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Civil Liability for Damages Caused by Unmanned Vehicles in Russian and Foreign Law

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Abstract: The paper is devoted to the identification and exploration of the legal regime of unmanned vehicles as objects of civil rights. The purpose of the study is to develop an adequate mechanism for the legal regulation of relations using innovative digital technologies (unmanned vehicles) in the transport industry. To achieve this goal, the following tasks were set: 1) to analyze the provisions of the current legislation regulating relations regarding the use of unmanned vehicles; 2) to determine the features of the civil law regime of unmanned vehicles as an object of civil rights; 3) to identify the conditions of liability for damages caused by using unmanned vehicles.

The main issue with identification of unmanned vehicles as objects of civil rights is the broadness and vagueness of the terms used in the legislation, including the questionable term *vehicle*. The category of unmanned vehicles is not precisely defined and might or might not include not only unmanned transport, but also such objects as drones, wheeled robots, etc. The study proposes new regulation with identification of its scope and clear principles for the discernment of unmanned vehicles as means of transportation.

For the development of new regulation, the issue of liability is especially critical. The study shows how the inclusion of strict liability, risk-balancing, and other mechanism of liability allocation can influence the norms, and how governing bodies in different countries apply strategies that include the legislative methods, self-regulation, and the usage of existing liability models.

Keywords: vehicle; unmanned transport; autonomous vehicle; artificial intelligence; unmanned device; digitalization of the transport industry; unmanned aerial vehicles; intelligent transport system

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Contents

I. Introduction

One of the long-term goals of the Transport Strategy of the Russian Federation until 2030[1] is the digital and low-carbon transformation of the industry and accelerated introduction of new technologies. The most important task for the formation of the Unified Backbone Network in this strategy is the preparation of the infrastructure and telecommunication components of key road, railway, and inland waterways for the operation of unmanned transport.

[1] Order of the Government of the Russian Federation No. 3363-R dated 27 November 2021 "On the Transport Strategy of the Russian Federation until 2030 with a forecast for the period until 2035." Collection of Legislation of the Russian Federation, (2021). No. 50 (Part IV). Art. 8613. (In Russ.).

In connection with the projects implementation in the fields of unmanned vehicles and artificial intelligence in the transport industry and considering the widespread introduction of new technologies and the need for their unhindered application, it is necessary to develop an adequate mechanism for legal regulation. Currently, experience is being gained in introducing innovative digital technologies into the transport industry. Therefore, it is important to know scientifically the categories used, to generalize best practices, to analyze the current legislation regulating the area under consideration, and to determine trends in its development. Certain problems that need solutions can be identified when developing rules and regulations for the use of unmanned vehicles.

Moreover, it is important to determine the grounds and conditions of civil liability imposed in the event of accidents involving unmanned vehicles, including the issues of insurance.

This issue is not the only one and it is mainly related to how the operation of unmanned vehicles should be carried out, which is based on the definition of its civil law regime. An important point in determining the legal regime of unmanned vehicles are the rules of admission of unmanned vehicles to operation, while the most urgent is the need to establish rules for the operation of these types of transport, standards and safety criteria for the operation of unmanned vehicles and their control, and methods for regulating the use of unmanned vehicles on the roads, monitoring of their compliance with traffic rules, speed limits, etc.

In addition, it is essential to establish principles for protecting users' personal data when using unmanned vehicle technologies, to develop and establish procedures for identification and subsequent authentication of users when employing innovative digital technologies in the operation of unmanned vehicles.

The purpose of the study is to develop an adequate mechanism for the legal regulation of relations using innovative digital technologies (unmanned vehicles) in the transport industry. This will facilitate a comfortable living environment, develop a transport and energy infrastructure, and ultimately contribute to strengthening the economic security of the State through effective transport connectivity in the

country. To achieve this goal, it is necessary to analyze the provisions of the current legislation regulating relations regarding the use of unmanned vehicles, determine the features of the civil law regime of unmanned vehicles as an object of civil rights, and identify the conditions of liability for damages caused by using unmanned vehicles.

II. Methodology

The research is based on review and analysis of the provisions of legal, technical, economic sciences, as well as studies of empirical material and judicial practice. The main research methods include general philosophical methods of deduction when the authors explored general legal provisions and their application to certain types of objects of civil rights, primarily vehicles, induction when the authors examined the features of the legal regime of certain types of unmanned vehicles and subsequent identification of general principles, analysis and special legal methods including the formal legal method, the method of legal modeling and the methods of comparative law analysis.

III. Analysis of Current Legislation in the field of Regulation of Relations regarding Unmanned Vehicles

In the Russian Federation, increased attention is being paid to the development of the transport industry in the context of the economy digitalization. Innovative technologies are considered as one of the most important tools for solving transport problems, as well as establishing and improving the connectivity between various regions of a large country.

