Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Use of modern technologies by public transport passengers during the COVID-19 pandemic

Grazyna Rosa*

University of Szczecin, Institute of Spatial Management and Socio-Economic Geography, Poland; grazyna.rosa@usz.edu.pl

Abstract

This paper presents the results of primary research involving a survey of Polish passengers during the COVID-19 pandemic. The survey was conducted in January 2022 using the CAWI method on a representative sample of N = 1,129 Polish adults aged 18 to 60. First, means of transport were classified by distance covered into urban, regional and interregional transport. Survey participants were asked a series of questions regarding the use of modern technologies in public transportation. Before that, however, the frequency of urban (agglomeration), regional, interregional (transregional) and private transport use during the COVID-19 pandemic was examined. More than half of respondents said they used modern technology across all modes of public transportation, and about a quarter said that while they had not yet used these technologies, they intended to do so. Only about 15% of respondents replied they did not use and did not intend to use modern technologies, regardless of the mode of transport. The aim of the paper is to examine the use of modern technologies by passengers in the era of the COVID-19 pandemic. Research results may help to influence passengers' purchasing decisions and to improve services offered by carriers in accordance with the objectives of long-term transport policy of both the European Union and Poland related to sustainable transport development.

Keywords: transport passengers, modern technologies, COVID-19

Corresponding author. Grazyna Rosa Phone: +48-797-725-864 (P.S.), E-mail address: grazyna.rosa@usz.edu.pl
1. Introduction

Lasting nearly three years, the COVID-19 pandemic has irrevocably affected the operating strategies of carriers and transport operators around the world. Moreover, it has permanently changed travelers' expectations and preferences. In a short period of time, an entire society had to "move" its activities to the Internet, and to work, study, and interact with each other online. New habits of performing certain activities online developed, and gradually travelers began to notice the advantages of the changes taking place and express their new needs. The needs of the market, both in terms of demand and supply, have contributed to the rapid development of modern technologies and increased their popularity. Examples of solutions adopted in passenger transport in Poland include: the ability to check railroad connections online, the availability of electronic tickets, purchasing tickets online, purchasing tickets using mobile devices, being able to check information in social media, Wi-Fi in vehicles, tracking the current location of the vehicle with a mobile application through GPS tracking system. With a new approach to meeting travelers' expectations, companies competing on the passenger transport market perform professional analyses of the market and customers' preferences so that they can make improvements that are most appreciated by customers. The aim of the paper is to examine the use of modern technologies by public transport passengers in the era of the COVID-19 pandemic. The results of the research and modernising public transport to address the needs of the passengers may help to influence the passengers' purchasing decisions in accordance with the objectives of long-term transport policy of both the European Union and Poland related to sustainable transport development.

2 Literature review

With a new approach to meeting travelers' expectations, companies competing on the passenger transport market are performing professional analyses of the market and customers' preferences so that they can make improvements that are most appreciated by customers. These include, above all, all solutions offered in the area of innovativeness in both Polish [1, 2, 3, 4] and foreign literature [5, 6, 7, 8]. An important element for travelers is the availability of WiFi in vehicles. They are eager to use their travel time for work, study or entertainment, and Internet access on the train or bus is becoming one of their primary expectations. As compared to 2019, the total number of trains providing this service increased significantly in 2020 – by almost 8%[9].

In order to improve travel comfort, the rolling stock used on regional and long-distance routes is being replaced and upgraded. New vehicles of a very high standard with many modern facilities for passengers that significantly improve travel comfort are coming into service. One such facility is the use of modern technology. Special requirements of travelers are also described by [10, 11]: ability to check information in social media, use WiFi in vehicles, or track the current location of the vehicle with a mobile application [12]. One of the noteworthy improvements is equipping the cars with the GPS tracker. GPS facilitates train traffic management, and allows passengers to locate the train online. GPS functionality in as many traction vehicles as possible will allow passengers to obtain information about a route, train, delay or holdbacks. The standard of equipment due to GPS tracking systems has increased for all vehicle types [9]. The survey conducted by the Office of Rail Transport in 2019 shows that 67.3% of respondents like traveling by rail [3].

