UDK:007.52:368.178:368.169:681.515:368.86:347.253

Professor Slobodan O. Jovanović, Ph.D. [1]

REGULATORY CHALLENGES OF ROBOTICS AND INSURANCE AGAINST DAMAGE CAUSED BY ROBOTS

REVIEW ARTICLE

Abstract

With the advancement and introduction of robots, the law on robotics that is yet to be developed and formed as a separate legal science, has to provide answers to numerous questions *de lege ferrenda* such as the legal position of smart, autonomous robots, the issue of robot producers' and owners' liability, termination of robots, as well as other aspects of property rights.

The emergence of a new generation of robots (capable of learning while moving and by gaining experience from environment) or autonomous vehicles, opened up a whole range of issues and challenges in terms of civil and legal liability. In this paper, the author explores different definitions of the term "robot" and the issue of civil and legal liability for damages caused by robots. Since international and national legal sources of liability, hazardous matters and hazardous activities do not cite any specific product but establish general rules and principles of responsibility and consumer protection, the author's presentation in this paper is based on the application of the legal positivism to an object called "robot".

Key words: *robot, hazardous matter, product, liability, insurance*

I. Introduction

As far back in time as 322 B.C., Aristotle, in his works *Politics*, discussed the needs for the existence of appropriate tools to help the performance of particular

[1] President of the Insurance Law Association of Serbia
E-mail: nsbob@sezampro.rs
Paper received on: April 25, 2018
Paper admitted on: May 1, 2018

activities and household management, stating "...for if every tool could perform its own work when ordered, or by seeing what to do in advance, like the statues of Daedalus in the story, or the tripods of Hephaestus which the poet says 'enter self-moved the company divine, if thus shuttles wove and quills played harps of themselves, master-craftsmen would have no need of assistants and masters no need of slaves."[2] In 1478, Leonardo da Vinci designed what is considered the first self-propelled wagon, powered by clockwork springs. He also created a drawing of the earliest recorded humanoid, his knight in armour. It is unknown whether da Vinci's sketch was ever constructed. In theory, this early robot could perform several movements including sitting up and waving. (*A Brief History of Robotics, 2016*). However, after these ideas from different periods came to light, a long time has passed and human civilization has made numerous scientific discoveries and invented various technologies that, mutually combined, with the application of a multidisciplinary approach, enabled the first automated machines and robots to be conceived and produced.

Information and communication technologies, computers and programming play a special role in the development of robotics. The example of "programming" a robot was first set by an American science fiction writer Isaac Asimov in a 1950 collection of short sci-fi stories *I, Robot*, by formulating three laws of robotics, as follows: : 1. A robot may not injure a human being or, through inaction, allow a human being to come to harm; 2. A robot must obey any orders given to it by human beings, except where such orders would conflict with the First Law.; 3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law. Here, a question may be raised as to whether these rules should be extended to some other aspects of communication between robots and environment modelled upon those happening among people (introductions, explanations about how to make decisions, etc.).

Automated machines and robots are notably introduced to replace people in performing certain hazardous actions or tasks in the production, detection and deactivation of mines and explosive devices, etc. The automation of production is accelerating around the world and thus, 74 robot units per 10,000 employees was the new average of global robot density in the manufacturing industries in 2017, whereas in 2015, there were 66 robot units. The highest robot density was 99 units in Europe, 84 units in the North and South America and 63 units in Asia (IFR, 2018). However, when these data are analysed by countries, the highest density of robot units per 10,000 employees was in South Korea (631), followed by 488 robot units in Singapore. Germany took the third place with 309 robot units, fourth was Japan with 303 robot units and then Sweden with 223 robot units, Denmark with 211 robot units,

[2] Aristotle, *Politics*, Book 1.1253b. available at: *http://www.perseus.tufts.edu/hopper/text?doc=Perseus%3Atext%3A1999.01.0058%3Abook%3D1%3Asection%3D1253b.*

and the only country in the Balkans to have rankings was Slovenia, with 137 robot units which, according to this indicator, came before Slovakia, France, Switzerland, the Check Republic and Austria (IFR, 2018).