To date, many documents highlighting the importance and growing role of the use of unmanned vehicles in the development of the country's economy in general and the transport industry in particular have been adopted and are in force in the Russian Federation. Primarily these documents include program documents, strategic planning documents, documents aimed at stimulating innovative development and facilitating scientific research, including documents regulating the use of unmanned

vehicles,[2] as well as industry strategic planning documents of the Russian Federation.[3]

The Government of the Russian Federation approved the Concept of Ensuring Road Safety with the Participation of Unmanned Vehicles on Public Roads[4] (hereinafter referred to as the Concept). An analysis of the Concept allows us to conclude that the term "unmanned vehicle" is not homogeneous. Such vehicles include both highly and fully automated vehicles that can be driven without human intervention in an unmanned mode using an automated driving system. However, highly automated vehicles can be driven by a human as a backup option, while fully automated vehicles do not require human intervention in their operation. Conventional automated vehicles controlled by humans using technology are not classified as unmanned vehicles if they have a low (1st and 2nd) level of automation. The 3rd, 4th and 5th levels of

[2] *See* Decree of the Government of the Russian Federation No. 1596 dated 20 December 2017 (as amended on 16 January 2023) "On approval of the state program of the Russian Federation 'Development of the transport system.'" Collection of Legislation of the Russian Federation, (2018). No. 1 (Part II). Art. 340; Order of the Government of the Russian Federation No. 2146-r dated 31 December 2009 (as amended on 3 March 2022) "On approval of the program of activities of the State Company 'Rossiyskie avtomobilnye dorogi' for the long-term period (2010–2020)." Collection of Legislation of the Russian Federation, (2010). No. 7. Art. 765; Decree of the Government of the Russian Federation No. 1415 dated 26 November 2018 (as amended on 7 February 2022) "On conducting an experiment on trial operation of highly automated vehicles on public roads" (together with the Regulation on conducting an experiment on trial operation on public roads of highly automated vehicles). Collection of Legislation of the Russian Federation, (2018). No. 49 (Part VI). Art. 7619, etc.

[3] *See* Order of the Government of the Russian Federation No. 20-r dated 17 January 2020 "On approval of the Strategy for the Development of the Electronic Industry of the Russian Federation for the period until 2030." Collection of Legislation of the Russian Federation, (2020). No. 4. Art. 410; Order of the Government of the Russian Federation dated 21 June 2023 No. 1630-r "On approval of the Strategy for the Development of unmanned aviation in the Russian Federation for the period up to 2030 and for the future up to 2035 and the action plan for its implementation," etc.

[4] Order of the Government of the Russian Federation No. 724-r dated 25 March 2020 "On approval of the Concept of ensuring road safety with the participation of unmanned vehicles on public roads." Collection of Legislation of the Russian Federation, (2020). No. 13. Art. 1995.

automation refer to automated driving systems and they are defined in the Concept as unmanned vehicles.

When determining the grounds for liability for damage caused due to the use of unmanned vehicles, the Concept proposes to take into account both the qualitative characteristics of the object itself, and the state of the road transport infrastructure, as well as the participation of the driver in driving.

In the transport industry, various experimental legal regimes have been established.[5] Recommendation systems themselves and intelligent decision support systems (technologies that make independent decisions based on environmental data used, for example, in service robots, unmanned vehicles) are classified by current legislation as artificial intelligence technologies.[6]

These documents are mainly of a conceptual or strategic nature, aimed at establishing experimental legal regimes, and they do not contain rules that would make it possible to unambiguously determine the legal regime of unmanned vehicles and establish the conditions of liability for damage caused during their operation. Thus, the development of the legal framework for the use of unmanned vehicles in Russia has not yet been completed, and some rules and regulations have not yet been established. Addressing these issues requires a comprehensive approach and participation of various regulatory authorities.

[5] *See* Decree of the Government of the Russian Federation No. 309 dated 3 September 2022 "On the establishment of an experimental legal regime in the field of digital innovations and approval of the Program for an experimental legal regime in the field of digital innovations for the operation of highly automated vehicles." Collection of Legislation of the Russian Federation, (2022). No. 12. Art. 1817; Decree of the Government of the Russian Federation No. 1849 dated 17 October 2022 (as amended on 17 April 2023) "On the establishment of an experimental legal regime in the field of digital innovation and approval of the Program for an experimental legal regime in the field of digital innovation for the operation of highly automated vehicles in relation to the implementation of the initiative 'Unmanned Logistics Corridors' on the public highway of federal significance M-11 'Neva'." Collection of Legislation of the Russian Federation, (2022). No. 43. Art. 7409, etc.

[6] Order of Rosstat No. 538 dated 29 July 2022 (as amended on 21 November 2022) "On approval of forms of federal statistical observation for organizing federal statistical observation of activities in the field of education, science, innovation and information technology." ConsultantPlus Law Reference System. The document was not published.

