains have changed a lot, and the changes introduced concern both the aesthetics of the vehicles, amenities for travelers and innovations affecting travel safety.

Opinions of travelers also confirm that passenger transport has undergone a major metamorphosis, but passengers do not notice many changes related to safety, which can be attributed to insufficient communication of carriers about innovations, and consequently building a positive image of public transport, in this case rail transport (Hernik and Mazur, 2018).

Rail services, due to their universality, should take into account the wide possibilities offered by information technologies. This applies to the entire process of passenger service, from the purchase of a ticket to arrival at commercial points of sale and the journey itself (an example is the ExtenSive project , aimed at developing both passenger applications and software for carriers, which will ultimately enable the provision of transport services of the highest standard (Stencel, 2023).

Public transport has to be more comfortable and attrac tive for passengers. Customers are influenced by many factors when choosing a mode of transport. Psychological factors have an important role among them (Dolinayova, 2019). Understanding the psychosocial factors that influence public transportation usage behavior can provide important implications for transport policies aimed at managing travelers' mobility behavior (Cerna, Zitricky, and Danis, 2017). Another important factor is an access to the timely relevant information (Monzon, Hernandez, and Cascajo, 2013).

In urban transport, information plays a special role, because it allows, among other things, to plan a trip, but also to verify any difficulties that may arise during the journey. The development of modern technologies contributes to the emergence of new forms of information in urban transport (Modelewski, 2018). Moreover, such innovative solutions are to encourage travelers to use group or group forms of transport (Górniak, 2022).

Mobile applications are the most widespread. Already Stopka (2014) dealt with the requirements of users of a mobile application supporting door-to-door mobility in public transport. These applications are often created by carriers to coordinate timetables, synchronize arrival and departure times of various means of transport, and travel information systems (Ezzedine, Bonte, Kolski, and Tahon, 2008).

Currently, there are many incompatible applications designed to search for passenger information and it is necessary to combine them to find all the relevant travel data needed for various modes of transport. Most of them allow you to buy a ticket, they also have additional functions, i.e. payment for parking in the city (MoBI LET, MPay, Skycash). Outside the reach of selected applications, there are both local (e.g., mobiWAWA) and international (e.g., MPay) tools.

Due to the fact that the situation during the journey may change (this may be due to traffic difficulties, traffic jams), but also the traveler should have clear access to information about the journey when using the transport service, voice messages. In addition, the vehicles are equipped with various types of boards showing the current passage: static and dynamic). This information includes key elements for the traveler, i.e., line number, direction of travel or estimated time of travel by public transport.

It is also important to correctly and accurately mark the vehicle in which the traveler will be moving. The functioning of mobile applications as part of urban transport greatly facilitates travel. Probably the advantage of mobile applications operating on an international scale is their versatility and the possibility of using them in different places (in this case - in Europe) (Górniak, 2022).

3. Data and Methods

The study was conducted in January 2022 using the CAWI method on a representative nationwide, random-quota sample of N = 1,129 adult residents of Poland aged 15 to 60, where the total amounts were selected according to the representation in the population of Poles for the variables sex, age, size place of residence. In other words, the sample was divided into 50 strata resulting from the intersection of categories within variables 2 (gender), 5 (age), 5 (size of town) and the respondents were randomized for each of them.

The data for quoting the sample comes from the National Census of Population and Housing 2011, which was conducted by the President of the Central Statistical Office on the basis of the Act of 2010. It was run on the territory of the Republic of Poland from April 1 to June 30, 2011, as at the end of March 31, 2011.

The study used one of the most popular methods - an online survey, which guarantees reaching a representative sample in a short time. This method also has limitations - only people who use mobile devices can participate in the study. The research tool was an original questionnaire prepared for the purpose of the study.

The answers to all questions were described using aggregate statistics, which include: mean (*M*), standard deviation (*Sd)*, median (*Me*) and modal (*Md*). In addition, for variables measured on quantitative scales, the Kolmogorov-Smirnov (*KS)* test was performed to check whether the distribution of results deviates from the normal one. In order to increase the accuracy of the analysis of quantitative data, the occurrence of the level of statistical significance of the relationship between the variables was examined.

For this purpose, among others, chi square test (chi^2) Kruskall-Wallis test and Spearman's correlation coefficient (*rho*). Due to the limited size of the article, selected research results will be discussed in the following sections, concerning only the use of modern technologies in urban transport by the respondents.

