



REVISTA INCLUSIONES

INVESTIGACIÓN Y CIENCIA DESDE EURASIA

Revista de Humanidades y Ciencias Sociales

Volumen 7 . Número Especial

Julio / Septiembre

2020

ISSN 0719-4706

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**LEGAL REGULATION OF AUTONOMOUS TECHNICAL MEANS:
MAIN CHALLENGES AND RELATED APPROACHES**

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Fecha de Recepción: 28 de marzo de 2020 – **Fecha Revisión:** 27 de abril de 2020

Fecha de Aceptación: 24 de junio de 2020 – **Fecha de Publicación:** 01 de julio de 2020

Abstract

The article studies some legal issues associated with the newly formed ability of technical means (physical and virtual entities) to independently make legally relevant decisions. The authors of the article have considered the issues of legal identity, algorithmic transparency and accountability, the atmosphere of trust, moral choice and emotional connection between a person and a machine since they are interdependent and somehow affect all types of autonomous technical means. This article proves that autonomous technical means resulted from the Fourth Industrial Revolution are qualitatively different from traditional objects of law (material and non-material). While preparing the article, the authors used methods of collecting and studying isolated facts, generalization, scientific abstraction, legal methods and methods of objectivity, specificity and pluralism. They have concluded that the existing approaches to the legal regulation of autonomous technical means depend on the type of technology, type of technological products or their field of application. The article proposes an alternative approach that develops new legal regulation based on cross-cutting legal issues arising from the fact that modern technical means become autonomous. This approach enables to put forward and substantiate the following thesis: to establish stable and balanced regulation, it is advisable to develop a legal regime that provides for specific control over legal relations and a special set of legal means.

Keywords

Autonomous technical means – Artificial intelligence – Automated decision system

Para Citar este Artículo:

Kuteynikov, Dmitry; Izhaev, Osmas; Lebedev, Valerian y Zenin, Sergey. Legal regulation of autonomous technical means: main challenges and related approaches. Revista Inclusiones Vol: 7 num Especial (2020): 346-356.

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Introduction

Nowadays humanity experiences the mass introduction of accumulated knowledge into practice. The period is regarded as an "the age of implementation" that involves the creation of specific products based on the research conducted in previous decades¹. These historical periods are usually called technological revolutions, during which the existing social relations transform as a result of the gradual introduction of new technical means.

The following five factors are the driving forces of the Fourth Industrial Revolution: data, algorithms, networks, cloud technologies and exponential hardware improvements². Different combinations of these factors have led to the formation and mass introduction of technical means controlled by algorithms in public life. These technical means can function autonomously and have the ability to perform independent (unmanned) actions. The mass introduction of autonomous software and hardware systems that conditioned by the current technological revolution and their integration with physical and biological objects lead to the creation of autonomous technical means capable of carrying out actions independent of people.

Within the framework of jurisprudence, technical means are traditionally considered as objects of material (movable and immovable things) and non-material (intellectual deliverables) world and have the status of legal objects. Modern technical means acquire a fundamentally new quality – autonomy. From the legal viewpoint, it is not revolutionary as the actions of a "robot vacuum cleaner" do not affect social relations and do not entail any legal consequences³.

The main objective of this article is to consider the legal regulation of autonomous technical means. To achieve this objective, we set the following tasks:

- To determine the legal properties of autonomous technical means that vary depending on the degree of their integration with a person, the level of autonomy and the ability to make independent legally relevant decisions;
- To consider legal approaches to integrating autonomous technical means into public life: a) the legal identity of autonomous technical means; b) algorithmic transparency and accountability; c) complex decisions from the viewpoint of human morality; d) atmosphere of trust in the field of human interaction with autonomous technical means; e) emotional connection between a person and a machine. Autonomous technical means that somehow participate in public relations pose a challenge for law. In some countries, unmanned vehicles are road users and independently carry out actions that are important for human life. They are complex technical means capable of independently choosing between several alternative solutions in unpredictable conditions. An increasing number of tasks is delegated to such autonomous technical means and the boundaries of their discretion expand, which can create a new way of human interaction with such technical means based on some legal independence.

¹ K. F. Lee, *AI Superpowers: China, Silicon Valley, and the New World Order* (Boston: Houghton Mifflin Co, 2018).

² E. A. Brynjolfsson, McAfee. *Machine, Platform, Crowd: Harnessing Our Digital Future* (New York: W.W. Norton, 2017).