Despite the fact that automotive industry has been the highest robot consumer from the very beginnings, other industries, such as the semiconductor industry and electronics, metals, plastics and rubber, the food industry, consumer goods, medical science and pharmaceutical industry have also found ways to expand and improve their services. In addition, non-productive application of robots is possible in the areas of safety, healthcare, cleaning of environment, space and underwater research**.** Robotics will develop more intensively in the coming decades due to the expansion of scientific fields and greater demand for a faster and cheaper way of doing simple jobs.

It should be borne in mind that robotics is characterized by a various set of features such as, for example, the Internet, which will create new dilemmas for lawyers and legislators. With the advancement and introduction of robots, the law of robotics that is yet to be developed and formed as a separate legal science, has to provide answers to numerous questions *de lege ferrenda* such as the legal position of smart, autonomous robots, the issue of robot producers' and owners' liability, termination of robots, as well as other aspects of property rights.

The emergence of a new generation of robots (capable of learning while moving, by gaining experience from environment) or autonomous vehicles, opened up a whole range of issues and challenges in terms of civil and legal liability. Existential and ethical risks represent especially sensitive area of robotics development and artificial intelligence. In the future, the robots could fully master cognitive and sensible functions of human beings and independently undertake certain actions that would not always be for the benefit of their creator. Additionally, functions and purposes of robots are defined by humans and thus, it is not surprising that on 28 July 2015, at the opening of the 24th International Conference on Artificial Intelligence in Buenos Aires, researchers released an open letter advocating a ban on offensive autonomous weapons beyond meaningful human control.[3] According to the signatories of that letter, if any major military power pushes ahead with AI weapon development, a global arms race is virtually inevitable, and the endpoint of this technological trajectory is obvious: autonomous weapons will become the Kalashnikovs of tomorrow.[4]

[3] Autonomous Weapons: An open letter from AI & Robotics researchers. Available at: *https://futureoflife.org/open-letter-autonomous-weapons#signatories,* 6. 4. 2018.

[4] On 6 April 2018, this letter was signed by more than 20.000 researchers (scientists and founders of major high-tech companies) among them being: Stephen Hawking (mathematician and physicist), Noam Chomsky (linguist and philosopher), Elon Musk (founder of *SpaceX*, *Tesla*, *Solar City*), Steve Wozniak (*Apple* co-founder) and numerous other professors of renowned US universities and institutes. Available at: *https://futureoflife.org/open-letter-autonomous-weapons#signatories,* 6. 4. 2018.

In this paper, the author explores different definitions of the term "robot" and the issue of civil liability for damages caused by robots. Since international and national legal sources of liability, hazardous matters and hazardous activities do not cite any specific product but rather establish general rules and principles of liability and consumer protection, the authors' presentation in this paper is based on the application of the legal positivism to an object and a product called "robot".

II. The Term "Robot"

Although the origin of the term "robot" is commonly associated with the American science fiction writer Isaac Asimov and his short story Runaround from the aforementioned collection of science fiction short stories, this term first appeared in 1920, in the science fiction play of Karel Capek entitled Rossum's Universal Robots (*Rossumovi Univerzální Roboti*). Thus, the term "robot" is thought to have come from the Czech word "robot" (forced labour), which should indicate the slavery of a robot as a device which serves people permanently.[5] It is a common knowledge that in that play, Capek was the first to point to the possible abuse of technology, artificial intelligence, and robot rebellion against humans.

According to the Oxford Dictionary, the word „robot" has several alternative meanings. Technical definition is that a robot is a machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer, whereas according to the sociological definition, a robot is a person who behaves in a mechanical and unemotional manner.[6] According to the Encyclopaedia Britannica, robot is any automatically operated machine that replaces human effort, though it may not resemble human beings in appearance or perform functions in a humanlike manner.[7]

Since 2013, autonomous robots have been in the focus of the French Association for Digital Science and Engineering (*Allisten*) and the French Commission for Ethics of ECT Research (*CERNA*). The aforementioned Commission adopted the definition of a robot based on its conventional features and purpose (hardware and software combination) according to which "a robot is a machine that implements and integrates: (1) capacities for gathering data through sensors that detect and record physical signals; (2) capacities for interpreting those data so as to produce knowledge; (3) capacities for making decisions, i.e. determining and planning actions on the basis of the data and knowledge; actions are intended to meet the goals

[5] R.U.R. *Encyclopaedia Britannica*. Available at*: https://www.britannica.com/topic/RUR*, 22. 3. 2018.
[6] Robot. *Oxford Dictionaries*, Oxford University Press. Available at: *https://en.oxforddictionaries.com/definition/robot,* 22. 3. 2018.
[7] Robot technology. *Encyclopaedia Britannica*. Available at: *https://www.britannica.com/technology/robot-technology*, 22. 3. 2018.

that are set by a human being most of the time, or by the robot itself, and to react to some events; (4) capacities for carrying out actions in the physical world thanks to effectors or through interfaces." (La CERNA, 2014, 12).

