 Original article
https://doi.org/10.21683/1729-2646-2020-20-3-47-52

A study of the society's attitude to the introduction of unmanned passenger transportation

Marina V. Korabliova[1]*, Larisa I. Rogavichene[1]
[1]*ITMO University, Russian Federation, Saint Petersburg*
**korablevamary@yandex.ru*

Marina V. Korabliova

Larisa I. Rogavichene

Abstract. Aim. *Obtaining initial data regarding the attitude of the Saint Petersburg residents to the emergence of unmanned vehicles in public transportation, identifying possible barriers and advantages, people's readiness to start using innovative vehicles.* **Methods.** *The research uses the methods of statistical analysis, polling, mathematical analysis. The paper presents the method of the research and makes hypotheses that it is to confirm or refute.* **Results.** *The paper highlights the correlation between the attitude of the surveyed to unmanned passenger transportation and how often they use public transportation. The authors identify the advantages and disadvantages of deployment of urban unmanned transportation based on the poll results.* **Conclusion**. *The paper highlights the city residents' attitude to the introduction of unmanned transportation. The results of a survey of Saint Petersburg residents aimed at revealing their fears and readiness to use unmanned urban public transportation. Those surveyed prefer not to be the first who try the innovative transport, and intend to wait for the practical experience and other people's opinion. Most importantly, people are worried about faults in the system and in its communication both with passengers and other road users. Legal issues and software vulnerability to potential cyberattacks are mentioned as well. In terms of advantages the surveyed noted that the presence of unmanned vehicles will improve the observance of traffic regulations, reduce congestion and the risk of traffic accidents.*

Keywords: *unmanned vehicle, innovation, urban passenger transportation, infrastructure.*

For citation: *Korabliova M.V., Rogavichene L.I. A study of the society's attitude to the introduction of unmanned passenger transportation. Dependability 2020;3: 47-52. https://doi.org/10.21683/1729-2646-2020-20-3-47-52*

Received on: *25.05.2020* / **Revised on:** *26.06.2020* / **For printing:** *21.09.2020*

Introduction

Today, unlike a few years ago, unmanned vehicles do not seem to be a thing of fantasy. In many countries around the world, including Russia, unmanned vehicles are undergoing tests [1, 2, 3]. For instance, on November 26, 2018 the Russian Prime Minister Dmitry Medvedev signed the resolution on unmanned vehicle testing on public roads. According to the document, the experiment will be held from December 1, 2018 through March 1, 2022 in Moscow and the Republic of Tatarstan [4].

According to the Concept of development of the passenger transportation system in Saint Petersburg [5], on a week day in Saint Petersburg 6830 ths rides (100%) are made, out of which 4980 ths (73%) using public transportation and 1850 ths (27%) using automobiles. Thus, despite the growing vehicle-to-population ratio, public transportation caters for 73% of the demand for passenger transportation, remaining the key element of Saint Petersburg's transportation system.

According to the World Health Organization (WHO) [6], over 3 ths persons are killed and 100 ths are seriously injured in traffic every year worldwide.

The Russian traffic accident statistics [7] show that 2019 proved to be a better year for motorists than the previous one. Thus, in 2018, 168099 accidents were registered. In 2019, this figure dropped by 2.2% to 164358.

The General Administration for Traffic Safety statistics [7] show that over 80% of traffic accidents in Russia were caused by drivers.

In Saint Petersburg 5529 accidents happened that were caused by traffic violations [7], in other words, due to the human factor.

The relevance of the research consists in the fact that the use of unmanned transportation will allow reducing the number of traffic accidents caused by the human factor. However, due to various concerns and fears, not all city residents are prepared to see unmanned public passenger transportation (UPPT) in the streets. As there is no prior research providing insight into the attitude of the people of Saint Petersburg to unmanned transportation as an alternative to conventional buses, trolleybuses and streetcars, it was decided to conduct an online poll in order to identify and analyze the existing hindrances to the transition to unmanned transportation.