³ S. Burton; I. Habli; T. Lawton; J. McDermid y Z. Porter, "Mind the gaps: Assuring the safety of autonomous systems from an engineering, ethical, and legal perspective", *Artificial Intelligence* num 279 (2020).

Due to technological development, legal science faces new challenges: 1) there are autonomous technical means; 2) these technical means acquire the ability to participate in public relations and make legally relevant decisions; 3) there are new ways of human interaction with objects of the material and non-material world. The above-mentioned circumstances cause several legal issues, whose solution requires the development of a qualitatively new approach to the regulation of public relations with the participation of such smart objects.

Literature Review

Many scientists and experts studied the legal regulation of autonomous technical means. For instance, Kai-Fu Lee⁴ considered artificial intelligence, its legal status and the legal regulation of autonomous equipment. E. Brynjolfsson and A. McAfee⁵ focused on robotic technology and its legal status and suggested introducing this phenomenon into the existing legal field. Barfield, Woodrow and Ugo Pagallo⁶ examined artificial intelligence, the prospects for its implementation in human life and possible legal issues. E. Awad, S. Dsouza, R. Kim, J. Schultz, J. Henrich, A. Shariff, J. F. Bonnefon and I. Rahwan⁷ presented the results of their experiment on the behavior of robots and machines and examined the issue of responsibility in cases of low-quality work conducted by technical means. Many other scientists considered these issues.

Methods

While conducting this study, we proceeded from the thesis that technical means of the Fourth Industrial Revolution pose challenges to law since they have the ability to independently make legally relevant decisions. In this regard, all legal issues are caused by the autonomy of such technical means. Thus, we decided to consider such cross-cutting issues as the legal identity of autonomous technical means, algorithmic transparency and accountability, conditions for the atmosphere of trust, moral choice and emotional connection between a person and a machine. These issues should be resolved through the development and adoption of an adequate system of legal regulation. In this regard, we deem it appropriate to highlight and consider the above-mentioned set of problems. At the same time, we understand that the autonomy of technical means causes many problems besides the ones studied in this article, but we cannot reveal them all due to the limited length of this scientific work.

Results

The legal identity of autonomous technical means

Autonomous technical means have the potential to become subjects of legal relations. Depending on the degree of autonomy, such technical means can conditionally be classified into the following three groups:

⁴ K. F. Lee, *AI Superpowers: China, Silicon Valley, and the New World Order* (Boston: Houghton Mifflin Co, 2018).

⁵ E. A. Brynjolfsson, McAfee. *Machine, Platform, Crowd: Harnessing Our Digital Future* (New York: W.W. Norton, 2017).

⁶ B. Woodrow y U. Pagallo, *Research Handbook on the Law of Artificial Intelligence* (Cheltenham: Edward Elgar Pub, 2018), 213-250.

⁷ E. Awad; S. Dsouza; R. Kim; J. Schultz; J. Henrich; A. Shariff; J. F. Bonnefon y I. Rahwan, "The Moral Machine experiment", *Nature* num 562 (2018): 59-64.

a) Technical means that have autonomy in decision-making within a certain sphere (specific territory or authority). They might participate in legal relations but are not legal subjects in a generic sense. Their list includes autonomous vehicles of Level 4 and Level 5⁸, service robots and other highly automated systems of the Internet. The responsibility for such technical means lies with traditional entities (owner, user, manufacturer, operator, etc.) depending on a specific situation.

b) Autonomous technical means that are capable of making a wide range of legally relevant decisions. Depending on the model chosen by a particular state, such technical means can be recognized as digital entities, legal entities, agents or partners whom a person voluntarily allows carrying out legally relevant actions on their behalf. Autonomous enterprises, managerial robots and satellite robots can also serve as abstract examples. Despite a wide range of their powers, responsibility also rests with traditional actors.

c) Technical means having full-fledged free will (except for some legal capacity, for example, political rights). Such technical means become subjects of law and have a special legal status close to the legal status of an individual and can protect their rights. Nevertheless, they are connected with a person and bear joint responsibility.

The full-fledged legal regulation of relations that arise during the formation and implementation of such products will require altering a wide range of legal acts. The vector of such regulation will be largely determined by social, political and economic factors.