At the same time, an analysis of current regulatory legal acts shows that a larger number of norms and rules are regulating unmanned aerial vehicles that are fully automated, since they pose the greatest threat to safety, despite them being one of the breakthrough technologies, playing crucial role in the technological development.[7]

Acts aimed at regulating relations regarding the use of unmanned aerial vehicles, including unmanned aerial vehicles, can be divided into a separate group. While the Ministry of Labor and Social Protection of the Russian Federation has adopted a professional standard for workers operating unmanned aerial vehicles, it has not yet been adopted for workers servicing unmanned vehicles. Therefore the employer is forced to rely on outdated regulations that, taking into account the rapid development of artificial intelligence, do not meet the modern needs of society (Blagodir, 2023, pp. 19–22).

Thus, at the present stage, most of the regulatory legal acts regarding the use of unmanned aerial vehicles deal with regulating operation of unmanned aircraft: basic requirements have been established for their development, production, operation, maintenance, and access to the ability to control such a device. Many acts contain provisions prohibiting the use of unmanned aircraft either in a certain territory or over a certain object. These restrictions can be either permanent or temporary. Relations regarding the use of other unmanned devices, including other types of vehicles, are more unsettled.

The acts adopted are primarily of an administrative nature and contain mainly mandatory norms. At the same time, as a rule, the peculiarities of civil law regulation of the relevant relations are not highlighted. Article 128 of the Civil Code of the Russian Federation contains an exhaustive list of types of objects of civil rights where neither unmanned vehicles nor artificial intelligence are named. Thus, it is currently relevant to find an answer to the question of what types

[7] *See* The Air Code of the Russian Federation No. 60-FZ dated 19 March 1997. Collection of Legislation of the Russian Federation, (1997). No. 12. Art. 1383; Decree of the Government of the Russian Federation No. 658 dated 25 May 2019 (as amended on 12 August 2022) "On approval of the Rules for state registration of unmanned civil aircraft with a maximum take-off weight from 0.15 kilograms to 30 kilograms imported into the Russian Federation or produced in the Russian Federation." Collection of Legislation of the Russian Federation, (2019). No. 22. Art. 2824, etc.

of existing objects they can be attributed to or whether the allocation of their independent types is required. In particular, special rules regulating the issues of liability for damages caused through usage of unmanned aerial vehicles, including the vehicles that can be classified as unmanned vehicles, are not developed.

IV. The Civil Law Regime of Unmanned Transport as an Object of Civil Rights

The difficulty of determining the legal regime for unmanned vehicles is associated with several factors. First, it is necessary to determine whether unmanned devices are vehicles under current legislation. Second, an important factor is the establishment of a legal regime for the technologies that define a specified device as unmanned. In this sense, it is also problematic to define artificial intelligence and its technologies as objects of civil legal relations. At the same time, it is impossible to identify the categories of an unmanned vehicle and artificial intelligence. Artificial intelligence can be objectified as intellectual property, while an unmanned vehicle is a thing in which this result of intellectual activity can be embodied. However, this is not a mandatory requirement for unmanned vehicles. Therefore, it is certainly important to develop the norms on artificial intelligence, but this alone will not fully determine the specifics of the legal regime of unmanned vehicles. In addition, it is important to determine the subject of responsibility for the damage caused by unmanned vehicles. Consequently, the concept of the owner of a source of increased danger should be reconsidered.

In the literature (Ananenko, 2022, pp. 71–74), unmanned vehicles are defined as a subtype of vehicles that has certain qualitative characteristics, namely:

— autonomy (automation) of control;

— a high-tech nature and the need for special education and training for subjects managing them;

— the need for the operation of an unmanned vehicle within a certain system, which also includes means of control and monitoring;

— classifying such a vehicle as a source of increased danger.

The vehicle itself is considered to be a thing as an object of civil law. It is a composite thing. The activity of operating the vehicle, but not the vehicle itself, can be recognized as an activity that creates an increased danger to others.

According to the judicial interpretation of Art. 1079 of the Civil Code of the Russian Federation, any activity the implementation of which creates an increased likelihood of causing harm due to the impossibility of full human control over it, as well as activities involving the use, transportation, storage of objects, substances, and other objects of production for economic or other purposes, having the same properties[8] can be regarded as the source of increased danger.

The spreading and increased danger of drones led to proposing unification of the judicial practice decisions to include to the objects enlisted in Art. 1079 of the Civil Code of the Russian Federation new sources of increased danger, such as remotely controlled vehicles, drones, quadcopters, etc. (Antonov, 2021, pp. 7–10). However, it seems that identifying the activities involving the operation of unmanned vehicles as creating an increased danger to others is possible under the current norms and judicial practice, since the law does not contain an exhaustive list of sources of increased danger.

The definitions of *a vehicle* and *transport* used in civil legislation are not stipulated in the Civil Code of the Russian Federation. It has been noted in the literature that in civil law a unified approach to understanding a vehicle cannot be developed, since this definition is used in various institutions of civil law and the term *vehicle* is defined in each specific case taking into account the peculiarities of emerging legal relations, in particular, property, contractual or tortious. At the same time, a decisive role in defining a vehicle in a particular legal situation is given to the court and judicial practice (Martynov, 2005, p. 38).

