Digital technologies and new mobility

N O Bludyan$^{1,2,3}$

1 Motor transportations, Moscow Automobile and Road Construction State Technical University (MADI), 64, Leningradsky prospect, Moscow, 125319, Russian Federation
2 Administration, the Association for the advancement of the transport industry "Transport Association of the Moscow Agglomeration" (The Association "TAMA"), 2, Denisa Davydyova, Moscow, 121170, Russian Federation
3 Corresponding author email: np-tama@mail.ru

Abstract. New types of mobility for people started to appear with the development of digitalization in various fields of transport industry. The article discusses the development trends of digital technologies in transport sector. The current situation of the use of digital technologies in transport is observed. Forecasts of the development and introduction of new technologies in digitalization are given. The author presents the overview and forecasts of the need for regulation of transport, taking into account modern technologies as well as the overview of new types of mobility for remote cities where it is not possible to create scheduled routes. The analysis and review of such directions of transport as sharing are presented. The advantages and disadvantages brought by car sharing in cities are substantiated. The analysis of the policies of different cities in stimulating people to transition to general economy and sharing cars is presented. As a result the overview of the advantages and disadvantages of carpooling system is reflected. Necessary legal regulation of carpooling and control over this type of activity are proposed. The article touches upon the issue of the fight against mass motorization through the use of vehicle sharing.

1. On-Demand Mobility

Currently, a new method of organizing the system of urban passenger transport – on-demand mobility - is widely discussed in the professional environment. On-demand passenger transport offers a more flexible service to passenger traffic, as it is based on the number of incoming requests for transportation. This is a user-oriented type of public transport, which differs from the traditional route transport by flexible routes based on the presented demand [1].

An example of on-demand mobility is “Bwcabus” from Wales (UK). This company is focused on serving primarily the rural population and people living on the outskirts. Local bus routes are being reduced in order to save money, which causes isolation and the inability of people who do not have personal vehicles to carry out social and labor trips. This service allows people, after free registration, to order buses that provide them with communication with other main public transport and other cities, and access to basic services in the nearest cities at the right time [2].

On-demand transportation in urban traffic is relevant during non-peak periods, as well as in areas with low passenger traffic. Thanks to such a system, passengers will be able to request boarding and alighting at any non-prohibited place through a mobile application. Such a concept is planned on night bus routes instead of fixed-time traffic. Such a system will provide a better and more individualized bus service with the possibility of reducing the waiting time [1].

The studies by specialists from Sydney have shown the unprofitability of on-demand mobility. According to experts, this is due to the fact that small capacity buses are used and this forces to hire more drivers. They also noted the unwillingness of people to order transportation through the app in advance, as it causes discomfort, unlike a trip by private transport [3].

Successful projects and startups working on the principle of “on-demand” transportation can be highlighted. In Oxford, for example, passengers can call a PickMeUp minibus to any street in the...
eastern part of the city. Such a service provides travel cheaper than in a taxi, and no more expensive than transport following fixed routes. With the new technology, it is possible to determine where people are and provide them with transportation services, thereby creating new mobility and opportunities for people [4].

The cost of owning private vehicles, increasing the time of traffic congestion, restrictions on expanding road infrastructure, the need to save resources and reduce emissions - all this contributes to the development of on-demand mobility. It is predicted that in the near future a large proportion of the population in the city will come to usage public vehicles [5].

2. Car-sharing
Car-sharing is a group car use. This service is a form of short-term car rental. It is suitable for people who need a car for a short period of time. The peculiarity of the service is that drivers need to pay only for the time of actual use of the car, and the cost depends on the duration of use and class of the car.

Speaking about the value of car-sharing, it should be noted that this service can be used 24 hours a day. The development of specialized parking in different parts of the city makes it possible to take, leave such a car next to work or place of residence.

As of August 2017, Moscow car-sharing is the most dynamically developing free-float market in the world. The very first operator of car sharing in Moscow and Russia, the company “Anytime” appeared in 2012. By mid-November 2018, the car-sharing market in Moscow was over 13.5 thousand cars, and the total number of trips per day was 60 thousand. The largest operator of the car-sharing market in Moscow is "Yandex.Drive", the size of the rolling stock exceeds 6500 car-sharing cars. Belcacar and Delimobil are also among the largest domestic car-sharing companies. For comparison, according to analysts at ING Bank, as of October 2018, the total fleet of car sharing operators in 13 European countries combined amounted to only 15 thousand cars. According to the Moscow Department of Transport, 300 new cars are added to the fleet of car-sharing operators in Moscow every week. According to the data from the investment bank JPMorgan, the goal of the Moscow government is to reach the index of 25 thousand cars. In this case, one car-share will have 500 residents and according to this indicator, Moscow will be able to catch up with world leaders in this area: Toronto (one vehicle to 498 inhabitants), Madrid (500), Stuttgart (515) and New York (525). According to analysts of PwC consulting company, by 2025 the Moscow car-sharing fleet will reach 30 thousand cars [6].