The creation of technical means of the second (b) and third group (c) and their further integration into public life necessitates the resolution of the issue of their legal personhood. This problem has been well studied in science, fiction, cinema and computer games. Although there are many different opinions, we would like to dwell on three legal methods of endowing autonomous technical means with subjective features^{9,10}. The first method endows something with the status of a subject regardless of its essence but on public consent. The second method assumes that legal personhood is typical only of people (biological subjects) and legal entities have legal personhood only because the same people are responsible for their functioning. According to the third method, the key condition for legal personhood is rationality and understanding of one's responsibility. In this case, an autonomous technical means has an opportunity to acquire the necessary qualities and become a subject due to their technical development.

Algorithms: transparency and accountability

The autonomy of technical means is conditioned by their built-in algorithms. The decisions made by such technical means can have legal significance and a large impact on the decisions made by a person¹¹. Due to the complex technical structure of their algorithms, the logic of their functioning and the reasons for making this or that decision are difficult to

⁸ SAE International. SAE International Releases Updated Visual Chart for Its "Levels of Driving Automation" Standard for Self-Driving Vehicles. Available at: <https://www.sae.org/news/press-room/2018/12/sae-international-releases-updated-visual-chart-for-its-%E2%80%9Clevels-of-driving>

⁹ B. Woodrow y U. Pagallo, *Research Handbook on the Law of Artificial Intelligence* (Cheltenham: Edward Elgar Pub, 2018), 213-250.

¹⁰ N. Naffine, "Who are law's persons? From Cheshire cats to responsible subjects", *Modern Law Review*, Vol: 66 num 3 (2008): 346-367.

¹¹ E. A Kirillova; A. V. Pavlyuk; T. Zulfugarzade y I. A. Mikhailova, "Bitcoin, lifecoin, namecoin: the legal nature of virtual currency", *Journal of Advanced Research in Law and Economics*, num 9 (2018).

explain and understand. The subject of the relevant legal relations does not have the opportunity to assess the validity, fairness and legality of the decision taken in their relation and de facto loses the right to appeal. At the same time, the privacy of decision-making is connected with high risks of violating individual rights. To date, sufficient experience has been gained in the application of algorithms, in particular, cases of their negative impact on civil¹², political¹³, economic¹⁴ and social¹⁵ human rights and freedoms.

The transparency and accountability of algorithms still have not been unambiguously enshrined in legal acts of different states. At the same time, there are many studies on this topic in the scientific and practical sphere. In our opinion, legal regulation should ensure that a subject receives the relevant information regarding the decision made and create legal conditions for the supervision of algorithms by the competent authorities.

However, we do not claim that it is necessary to disclose information on the operation of such algorithms, which means opening a "black box". First, the provision of technical information does not fully explain the logic of decision-making. Second, it is a rather resource-intensive process and involves a wide range of actors. Third, this approach will also disclose trade secrets, which will have negative consequences.

It is better to apply measures aimed at disclosing information about the logic of decision-making in certain situations. For example, it can be input data analysis, design/code review and statistical analysis, sensitivity analysis and static explanation) (variables that determine the result)¹⁶.

To ensure the accountability of algorithms, balanced legal norms should be developed to impose the necessary and sufficient responsibilities on entities related to automated decision-making systems and regularly audit the functioning of their algorithms. For instance, the US "Algorithmic Accountability Act of 2019" and "Personal rights: automated decision systems" sent to the federal and state legislatures (California) contain some of these measures. In particular, these acts stipulate the obligation of some persons using automated decision-making systems in their activities to conduct automated decision system impact assessment during their development and use, including design and training data for compliance with the requirements of accuracy, fairness, impartiality, non-discrimination, confidentiality and security. Supervisory authorities should provide a detailed description of the automated decision-making system, its design, training capabilities, data and purpose.

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¹² J. Angwin; J. Larson; S. Mattu y L. Kirchner, Machine Bias. There's software used across the country to predict future criminals. And it's biased against blacks. 2016. Available at: <https://www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing>

¹³ The Cambridge Analytica Files. Guardian. Available at: <https://www.theguardian.com/news/series/cambridge-analytica-files>

¹⁴ Uber's New Pricing Idea Is Good Theory, Risky Business. Perma. Available at: <https://perma.cc/2T8E-J5K8>. Amazon Doesn't Consider the Race of Its Customers. Should It? Bloomberg. Available at: <https://www.bloomberg.com/graphics/2016-amazon-same-day/>.

¹⁵ A. Datta; M. C. Tschantz y A. Datta, "Automated Experiments on Ad Privacy Settings: A Tale of Opacity, Choice, and Discrimination", Proceedings on Privacy Enhancing Technologies, num 1 (2015): 92-112. Available at: 10.1515/popets-2015-0007.