At the EU level, the Parliament took steps toward adopting the law on robots and thus, on 31 May 2016, the European Parliament's Legal Affairs Committee delivered to the European Commission a Draft Report with Recommendations on the Civil Law Rules on Robotics (Draft Report, 2016). This Draft Report sets forth detailed recommendations on the content of the final version of the civil law, including the definition of smart robots, production quality standard, regulations on studying, developing and using robots. Based on that Draft Report, the European Parliament adopted the Resolution[8] on 17 February 2017 recommending to the European Commission to, among other things, make a draft definition and classification of „smart robots" and include the following characteristics: (1) the acquisition of autonomy through sensors and/or by exchanging data with its environment (inter-connectivity) and the trading and analysing of those data; (2) self-learning from experience and by interaction (optional criterion); (3) at least a minor physical support; (4) the adaptation of its behaviour and actions to the environment; and (5) absence of life in the biological sense; (European Parliament Resolution, 2017, item 1).

The International Organization for Standardization – ISO differentiates between several types of robots (industrial robots, service robots, personal service robots and professional service robots and mobile robots) depending on their applications. According to the standard of this organisation "robot is an actuated mechanism programmable in two or more axes with a degree of autonomy, moving within its environment, to perform intended tasks" (ISO 8373:2012, 2.6). Within the meaning of this standard "autonomy" means ability to perform intended tasks based on current state and sensing, without human intervention, whereas "control system" means set of logic control and power functions which allows monitoring and control of the mechanical structure of the robot and communication with the environment (equipment and users).

Although all of the above definitions apply to different types of devices or machines that can independently perform certain functions, we consider that robots, as defined by the International Organization for Standardization, is a definition concise and abstract enough to include all the forms and levels of robot autonomy and automation. On the other hand, it is often difficult to predict the trend of technological development and new opportunities it will bring, which is why the adopted rules may become obsolete and incomplete relatively quickly.

Robots find their application in different areas of life and work of humans. Thus, according to the Frankfurt-based International Robotics Association, all personal

[8] European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)), P8_TA (2017)0051.

and domestic robots perform different services for their owners, and such types of robots are divided into the robots: (I) for domestic tasks (1. companions / assistants and humanoids; 2. vacuuming and floor cleaning; 3. lawn mowing; 4. pool cleaning; 5. window cleaning; 6. home security and surveillance; 7. others); (II) for entertainment (8. toy / hobby; 9. multimedia; 10. education and research and 11. others) and (III) for elderly and handicap assistance (12. robotized wheelchairs; 13. personal aids and assistive devices, 14. other assistance functions) (IFR, 2017, 47). Professional service robots are divided into: field robots (in agriculture, mining, space); professional cleaning robots; inspection and maintenance systems robots (tanks, pipes, sewers, factories); robots in construction and demolition; robots in logistic systems (autonomous guided vehicles, automated cargo handling); medical robotics (diagnostic systems, surgery, therapy, rehabilitation); for rescue and security (fire and disaster fighting robots); defence robotics (demining, unmanned aerial vehicles, unmanned ground based vehicles and unmanned underwater vehicles); underwater systems for general use; powered human exoskeletons; mobile platforms; public relation robots (hotel and restaurant robots, mobile guidance, robots in marketing, robot joy rides); other robots not specified above (IFR, 2017, 48). The foregoing classification of robots does not include other types of robots in industry, medicine, agriculture, science, etc.

III. Legal Position of Robots in Civil Law System and Liability Issue

Robots and robotized devices capable to independently manage and control their movements and/or actions may potentially pose a threat to persons and property in their surroundings. Practical application of artificial intelligence and independent learning of robots through experience and information collected from their environment, which are devoid of any human control or intervention, may lead to a material and/or non-material damage caused by a robot. This can happen when a robot in a self-learning process makes a decision to modify pre-programmed commands and actions. Then the question arises as to whether the liability of the robot is non-contractual or it can be perceived as contractual liability. The answers to these questions can be found in product safety and defective product liability regulations and regulations on dangerous objects of property and/or dangerous activities. However, the complex issue of establishing the liability of robot producer and software developer poses an additional problem because their liability cannot be determined in the same manner (Calo, 2009).