4. Results - The Use of Modern Technologies

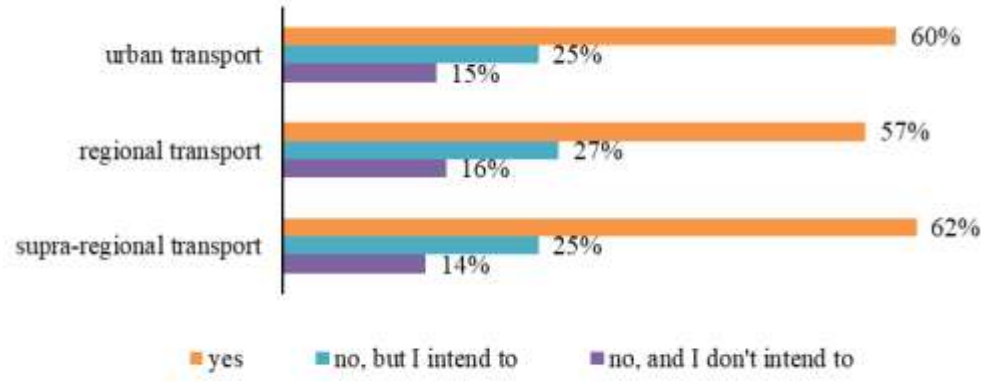
The participants of the study were asked whether they use modern technologies to obtain information, purchase a ticket and check the route or timetable in urban, regional and supra-regional transport. The responses to these are summarized in Table 1 and Figure 2. Across all transport modes, more than half of the respondents answered in the affirmative and around a quarter said that they had not yet used these technologies but intended to do so. Only about 15% of the respondents admitted that they have not used and do not intend to use modern technologies. In this case, the type of transport did not matter.

Table 1. *The use of modern technologies to obtain information, purchase a ticket, check the route or timetable*

Transport type	**urban**		**regional**		**supra-regional**	
Answers	*n*	%	*n*	%	*n*	%
Yes	534	60	484	57	422	62
no, but i'm going to use it	219	25	227	27	169	25
no and i'm not going to use it	137	15	136	16	95	14
no data	239		282		443	
Md	Yes		Yes		Yes	

Source: *Own research.*

Figure 2. *Using modern technologies to obtain information, purchase a ticket, check the route or timetable in urban (agglomeration), regional and supra-regional transport - percentage of indications*



Source: *Own research, N=1129.*

Regardless of the type of transport (and the length of the journey), we can distinguish permanent segments of travelers who use modern technology solutions, intend to use them or do not use them and will not.

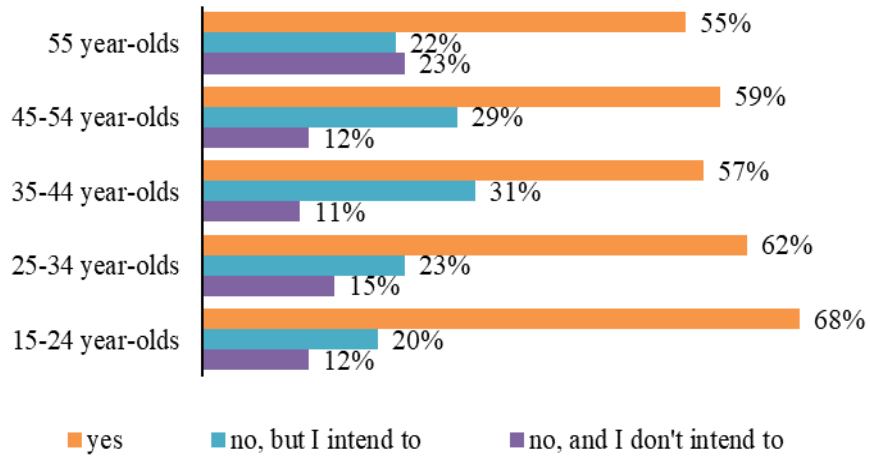
The conducted analysis of the use of modern technologies to obtain information, purchase a ticket as well as check the route or timetable in urban transport will be presented in detail below.

Figure 3 present the answers to this question broken down by age group. To check whether there are differences between age groups in relation to modern technologies, a series of chi^2 test were conducted. For the affirmative answer and "no, but I intend to use it", they turned out to be statistically insignificant, which means that there were no significant differences between the age groups in terms of the selected answers.

A statistically significant difference appeared among people who did not want to use these technologies (*chi* ^{2} = 16.08; *df* = 4; *p* = 0.003): people over 55 (23%) definitely more often expressed their lack of intention to use these solutions than younger participants tests.

