Autonomous Vehicles within the Urban Space and Transport Security Challenges: Legal Aspect

Los vehículos autónomos en el espacio urbano y los retos de la seguridad del transporte: aspecto legal

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Abstract

Nowadays autonomous vehicles are getting widespread use in different parts of the world. In some countries, they are being tested within the urban traffic whereas other counties have been already operating them. Such vehicles possess a number of obvious advantages. We cannot but agree that these cars are the future. However, before complete implementation and mass use of autonomous transport on public roads, it is necessary to resolve a number of problems concerning their safety towards road-users. Except for ethical, economic, and other aspects, it also embraces the legal aspect. The article analyses legal problems of ensuring transport security when using autonomous vehicles. It also touches upon the issues of obligations and liability. Special attention is paid to the matters of criminal liability for offences involving an autonomous vehicle. The conducted legal research allowed concluding that it is necessary to improve legislation in the sphere of operating such vehicles. It is essential to enshrine in law autonomous vehicles (whether fully-autonomous or partially-autonomous) operation rules, oblige their owners to perform regular diagnostic assessment, and to add demands to periodic vehicle inspection. When regulating criminal liability for harm caused by a self-driving vehicle, one must proceed from the layer of its autonomy which stipulates bringing the general public to responsibility.

Keyword: Security; Road Traffic; Autonomous Vehicles; Automated Driving; Autonomous Driving, Automated Vehicles, Self-Driving; Responsibility

Resumen

Hoy en día, los vehículos autónomos están teniendo un uso generalizado en diferentes partes del mundo. En algunos países, se están probando dentro del tráfico urbano, mientras que otros condados ya los han estado operando. Estos vehículos poseen una serie de ventajas obvias. No podemos dejar de estar de acuerdo en que estos coches son el futuro. Sin embargo, antes de la implementación completa y el uso masivo del transporte autónomo en la vía pública, es necesario resolver una serie de problemas relacionados con su seguridad para los usuarios de la carretera. A excepción de los aspectos éticos, económicos y otros, también abarca el aspecto legal. El artículo analiza los problemas legales de garantizar la seguridad del transporte cuando se utilizan vehículos autónomos. También toca las cuestiones de obligaciones y responsabilidad. Se presta especial atención a la materia de responsabilidad penal por infracciones relacionadas con el vehículo autónomo. La investigación jurídica realizada permitió concluir que es necesario mejorar la legislación en el ámbito de la operación de dichos vehículos. Es esencial consagrar en la ley las reglas de operación de los vehículos autónomos (ya sean completamente autónomos o parcialmente autónomos), obligar a sus propietarios a realizar evaluaciones de diagnóstico regulares y agregar demandas a la inspección periódica de los vehículos. Al regular la responsabilidad penal por los daños causados por un vehículo autónomo, se debe partir del nivel de su autonomía que estipula la responsabilidad de la ciudadanía.

Palabra clave: seguridad; Tráfico en la carretera; Vehículos autónomos; Conducción automatizada; Conducción autónoma, vehículos automáticos, conducción autónoma; Responsabilidad

Introduction

More and more vehicles are becoming equipped with various driver assistance technologies. At present vehicles with certain automated functions have been already exposed in the market. These functions provide crash avoidance, automatic braking, parking, lane-keeping control, blind spot control, and other things.

Nowadays autonomous vehicles (AV) that are the subject of our research are being intensely tested in many parts of the world. In some countries, they have been already operating.

For the purpose of AV classification there are 6 levels of driving automation elaborated by SAE International (SAE, 2016):

level 0: completely manual operation with an option to risk warning (emergency notification system);

level 1: the driver must be ready to assume control at any moment. Following automated systems may be available: Adaptive Cruise Control, automated parking system, and Lane Keeping Assistance;
level 2: the driver must be ready to intervene if the system fails. The automated system controls steering, braking, and acceleration or it can be disabled;

level 3: the driver is not required to control the vehicle under predictability of road traffic and environment (for example, autobahns). However, the driver must be able to take control;
level 4: it is similar to level 3 but it does not require the driver's interaction;

level 5: does not require the driver's attention except for system start-up and setting a driver destination. The automated system can ensure driving to any endpoint allowed by law.