Ongoing research and analysis of car-sharing activities in the urban environment shows that car-sharing has become part of an integrated public transport network. The interchangeability of car-sharing and conventional public transport in the event of a failure of one of them [7] is traced.

The German experience shows that car-sharing has become an important factor for sustainable urban mobility. To enhance the positive effect of car sharing, more users are required in such a system, then personal cars will be more actively displaced. This can be done with the involvement of additional users, such as women, the elderly, the population living on the periphery of cities [8].

Studies in Portugal have shown once again that the sharing of vehicles contributes to more efficient and sustainable mobility (with fewer vehicles per capita) and to the development of a sustainable transport system. In addition to the listed advantages it is possible to add such important fact as reduction of consumption of physical and economic resources at users of this system. The studies suggest a reduction in energy consumption and negative impact on the environment due to the refusal of people from personal transport in favor of car sharing. This is expected to result in a 35-47% reduction in energy consumption and a 35-65% reduction in CO2 emissions when hybrid vehicles are used in co-located environments. The number of owners of personal vehicles is expected to increase from 1 to 6 per car sharing vehicle [9].

According to experts, carsharing is one of the most promising services in the future. Using the systems of this service, it is possible to efficiently use unmanned vehicles, which, according to forecasts of Frost and Sullivan and RBK, will already occupy 40% of the global passenger car market by 2025 [10].
Surveys of car-sharing customers have shown that after joining the car-sharing scheme, they are much more likely to walk, cycle and use public transport than before. Muhammad’s study in Switzerland showed that the use of mobile transport for car-sharing users increased by 25% after they joined mobility, the Swiss provider of car-sharing [11].

A customer survey in Brussels showed that 60% of Cambio customers are holders of public transport subscriptions (STIB) and 22% have become new holders of subscriptions since they registered with Cambio [11].

In Quebec, thanks to the joint proposal "duo: car + bus" from RTC, the local public transport operator, and the car-sharing company Communauto, the number of monthly public transport tickets purchased by car-sharing clients increased by 45% after the launch of the proposal [11].

In addition, cooperation with carsharing provides a more dynamic image of public transport, and a more flexible and broad offer of mobility. These arguments clearly show that car sharing has become an important element of a sustainable transport strategy. In Zurich, Switzerland, 6% of residents are car sharing customers [11]. At the moment, this is the goal that large cities and agglomerations of the world should strive for.

3. Carpooling

Carpooling (ridesharing) represents joint use of vehicles for movement at different distances. It is assumed that the driver's trip was planned by himself and would have been carried out in any case, but he is looking for fellow travelers willing to share the costs. Examples of ridesharing are companies (services) BlaBlaCar, karzoo (France), mitfahrgelegenheit and mitfahrzentrale (Germany), carpool (Belorussia), carpoolworld (America), etc. At present, we can observe a trend in the development of the paradigm of "sharing economy", with the transition from ownership of goods to joint use. Greater success among transport sharing is worth noting on Internet platforms that allow planning common trips, as well as finding travel companions for car owners and finding routes for passengers, such as Blablacar and Carpooling. Middle-aged people are more likely to use new digital resources, but older people unfortunately still use traditional transport systems [12]. In Europe, the concept of carpooling has been developed and promoted through internet and social media. The Internet has also helped spread the idea of real-time car sharing with a mobile device. However, there are still no clear algorithms for creating routes in applications that take into account all the interests of drivers and passengers [13].

In order to achieve compromise solutions that will ensure good compliance of the offer for both drivers and passengers of carpooling, constantly adjusting algorithms are necessary. Scientists from Poland have proposed algorithms that are applicable even in the BlaBlaCar application, presented the task of unification and the procedure of its solution. The task was reduced to the construction of an optimal route, taking into account the combination of “interests” for passengers and drivers [13].

Vehicle sharing is the foundation for a sustainable and safe mobility environment using fewer cars to transport more people. One of the main problems is drivers’ confidence in passengers and vice versa. Greece has proposed a solution to this problem by using mechanisms to assess the reputation of users, which could rank users according to their behavior according to the assessments and feedback of other users. Special attention is paid to the stability of such a system from attackers and the preservation of personal data [14].