Since robot is a device or a machine with higher or lower degree of autonomy which moves and performs particular actions and tasks, the question arises whether it can be considered that, in legal terms, robots are included in the legal concept of a dangerous object of property? To answer this question we need to analyse generally

accepted definition of a dangerous object. Firstly, it should be borne in mind that despite the fact that the Law of Contract and Torts regulates the matter of liability for the damage caused by a dangerous object of property or dangerous activity, it does not define the term „dangerous object". On the other hand, according to the definition as per Article 136 of the Project led by the professor Mihailo Konstantinović, dangerous are moveable and immoveable objects which by their position, properties and existence pose an increased hazard to the environment (Konstantinović, 1969, Art. 136). According to this definition, in legal sense, the robot would represent a dangerous object and a risk of damage that cannot be always avoided even when exercising the utmost possible care. It is actually its autonomy and future ability to independently decide and perform actions that poses a potential danger of detrimental behaviour of robots in a given environment. If a robot is understood as a machine or a device that will be used in the future on a daily basis, then a robot, just like a motor vehicle, becomes a danger from the moment it is put into operation. We can draw this conclusion from the commentary of the professor Jakov Radišić entered in Art. 173 of the Law of Contracts and Torts, according to which, while the vehicle is moving, a person is not able to fully control it and prevent all risks of damage it can potentially cause. This is supported by the abovementioned definition of robots given by the International Organization for Standardization according to which a robot is only a device which is actuated (actuated mechanism). However, here should be borne in mind that the properties and circumstances based on which the robot owner could be excluded from liability for the loss caused by a robot is subject to arbitrary decision. Thus, the robot owner could be exempted from liability in the event when the claimant suffers a loss after having interacted with a robot in situations and under the circumstances that are not considered customary and generally accepted behaviour and when that was contrary to the purpose and the characteristics of the robot.[9] In such case, Article 177, paragraph 2 of the Law of Contracts and Torts could be applied and the robot owner could claim that the loss occurred through a sole action of the claimant. In addition, according to the case law, the holder of a dangerous object, in addition to the obligation to keep the object in good working condition, is obliged to adjust the use of such dangerous object to the prevailing conditions.[10] This means that keeping the robot in a good working condition should

[9] For example, a building cannot be a dangerous object just because pupils used the fact that the roof was low, climbed using window grids, and walked along the roof of the school building, because the roof and grids were not intended for climbing and walking thereon. (Judgement of the Court of Appeal in Novi Sad, Gž-4061/10, 14- 9- 2011. Available at: *http://www.ns.ap.sud.rs/index.php/srl/sudska-praksa/172-gz-4061-10,* 22. 3. 2018.)

[10] The court established that the claimant entering the elevator could have safely done so if the persons in the elevator had pushed and held the „stop" button or button intended for door opening, which certainly does not demonstrate the adjustment of elevator operation to deafferented patients (Judgement of the Court of Appeal in Belgrade, Gž-7461/10, 19-10-2011. Available at*: http://www.bg.ap.sud.rs/cr/*

enable its constant behaviour within its scope and purpose of an efficient and safe performance of the expected functions. Otherwise, its owner or other holder cannot be excluded from liability for the damage caused by a dangerous object - a robot.

The next question that will inevitably arise in the future, when robots become completely autonomous, is whether they should have the legal capacity and rights and obligations. Any affirmative answers to such questions will also pose other questions: whether a robot should also be considered legally competent or have the ability to conclude contracts and passive processing ability, and to what extent? At the moment, the mentioned issues do not attract the attention of the legislators, but with the development of robotics, this and other issues may arise, because even though in the early twentieth century robotics was perceived as remote future that may not come true, today we are the witnesses of the civilization that is increasingly focusing on such developments.