Autonomous vehicles are related to the "SmartCity" concept (Šurdonja, 2019). The introduction of blockchain technologies is suggested for the management of urban flows (Narbayeva, 2019). Thus, there is some groundwork for the creation of an integrated autonomous transport network within "SmartCity" concept.

Herewith up to the present no consistent conceptual framework has been worked out in science. So, in order to define the notion of an autonomous vehicle, academic literature gives such terms as "automated driving", "autonomous driving", "autonomous vehicles", "automated vehicles", "self-driving vehicles", and others.

The implementation of AV implies a lot of objective benefits. Mainstreaming of these vehicles leads to an increase in highway vehicle capability (Morando, 2018), it provides more transportation accessibility including people with disabilities. Deployment of AVs will also result in economic benefits for companies that can reduce personnel costs (López-Lambas, 2019). In addition, Japanese scientists point to the reduction of driving stress and emotional spending for private car users (Abe, 2019). Moreover, researches confirmed the positive impact of using AVs on population health in general (Dean, 2019).

However, the issues of security in cases of using AVs appear to be rather ambiguous. On the one hand, it is commonly accepted that autonomous vehicles are safer since their operation excludes the human factor (Ryan, 2019). But in fact, the situation is not so clear-cut and some researches reveal conflicting points of view on the issue of autonomous vehicles' security (Pyrialakou, 2020). Some of them are concerned about the threat of the automated system failure, cyberattacks on the driving system, and other security threats. Herewith the security issue of all road users including pedestrians arises.

Special concern is sparked around the accident which happened with Tesla's car and caused death in the USA in 2016 (Stilgoe, 2018). Furthermore, in the USA, Japan, and Australia there were several lawsuits on the matter of defining liability for the car crash involving level 3 vehicles. In most cases, car cameras and steering angle sensors indicated that the driver was definitely guilty. Nevertheless, in California, there were two cases that indicated the fact that it was objectively a manufacturing defect that caused these accidents (Ryan, 2019).

The results of the public opinion poll gained in the course of research point at the fact that people are much more intolerant of accidents caused by AVs rather than individuals (Salonen, 2019).
A number of security issues associated with the use of AVs lie within the legal boundaries and directly depend on legal regulation.

The emergence and use of AVs set out to provide security in this sphere. Ensuring vehicle security has an impact on criminal nature in the given sphere as well as on people's quality of life (Šoltés, 2017).

Autonomous vehicles' operation can result in the infliction of harm of different character and extent. In the context of the criminal law aspect of the

subject matter covered one should consider two areas of research:
- criminal liability for harm caused by the use of such vehicles;
- criminal liability for harm resulted from illegal access to electronically stored information of these vehicles.

The first area is connected with liability for personal injury or property damage as a result of operating AVs. The level of vehicle autonomy can be different. There are partially autonomous vehicles when only several functions are automated but in general, the driver controls a vehicle, and fully-autonomous vehicles when driving is performed without the human control. In each of these situations, there is a question of who must bear liability for harm inflicted by the use of such a vehicle: a driver, a manufacturer, an owner, a product engineer, or some other related person. It is impossible to give a definite answer to the question.

Certain researchers fairly bring about the following issue: is the passenger of AV allowed to be oblivious to the vehicle operation, or he or she must be attentive and able to react in case of emergency (Bartolini, 2017).

Fully or partially autonomous vehicles operate due to the use of computers and software support. Modern cars are connected to cyber-space, they function on the basis of data and connect to other smart devices. That is why they have become vulnerable to cyber crime (Markelj, 2018). In this scenario, illegal access to electronically stored information of the car may occur. It can result in a road traffic accident and consequently to personal injury and property damage. Another scenario is also possible. A cyberattack may provide access to confidential, personal information which includes personal data, personal privacy, and other legally protected secrets.