In 2019-2022, that is during the period of the COVID-19 virus spread, a number of studies were conducted to examine the impact of the pandemic on the socio-economic environment, both on the global [13, 14,15, 16] and national level, as well as in relation to specific markets [17, 18]. The situation in the transport market has changed as a result of the economic downturn as well as restrictions and limitations introduced due to the spread of coronavirus. Most passenger rail and road transport operators were forced to cut back on their services and instead of seeking to resume their normal business, they had to minimise losses due to a decrease in the number of passengers [19] which has been reflected in publications of 2020 and 2021 [13, 14, 19, 20]. The pandemic has also left its mark on the behavior of public transport passengers [21, 22, 23]. The closure of commercial, educational, sports, and cultural institutions resulted in significant travel restrictions. Mandatory home isolation and deluge of alarming information have caused changes in travelers' attitudes and decision-making patterns. The attitude of travelers towards the use of modern technologies has also changed. This issue is discussed in numerous publications [24, 25]. However, the pandemic has not adversely impacted the passenger attitude to travel. In a 2021 survey [9], as many as 83.4% of passengers said that they enjoyed traveling.
3. Research methodology

The aim of the quantitative research presented in the paper "Impact of the COVID-19 pandemic on travelers' preferences in urban, regional and interregional transport in the context of sustainable development" was to assess the impact of the coronavirus pandemic on the preferences and behaviors of passengers of different modes of public transport and private transport. In the following part of the paper, only selected results of the research, concerning modern technologies, will be presented.

The research was carried out using the survey method. Pre-testing of the questionnaire was conducted on a small sample of respondents in January 2022 using the CAWI method on a sample of N=30 adults and was designed to verify whether the instructions and the wording of the questions were comprehensible to the respondents. After some shortcomings were identified, the questionnaire was modified and data collection could begin. The implementation phase consisted of data collection, processing, analysis and interpretation of results. The survey was conducted in January 2022 using the CAWI method on a representative sample of N = 1,129 Polish adults aged 18 to 60. The survey was conducted on a nationwide, random and quota sample of individuals aged 18 and over, with totals selected according to representation in the Polish population for such variables as gender * age * city/town population. This means that the sample was divided into 50 strata resulting from the intersection of categories within the variables 2 (gender) * 5 (age) * 5 (city/town population) and for each of these strata the respondents were sampled. The data for quota sampling were derived from the National Population and Housing Census 2011 which was conducted by the President of the Central Statistical Office under the 2010 Act. It was conducted on the territory of the Republic of Poland from 1 April to 30 June 2011, as of the end of 31 March 2011. Responses to all questions were described using summary statistics: mean (M), standard deviation (Sd), median (Me), and mode (Md). In addition, for variables measured on quantitative scales, a Kolmogorov-Smirnov (KS) test was performed to see whether the distribution of the results deviated from the norm. In order to increase the relevance of the quantitative data analysis, the level of statistical significance of the relationship between variables was examined. To this end, the chi-square test (\( \chi^2 \)), Kruskal-Wallis test and Spearman correlation coefficient (\( \rho \)), among others, were used.

A total of 1,129 adult residents, including 579 women (51%) and 550 men (49%), participated in the survey. Both age groups, 14-24 and 25-34, included 18% of respondents, 16% were between 35 and 44, while 29% were at least 55 years old. The median age for this variable was 35-44 years. Almost half of the respondents (46%) had a secondary education. The second largest group was those with at least a master's degree (30%). 11% of respondents had a bachelor's degree, 9% had completed vocational school, and 3% had completed only elementary school. The largest group, more than one-quarter (26%) of respondents, held office jobs and one-fifth (20%) were retired. The smallest subpopulations included: primary education students (4%), higher education students (5%), and business owners (4%). The next question concerned the population size of the survey participants’ place of residence. More than one-third of survey participants (37%) lived in rural areas. Nearly one in five respondents (19%) lived in a town of 20,000 to 100,000 residents. 17% of respondents lived in a city of 101,000 to 400,000 residents. Towns under 20,000 residents and cities over 400,000 residents were selected by slightly more than 13% of respondents, respectively. The largest number of respondents (14%) lived in Mazowieckie Province. Slightly less (13%) lived in Śląskie Province. Other provinces were selected by no more than 10% of respondents. The fewest respondents lived in Lubuskie Province (2%) and Opolskie Province (2%).