Regarding the issue of liability for the loss caused by a robot, the regulations on product liability may be applied. According to Art. 179 of the Law of Contracts and Torts, a product is an object that was put on sale or manufactured by a producer, which due to a defect unknown to him may cause injury or loss to persons or property. In accordance with the Hague Convention on the Law of 1973 Applicable to Products Liability (ratified on 4 March 1976)[11], the expression „product" means natural and industrial products, whether raw or manufactured and whether movable or immovable (Art. 2, paragraph 1, item /a). However, unlike the aforementioned Hague Convention and the Consumer Protection Law of the Republic of Serbia, the Council Directive of 1985 Concerning Liability for Defective Products[12] considers a product to be only movables, including electricity and excluding agricultural products and games.[13] However, when it comes to robots, objects are always moveable according to the International Organization for Standardization. On the other hand, a question arises as to whether all types of robots will become moveable objects or there will also be stationary robots that will be immoveable by their very nature. For example, a robotized building that independently performs the functions of air conditioning, heating, alarming of tenants in the event of fire or natural disaster, solar power management, independent interventions (fire protection, repair and maintenance of building devices such as elevators and other equipment, etc.).

According to the Hague Convention (Art. 3), the following shall be liable for an inoperable robot: manufacturers of a finished product or of a component part,

articles/sudska-praksa/pregled-sudske-prakse-apelacionog-suda-u-beogradu/gradjansko-odeljenje/parnica/naknada-stete/gz-7461-10.html, 22. 3.2018.)

[11] Decree on the Ratification of the Convention on the Law Applicable to Products Liability, *Official Gazette of SFRY – International Treaties*, no. 8/1977, 21 September 1977.

[12] Council Directive of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products, *Official Journal of the European Communities*, L 210, 7. 8. 1985, 29–33.

[13] Law on Consumer Protection, Art. 5, paragraph 1, item 14.

robot suppliers, persons in the commercial chain of preparation or distribution of a product, as well as the agents or employees of the persons specified above. On the other hand, it should be borne in mind that the liability for the compensation of damage caused by application or actions of a robot as a dangerous object lies upon its owner. A robot holder may be its owner or a person in whose possession the robot is. Person having factual exercise of power over the robot would be the person who has not gained legal power over the robot but rather the possibility to dispose of the robot and use it in accordance with the legitimate legal grounds– agreement for lease etc. Thus, the legal concept of factual exercise of power indicates that these are not the categories of pre-defined persons but only the persons that can be defined. Here, we exclude the cases of possible unlawful possession by persons (thieves) who come to the possession of robots without legal grounds therefor.

The next legal issue regarding future autonomous robots is whether they will be able to acquire property. So far, the courts in the United States have built a certain practice in relation to robots controlled by humans. To that extent, there is an example of a dispute raised by a research and salvage company with limited liability *Columbus-America Discovery Group*, formed in 1985 to conduct multi-disciplinary research, to develop sophisticated deep-ocean technology, and to locate, explore, and recover the remains of the *SS Central America* sunk in 1857 at the times of "gold rush" in California, USA.[14] Until 1989 no one even wondered if a brave diver or a gold digger could reach the shipwreck and get the gold that the ship was carrying when it went down at the depth of over 2.400 meters. The aforementioned company managed to get to the shipwreck by using the most advanced technology at that time, which also included a robotized submarine equipped with cameras and actuator that, upon the operator's command, could capture objects. The Company wanted to protect its right of first salvor before the court and establish its exclusive right to reward in accordance with the law of maritime salvage. The law of maritime salvage and finds protects the rights of one who undertakes such a recovery project to carry it to completion without interference from others who seek to share in the enterprise and reward[15]. In this particular case, it was about gold bullions worth 400 million Dollars (in 1857 it was worth about 1.2 million Dollars).

[14] The journey began on the 20th of August, 1857 when the mail steamer *Sonora* left San Francisco harbor carrying about 600 passengers and crew, and three tons of gold bound for New York. Arriving at the Pacific coast of Panama, the travelers were met by a train which took them to the Atlantic coast to board the mail steamer *Central America*. The *SS Central America* was a wooden hulled steamship with two large iron side paddle wheels. On September the 3rd, the *Central America* left Panama for New York. On the 9th a storm began to rise and by the 10th it had developed into a hurricane. On Friday morning, September 11th, a leak was discovered. Some passengers were rescued by the ship *Marine*, whereas three survivors were found eight days after, 400 miles north of the shipwreck (Columbus-America Discovery Group and the SS Central America, 1998, 2–3).

[15] Recovery Limited Partnership v. The Wrecked and Abandoned Vessel, S.S. Central America, et al., United States District Court Eastern District of Virginia, Norfolk Division, CIVIL ACTION NO: 2:87cv363, August 31, 2016, 8.