These problems should be resolved today with the help of legal measures as promptly as possible.

Methods

The systematic approach allowed scrutinizing the system of legal regulation with regard to the operation of an autonomous vehicle. The method of comparative law made it possible to conduct a comparative analysis of legislation and scientists' viewpoints in order to adopt successful practices in the sphere of legal regulation. In addition to the mentioned methods, the authors applied such methods as analysis, synthesis, induction, deduction as well as scientific modelling. The last method allowed considering the model of the legal groundwork of security provision when using an autonomous vehicle.

An essential methodological aspect in considering personal and public security issues is the necessity to implement the pragmatic function of science as security provision presumes early detection, analysis, and assessment of security threats. Within the framework of the given research, the authors speculated about possible loopholes in the current legislation, which may become an obstacle to the deployment of autonomous transport.

The polling method enabled us to obtain data on the people's attitude towards AVs. In January 2020 we polled Russian citizens with the purpose of defining their attitude towards AVs and criminal liability for harm inflicted as a result of autonomous vehicle operation. Various scenarios and multiple-choice questions were given. The poll comprised citizens aged between 18 and 68 (18-30-year-olds made up 43 per cent, 30-50-year-olds made up 27 per cent, 50-60-year-olds made up 22 per cent, over 60-year-olds made up 8 per cent), city residents (65 per cent) and peasant population (35 per cent), motor vehicle drivers with an experience of less than one year (7 per cent), from 1 to 5 years (20 per cent), 5 to 10 years (48 per cent), over 10 years (25 per cent), women (36 per cent) and men (67 per cent).

Results and Discussion

First and foremost it is necessary to consider general legal regulation of autonomous vehicle operation.
The Vienna Convention on Road Traffic concluded in 1968 initially presumed that every driver should always be able to control his or her vehicle. Thus, over a long period of time, there was an impassible barrier for autonomous vehicles.

Herewith the deployment of various autonomy technologies in the sphere of road traffic required revision of the Vienna Convention. The text incorporating amendments to the Convention was issued in 2014. The amendments were enacted in 2016. The essence of amendments consists in permission of self-driving mode assuming the driver will be able to deactivate it at any moment or switch to manual mode. This event has become the first step towards autonomous driving.

However, these amendments appear to be rather disputable as they raise a question of whether the use of a car without the driver inside is permitted or not (Neznamov, 2018). In other words, a car will resemble an elevator without common control components except for navigation. It seems that to achieve this goal it will be necessary to amend the Vienna Convention once again. At this point, we

can concur with Bartolini's (Bartolini, 2017) opinion that the existing legal system is endeavouring to follow the development of autonomy technologies and keep pace with it rather than to supervise it.

After amending the Vienna Convention corresponding norms appeared in different counties' legislation such as Germany, Finland, Spain, Sweden, the USA, Australia, and others. Herewith in different countries, the number of sanctions for an AV is not the same.

Driver assistance systems of SAE levels 1 and 2 have been already functioning in many vehicles, and they do not require any special legislative control.

From a legal perspective SAE autonomy levels 3 and 4 vehicles are of particular interest since in these cases the driver is not required to control a vehicle. Legislation of different countries does not regulate this aspect in the same manner. As an example let us provide excerpts from legislation of some European countries.

France
Article R. 412-6 of the French Road Traffic Code says that:
- any moving vehicle must have a driver;
- any driver constantly has to be in such a state and position to conveniently and without delay execute all maneuvers required of him.

Germany
In 2017 the Bundestag passed an amendment to Road Traffic Act. According to it, the driver is allowed to shift his/her attention from operating a highly or fully-automated vehicle. However, the driver has to remain alert in order to be able to take over the driving functions without delay.
During the operation of the automated driving regime full responsibility rests on the manufacturer.

Italy
Articles 46 and 141 of the Road Traffic Code prescribe that:
- a vehicle must be always operated by a human;
- the driver has to ensure full and constant control over a vehicle.