4. Research results

Survey participants were asked a series of questions regarding the use of modern technology in public transportation. First, however, they were surveyed about how often they use urban (agglomeration), regional, interregional (interprovincial), and private transport.

As can be seen in Table 1, the largest number of respondents use urban, regional, and interregional transport occasionally. Moreover, more than half of the respondents use these modes of transport occasionally or never. In contrast, private transport is used every day or several times a week by more than half of the survey participants, with the largest group, nearly one-third, using it on a daily basis.

Table 1. Frequency of use of public (agglomeration), regional, interregional (interprovincial) and private transport – number and percentage of respondents with mode
Survey participants were asked if they used modern technologies to purchase a ticket or to check a route or timetable on urban, regional, and interregional transport. The responses are summarized in Table 2. More than half of the respondents answered in the affirmative for all modes of transportation, and about a quarter said that while they had not yet used these technologies, they intended to do so. Only about 15% of respondents admitted they had not used and did not intend to use modern technologies, regardless of the mode of transport.

Table 2. Use of modern technologies in urban (agglomeration), regional and interregional transport for purchasing tickets, checking the route or timetable – number and percentage of respondents with mode

| Use /transport | urban | regional | interregional |
|----------------|-------|----------|---------------|
|                | N     | %        | N             | %    | N             | %    |
| yes            | 534   | 60%      | 484           | 57%  | 422           | 62%  |
| no but I intend to use | 219   | 25%      | 227           | 27%  | 169           | 25%  |
| no and I do not intend to use | 137   | 15%      | 136           | 16%  | 95            | 14%  |
| no data available | 239   |          | 282           |      | 443           |      |
| Md             | yes   | yes      | yes           |      |               |      |

Source: Own research

Urban transport – research results

Survey participants were asked whether they used modern technologies in urban transport to purchase tickets, check routes or timetable. Table 3 summarizes their responses by age groups. To see if there were differences between the age groups in terms of attitudes towards modern technology, a series of \( \chi^2 \) tests were carried out. For the affirmative answer and "no but I intend to use", the differences were found to be statistically insignificant, meaning that there were no significant differences between the age groups in terms of the answers selected. However, a statistically significant difference was reported among respondents unwilling to use these technologies (\( \chi^2 = 16.08; df = 4; p = 0.003 \)): individuals over 55 (23%) far more often than younger respondents said they had no intention to use these solutions. In addition, the Kruskal-Wallis test was conducted to see if there was a relationship between the age of survey participants and their attitude to the use of modern technologies. The result proved to be statistically significant (\( \chi^2 = 10.93; df = 2; p = 0.004 \)) which suggests the existence of such differences: on average, the youngest respondents use modern technologies most often, while the oldest do not use them or do not intend to use it.
Table 3. The use of modern technologies in public urban transport by age group

| Use/Age                  | 15-24 years | 25-34 years | 35-44 years | 45-54 years | 55 years and over | chi² |
|-------------------------|-------------|-------------|-------------|-------------|-------------------|------|
|                         | N           | %           | N           | %           | N                 | %    |
| yes no but I intend to  | 118         | 68%         | 101         | 62%         | 75                | 57%  |
| use                     |             |             |             |             | 101               | 59%  |
|                         |             |             |             |             | 139               | 55%  |
| no and I do not        | 35          | 20%         | 37          | 23%         | 41                | 31%  |
| intend to use          |             |             |             |             | 49                | 29%  |
|                         |             |             |             |             | 57                | 22%  |
|                         | 20          | 12%         | 24          | 15%         | 15                | 11%  |
|                         |             |             |             |             | 20                | 12%  |
|                         |             |             |             |             | 58                | 23%  |

Source: Own research

Table 4 presents the answers to the question about the use of modern technologies broken down by the population size of the place of residence. To check whether there are differences between these groups in relation to modern technologies, a series of chi² tests were carried out. They revealed a statistically significant difference among respondents who have not yet used modern technologies, but intend to do so (chi² = 12.93; df = 4; p = 0.012): among individuals inhabiting cities with a population of 101,000 to 400,000 (19%) and over 400,000 (16%), there were fewer respondents who had not used modern technology but intend to do so, as compared to residents of smaller towns. In addition, the Kruskal-Wallis test was conducted to see if there was a relationship between the survey participant's place of residence and their attitude towards the use of modern technologies. The result was found to be statistically significant (chi² = 9.19; df = 2; p = 0.010) which suggests the existence of such differences: on average, respondents who did not use but intended to use modern technologies lived in smaller towns and cities than respondents who used, did not use and did not intend to use modern technologies.