In the legal literature, many attempts of defining a vehicle have been made, as a rule, in relation to specific types of legal relations. For

[8] Resolution of the Plenum of the Supreme Court of the Russian Federation No. 1 dated 26 January 2010 "On the application by courts of civil legislation regulating relations under obligations resulting from harm to the life or health of a citizen." Bulletin of the Supreme Court of the Russian Federation, (2010). No. 3.

example, the subject of a vehicle rental agreement involves technical devices, the use of which:

— is possible only with qualified management and proper technical operation by a professionally trained crew;

— intended for the transportation of goods, passengers, luggage, or towing objects and capable of moving along with them;

— possessing the properties of a source of increased danger (Em, 2011, pp. 315–383).

It was proposed to define a vehicle that is the object of a lease agreement as a vehicle, the ownership and use of which requires its management and ensuring its proper technical operation (Braginsky and Vitryansky, 2000, p. 505).

In current legislation, definitions of a vehicle are given in various regulatory acts of an administrative nature. It should be borne in mind that their content also varies depending on the specifics of social relations included in the subject of regulation of a particular normative legal act.

Under Federal Law No. 16-FZ dated 2 September 2007 "On Transport Safety,"[9] vehicles are defined as devices intended for the transportation of individuals, cargo, luggage, hand luggage, personal belongings, animals, or equipment installed on the said vehicles and devices in the meanings defined by transport codes and charters. This law does not specifically name unmanned vehicles, although other types are listed.

When referring to self-driving vehicles, such terms as autonomous vehicle, highly automated vehicle, driverless car, unmanned vehicle, fully automated vehicle, robotic car, self-driving vehicle, unmanned aerial vehicle are used.

Unmanned devices intended for transportation can be divided into unmanned vehicles, unmanned aircraft, unmanned wheeled vehicles for road delivery, etc. Obviously, these objects, on the one hand, must have different legal regimes (requirements for registration, certification, recognition or non-recognition as a vehicle, permission to drive, etc.); while in general, as objects of civil rights, they can have similar features

[9] Collection of Legislation of the Russian Federation, (2007). No. 7. Art. 837.

as well as differences. In addition, current regulation refers autonomous vehicles, and forklifts for transport terminals to autonomous devices such as autonomous rail transport and autonomous water transport.

Prof. Evgeniy V. Vavilin rightly noted that the term "unmanned vehicle" is inherently inapplicable for regulating relations related to the creation and use of highly automated or fully automated vehicles, since it does not reflect an essential characteristic for a given legal object, which, in turn, leads to confusion of heterogeneous concepts of "unmanned vehicle" and "autonomous vehicle." Therefore, in order to form effective legal regimes for these objects, it was proposed to fundamentally distinguish them depending on the degree of their autonomy (Vavilin, 2023, p. 3).

The content of the terms "unmanned vehicle" and "autonomous vehicle" do not coincide, which requires determining the relationship between these two objects. In addition, the definition of an unmanned device that may include, for example, both unmanned aerial vehicles that are not vehicles, and those that are, is also questionable. Not every unmanned device can be recognized as a vehicle. Thus, it is necessary to differentiate the legal regime of unmanned devices that are recognized as vehicles under the current legislation and other unmanned devices that do not have a vehicle regime. Obviously, unmanned vehicles can be recognized as vehicles if they fall within the characteristics of vehicles as determined in the above-mentioned regulatory legal act.

Currently, the concepts of an unmanned vehicle and an unmanned aircraft are enshrined in regulatory provisions. Moreover, the concept of an unmanned aircraft is defined in the Air Code of the Russian Federation, and an unmanned vehicle is defined in the Concept of Ensuring Road Safety with the Participation of Unmanned Vehicles on Public Roads that formally narrows the category of an unmanned vehicle, in fact, to unmanned cars.

In this case, an unmanned vehicle in a broader sense can include both unmanned aircraft, unmanned vehicles and, obviously, other types of transport.

An analysis of the categories available in existing regulatory sources that denote certain types of unmanned devices allows us to conclude

that there are differences in the definition of their main features and a lack of unity in determining their legal regime.

On the one hand, this is justified by the need to consider the specifics of various types of transport and infrastructure requirements; on the other hand, it complicates the determination of their legal regime. In connection with the above, it is necessary to ensure uniformity of terminology in terms defining the category of "unmanned vehicle" and to highlight the differences in its individual types (unmanned vehicle, unmanned aircraft, and other unmanned vehicles).

It is also necessary to determine the relationship between the categories "unmanned device" and "autonomous device," including the identification of the term of "autonomous railway transport" and "autonomous water transport" in strategic documents. It may also be justified to define the category of other unmanned devices that do not have the characteristics of a vehicle.

The legal regime of autonomous devices and the legal regime of unmanned devices may have similar features, but the content of the designated categories still has differences. When developing regulations, it is desirable to use uniform terminology in order to avoid problems of interpretation of various regulations.