Russia
According to Traffic regulations (clause 1.2) the driver is required to be inside a vehicle and personally operate it. Herewith in 2018, the Government legalized realization of the experiment on the trial operation of highly-automated vehicles on public roads.

Thus, from the list of above-mentioned countries only Germany is most ready for greater autonomy from the legal point of view. In other countries the operation of SAE level 3 and above vehicles is still outside the legal environment.

It is necessary to realize that legal regulation of AV operation is quite extensive and it goes beyond traffic rules. It comprises a broad range of issues related to administrative and criminal liability, compensation for harm, insurance law, data security, and others.
Let us turn our attention to a debatable point of legal problems that appear to be the main obstacles for automated driving.

To address security problems of AVs the interdisciplinary research program "BRidging gaps for the adoption of Automated Vehicles" (BRAVE) was rolled out within the framework of the European Union program "Horizon 2020". BRAVE specialists pointed out that two legal issues represent special interest for potential users of AV. They are responsibilities (in case of an accident) and confidentiality or data protection (Johnsen, 2017).

The conducted public opinion poll has revealed the following results. 91 per cent of respondents expressed confidence about the fact that in the nearest future autonomous vehicles will become widespread. Herewith 66 per cent expressed doubts about autonomous vehicle security. These doubts are connected with unwillingness to entrust control to a computer (31 per cent), the possibility of a computer system error (60 per cent), or inability to get full control over transportation (45 per cent). The attained results are not unique and fit the data got in the course of similar investigations in other states (Pauzie, 2016; Šurdonjaa, 2020).

Our poll has revealed that the level of trust towards an AV is in direct proportion to the level of its automatisation. The lowest level of trust is expressed towards fully autonomous vehicles that do not even involve a person who can take control in case of emergency. On the contrary, the highest level of people's trust (81 per cent) is shown towards partially autonomous vehicles (self-parking, Adaptive Cruise Control, and so on). Other investigations pointed at the fact that in many cases drivers of Tesla were sleeping instead of keeping an eye on the safety of traffic (Lee, 2020). These are the facts that generate scepticism and even negative attitude towards automated vehicles.

Also, the respondents were asked a question whether they admit a possibility that by the year 2050 autonomous vehicles will substitute the

traditional ones, 96 per cent of the respondents answered negatively. It illustrates that citizens pursue a prudent approach in the given issue. It can be explained in a logical way from a psychological perspective. From early childhood we teach children to make decisions independently and bear responsibility for them. The driver's life and health depend on his or her decision-making. That is why it is so psychologically difficult for a human to entrust the car with these functions. These conclusions do not allow us to agree with Gary Marcus's viewpoint that in the nearest decade AVs will accomplish the level of excellence which will lead to the prohibition of manual driving on a legal basis (Marcus, 2012).

Various scientific publications that touch upon the legal aspect of this issue delineate the general range of problems and do not raise any specific issues. Generally, we concur with other researches on the main legal issues. But we would like to emphasize some particular challenges which must be addressed legally.

1. Weather conditions challenge. The researches point out the fact that many of automatic systems and sensors that ensure autonomous driving mode operate properly only under optimal weather conditions or during daylight hours (Bartuska, 2020). It is also said that most part of test drives is conducted in sunny weather that is far from reality (Rehrl, 2018). A special concern is raised around this issue in Russia since its road and the climatic environment is characterized by extended periods of negative temperatures (up to 8-10 months per year); significant pollutions of road pavement that prevent automatic identification of road markings; slippery roads in winter, spring, and autumn; two-lane roads which require wrong-way driving in order to overtake vehicles that move in the same direction; significant road unevenness causing accidents (Buznikov, 2019).

In the beginning, it may seem that weather challenge represents a technical problem rather than the legal one. However, one can imagine such weather conditions (hurricane, tropical downpour, hail, blizzard) that are extreme for automatic driving. In other words, under these weather conditions, the automated technology does not guarantee safe driving. These weather conditions are entitative, and this problem exists also in aviation when a flight is delayed. In this respect two questions arise: 1) what actions will the autonomous system take to escape the accident: control transfer to the driver, complete stop, cancellation of the further trip, or its continuation? 2) In case of an accident on account of sudden weather changes will it be considered force majeure circumstances and who will be responsible for it? Hence, a legal problem arises. It is necessary to regulate extreme weather conditions in certification for a vehicle.