The key aim of the poll was to obtain initial data regarding the attitude of the Saint Petersburg residents to the emergence of unmanned vehicles in public transportation, identify possible barriers and advantages, people's readiness to start using innovative vehicles.

The big city was the object of research. The topic of research was the attitude of the Saint Petersburg residents to the introduction of UPPT.

Before the beginning of the polling process, the following hypotheses were made:

1) males are more prepared to the deployment of UPPT than females;

2) people aged under 30 are better disposed to the application of innovative technology than respondents from other age groups, as well as better informed on the developments in unmanned transportation;

3) the primary problems associated with the application of unmanned transportation would be people's distrust of the safety of unmanned transportation, the system itself and possible faults, electronic systems failure; inability of the technology to correctly react to traffic incidents;

4) it is assumed that among the advantages of the introduction of UPPT the respondents would, above all, note the potential improvement of road safety, reduction of the number of traffic accidents, observance of traffic regulations by the road users.

Method of research

The following method is proposed for the research:

1. Target audience definition.
2. Sample definition.
3. Surveying with the use of a predefined questionnaire with open and closed questions.
4. Processing of the results and conclusions.

1. Target audience definition.

The target audience of the survey was residents of Saint Petersburg [8] aged 18 or older with no other limitations. The entire assembly is 4460446 persons, the total number of Saint Petersburg residents aged 18 or older as of 2019.

2. Sample definition.

It was required to poll 384 residents of Saint Petersburg in order to obtain specific results. The required sample size was calculated under the assumption of confidence probability of 95% and confidence range (error) of 5%.

Remote polling was conducted in January and February 2020.

3. The research.

The polling questionnaire consisted of three blocks: title, general and main.

The title block introduced the respondents to UPPT, indicated the goals of the research, outlooks of the results application, as well as informed that the polling was anonymous and the results were confidential.

The general block was intended for obtaining general information on the respondents. It contained questions regarding the respondents' gender (male or female), age group with three possible options: up to 30, from 31 to 59, 60 and older, frequency of use of public transportation and awareness of the developments in UPPT.

The main block included a number of rating questions aimed at identifying the public opinion on the subject matter of the research. In this block, the respondents were expected to evaluate their agreement with statements that reflect the presumed difficulties that the deployment of UPPT may cause. The agreement or disagreement was to be expressed on a Likert scale [9] of 5 items, where the leftmost, "Strongly disagree", corresponded to the numerical value 1, while the rightmost, "Strongly agree",

corresponded to the numerical value 5. Besides the Likert scale this block included open questions intended for the collection of information on people's concerns regarding the introduction of innovative public transportation and what advantages they expect. Along with questions about the expected barriers, the research participants were asked about their general disposition towards the introduction of UPPT, also using a Likert scale of 5 items, where 1 indicated "Strongly negative", while 5 indicated "Strongly positive".

4. Processing of the results and conclusions.

The poll produced 472 responses. Upon filtration, removal of incomplete and redundant information, 411 valid responses of unique people were collected, 197 (47.93%) males and 214 (52.07%) females.

Based on the resulting data, a "portrait" of an average respondent was drawn.

Out of those surveyed 126 persons practically never use public transportation on a daily basis. 75 people use public transportation 2 or 3 times a week, while 102 persons use public transportation 4 or 5 days a week. 108 respondents use public transportation every day. That is shown in Fig. 1.

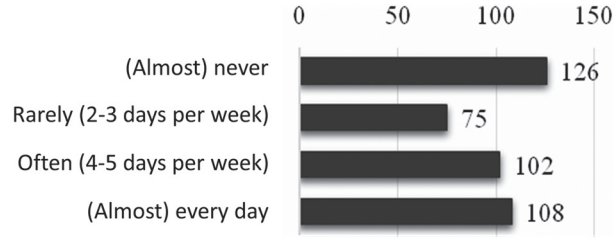

Fig. 1. Frequency of the respondents' rides in public transportation

The responses to the question regarding the awareness of unmanned public transportation are shown in Figure 2.