Currently, the operation of highly automated vehicles on public roads, as well as the consolidation of these concepts in regulatory legal acts, is still of an experimental nature. Based on the results of the experiment concerning admission of fully automated vehicles on public roads, corresponding regulatory legal acts defining legal regime for their use will be developed.

However, it is now necessary to systematize the accumulated experience, determine the relationship between definitions, and theoretically comprehend the accumulated problems of legal regulation of unmanned vehicles in order to, upon completion of the experiment, select the most adequate mechanism for legal regulation of the relations under study and resolve the fundamental issue of the possibility of using innovative objects, or prohibiting or restricting their us.

We also must not forget that the features of unmanned vehicles as objects of civil rights today cannot be determined without resolving the issue of the legal regime of artificial intelligence and its technologies.

The emergence of risks in the use of unmanned vehicles is due, among other things, to the fact that the artificial intelligence system has a high degree of autonomy and can make decisions independently (Russkevich and Tikhomirov, 2023, pp. 35–47). It seems that, in general, digital objects, including artificial intelligence, are not new independent objects of civil rights today. They can be objectified as already named objects, considering the peculiarities of their fixation in the digital environment.

V. Conditions for Liability for Damages Caused when Using Unmanned Vehicles

The issue of liability in the field of unmanned transport (intelligent transport systems, ITS) comes from the use of artificial intelligence technologies and the possibility of imposing legal liability on persons using these technologies. For this study, the most important classifications are the classifications of legal liability based on industry affiliation, the subject held accountable, the scope of implementation of legal relations and the nature of coercive measures. In this study, the main emphasis was placed on civil, administrative, and criminal liability in the context of the development, production, implementation and use of artificial intelligence and robotics systems in unmanned vehicles.

According to the direction of legal liability, it is possible to distinguish: (1) positive liability, considered as a manifestation of social responsibility and the quality of a responsible subject who exercises self-control and conscientiously fulfils his duties; (2) negative liability for the offenses committed. The meaning of liability in law is not limited to punishment for illegal actions but is also aimed at developing a responsible attitude towards the fulfilment of duties by the subject. However, positive liability is possible only if information duties are formally defined and there is a system of incentives for their compliance. Negative legal liability, because of an identified offense, is aimed at the forced restoration of violated rights and the imposition of sanctions on the perpetrators. Consequently, it is a form of legal liability in the narrow sense.

Different industries have different legal responsibilities. Administrative and criminal liability differ in that they arise before the state when the law is violated by individuals or legal entities. Civil liability is traditionally of a monetary or compensatory nature.

In the field of development, production, operation and use of artificial intelligence and robotics systems as an element of unmanned transport, the following situations arise that require the introduction of liability:

— Errors in the development and production of artificial intelligence systems, leading to damage and violations of the law.

— Unauthorized access to the artificial intelligence system and related databases.

— An artificial intelligence system with the ability to self-learn commits an offense based on its decisions.

— Creation of artificial intelligent systems for the purpose of committing offenses or abuse of rights.

Liability may apply to an entity (an individual or a legal entity) required to comply with certain rules and precautions when creating and using objects containing elements of artificial intelligence. Until now, the legal status of developers, manufacturers, owners and users (operators) of artificial intelligence systems, including the obligations to take reasonable care, has not been defined, which creates a certain legal vacuum.

The European Parliament Resolution notes that "whereas the more autonomous robots are, the less they can be considered to be simple tools in the hands of other actors (such as the manufacturer, the operator, the owner, the user, etc.)."[10]

Additionally, the characteristics of certain types of systems and devices operating using artificial intelligence should be considered in terms of their degree of autonomy from both humans and other devices. Thus, unmanned vehicles are often not completely autonomous, but act by entering into a certain complex, interacting with other unmanned

[10] Resolution of the European Parliament "Civil law on robotics" dated 16 February 2017. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52017IP0051&rid=9 [Accessed 20.06.2023].

vehicles, a control centre, control rooms, relay nodes, etc. In many cases, it is possible to adjust and (or) control "actions" of the vehicle.

The researchers note that self-driving vehicles, as classified by the Society of Automotive Engineers SAE International, vary in terms of autonomy and driver assistance as follows:

1. zero level: completely manual control and the presence of a notification system about dangerous situations on the road;

2. first level: the driver is ready to take control at any time. In this case, the vehicle may contain the following automation elements: cruise control, automatic parking system, lane departure warning systems;

3. second level: the driver does not control the movement of the vehicle on roads with predictable traffic, but is ready, if necessary, to take control at any time;

4. third level: similar to the previous level, but does not require constant driver attention;

5. fourth level: no action is required on the part of the driver other than starting the system and selecting a destination (Korobeev and Chuchaev, 2019, p. 22).

A similar system of grading vehicles by level of automation is observed in the draft Preliminary National Standard IEC 62290-1: 2014 Control and monitoring systems for railway passenger transport in urban and suburban traffic.[11]

What has been described once again demonstrates the need for potential prosecution in connection with the development, production, operation, and use of artificial intelligent systems to take into account the degree of their autonomy from humans.