¹⁶ European Parliamentary Research Service (EPRS). A governance framework for algorithmic accountability and transparency. 2019. Available at: [http://www.europarl.europa.eu/RegData/etudes/STUD/2019/624262/EPRS_STU\(2019\)624262_EN.pdf](http://www.europarl.europa.eu/RegData/etudes/STUD/2019/624262/EPRS_STU(2019)624262_EN.pdf)

The problem of difficult moral choice

The ability of autonomous technical means to make decisions that are difficult in terms of morality (the "trolley problem") requires them to interpret complex human morality formed during centuries-long evolution.

Within the framework of the "Moral Machine" project, scientists of the Massachusetts Institute of Technology conducted an online experiment embracing about 40 million people over the globe. The participants had to make a moral choice for an unmanned vehicle in a state of emergency: to hit and kill two elderly men and one elderly woman who are crossing on a "do not cross" signal or to swerve and crash into an obstacle that would result in the death of three passengers – an adult man, an adult woman and a boy. The experiment results showed that the participants considered various indicators (gender, age, pedestrian/passenger, social status, etc.) that are could be important for making the right decision. Their absolute majority opted for the following three indicators: the number of victims; a person's life is more valuable than the life of an animal; the lives of young people are more valuable than those of seniors¹⁷. From the legal perspective, it is worth mentioning that the respondents did not consider the violation of formal law as the most important factor for making a moral choice. This information makes us think about how adequately modern law reflects people's moral preferences and what approach (formal or informative) should be applied when teaching (programming) technical means of increased danger¹⁸.

Creating an atmosphere of trust in the field of human interaction with autonomous technical means

The most important task for creating an atmosphere of trust is free access to information on technical means. Everyone should be able to study the essential functioning of equipment that is potentially dangerous to life and health. The state and private sector should disclose this information and provide the necessary statistics. This also leads to the problem of objectivity in evaluating the information they provide.

Some types of autonomous technical means have no direct analogues, which complicates their integration into public life. For example, the US government's highway safety agency let Nuro from Silicon Valley to temporarily operate a low-speed autonomous delivery vehicle that bypasses human-driver safety rules¹⁹. These technical means are not equipped with a steering wheel, side and rear-view mirrors and a brake pedal, which makes them different from traditional vehicles. These objects can cause distrust due to the lack of sufficient information on their safety for human life and health. An interesting measure to form a clearer idea of how some technical means work is the method of "putting yourself in the place of a machine". Thus, the Moovellab project allows a person to feel like an unmanned vehicle. Various devices simulating computer vision are connected to a person. Such projects demonstrate the complexity of technical devices and their specific understanding of the material world, which can help people form a comprehensive attitude towards the former.

¹⁷ T. Imai, "Legal regulation of autonomous driving technology: Current conditions and issues in Japan", IATSS Research, Vol: 43 num 4 (2019): 263-267.

¹⁸ E. Awad; S. Dsouza; R. Kim; J. Schultz; J. Henrich; A. Shariff; J. F. Bonnefon y I. Rahwan, "The Moral Machine experiment", Nature num 562 (2018): 59-64.

¹⁹ P. Čerka; J. Grigienė y G. Sirbikytė, "Liability for damages caused by artificial intelligence", Computer Law & Security Review, Vol: 31 num 3 (2015): 376-389.

Each person should understand with whom they interact and when objects of the material world can act autonomously (as well as the degree of their autonomy). For example, Google Duplex, an extension of the Google Assistant, can place a phone call to the chosen restaurant and book a table there. This extension is currently functioning in 43 US states (new services have been added recently).

Thus, autonomous technical means must be equipped with appropriate identification marks, while devices imitating human features should disclose information about themselves at least in vital spheres of public life. California drones laws have already highlighted the need to install a special visual indicator inside their cockpit that would signal a switch to autonomous mode.

One study of the human-machine interaction used communication with a chatbot as an example. It demonstrated that if people do not realize that they communicate with an algorithm, the machine enters into communication with them more effectively. When a person knows the true nature of their counterparty, the above-mentioned value of this algorithm is lost²⁰.

In some cases, to increase the efficiency of autonomous technical means, there can be legislative exceptions to the rule of informing a person about the nature of their counterparty.