In addition, the Kruskal- Wallis test was conducted to check whether there is a relationship between the age of the study participant and his attitude to the use of modern technologies. It turned out to be statistically significant (*chi* ^{2} = 10.93; *df* = 2; *p* = 0.004), which means that there are such differences: people using modern technologies are on average the youngest, while those who do not use and do not intend to use them - the oldest.

Figure 3. *The use of modern technologies in public urban transport, broken down by age groups*



Source: *Own research, N=1129.*

Figure 4 present the answers to the question about the use of modern technologies broken down by the size of the place of residence. To check whether there are differences between these groups in relation to modern technologies, a series of chi^2 tests was conducted.

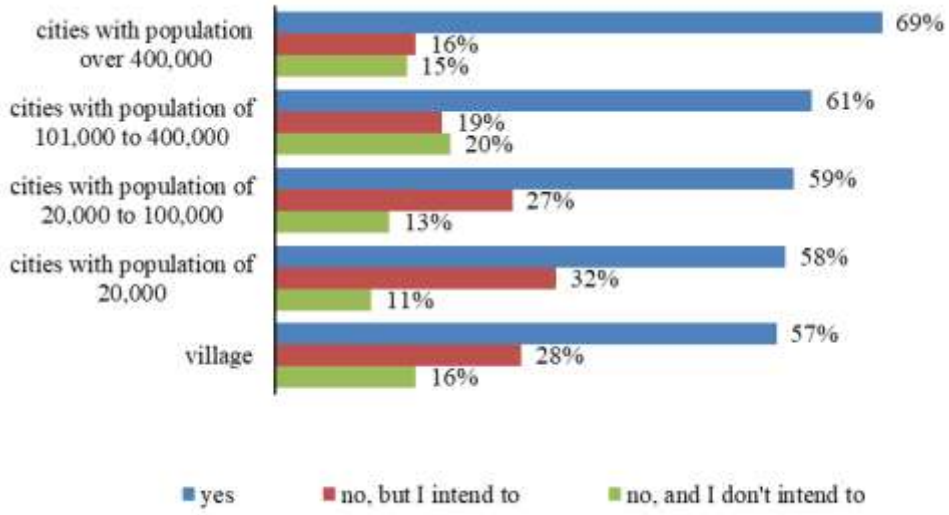
They showed that a statistically significant difference occurs among people who have not used modern technologies so far, but intend to do so (*chi*^{2} = 12.93; *df* = 4; *p* = 0.012), among people from cities with a population of 101,000 to 400,000 . inhabitants (19%) and over 400 thousand.

There were fewer inhabitants (16%) who did not use modern technologies, but intend to do so, compared to the inhabitants of smaller towns. In addition, the Kruskal- Wallis test was conducted to check whether there is a relationship between

the place of residence of the study participant and his attitude to the use of modern technologies.

It turned out to be statistically significant (chi^2 = 9.19; *df* = 2; *p* = 0.010), which means that there are such differences: people not using modern technologies, but wanting to use modern technologies, lived on average in smaller towns than people using and not using modern technologies and having no such intention.

Figure 4. *The use of modern technologies in public urban transport, broken down by place of residence*



Source: *Own research, N=1129.*

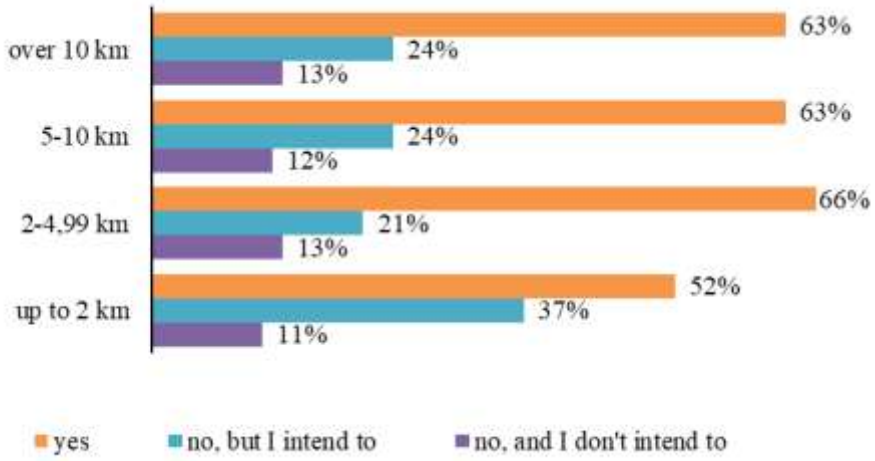
Figure 5 present the answers to the question about the use of modern technologies broken down by the average travel distance in public urban transport. To check whether there are differences between these groups in relation to modern technologies, a series of chi^2 tests was conducted. None of them turned out to be statistically significant, which means that the average travel distance is not related to the attitude to the use of modern technologies in public transport.