Bringing to legal liability involves establishing the grounds for liability and the elements of crimes in the legislation. One of the mandatory elements of the crime is the subject of the crime.

[11] Preliminary national Standard (draft) (IEC 62290-1: 2014) Management and control systems for railway passenger transport in urban and suburban traffic. Part 1: Principles and fundamental concepts of system design (IEC 62290-1:2014, Railway applications — Urban guided transport management and command/control systems — Part 1: System principles and fundamental concepts, MOD), (2014). Moscow: Standartinform Publ.

Traditional subjects of crimes in the field of relations related to artificial intelligence include developers, manufacturers, sellers, operators and users of solutions and devices using artificial intelligence, as well as persons committing crimes in which these objects are the subject or object of such an offense. New and still controversial subjects include the devices and solutions with artificial intelligence themselves.

Various mechanisms of responsibility can be represented in the Fig. 1.

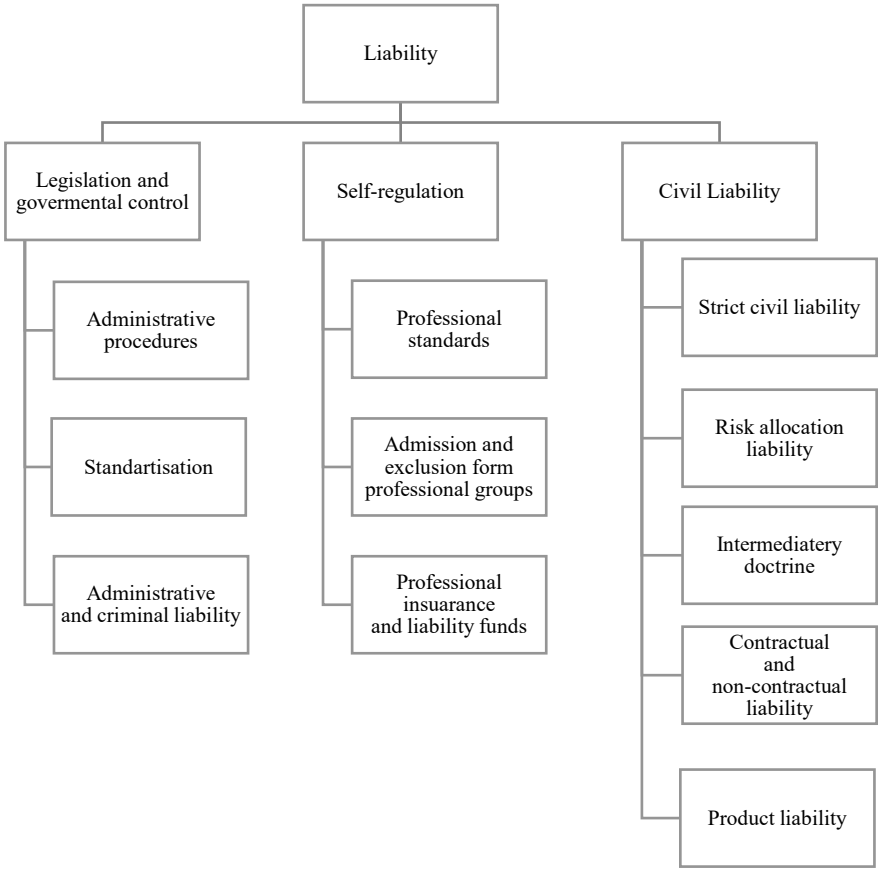

Figure 1. *Liability mechanisms and regulations. Source: Compiled be the authors*

Summarizing global approaches to liability, we can identify several different mechanisms:

— legislative methods/state control,

— self-regulation,

— civil liability.

Self-regulation is most applicable when low-risk technologies are used. As the risk increases, the level of responsibility and the strictness of the rules must increase. Additionally, the person responsible for delegating decisions to artificial intelligence should be held accountable.

EU approaches to liability are outlined in 2019 report.[12] When allocating liability, consideration should be given to the fair and effective distribution of losses, especially in cases where it is unclear whose wrongful conduct caused the loss, or who benefited from the acts that caused the harm, or who controlled the risks, or who is the person for whom insurance is most beneficial and profitable. Access to justice should not be difficult for the injured party since the evidentiary procedure is expensive and complex. Guilty and innocent liability regimes can coexist because they give the victim more tools to defend himself. The operator and manufacturer of artificial intelligence technology bear strict liability as risk controllers. In case of unforeseen losses, the operator is liable under the doctrine of agency. The strict liability policy is reflected in the regulation of Art. 401 of the Civil Code of the Russian Federation: an entrepreneur is liable as long as losses were not the result of Force Majeure.