2. The issue of car-sharing and maintenance liability. It is commonly accepted that the deployment of autonomous vehicles is a substantial benefit for car-sharing companies (Pakusch, 2018).

Herewith as contrasted with conventional cars with traditional components (engine, transmission, and so on), AV is much more technically complex. It is a set of highly-complex systems that ensure autonomous driving. The failure of the system has a direct impact on road safety. In case of a privately owned vehicle and responsibility for its regular maintenance rests with the owner.

In a car-sharing industry, this responsibility a priori lies with corresponding companies that operate their fleet. But active use of car-sharing vehicles which are often given in rent raises a question of responsibility for the technical condition of the car that ensures the client's security. Dealing with AV this responsibility increases. This must be enshrined in law. Car sharing companies must be obliged to perform a regular diagnostic assessment of vehicle systems.

3. The problem of making the final decision: is it up to the human or technical devices. In 2002 there was an aircraft crash in which Russian airliner collided with the DHL cargo aircraft over Lake Constance in Germany. According to the official investigation of The Interstate Aviation Committee, the cause of the accident is the ambiguities in the procedures regarding the use of TCAS and the controller's instructions. The traffic collision avoidance system instructed the crew to climb whereas the controller ordered them to descend. Nowadays the issue of the priority given to the human or automated system is not addressed in international and national instructions that regulate flights.

The same problem may be associated with autonomous vehicles. It is generally accepted that in case of emergence the driver must intervene in the process in order to avoid an accident as well as he or she must not sleep or watch videos during the vehicle movement (Lee, 2020). Thus, the final decision about accident prevention remains with the human. At the same time in case of emergency existing autonomous braking system and lane-keeping control take over vehicle control from a human. It may be assumed that the driver could consider a certain situation to be critical relying on his or her subjective sensations, so he or she shifted to manual driving and failed to escape an accident. Herewith from the objective point of view, the

situation was not critical and the autonomous system could have managed with it according to indicators. So, this dilemma between the human and automation also raises the issue of liability.

4. The driver's qualification. It is known that any advanced system which facilitates driving involves loss of driver qualification. To provide an example we can imagine a person who has been driving a car with automatic transmission for a long period of time but was offered to drive a manual transmission car. It is unlikely that this skill would revive, especially in a stressful situation. The same thing will be observed with automatic parking when the ability of manual parking would be lost.

A similar problem which is generally acknowledged is also typical for aviation. With the mass use of autopilot the airline policy is aimed at reducing flight training time in a manual mode. Consequently, pilots are losing their manual flying skills. However, pilots are obliged to practise emergency situations and manual flying.

If to consider this situation in terms of autonomous vehicles, the following question arises. After being out of practice of manual diving for a long period of time will the driver possess the necessary qualification to take control especially in a stressful emergency situation? Moreover, scientists emphasize that driving highly AV appears to be tedious in the long run which reduces situation awareness and it may intensify the driver's drowsiness (Aria, 2016).

In this case introduction of a special driver's licence is possible. It is also important to issue a legal norm on the requirement to pass regular driving tests. The problems of driver qualification and prevention of its loss should be addressed by means of law until the level of automation approaches the level of an automatic lift.

5. Liability for the road traffic offence. In practice, it may happen that an automated driving system fails to recognize a road sign behind the leaves or another vehicle, or because the sign is covered with the snow or for the reason of existing time restrictions including passing a road traffic accident. In this case, one automatic device (traffic enforcement camera) will write a ticket to another one (self-driving system).

In spite of general similarity and clarity for the human driver, road signs (including their size), as well as colour of road marking, type of traffic lights in different countries may vary a little. It also can be the reason for the road traffic offence.