Table 4. The use of modern technologies in public urban transport by place of residence

| Use/Place of residence | rural area | town under 20,000 residents | town of 20,000 to 100,000 residents | city of 101,000 to 400,000 residents | city over 400,000 residents | chi² |
|------------------------|------------|------------------------------|-----------------------------------|-----------------------------------|----------------------------|------|
| yes                    | 167        | 57%                          | 55                                | 58%                               | 110                        | 59%  | 106                        | 61%  | 96                         | 69%  | 5.99                       |
| no but I intend to use | 82         | 28%                          | 30                                | 32%                               | 51                         | 27%  | 33                         | 19%  | 23                         | 16%  | 12.93*                     |
| no and I do not        | 46         | 16%                          | 10                                | 11%                               | 25                         | 13%  | 35                         | 20%  | 21                         | 15%  | 5.28                       |

Source: Own research

In the next step, responses to the question about the use of modern technology in public transport were broken down by province. The distribution of responses according to provinces was analyzed using chi² tests. The results proved to be statistically insignificant which means that the decision to use modern technologies did not depend on the province. Next, the responses to the question about the use of modern technologies were compiled and broken down by the average travel distance in public urban transport. A series of chi² tests were carried out to check whether there were differences between these groups in relation to modern technologies. None of the results was statistically significant which means that the average travel distance was not related to the attitude towards the use of modern technologies in public transport. In addition, the Kruskal-Wallis test was carried out to see if there was a relationship between the average travel distance on public urban transport and the attitude towards the use of modern technologies. The result was statistically insignificant (chi² = 1.84; df = 2; p = 0.398) which means there are no differences in average travel distance between those who use modern technology in urban transport and those who do not (both those who intend to use modern technology and those who do not intend to use it in urban transport).

Regional transport – research results

Survey participants were asked whether they use modern technologies in regional transport to buy tickets,
check the route or timetable. Table 5 summarizes the responses to this question by age group. To test whether there are differences between age groups in relation to modern technologies, a series of \( \chi^2 \) tests were carried out. They revealed a statistically significant difference among respondents who do not want to use these technologies (\( \chi^2 = 12.12; \ df = 4; \ p = 0.017 \)): individuals over 55 (22%) were much more likely to express no intention to use these solutions than younger survey participants. In addition, the Kruskal-Wallis test was conducted to see if there was a relationship between the age of survey participants and their attitude towards the use of modern technologies. The result proved to be statistically insignificant (\( \chi^2 = 4.53; \ df = 2; \ p = 0.104 \)) which means that the use of technology in regional transport was not related to the age of respondents.

Table 5. The use of modern technologies in regional transport by age group

| Use /Age                  | 15-24 years | 25-34 years | 35-44 years | 45-54 years | 55 years and over | \( \chi^2 \) |
|---------------------------|-------------|-------------|-------------|-------------|-------------------|------------|
| yes                       |             |             |             |             |                   |            |
| no but I intend to use    | 97          | 88          | 67          | 94          | 138               | 1.92       |
| no and I do not intend to use | 37          | 47          | 45          | 45          | 57                | 8.82       |

* * \( p < 0.05 \)

Source: Own research

Table 6 summarizes the responses to the question about the use of modern technologies in regional transport broken down by the population size of the place of residence. To determine whether there are differences between these groups in relation to modern technologies, a series of \( \chi^2 \) tests were carried out. The results of all of them were found to be statistically insignificant. In addition, the Kruskal-Wallis test was conducted to see if there was a relationship between the survey participant's place of residence and their attitude to the use of modern technologies. It proved to be statistically significant (\( \chi^2 = 7.58; \ df = 2; \ p = 0.023 \)) which means that responses were related to the place of residence: residents from the smallest towns did not use technology but intended to do so, while respondents living in the largest cities used modern technology in public transport.