Responsibility does not always fall on the developer/manufacturer of the ITS; sometimes the driver's actions and especially his negligence may be the cause of liability. For example, the case in Florida (Smith, 2017) where a driver was negligent and his negligence resulted in damage. The Arizona Uber case, where the operator of an autonomous vehicle was even punished for manslaughter (Shepardson and Somerville, 2019).

Liability in Germany can be assigned to the driver even if the decision was made by the vehicle. Fault is not a prerequisite for liability. In addition, the amount of compensation for damage is higher than the

[12] Liability for Artificial intelligence and other emerging digital technologies. Available at: https://www.europarl.europa.eu/meetdocs/2014_2019/plmrep/COMMITTEES/JURI/DV/2020/01-09/AI-report_EN.pdf [Accessed 22.06.2023].

usual amount: for damage to health and life, compensation should be 10 million euros instead of 5 million for ordinary cars; in the case of paid passenger transport, an additional 2 million euros are required (instead of 600 thousand euros for ordinary cars). The general approach is that at every stage of the vehicle's use it should be clear who is driving the vehicle so that the fault and liability can be assigned. Thus, even in a fully automated vehicle someone must be in control, e.g., an operator, who is responsible in case of any damage. The German Civil Code allows for the imposition of liability on an innocent person in a number of cases, including in relation to the ownership of a car. However, there are some exceptions to this rule, such as unforeseen circumstances. In addition, Criminal Code of Germany, 1982[13] states that careless behaviour must be specifically prescribed in order to be punished by law. Otherwise, criminal liability is possible only for culpable behaviour. In the case of automated vehicles, such provisions mean that only if the driver could have foreseen and could have taken steps to prevent the damage, he will be held liable.

Singapore does not recognize the responsibility of the autonomous vehicle and its operator, placing full responsibility on the driver for what happens while driving; however, it is the operator's responsibility to check that the vehicle has appropriate insurance and make a deposit with the traffic authority.

Taiwan, through adoption of the 1968 Vienna Convention on Road Traffic, recognizes the responsibility of the driver, who must be able to take control of the vehicle at any time. In 2018, Taiwan passed the Autonomous Vehicle Technology Experimentation Innovation Act,[14] but the law omitted liability issues. To minimize the risk, the law requires obtaining permission for testing from the authorities and ensuring sufficient insurance coverage. It is possible to exclude the application of certain rules for the testing process of unmanned aerial vehicles, but these exceptions cannot be made for civil and criminal liability.

[13] Available at: https://www.gesetze-im-internet.de/stgb/ [Accessed 22.06.2023].

[14] The Unmanned Vehicles Technology Innovative Experimentation Act. 19 December 2018. Available at: https://law.moj.gov.tw/ENG/LawClass/LawAll.aspx?pcode=J0030147 [Accessed 22.06.2023].

In Canada, there are local regulations such as the Ontario Automated Vehicles Pilot, that contains rules for the use of Level 3–5 automated vehicles, including transferring the whole responsibility to the driver regardless of whether the system was on autopilot or manually operated. Under the Ontario Highway Traffic Act, 1990 (Part XI, Section 192),[15] the driver is responsible for all losses and liabilities incurred by a third party due to the negligent operation of the vehicle. Therefore, the driver is always responsible, even if he did not drive the vehicle. As an additional rule, Ontario laws require vehicle insurance and liability insurance (for automated vehicles, the amount of coverage cannot be less than C$ 5,000,000), insurance must cover damage to the health and life of third parties, as well as damage to the property of a third party.

All liability rules are aimed at potential participants: designers, manufacturers, service agencies/operators and drivers. There are already some existing rules and regulations that may apply to these entities, such as Product Liability and Civil Damage Laws. However, some rules should be developed for accidents related to the nature of ITS and unmanned vehicles. Currently, Russia does not have a special law dedicated to the liability of technologies related to artificial intelligence, but it is a matter of time before such a law is proposed. Liability issues are closely intertwined with insurance issues. Thus, the current legislation should also include some rules on compulsory insurance of all the ITS subjects.

At the moment, Russian legislation has only the most basic regulation of ITS in the form of acts on data protection and legal liability for damages. Thus, in Russia, unified standards have not been developed for the use of artificial intelligence technologies in ITS. All documents regulating liability in the case of the use of unmanned vehicles are more declarative in nature. As part of national technical initiatives, an AVTONET working group has been created that, among other things, should:

1. establish safety requirements and appropriate methods for assessing the conformity of wheeled vehicles with a high degree of automated control;

[15] Available at: https://www.ontario.ca/laws/statute/90h08 [Accessed 22.06.2023].

2. establish the features of transporting goods by vehicles with a high degree of automated control;

3. establish requirements for the network interaction of vehicles with a high degree of control automation with road infrastructure and requirements for road infrastructure elements that ensure the safe operation of wheeled vehicles with a high degree of control automation on roads.

However, these instruments have not been developed so far.