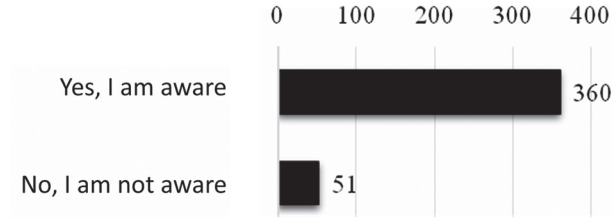

Fig. 2. The respondents' awareness of unmanned vehicles

As can be seen from Figure 2, only 12% of the respondents did not know about the developments in unmanned transportation. Out of the 51 persons who never heard of the developments in unmanned public transportation 63% (32 people) are 60 years of age or older. This correlation is shown in Fig. 3.

As can be seen from Fig. 3, people aged under 30 are best informed of innovative developments (214 people), while people 60 years of age or older are less aware of those. Their number was only 10. 136 people aged 31 to 59 are aware of the developments and only 8 persons are not. 11 people aged under 30 stated that they were also not aware of unmanned vehicles.

As the results, for each question of the main block with a Likert scale, the average value was calculated both for the total number of those surveyed, and for each individual group. The obtained values can be considered as the rating of the attitude of a certain group of city residents to UPPT.

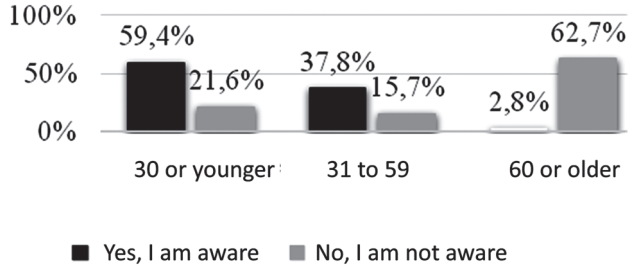

Fig. 3. Correlation of people's awareness of the developments in unmanned transportation and age

The results of the research allow concluding that the respondents are generally well disposed towards unmanned vehicles. Thus, the average score for all those surveyed is 3.95 points.

Surveyed females have a more positive attitude to unmanned transportation. Their average estimate is 3.58 points. Males are more skeptical about innovations and their average estimate is 3.47. This gender-based distribution of the attitude to innovations is shown in Fig. 4.

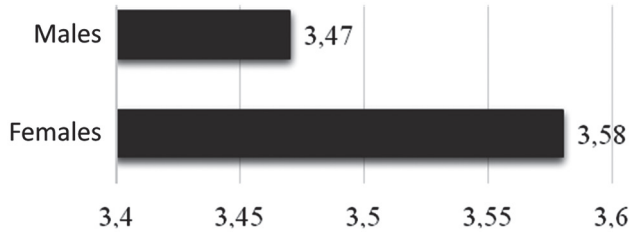

Fig. 4. Correlation between the attitude to unmanned vehicles and gender

It can be assumed that males are more skeptical about unmanned transportation because driving is their hobby. Besides, careless driving is often the case. The introduction of unmanned vehicles implies, strict observance of traffic regulations, as an artificial system is not yet trained

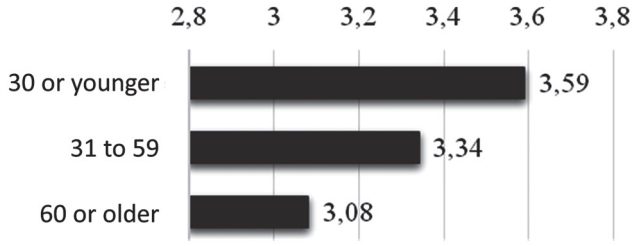

Fig. 5. Correlation between the attitude to the deployment of unmanned vehicles and age

to react to unexpected traffic situations, including a human-controlled vehicle suddenly changing lanes may confuse an autonomous vehicle.