This poses the question of liability for a road traffic offence which takes place in a self-driving mode. We assume that the driver must not take responsibility for such violations since the automated system does not imply continuous control over the speed limit and compliance with traffic rules.

6. Unhampered information exchange. Data protection appears to be one of the most significant aspects of dealing with AV operation. This refers, firstly, to data confidentiality which disclosure threatens privacy and leads to the necessity of their protection. Secondly, it implies the threat of cyber-attacks including terrorist ones on data.

We would like to touch on the legal aspect of data exchange which fosters secure environment when operating AVs. According to researches' opinion, the following objectives should be addressed: informing the nearest service stations or emergency response services about impairment and related road traffic accident; collection of statistical data on the most frequent causes of premature failure under certain operational circumstances, which will facilitate predicting of the possibility of failure, warn the driver, and anticipate the activity of service centers (Makarova, 2018). In other words, unhampered information exchange must be organized.

It may be complicated by the fact that a car can be used in several countries within one day taking into account that vehicle manufacturers will also differ. In this case, there must be no typical for mobile devices conventional conflict of interest between iOS and Android operating systems connected with application and device management and others. Contradictions between GPS and CLONASS are also known.

For the purpose of ensuring transport security when operating AVs, it is necessary to create a transparent legal environment for unhampered information exchange regardless of national legislation, vehicle manufacturer, point of use, and other indicators.

7. The issues of criminal liability that need to be differentiated according to the level of vehicle automatization. It has been estimated that 54 per cent of respondents has experienced the use of partially-autonomous vehicles that is to say the vehicles with intelligent driver assistance system. Herewith 84 per cent stated that in case of personal injury caused by operating such a vehicle the driver must not take criminal responsibility as it is to be laid on the manufacturer. Only 11 percent pointed at the driver's blame, and 5 per cent indicated reciprocal responsibility of the driver and

manufacturer. These data suggest that the respondents (all of them are drivers) tend to take away responsibility for harm caused by the use of such intelligent systems. In fact, in these cases, the vehicle does not drop out of the driver's control as he or she is just supported by the computer. It is the driver who must control driving and if necessary to apply emergency brake and discharge automated "assistants". That is why in the vast majority of cases the driver is subject to criminal liability, let us say, for vehicle-pedestrian collision who suddenly appeared in front of the car performing automatic parking.

Cases with a fully-autonomous system should be considered differently. Though two situations may occur. The first one implies full autonomy of a vehicle that does not require safety monitoring and human interference in case of emergency. The second situation implies partial autonomy which requires the presence of a human supervisor who is obliged to take control in case of emergency. In the first scenario, there is no driver and its operation is fully provided by machine intelligence. If the operation of this vehicle leads to personal injury or property damage, individuals who are in charge of security must bear responsibility. Examples may include an automobile designer, manufacturer (auto maker, vehicle assembler, and vehicle mechanical technician), owner, person in charge of regular maintenance and release on the road, and so on. Depending upon the cause of an accident the scope of these persons may vary significantly. With reference to AVs, it is very important to enshrine in law tougher requirements on vehicle inspection and vehicle pre-trip inspection. Manufacturers, owners, and other persons of similar scope will bear criminal responsibility according to general rules on the infliction of harm notwithstanding their involvement with autonomous vehicles if their action (inaction) causes personal injury. We suppose that within this approach heightened danger to the public of AV is not taken into account. So, it compels to introduce into criminal law a particular norm on responsibility for manufacturing and operation of AVs.

When AV is controlled by a human (inside the vehicle or in the remote mode) he or she is liable to take definite actions in case of emergency (for example, to apply emergency brake and so on). From a legal perspective, this person cannot be regarded as a driver since it is a person who operates a vehicle. Actually, the driving process is performed by a computer (machine intelligence). The human's role consists in the necessity to intervene at risk of an accident. Therefore, in cases when such a supervisor makes a mistake, he or she cannot bear responsibility as a driver. In the Criminal Code of the Russian Federation responsibility of a driver and other road users varies widely (articles 264 and 268 of the Criminal code of the Russian Federation). However, there are no grounds for reducing the responsibility of such persons. That is why we suggest that it is essential to make it a criminal offence for people who are in charge of supervising the autonomous vehicle safety.