Table 6. The use of modern technologies in public regional transport by place of residence

| Use/Place of residence | rural area | town under 20,000 residents | town of 20,000 to 100,000 residents | city of 101,000 to 400,000 residents | city over 400,000 residents | \( \chi^2 \) |
|------------------------|------------|-----------------------------|-------------------------------------|-------------------------------------|---------------------------|------------|
| yes                    | 153        | 52%                         | 56                                  | 54%                                 | 107                       | 61%        |
| no but I intend to use | 91         | 31%                         | 32                                  | 31%                                 | 43                        | 25%        |
| no and I do not intend to use | 50        | 17%                         | 16                                  | 15%                                 | 24                        | 14%        |

Source: Own research

Next, responses to the question about the use of modern technologies in regional transport, broken down by province, were analyzed. The distribution of responses depending on the province was examined using \( \chi^2 \) tests. For affirmative answers the result was found to be statistically significant (\( \chi^2 = 30.29; \ df = 15; \ p = 0.011 \)) which means that there are significant differences in the percentage of respondents who use modern technologies by province. By far, the highest number of individuals using technology, 71%, was in Zachodniopomorskie Province, while the lowest number
(39%) in Świętokrzyskie Province. Moreover, for respondents who do not want to use modern technologies the result of the \( \chi^2 \) test proved to be statistically insignificant (\( \chi^2 = 30.25; df = 15; p = 0.011 \)) which means that there are considerable differences between the provinces in the percentage of individuals who do not want to use modern technologies. The highest number of respondents who did not want to use modern technologies in regional transport came from Opolskie Province (30%) and Świętokrzyskie Province (29%) and the lowest number from Małopolskie Province (4%) and Zachodniopomorskie Province (4%).

In the next step, the responses to the question about the use of modern technologies, broken down by the average travel distance, were analyzed. A series of \( \chi^2 \) tests were carried out to determine whether there are differences between these groups in relation to modern technologies. None of the results proved to be statistically significant which means that the average travel distance was not related to the attitude towards the use of modern technologies in public regional transport. In addition, the Kruskal-Wallis test was carried out to find out if there was a relationship between the average travel distance on public regional transport and the attitude to the use of modern technologies. The result proved to be statistically insignificant (\( \chi^2 = 2.55; df = 2; p = 0.279 \)) which means that travel distance does not differ between those using modern technology, those not using modern technology and those who intend to use modern technology in the future.

### Interregional transport – research results

Survey participants were asked whether they use modern technologies in public interregional transport to buy tickets, check the route or timetable. In the next step, the answers to this question, broken down by age group, were analyzed. To determine whether there are differences between age groups in relation to modern technologies, a series of \( \chi^2 \) tests were carried out. All results were found to be statistically insignificant which means that responses did not vary by age group. In addition, the Kruskal-Wallis test was conducted to find out if there was a relationship between the age of survey participants and their attitude towards the use of modern technologies. The result proved to be statistically insignificant (\( \chi^2 = 0.47; df = 2; p = 0.790 \)) which means that the answers given were not related to age. Table 7 presents the answers to the question about the use of modern technologies broken down by the population size of the place of residence. To determine whether there are differences between these groups in relation to modern technologies, a series of \( \chi^2 \) tests were carried out. All results proved to be statistically insignificant which means that the responses given did not differ by place of residence. In addition, the Kruskal-Wallis test was conducted to see if there was a relationship between the survey participants’ place of residence and their attitude towards the use of modern technologies. The result was found to be statistically significant (\( \chi^2 = 7.06; df = 2; p = 0.029 \)) which means that the attitude towards the use of modern technologies was related to the average population size of the place of residence: on average, those who did not use modern technologies but intended to do so lived in smaller towns than those who selected other answers, and those who did not use modern technologies and had no intention of doing so lived in the largest cities.