Out of the received responses it can be concluded that the older the respondents are, the more skeptical they are about the idea of deploying UPPT in Saint Petersburg. The obtained rating of age groups' attitude to the potential deployment of unmanned vehicles is shown in Fig. 5.

Young people from the first age group are more open to innovations that respondents from the third group. They are more open to new technology, in particular in transportation. Practice showed that people aged under 30 more actively use modern alternative means of transportation (e.g. mono-wheels, electric scooters, etc.) to get around the city.

Fig. 6 shows the correlation between the attitude to the replacement of conventional with unmanned transportation and the frequency of rides.

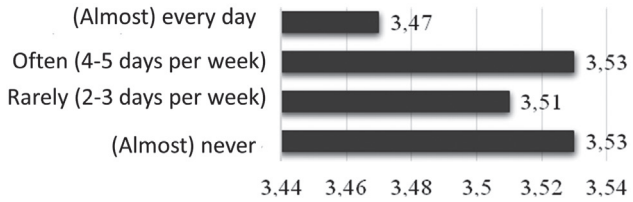

Fig. 6. Correlation between the attitude to the replacement of conventional with unmanned transportation and the frequency of rides

The average estimate made by people who use public transportation almost every day is 3.47 points. The numbers of people who often use public transportation (4 or 5 days a week) and those who never use it proved to be equal (3.53). That implies that the respondents who have a personal vehicle or do not use public transportation for other reasons have an equally good opinion regarding UPPT as those who frequently use public transportation.

As the survey showed (Fig. 6), people's attitude to the replacement of conventional public transportation with UPPT practically does not depend on the frequency of use. The ratings in this section are close to the average value of 3.5.

A significant difference in the ratings was obtained in groups formed on the basis of the awareness of the developments in unmanned transportation, which can be seen in Fig. 7.

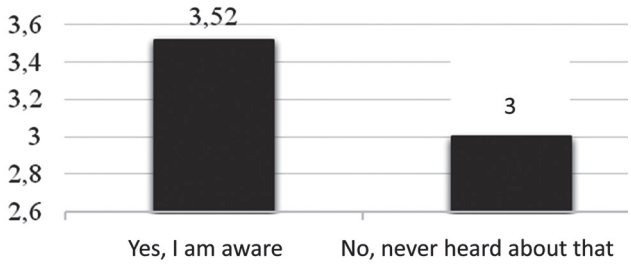

Fig. 7. Correlation between the attitude to unmanned vehicles and the awareness

The survey showed that most respondents are aware of the current developments in unmanned transportation. That should not be a surprise, as Saint Petersburg often hosts exhibitions, forums and conferences dedicated to unmanned transportation.

Among people's main worries due to the deployment of unmanned vehicles we can identify:

– initial surprise of drivers and pedestrians at the emergence of unmanned transportation. For instance, people might start taking videos on their smartphones and get distracted from the road and driving;

– video cameras and lidars collecting mud from the vehicles ahead;

– loss of communication with the dispatcher in an emergency situation (a passenger feeling sick, vehicle malfunction, short circuit);

– excessive vigilance by the unmanned vehicle in nighttime, in fog, bad weather;

– possible software faults;

– the infrastructure not being prepared for the deployment of UPPT.