Those states where criminal corporate liability is admissible hold promise for quick adaptation of criminal legislation to the conditions of using AV. It stems from the fact that it is virtually impossible to identify a particular person who has made miscalculations in engineering, manufacture, or software configuration. Under such conditions, no individual can be arraigned on a criminal charge. Institution of criminal corporate liability is a way out of the situation for ensuring criminal legal protection of these social relations.

One more problem to be resolved is the issue of responsibility of AV passengers. Namely, does the passenger have to pay attention to faulty operations of a vehicle and take any actions without a driver? A passenger by reason of the specific nature of his/her legal status cannot and must not intervene in the vehicle control system. This possibility must not ever exist since it will cause another actual danger that is intended infliction of property danger (a vehicle or freight) or harm to a passenger. This may refer to hooliganism as well as crimes of terrorism. However, a passenger should be able to stay alert. Operation of autonomous vehicles should allow for a button communication device to contact a person who can intervene in the driving process. Moreover, on the basis of analogy with rail transport an emergency brake valve or its alternative must be engineered to take actions in extreme circumstances.

Since autonomous vehicles operate with the help of software, one of security threats in this case is connected with the risk of hacking, modification of data, and other manipulations. These actions may intentionally or by negligence cause personal injury or property damage. In the Russian criminal code responsibility for such actions is envisaged in Section 4, Article 272 as illegal accessing of legally protected computer information if this act has resulted in destruction, blocking, modification, or copying of computer information, or caused serious consequences or the threat of their appearance.

The matter of responsibility for legal accessing of this information that has resulted in similar consequences will be resolved in a different way. For instance, a person who performs vehicle maintenance had incorrectly installed or updated software which resulted in infliction of injury to

health by negligence will be liable to criminal proceedings according to general norms (Articles 109,118 of the Criminal code of the Russian Federation).

Summary

On the basis of the conducted research we propose:
1. To institute rules of operation of fully or partially autonomous vehicles at the legislative level.

2. To improve international and national legislations in the sphere of operating autonomous vehicles, to enshrine at the statutory level responsibility of an owner of AV or a car-sharing vehicle to perform its regular preventive maintenance and enforce vehicle inspection requirements; introduce a special driver's licence for individuals that operate partially autonomous vehicles, and to issue legal norms on the necessity to pass regular driving tests (including defensive driving).

3. It is necessary to create a transparent legal environment for unhampered information exchange regardless of national legislation, vehicle manufacturer, point of use, and other indicators.
4. Differentiating criminal liability for harm inflicted by autonomous vehicle four categories of persons should be singled out in the criminal legislation: drivers; those who are in charge of traffic security; those responsible for ensuring vehicle operation safety (a manufacturer, an owner, a person who performs vehicle maintenance, and others); other persons that intervene in the driving process.

5. In those states where the institution of criminal corporate liability is not stipulated it is necessary to consider its adoption in respect to offences with the involvement of autonomous vehicles.

Conclusions

The conducted research has revealed that current legislation has not adjusted yet to the use of autonomous transport and to responsibility for harm inflicted in the course of its operation. There are still a number of challenges that are not legislated.

At present, it is possible to implement imposition of criminal responsibility for the harm inflicted as a result of the operation of fully or partially autonomous vehicles through the application of rules existing in criminal legislation. It is referred to basic elements of crime of infliction personal injury or property damage which are stipulated in legislation of any state as well as general liability rules for transport crimes. However, there are substantial difficulties with the identification of the subject of crime and his/her responsibility. Moreover, heightened danger to the public on the part of autonomous vehicles is not taken into account. In this respect, it seems advisable to address this problem through the introduction of a particular norm on criminal responsibility for manufacturing and operating autonomous transport.

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