The emotional connection between a person and a machine

It is quite challenging to govern the issues of human interaction with material and program objects that convey the characteristics of a person or an animal. For example, the Japanese scientists built a robot with software and sensors capable of responding to bodily sensations and demonstrating different facial expressions, including a smile, pain, anxiety and other emotions typical of people²¹. The development of technical devices that are like living beings and surround people from their childhood will inevitably lead to a strong emotional connection with them. At the same time, people reserving all of their property rights for such things, including their abusive treatment or free destruction, can harm society and depreciate human rights²². Thus, such technical means will require additional legal protection commensurate with the characteristics they received and the legal status of the original object.

Discussion

Legal approaches to regulating the functioning of autonomous technical means

Currently, the legal regulation of this sphere is still being formed. Modern states make efforts to regulate this sector through the adoption of various national strategies. For

²⁰ F. Ishowo-Oloko; J. Bonnefon y Z. Soroye, "Behavioral evidence for a transparency-efficiency tradeoff in human-machine cooperation", *Nat Mach Intell*, num 1 (2019): 517-521. Available at: <https://doi.org/10.1038/s42256-019-0113-5>

²¹ Designboom. Japanese scientists develop 'blade runner' robot that can feel pain. Available at: <https://www.designboom.com/technology/japanese-scientists-develop-hyper-realistic-robot-that-can-feel-pain-02-24-2020/>

²² E. A. Kirillova; A. V. Pavlyuk; O. E. Blinkov; E. V. Blinkova y E. L. Sidorenko, "Digital inheritance of social media accounts", *International Journal of Engineering and Advanced Technology*, Vol: 8 num 4 (2019): 963-967.

instance, more than 30 countries have adopted national strategies for the development of artificial intelligence and robotics. Direct legal regulation is fragmentary and aimed at controlling certain technologies in specific areas.

In particular, the Guidelines on Regulating Robotics developed as part of the European RoboLaw project suggest regulating public relations with due regard to the specific application of certain technologies. For example, this law applies to the use of robots in healthcare, unmanned vehicles on public roads, robotic prostheses and human care robots²³. These recommendations are reflected in the Resolution of the European Parliament "Civil law on robotics". Other jurisdictions, such as Germany and the State of California in the US, have laws governing the use of autonomous vehicles on public roads. We can conclude that the above-mentioned approaches to the legal regulation of autonomous technical means are based on three main principles:

- 1) The regulation of certain technologies (artificial intelligence, cyberphysical systems, big data, distributed registries, etc.);
- 2) The regulation of using technological products (unmanned vehicles, drones, etc.);
- 3) The regulation of the specific use of certain technological means in the most crucial spheres of public life (medicine, education, transport).

The advantage of this approach is the ability to quickly form a regulatory framework for experiments and the further introduction of specific types of autonomous technical equipment into service. The legal issues discussed in this article caused by the introduction of autonomous technical means are cross-cutting, i.e. there are typical of a wide variety of fields and are virtually independent of the technology type used and the type of technological product²⁴. The formation of a stable regulatory framework governing the use of certain technologies and products is a difficult task since legislators should consider their constant development. Modern software or material products often integrate various physical objects and processes, as well as several levels of software. Therefore, the use of different legal approaches, depending on the scope of technology and its specific type, will not allow for the development of stable and full-fledged legal regulation. We believe that an alternative approach is to establish a legal regime that will govern the issues arising from the formation of autonomous technical means.

Conclusion

Thus, the mass use of autonomous technical conditions the need to rethink how to interact with these creations. These innovative technical means change public consciousness, create new social relations and transform the existing ones. If this fact is neglected in the midterm, it will lead to social destabilization and technological lag. A solution to such challenges will be significant development of legal regulation. We believe that such social relations should be regulated with due regard to legal issues arising from the autonomy of technical means. This approach requires the development of an appropriate legal regime that offers special ways of regulating legal relations and a new set of legal means. The formation of such a legal regime with due regard to industry-specific regulation will simplify the understanding of the rights and obligations of all parties to legal relations and, as a result, will become an incentive for the development of the technology sector.

²³ P. M. Morkhat, *Pravo i iskusstvennyy intellekt* (Moscow: Unity Dana Publ, 2018).

²⁴ M. Allen, Chapter 3: Artificial intelligence (AI). *The Chief Security Officer's Handbook*, (2019): 35-65.

Acknowledgments

The reported study was funded by the Russian Foundation for Basic Research according to research project No. 18-29-16193.

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