#### Table 7. The use of modern technologies in interregional public transport by place of residence

| Use/Place of residence | rural area | town under 20,000 residents | town of 20,000 to 100,000 residents | city of 101,000 to 400,000 residents | city over 400,000 residents | \( \chi^2 \) |
|------------------------|------------|-----------------------------|-----------------------------------|-----------------------------------|-----------------------------|------------|
| yes no but I intend to use | 137 59%   | 47 57%                      | 96 67%                            | 80 61%                            | 62 65%                      | 3.56       |
| no and I do not intend to use | 67 29%    | 25 30%                      | 33 23%                            | 46 20%                            | 18 19%                      | 7.26       |
|no and I do not intend to use | 29 12%    | 10 12%                      | 15 10%                            | 26 20%                            | 15 16%                      | 6.08       |

Source: Own research

Next, the responses to the question of whether the respondent used modern technologies in interregional public transport, broken down by provinces, were compiled. The distribution of responses according to provinces was analyzed using \( \chi^2 \) tests. The results proved to be statistically insignificant which means that the decision to use...
modern technology in interregional transport did not depend on the province in which the respondent resided. Table 8 presents the responses to the question about the use of modern technologies broken down by the average travel distance in public urban transport. To determine whether there are differences between these groups in relation to modern technologies, a series of chi² tests were carried out. As can be seen in Table 8, individuals who traveled an average distance of 300-499.99 km more often used modern technologies (75%) and those who traveled 150-299.99 km were the least likely to do so (55%; chi² = 15.33; df = 4; p = 0.004). There was also a statistically significant difference regarding the respondents who did not use but intended to use modern technologies (chi² = 10.50; df = 4; p = 0.033): the lowest number of them traveled a distance of 300-499.99 km (17%) and the largest number an average distance of 150-299.99 km (32%). The result of the chi² test for the answer “no and I do not intend to use” was found to be statistically insignificant which means that there exit such differences: respondents who did not use but intended to use modern technologies traveled on average the shortest distances and those who used modern technologies – the longest distance.

Table 8. The use of modern technologies in transport and the average travel distance in public interregional transport

| use/travel distance | 50-99.99 km | 100-149.99 km | 150-299.99 km | 300-499.99 km | more than 500 km | \( \chi^2 \) |
|---------------------|-------------|---------------|--------------|---------------|------------------|----------|
|                     | N    | %   | N    | %   | N    | %   | N    | %   | N    | %   |        |
| yes                 | 48   | 65% | 58   | 60% | 93   | 55% | 116  | 75% | 65   | 63% | 15.33**|
| no but I intend to use | 18   | 24% | 27   | 28% | 54   | 32% | 26   | 17% | 23   | 24% | 10.50*  |
| no and I do not intend to use | 8    | 11% | 12   | 12% | 22   | 13% | 12   | 8%  | 12   | 13% | 2.57    |

* p < 0.05; ** p < 0.01
Source: Own research

5 Discussion

In the era of the COVID-19 pandemic, most survey participants use urban, regional and interregional transport occasionally. Across all modes of transport, more than half of the respondents answered that they used modern technology to purchase tickets and to check the route or timetable.

In urban transport:
- Those who use modern technologies are on average the youngest, while those who do not and do not intend to use them are the oldest;
- On average, respondents who do not use modern technologies but intend to do so lived in smaller towns or cities than those who use or do not use modern technologies and do not intend to do so;
- The respondent’s province is not related to the decision to use modern technologies;
- Average travel distance is unrelated to attitude towards the use of modern technologies in public transport. The average travel distance did not differ between those who use modern technology for urban transportation and those who do not.

In regional transport:
- The use of modern technologies in regional transport is not related to the age of respondents. Individuals over 55 (22%) far more often expressed no intention to use these solutions than younger survey participants;
- Individual who do not use modern technologies but intend to do so come from smaller towns, while those who use modern technologies in public transport come from larger cities;
- There are significant differences between the provinces in the percentage of respondents who use modern technologies. The highest number of individuals using modern technologies (71%) is in Zachodniopomorskie
Province, the smallest number (39%) in Świętokrzyskie Province. The highest number of respondents who do not intend to use modern technologies in regional transport comes from Opolskie Province (30%) and Świętokrzyskie Province (29%) and the lowest from Małopolskie Province (4%) and Zachodniopomorskie Province (4%);

- The average travel distance is not related to the attitude towards using modern technologies. The average travel distance did not differ between those who use modern technology in regional transportation and those who do not.