In June 1989, the Federal District Court in Norfolk issued a decision in which "telepossession" was defined as a new type of property in law, together with the legal concept of "telepresence" because this company, according to the American court, managed to acquire exclusive possession and property over the said shipwreck.[16] That was the first court decision to give legal recognition to the use of a remotely operated vehicle in lieu of actual human presence at a shipwreck site (Horrell, 1991, 31). In that particular case, the court provided the following explanation: **"**In the deep ocean, exercise of effective control is achieved not through physical presence of a human being at the ocean bottom, but instead through a combination of live imaging coupled with the capability to manipulate the environment through teleoperated or robotic vehicles. Effective possession of an object is attained in this unique environment by: (1) locating the object searched; (2) real time imaging of the object; (3) placement or capability to place teleoperated or robotic manipulators on or near the object, capable of manipulating it as directed by human beings exercising control from the surface; and (4) present intent to control (including deliberately not disturbing) the location of the object (so-called "telepresence" and "telepossession.")." This default judgement excluded all the rights of other salvors who were also in the vicinity of the shipwreck site.

The above case relates to quasi-property of a robot since it was operated by a human and thus, in that particular case, it was a tool which was used to successfully find a lost object and the property right acquired thereon (*modus acquirendi*). In that dispute, several insurance companies filed claims against the salvor company for surrender of the salvaged objects, stating that they had insured commercial shipments of gold and paid off claims for gold. However, the court found for *Columbus-America Discovery Group* on all the issues, dismissing the claims of underwriters. Insurance companies claiming the compensation for the paid off claims before the court based their right on period newspaper articles where it said that they had insured the particular policyholder and that the claim had been made and probably paid off by them in the amount of 1,219,189 Dollars and out of that sum, London insurance companies and American insurance companies paid 766,666 and 452,523 Dollars, respectively. According to the court, the underwrites who did not abandon hope of recovering the object insured would have kept the documents on the paid claim and in such case, they would be entitled to claim the recovery of the salvaged amount from *Central America* steamship. Interested insurance companies, despite keeping some documents for more than 100 years, failed to do so in the case of *Central America* steamship (they did not have the policy, commercial invoices, payment evidence etc. – author's note.) and the court decided in favour of the salvor.[17]

[16] Columbus-America Discovery Group, Inc. v. The Unidentified, Wrecked and Abandoned Sailing Vessel, *S.S. Central America, in rem,* No. 87-363-N, 1989 A.M.C. 1955, 1958-1959.

[17] Columbus-America Discovery Group v. Sailing Vessel, 742 F. Supp. 1327 (E.D. Va. 1990), US District Court for the Eastern District of Virginia - 742 F. Supp. 1327 (E.D. Va. 1990), August 14, 1990.

IV. Particular Aspects of Liability Insurance for Damages Caused by Robots

Bearing in mind that the use of robots is constantly increasing, there is a growing risk that at some point, some of them may cause damage. However, the application of new technologies also means that, in terms of insurance techniques, it is not possible to determine with certainty the number of devices in use, as well as the frequency and extent of damage, which is why it is often difficult to determine the adequate insurance premium and conditions. Although all manufacturers are legally obliged[18] to market only safe products, it is not always possible to exclude the risk occurrence. The characteristics and purpose of robots are defining elements for determining the type and intensity of the danger in its use and interaction with humans. The characteristics of a robot include its shape, size, weight, materials from which it is made, etc., and when it comes to its purpose, it is important what functions or tasks a robot performs, and in which environment and with whom it interacts: humans or objects.

The regulations on the liability for the product due to which the user or a third party sustained the damage through the functioning of a defective or insufficiently safe product - the robot - have no impact on the fulfilment of the manufacturer's obligations under the general product safety regulations. Thus, within the limits of their respective activities, producers are obliged to provide to the consumers and other users the relevant information, in order to enable them to assess the risks inherent in a product throughout the normal or reasonably foreseeable period of its use, where such risks are not immediately obvious without adequate warnings, and to take precautions against those risks (General Product Safety Act, Article 10). The manufacturer's liability may include failure to provide complete instructions for the correct use of robots, failure to warn about potential risks of proper use and about the hazards of incorrect use, or failure to take pro-active approach to improving monitoring and security, as well as irregular maintenance and servicing, wrong programming, etc.