The draft federal law provides for the introduction of a new type of mobility in the Russian Federation - “joint trips” (carpooling, ridding) [15]. The main purpose of this type of mobility is to reduce the number of cars on the road network of large agglomerations and cities, reduce the intensity of traffic flows and the likelihood of traffic jams and congestion, reduce the amount of harmful emissions from vehicles into the atmosphere, etc. Taking into account this fact and the lack of practical experience in implementing such projects, as well as understanding the possibility of turning "carpooling" into an illegal sector of transportation in contrast to the existing system of transportation by passenger taxi, at the initial stage it is necessary to provide strict conditions and restrictions on market entry in this new transportation system.
1. Based on article 2 of the draft law, it is proposed to use M1 category vehicles for transportation not related to business activities. The M1 category includes vehicles with 8 seats in addition to the driver’s seat. With a high degree of probability, it can be assumed that minibuses falling under the M1 category will become the prevailing vehicle for the provision of joint travel services. This circumstance, in turn, will lead to commercialization and entrepreneurship in this area. This will especially have a negative impact at the initial stage of implementation of the system, when an effective system of control and supervision has not yet been established. In order to facilitate and prioritize the use of classic cars with no more than 4 seats in the trips under consideration, (in addition to the driver’s seat), it is proposed to limit the number of passengers in one trip to three passengers. This will ensure the comfort of the trip of two passengers in the passenger car and one passenger next to the driver.

2. In article 2 of the draft law, it is proposed to clearly fix the name of aggregators of information on transportation that is not related to entrepreneurial activity as follows: “aggregator of information on services for non-commercial transportation”.

3. We consider it necessary to legislatively prohibit the carriage of passengers under contracts of non-commercial chartering on interregional routes. Otherwise, we will create all the legal conditions for the prosperity of the illegal segment of commercial transportation in inter-regional communication by minibuses and sedans (for example, the Tula-Moscow route). Transportation on adjacent inter-regional routes will fully satisfy the needs of real carpooling.

4. It is proposed to identify only citizens of the Russian Federation with national category B driver’s licenses as freighters that provide transportation services under non-commercial charter agreements. In this regard, delete from paragraph b) of article 7 the paragraph that begins with the words “or an international driver’s license ...” (p. 11, 12 of the bill).

5. The conditions and requirements for the financial relationship between the owner of the aggregator and the charterer are not clear from the bill. On the basis of paragraphs g) and h) of article 5 the owner of the aggregator may impose on the shipowner and the charterer a commission is not acceptable to these participants. Clear legal regulation of the conditions of financial relations between the parties is required. The operational experience of the passenger taxi sector confirms the need for such regulation.

5.1. Article 4 of the draft law proposes to prescribe a mechanism for generating the amount of compensation to the driver from the passenger for non-commercial transportation, taking into account the actual expenses of the driver, thereby:

- Showing the passenger that the driver does not carry out business activities;
- “Clear” the services for finding fellow travelers from illegal entrepreneurs;
- Facilitating the control of supervisory authorities.

5.2. In part 3 of article 4 of the draft law it is proposed to prescribe the procedure of control over the collection by the charterer of a fee for the use of a vehicle under a non-commercial chartering agreement, as well as the liability of the charterer for the collection of a fee unreasonably exceeding its maximum amount established by the Government of the Russian Federation.

5.3. Part 9 of Article 4 of the draft law provides for a number of methods of payment for services under non-commercial charter contracts, and therefore this part of Article 4 is proposed to be revised as follows: "Payment for services under the non-commercial charter contract shall be made in the following order:"

6. We consider it inappropriate to allow the charterer carrying out the transportation of individuals by a vehicle which he has on loan. This right will lead to the widespread spread of uncontrolled
relations. It is proposed to edit paragraph 6 of article 2 in order to exclude the right to use rental vehicles.

6.1. Part 2 of article 9 of the bill makes changes to part 2 of article 8 of the Federal law "on protection of the rights of legal entities and individual entrepreneurs in the exercise of state control and municipal control", providing for the expansion of the list of works and services approved by the Government of the Russian Federation as part of activities in respect of which legal entities, individual entrepreneurs are notified of the commencement of certain types of entrepreneurial activity.

- In this regard, we consider it necessary to supplement Part 1 of Article 6 of the bill with the following words: “in the manner prescribed by the Federal Law “On the Protection of the Rights of Legal Entities and Individual Entrepreneurs under State Control (Supervision) and Municipal Control”.