In addition, the Kruskal- Wallis test was conducted to check whether there is a relationship between the average travel distance in public urban transport and the attitude to the use of modern technologies.

It turned out to be statistically insignificant (chi^2 = 1.84; *df* = 2; *p* = 0.398), which means that people using modern technologies in urban transport do not differ in the average travel distance from non-users (both intending to change it and reluctant to modern technology in urban transport).

The results of the research presented in the article showed that the respondents generally use modern technologies in all modes of transport (more than half) or intend to use them (about a quarter). Only about 15% of the respondents admitted that they have not used and do not intend to use modern technologies. People using modern technologies are on average the youngest, while people who do not use and do not intend to use them - the oldest.

Figure 5. *The use of modern technologies in public urban transport and the average travel distance*



Source: *Own research, N=1129.*

5. Discussion

The presented results of the author's research are similar to the results presented in the report of the Office of Rail Transport: "Passenger satisfaction survey - edition II" (https://utk.gov.pl/pl/dokumenty-i-formularze/opracowania-urzedu-tran/19585). The survey was completed by 1516 people. As the most common reason for travel, they indicated regular travel to/from work, school, university - 45%.

The respondents indicated that the most frequently used ways of checking timetables, ticket prices or buying a ticket include: searching for connections (75%), carriers' websites (64.1%) and applications for mobile devices (51.6%) (https://utk.gov.pl/pl/dokumenty-i-formularze/opracowania-urzedu-tran/19585).

The decrease in mobility and the use of modern information technologies as substitute services are also confirmed by qualitative research conducted in Poland using the CATI method on a group of about 1,050 respondents. The main subject of the study was to determine the weekly time spent on the

implementation of shipments in the period before and during the pandemic. The shortening of the travel time depended on the purpose of travel, means of transport, household size, occupation and fear of infection.

Occupational groups that recorded the highest average decrease in time devoted to relocations were: pupils (and students), administration employees, employees who could switch to remote work mode, retirees. The average decrease in the weekly volume of time devoted to displacement (all, not only those related to mandatory needs) amounted to 65-75% (Borkowski, Jażdżewska-Gutta, and Szmelter-Jarosz, 2021).

Confirmation of the research results can also be found in the works of other authors. Bąk and Borkowski (2015) studied the usefulness of ICT solutions in passenger transport from the perspective of transport users, taking into account real case studies from various European environments. Their main conclusion was that users in different regions with very different characteristics such as wealth, level of GDP, geographic location and cultural background have surprisingly similar attitudes towards ICT.

Kos, Krawczyk, Tomanek and Mercik (2022), and Kos, Krawczyk, and Tomanek, (2018; 2020) in their subsequent studies showed that the modern world is becoming a digital world. Alvin Toffler's global village is becoming a reality today and thanks to these tools. Modern communication instruments, the power and effectiveness of which have been so clearly demonstrated during the COVID-19 pandemic, are becoming an opportunity to change future mobility models. And not necessarily because remote communication could easily replace mobility.

We can probably expect changes in work models, including the introduction of hybrid work, models of occasional contact, models of distributed work in hybrid solutions. A lot will also change when it comes to technical equipment enabling remote work. Modern messengers will offer new functionalities.

The presented research results concern a specific period and in the future they can be repeated, developed and refined in order to learn about the needs, attitudes and preferences as well as changes in the use of modern technologies by the "digital user".

6. Conclusions

The term "digital traveler" is becoming more and more relevant. The results of the presented research showed that respondents generally use modern technologies in all types of public transport (more than half) or intend to use them (about a quarter). Only 15% of respondents admitted that they did not use and do not intend to use modern technologies.

Many people have learned to use modern solutions only because the COVID-19 pandemic forced them to do so, so carriers should accordingly maintain their new habits. Modern technologies in urban transport are generally used by young and professionally active people.

This group will grow over time, so carriers should develop comprehensive services related to the use of modern technologies and make them more appealing. The fact that older people make the least use of modern technologies in urban transport and, at the same time often choose public transport is an important information for carriers to take action to activate this group - educate, develop simplified applications, information and distribution systems.

Carriers should also develop action scenarios for residents of smaller towns who use modern information technologies in public transport to a lesser extent. The results of in-depth research may show what is the reason behind it.

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