When the damage caused by a robot can be attributed to defects in its design and construction, the manufacturing defect or damage occurred before the delivery and sale, this constitutes a factual matter that depends on the judgment of the court in each particular case. Bearing in mind that robotics is a relatively new engineering branch and that it is improved and innovated every day, it is possible that in many cases no sufficiently adapted technical standards and rules will exist, thus producing uncertainty of disputes brought before courts. Such conclusion can also be drawn from one of the grounds on which the producer may be excluded from liability for

[18] General Product Safety Act, Article 5.

the damage through the use of his product, stipulated in Article7, paragraph 1, item (e) of the Council Directive of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products. According to the said provision, the producer shall not be liable if he proves that the state of scientific and technical knowledge at the time when he put the product into circulation was not such as to enable the existence of the defect to be discovered. This could be a problem in the future, especially in the case of self-learning robots, unless the manufacturer has in place the adequate security procedures or systems that are defined and/or developed only after its circulation, in order to prevent material damage or bodily injury due to robot's misinterpretation, reasoning, and decision-making. With this complaint, the producer would be released from liability and would not be obliged to compensate the damage caused by a robot, but the question arises of satisfying the need to compensate the injured parties. In that case, the insurer is in a comfortable position because his obligation becomes effective only if there is liability of the producer.

We would also like to point out that the liability of a producer is regulated by only one Article of the Law of Contracts and Torts (Article 179) which does not explicitly provide for the possibility to exempt the producer from liability for the reasons stated above. However, we consider that the robot manufacturer can also be excluded from liability for the damage caused as aforementioned and under the Law of Contracts and Torts, because he can be excluded from liability if he proves that he did not know or could not have known that the object he sold was deficient or had properties that pose a risk of damage, which was why he could neither warn the claimant nor give to the claimant a proper instruction manual (Perović, 1995, 412). Further, the Law of Contracts and Torts does not define what is considered a defective product and, to that extent, the provision of Article 6 of the abovementioned Directive can be considered a road sign which shows that a product is defective when it does not provide the safety a person is entitled to expect, taking all circumstances into account, including: (a) the presentation of the product, (b) the use to which it could reasonably be expected that the product would be put and (c) the time when the product was put into circulation. Additionally, a product shall not be considered defective for the sole reason that a better product is subsequently put into circulation.

The foregoing inspired an advisor at the European Parliament to propose, as a possible solution, the formation of a special compensation fund for robot-induced damage. The liability would be based on the absolute liability system i.e. the fact that the damage was caused by a robot (Orsolya, 2016). According to that initiative, those who manufacture, programme or sell would pay into the fund or it could be raised as a new tax paid by all. A scenario where robots themselves will pay into the fund also seems possible just as in the case of driverless taxis (that might transfer the fare–or part of it–into the fund electronically and automatically, whereby a part

of the fund that has not been used for compensation payment could be re-invested in research and development). All of the above is still just an idea about possible solutions for covering the damage caused by this technological risk, and the future final legislative proposal of the European Commission is yet to be seen.

In this type of insurance, all claims for damages in accordance insurance terms and conditions, which arise from one and the same initial cause and one and the same source, and repeated or permanent defects on the product, are considered a single claim. A single claim for damages is a series of claims that represent a sum of two or more claims occurred for the same cause that can be attributed exclusively to one design, specification, formula in products or services provided by one insured person. The issue of cumulation of individual claims for the purpose of filing a single claim to the insurer is important for at least three reasons: the interpretation of the occurrence of the insured event, the existence of direct causality, and the determination of the amount of the insurer's liability. In addition to the above, a question can be posed how and in what way the injured parties should be indemnified, etc.

In product liability insurance, within many exclusions of the insurer's liability, we emphasize that in the practice of some US insurance companies there are at least two exclusions that could become relatively common in robotics. These are: computer virus infection and date recognition failure, which cause damage.

V. Conclusion

Innovative technologies and products generated by its application bring unknown risks for which the existing legal framework sometimes does not have a solution. This is particularly true for robotics and the issue of liability and product liability insurance because the technology is constantly developing and has created products which are used for many purposes. With the advancement and introduction of robots, the law of robotics that is yet to be developed and formed as a separate legal science, has to provide answers to numerous questions *de lege ferrenda* such as the legal position of smart, autonomous robots, the issue of robot producers' and owners' liability, termination of robots, as well as other aspects of property rights.