7. In our opinion, the number of trips by one charterer during the day cannot exceed two only if provided that the second trip is on the same route, but only in the return message. In other cases, the number of trips should be limited to one trip. (Article 7, paragraph 2).

8. In paragraph c) of part 1 of article 7 of the draft law, it is proposed to determine the total driving experience of a driver with a size of at least 3 years (by analogy with a passenger taxi). Clarification of the concept of “seniority” in the driver of a personal vehicle is required, as well as a system for monitoring the length of the driving experience.

8.1. In part 2 of article 7, it is proposed to establish a mechanism for controlling and blocking trips in excess of the proposed maximum. It is advisable to oblige the aggregators to automatically block the registration of driver trips in excess of the norm, and the norm should be clearly prescribed taking into account the long time intervals (number per month, year).

9. Article 3 (paragraph f)), as well as paragraph 3 of Article 4, introduces the concept of “maximum amount of a fee for using a vehicle”. From the considered edition of the bill its physical meaning is not clear. I consider it necessary to supplement article 2 with the concept of “maximum board size” and give a unit of measurement.

10. Paragraph 3 of Article 4 of the draft law defines two types of expenses. It is not clear why other costs are not taken into account, such as special liquids, tire wear and tear, depreciation of the vehicle, etc.

4. Conclusion
The mechanism of control and responsibility for a similar type of search for companions on the basis of any other online resources that are not essentially non-commercial transport aggregators is not clear. There are cases of mass use of social networks and messengers by "grey" carriers to search for passengers.

References
[1] DoorsAreClosing 2017 LTA to trial on-demand bus services, Blog on Land Transport Guru. Retrieved from: https://landtransportguru.net/hta-trials-on-demand-bus-services/
[2] European Network for Rural Development 2016 An on-demand rural bus service in rural WalesAvailable at, Project report. Retrieved from: https://enrd.ec.europa.eu/projects-practice/demand-rural-bus-service-rural-wales_en
[3] O’Sullivan M 2018 Sydney’s new on-demand buses test the public’s appetite The Sunday Morning Herald Retrieved from: https://www.smh.com.au/national/nsw/sydney-s-new-on-demand-buses-test-the-public-s-appetite-20180718-p4zs5d.html
[4] Topham G 2018 Oxford buses turn to Uber-style apps in on-demand experiment The Guardian Retrieved from: https://www.theguardian.com/business/2018/jun/29/oxford-buses-turn-to-uber-style-apps-in-on-demand-experiment
[5] Matus J, Heck S 2015 Understanding the future of mobility Techcrunch Retrieved from: https://techcrunch.com/2015/08/08/understanding-the-future-of-mobility/

[6] Posypkina A, Balenko E, Balashova A 2018 The Moscow city car-sharing market if the one of the fastest growing RBC Media Retrieved from: https://www.rbc.ru/technology_and_media/27/09/2018/5bab94a69a79474169e307c1?from=newsfeed

[7] Tyndall J 2019 Free-floating carsharing and extemporaneous public transit substitution Research in Transportation Economics 74 21-27.

[8] Giese F, Nobis C 2016 The impact of carsharing on car ownership in german cities Transportation Research Procedia 19 215–224.

[9] Baptista P, Melo S, Rolim C 2014 Energy, environmental and mobility impacts of car-sharing systems. Empirical results from Lisbon, Portugal Procedia of Social and Behavioral Sciences 111 28–37.

[10] Ol’hovikov D E 2018 Intelligent transport systems of Russia Information Magazine 7 19–20.

[11] UITP 2011 Becoming a real mobility provider Combined Mobility: public transport in synergy with other modes like car-sharing, taxi and cycling. UITP Position paper. Retrieved from: https://www.uitp.org/sites/default/files/cck-focus-papers-files/FPComMob-en.pdf

[12] Guercio E, Borean C, Zenezini G, Gargiulo E, Giannantoni R 2015 Dynamic ride sharing service: are users ready to adopt it? Procedia Manufacturing 3 777–784.

[13] Žak J, Maciej H, Grzegorz F 2019 Multiple criteria optimization of the carpooling problem Transportation Research Procedia 37 139–146.

[14] Salamanis A, Kehagias D D, Tsoukalas D, Tzovaras D 2019 Reputation assessment mechanism for carpooling applications based on clustering user travel preferences International Journal of Transportation Science and Technology 8(1) 38–46.