If we imagine potential legislative regulation in the form of a matrix, then it is necessary to consider the possibility of different types of liability for the owner of an autonomous vehicle (in this case, we mean both the legal owner and the person who was driving the vehicle at the time of the incident), the operator of the vehicle and the creator of the vehicle software. Bringing specific persons to responsibility should be based on the general conditions for the occurrence of one or another type of liability.

Liability		Level of autonomy of the vehicle				
		1	2	3	4	5
Civil	Strict	Owner	Owner	Owner	Operator / Software developer	Operator / Software developer
	General	Owner	Owner	Owner	Owner	Owner
Administrative		Owner	Owner	Owner	Owner / Operator / Software developer	Owner / Operator / Software developer
Criminal		Owner	Owner	Owner	Owner / Operator / Software developer	Owner / Operator / Software developer

Figure 2. *Responsibility matrix. Source: Compiled by the authors*

The possibility of bringing the operator and software developer to any type of liability is based on their ability to foresee the occurrence of negative consequences. In the absence of such possibility, liability of persons other than the owner of the vehicle should not arise.

It seems possible at this stage of legislative development to use the existing mechanisms of tort liability in civil law and general provisions on criminal and administrative liability. In the future, it will be possible to develop industry standards and special norms for the selection and evaluation of regulatory mechanisms.

Also interesting is the possibility of liability of artificial intelligence as a subject of legal relations and the development of norms that would establish criteria and types of such liability.

VI. Conclusion

Based on the conducted research, the authors can make the following conclusions.

First, at the present stage, many acts aimed at regulating relations in the field of the use of unmanned vehicles are conceptual in nature: they determine the main directions of development of the transport industry, as well as the features of establishing experimental legal regimes in the area under study. At the same time, most of the regulatory legal acts in the field of the use of unmanned aerial vehicles regulate relations regarding the operation of unmanned aircraft. These acts are primarily of an administrative law nature and contain mainly mandatory norms. At the same time, as a rule, the features of civil law regulation of the relevant relations are not highlighted. In particular, special rules devoted to issues of liability for harm caused when using unmanned devices, including those that can be classified as unmanned vehicles, are not highlighted.

Second, a heterogeneous nature of the term "unmanned vehicle," contradictions in the understanding of its content are manifested in the fact that in current sources such vehicles include both highly and fully automated vehicles that can be controlled without human intervention in an unmanned mode with using an automated driving system. However, highly automated vehicles can be driven by a human as a backup option, while fully automated vehicles do not require human intervention in their operation.

Third, an analysis of current regulations has shown that it is necessary to distinguish between the legal regime of unmanned devices

(unmanned mobile vehicles) that are recognized as vehicles in accordance with current legislation as well as other unmanned devices that do not have a vehicle regime. Thus, ethereal vehicles constitute a type of unmanned devices (unmanned mobile vehicles).

Forth, unmanned vehicles can include various types of vehicles: unmanned cars, unmanned aircraft, unmanned water transport, unmanned railway transport. Currently, the concepts of an unmanned vehicle and an unmanned aircraft are enshrined in regulations. However, the concept of an unmanned vehicle is enshrined in *the Concept of Ensuring Road Safety with the Participation of Unmanned Vehicles on Public Roads* that formally narrows the category of an unmanned vehicle, in fact, to unmanned vehicles.

Fifth, analysis of the categories available in current regulatory sources denoting certain types of unmanned devices allows us to come to the conclusion that there are differences in the definition of their main features and a lack of uniformity in determining their legal regime. On the one hand, this is justified by the need to take into account the specifics of various types of transport and infrastructure requirements. On the other hand, it complicates the determination of their legal regime. In connection with the above, we believe it is necessary to ensure uniformity of terminology in terms of defining the category of "unmanned vehicle" and to highlight the differences in its individual types (unmanned vehicle, unmanned aircraft, other unmanned vehicles).

Sixth, it is necessary to determine the relationship between the categories "unmanned device" and "autonomous device," in particular, in relation to the identification of the concepts of autonomous railway transport and autonomous water transport in strategic documents. It may also be justified to define the category of other unmanned devices that do not have the characteristics of the vehicle. When developing regulations, it is necessary to use uniform terminology to avoid problems of interpretation of various regulations.

Seventh, when determining the grounds for liability for damage caused when using an unmanned vehicle, it is necessary to take into account that its safe operation is associated both with the qualitative characteristics of the object itself (a vehicle equipped with modern

technologies that allow its automated control) and with the state of the corresponding transport infrastructure, as well as with the involvement of a person admitted to driving directly in the process of driving a vehicle.

Eighth, it seems possible, at the present stage of development of legislation, to use the existing mechanisms of tort liability in civil law, in particular, liability for harm caused by a source of increased danger, and general provisions on criminal and administrative liability. In the future, it will be possible to develop industry standards and special norms for the selection and evaluation of regulatory mechanisms.

Also, in the future it could be of interest to consider the possibility of liability of artificial intelligence as a subject of law and the development of norms that would establish criteria and types of such liability. However, now artificial intelligence is not considered as a subject of law, it can be recognized only as an object.

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