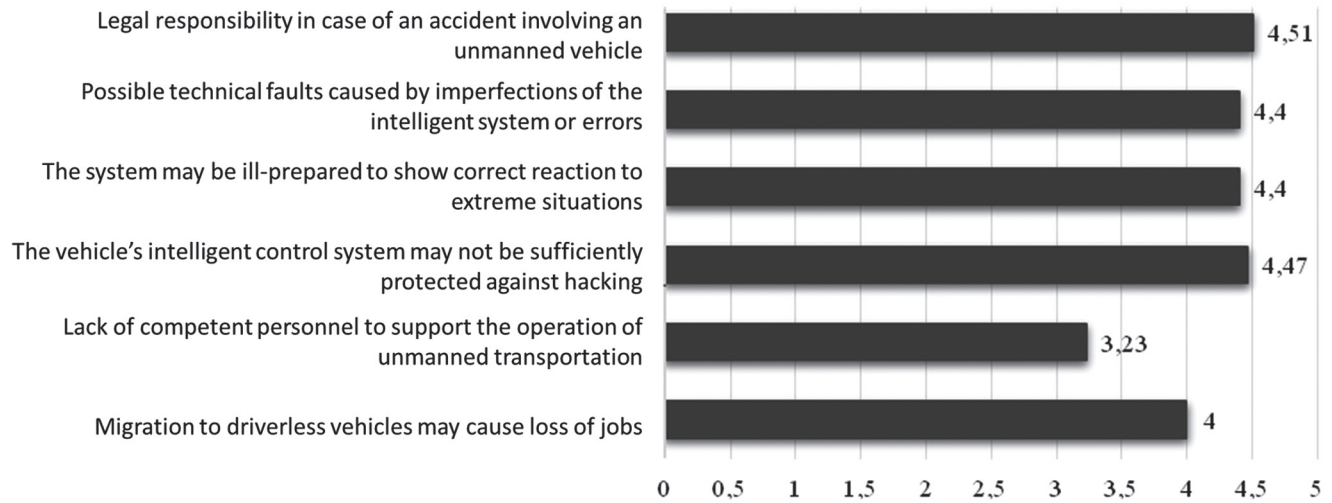

Fig. 8. Level of agreement with the identified obstacles

Among the advantages, the respondents noted the traffic safety, reduction of the number of traffic jams, reduction of the risk of traffic accident and improved observance of road regulations, elimination of routine driving operations, emergence of new professions.

However, for those advantages to materialize, the city residents must realize that an unmanned vehicle is a programmed machine that operates in accordance with specified algorithms and rules, therefore it is necessary to avoid emergencies by observing the road regulations.

According to the obtained results, those surveyed are seriously concerned about the above problems associated with the deployment of UPPT. Practically all such issues were rated on the average above three, while 5 problems out of 6 had the average score of 4 and higher. That can be well seen in Fig. 8.

The main causes of concerns are the legal matters, non-availability of a regulatory framework that would strictly define the scope of responsibility of the parties involved in an incident. Of practically equal concern are the consequences of cyberattacks on the control systems of unmanned vehicles. The respondents were least worried about possible loss of jobs in transportation, as well as shortage of well-trained and qualified staff that would ensure stable, safe and efficient operation of UPPT.

Conclusion

While automotive manufacturers, the press and the academia universally agree that unmanned vehicles will usher in the next age of transportation worldwide, this research identified, evaluated and ranked major concerns of future passengers regarding the quite radical innovations.

Females have a more positive attitude to the introduction of UPPT (their average assessment is 3.58), rather than males (average assessment 3.47).

The conducted research showed that if a person has doubts about the safety of a technology or its advantages, he/she usually refrains from using it.

Regarding the hypotheses made at the beginning of the paper, it can be noted that not all of them were confirmed. Thus, for instance, the first assumption that males are better disposed to the presence of innovative technology on roads proved to be false. It should be noted that only 5% of those surveyed expressed an overtly negative attitude to unmanned vehicles.

The second hypothesis proved to be correct. Young people of Saint Petersburg aged under 30 are more open to unmanned transportation. That may be due to the fact that the young generation is more and more dependent on gadgets and more familiar with modern technologies, and would want to personally try out things like unmanned passenger transportation. However, it was noted that the older the respondents are, the more skeptical they are about the idea of deploying of UPPT.

The third and fourth hypotheses were also confirmed by the research. Less than a half of those surveyed (30.4%) stated that they wanted to be the first to use UPPT. Those were 125 persons. Most respondents (214 persons, or 52.1%) intend to wait for other users' experience and start using it themselves only knowing it is safe. 17.5% of respondents (72 persons) would never use UPPT.