Different purposes of robot use have, to a certain extent, influenced the problem of defining this technological product of human society, which makes it possible to imagine that some robotic devices are not covered by the term "robot." The issue of the risk assessment of robot users and manufacturers or authors of computer programmes can notably highlight the dilemma regarding who has an interest in concluding insurance. For all these reasons, the legal framework of robotics and the terms and conditions of product liability insurance may prove to be inadequate, and in some cases it might happen that the insurer will have no interest in concluding insurance.

Literature

- "A brief history of robotics". (September 26, 2016). *EU Automation*. Available at: *https://www.euautomation.com/us/automated/article/a-brief-history-of-robotics*, 22/ 3/ 2018.
- Aristotle, *Politics*. Available at: *http://www.perseus.tufts.edu/hopper/searchresults?q=Aristotle%2C+Politics*, 22/ 3/ 2018.
- Calo, Ryan (November 25, 2009): Robotics & The Law: Liability for Personal Robots, The Center for Internet and Society,Stanford Law School. Available at: *http://cyberlaw.stanford.edu/blog/2009/11/robotics-law-liability-personal-robots,* 9/ 2/ 2018.
- "Columbus-America Discovery Group and the SS Central America". (1998). *Informs*. Available at: *http://www.columbia.edu/~dj114/SS_Central_America.pdf,* 22/ 3/ 2018.
- Council Directive of 25 July 1985 on the approximation of the laws, regulations and administrative provisions of the Member States concerning liability for defective products, *Official Journal of the European Communities*, L 210, 7/ 8/ 1985, 29–33.
- *Draft Report with recommendations to the Commission on Civil Law Rules on Robotics,* (2015/2103(INL)), European Parliament, Committee on Legal Affairs, 31/ 5/ 2016.
- European Parliament Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics (2015/2103(INL)), P8_TA(2017)0051.
- Horrell, Drew F.T. (September 1991): Telepossession Is Nine-Tenths of the Law: The Emerging Industry of Deep Ocean Discovery, *Pace International Law Review*, Volume 3, Issue 1, 309–362.
- IFR (2017): *World Robotics 2017 edition,* International Federation of Robotics, Frankfurt am Main.
- IFR (7 Febuary 2018): *Robot Density Rises Globally*, International Federation of Robotics, Press Release. Available at: *https://ifr.org/ifr-press-releases/news/robot-density-rises-globally,* 25/ 3/ 2018.
- Konstantinović, Mihailo (1969): *Obligacije i ugovori: skica za zakonik o obligacijama i ugovorima*, Centar za dokumentaciju i publikacije Pravnog fakulteta, Beograd.
- La CERNA (Novembre 2014): *Éthique de la recherche en robotique, Rapport n° 1 de la CERNA*, Commission de réflexion sur l'Éthique de la Recherche en sciences et technologies du Numérique d'Allistene, Paris.
- ISO 8373:2012(en), Technical Committee ISO/TC 184, Automation Systems and Integration, Subcommittee SC 2, Robots and Robotic Devices. Available at: *https://www.iso.org/obp/ui/#iso:std:iso:8373:ed-2:v1:en*, 22/ 3/ 2018.

- Perović, S. (redaktor) (1995): *Komentar Zakona o obligacionim odnosima*, Beograd, Savremena administracija.
- Orsolya, Zara (22 June, 2016): Robo Sapiens: a New Legal Person on the Horizon? *Euroscientist*. Available at: *https://www.euroscientist.com/robo-sapiens-new-legal-person-horizon/*, 22/ 3/ 2018.
- Robot, *Oxford Dictionaries*, Oxford University Press. Available at: *https://en.oxforddictionaries.com/definition/robot,* 22/ 3/ 2018.
- Robot technology. *Encyclopaedia Britannica*. Available at: *https://www.britannica.com/technology/robot-technology*, 22/ 3/ 2018.
- R.U.R. *Encyclopaedia Britannica*. Available at: *https://www.britannica.com/topic/RUR*, 22/ 3/ 2018.
- General Product Safety Act, *Official Gazette of RS*, no. 41/2009.
- Consumer Protection Law, *Official Gazette RS*, no. 62/2014.

Translated from Serbian by: ***Zorica Simović***