In interregional transport:

- Use of technology in interregional transport is not related to the age of respondents;
- On average, respondents who do not use modern technologies but intend to do so live in smaller towns or cities than those who use or do not use modern technologies and do not intend to do so, who live in the biggest cities;
- The respondent’s province is not related to the decision to use modern technologies for interregional transport;
- Those traveling an average distance of 300-499.99 km use modern technology most often (75%) while those traveling 150-299.99 km use it least often. On average, respondents who do not use but intend to use modern technologies travel the shortest distances and those who use modern technologies – the longest distances.

This is confirmed by the available research results [3,9,12]. Younger passengers are very willing to use new technological solutions offered to them [12, 26]. This is indicated by a large number of respondents who purchase tickets using mobile applications and Internet sales systems (websites) [5,12]. This is possible, among others, due to the availability of sales services anywhere and anytime, improved Internet access, the ease, speed and improved security of online payments. Moreover, the increasing number of online purchases suggests that the trend of using mobile applications and websites to purchase tickets will continue to grow. The above results correlate with statistical data published by the Office of Rail Transport based on annual reporting data from rail operators, which also refer to the whole transport market [3, 4, 15]. As the data show, the share of online channels (websites and mobile applications) in the sale of rail tickets is increasing at a marked pace year by year. Compared to 2017 and 2018 values, there has been a year-over-year increase of nearly 40% in the Internet's share of total sales [3, 15].

6 Conclusion

Given the ageing of the population, both in Poland and in Europe, it is important to have a strategic view on the decisions of travelers, especially those of school and working age, to be able to influence their purchasing habits regarding the use of public transport in terms of using modern technologies. Younger passengers are very willing to start using new technological solutions offered to them. This is indicated by a large number of respondents who claim that they purchase tickets with the use of mobile applications and Internet sales systems (websites). This is possible, among others, due to the availability of sales services anywhere and anytime, the improved Internet access, the ease, speed and improved security of online payments. An important segment declaring their willingness to use modern technology in transportation are travelers from small towns. They should be provided with such an opportunity. The third segment includes older travelers who do not express an intention to use modern technologies due to lack of appropriate skills and old habits. This creates a need for in-depth research on what factors will encourage each group of travelers to use new solutions.

Acknowledgement

The project is financed within the framework of the program of the Minister of Science and Higher Education under the name "Regional Excellence Initiative" in years 2019 – 2022; project number 001/RID/2018/19; the amount of financing PLN 10,684,000.00

Literature

[1] Gontarz T. Modernity as a guarantor of development, Railway Report, 01/2021, p.31
[2] Góra I., Innovation is an important factor, Railway Report, 01/2021, p.15
[3] Rail Passenger Satisfaction Survey" (survey_passenger_version_final.pdf) conducted by the Office of Rail Transport in 2019 (https://www.utk.gov.pl/pl/aktualnosci/18620,
The project is financed within the framework of the program of the Minister of Science and Higher Education under appropriate skills and technology in transportation are travelers from small towns, among others, regarding the use of public transport in terms of using modern technologies. Given the ageing of the population, both in Poland and in Europe, it is important to improve security of online payments for interregional transport; the willingness to pay of users of public transport and shared mobility services in Spain. "The methodology of rating quality standards in the regional passenger transport." Transport problems 10(1): 59–72.

Impact of COVID-19 pandemic on the railroad market in 2020, (2021), UTK, https://utk.gov.pl/pl/dokumenty-i-formularze/opracowania-urzedu-tran-16878_Wplyw-pandemii-COVID-19-na-rynek-kolejowy-w-2020-r.html).

Consumer behaviour during the COVID-19 pandemic, SGH Oficyna Wydawnicza, Warsaw 2021, p. 25.

The influence of COVID-19 on international and long-distance passenger rail transport. The cases of Italy and Poland – the first observations, Prace Komisji Geografii Komunikacji PTG, 23(2), 14–19.

Stress test passed. Micromobility in Poland 2020", http://mobile-miasto.org/stress-test-zaliczony-mikromobilnosc-w-poland-2020),

The Travel Trend Is Here to Stay, https://www.cntraveler.com/story/slow-travel-trend,