The survey also identified a number of problems, the most important of which are the legal aspect and lacking regulatory framework, possible cyberattacks, uncertainty of unmanned vehicles' reaction to emergency situations.

References

[1] Korobeev A.I., Chuchaev A.I. [Unmanned vehicles: new challenges to public security]. *Lex Russica* 2019;2(147):9-26 [accessed 10.03.2019]. Available at: https://cyberleninka.ru/article/n/bespilotnye-transportnye-sredstva-novye-vyzovy-obschestvennoy-bezopasnosti. DOI: 10.17803/1729-5920.2019.147.2.009-028. (in Russ.)

[2] Pokusaev O.N. et al. [On world market of autonomous (driverless) cars]. Modern Information Technologies and IT-Education 2018;3:737-747 [accessed 11/03/2019]. Available at: https://cyberleninka.ru/article/n/mirovoy-rynok-avtonomnyh-bespilotnyh-avtomobiley. DOI: 10.25559/SITITO.14.201803.737-747 (in Russ.)

[3] Brom A.E., Belonosov K.Yu. The issue of autonomous vehicle introduction into economic environment. Bulletin of the Moscow Region State University 2018;1:23-32. [accessed 12.04.2019]. Available at: https://cyberleninka.ru/article/v/issledovanie-problem-vnedreniya-bespilotnyh-avtomobiley-v-ekonomicheskuyu-sredu. DOI: 10.18384/2310-6646-2018-1-23-32. (in Russ.)

[4] [On the experimental operation of unmanned vehicles on public roads]. (accessed 12.04.2019). Available at: http://government.ru/news/34837/. (in Russ.)

[5] [Resolution of January 23, 2008 no. 44 On the concept of development of the passenger transportation system in Saint Petersburg, including the subway and other rapid transit for the period up to 2020]. [Tekhekspert: an electronic fund of regulatory and legal documents] [accessed 25.01.2020]. Available at: http://docs.cntd.ru/document/8467872. (in Russ.)

[6] [Traffic accidents statistics in Russia and abroad]. [accessed 28.10.2019]. Available at: https://tass.ru/info/3233185. (in Russ.)

[7] [General Administration for Traffic Safety. Indicators of the status of road traffic safety]. [accessed: 10.10.2019]. Available at: http://stat.gibdd.ru/. (in Russ.)

[8] [Saint Petersburg and Leningrad Oblast Office of the Federal State Statistics Service (PETROSTAT). Age and gender composition of the population of Saint Petersburg as of January 1, 2019. Statistical bulletin no. VS – 140/1148 of 20.12.2019]. Saint Petersburg; 2019. (in Russ.)

[9] Dubina I.N. [Mathematical foundations of empirical socioeconomic research. A study guide]. Altai State University Publishing; 2006. (in Russ.)

About the authors

Marina V. Korabliova, Master of technological management and innovation, ITMO University, 11/2 Chaikovskogo Str., room 1-S, 191187 Saint Petersburg, Russian Federation, korablevamary@yandex.ru

Larisa I. Rogavichene, Associate Professor, Candidate of Economics, Ordinary Senior Lecturer, Faculty of Technological Management and Innovation, ITMO University, 11/2 Chaikovskogo Str., room 1-S, 191187 Saint Petersburg, Russian Federation, rogavichene@itmo.ru

The authors' contribution

Korabliova M.V. analyzed the state of the art of the problem under consideration. She made the research questionnaire and conducted a research of the Saint Petersburg residents' attitude to the introduction of unmanned transportation. Processing of the obtained results.

Rogavichene L.I. drafted the plan and hypothesis of the research, as well as its questionnaire. She conducted a research of the Saint Petersburg residents' attitude to the introduction of unmanned transportation. Processing of the obtained results.

Conflict of interests

The authors declare the absence of a conflict of interests.