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The Potential Role of the Artificial Intelligence in Combating Climate Change and Natural Resources Management: Political, Legal and Ethical Challenges

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Abstract

The aim of the article is to study the role of artificial intelligence (AI) in solving current issues of climate change, environmental protection and natural resources management. The advantages and threats of using AI for the development of political and legal parameters for ensuring the safe and effective implementation of technological system, as well as ensuring sustainable control over its functioning and development trends, are analyzed. The relevance of the topic is substantiated by the fact that the legislative basis in this area is at the early stage of formation, while the scale of the impact of AI on all the aspects of social life may be impossible to accurately foresee. A special attention is paid to the analysis of the legal regulation of these issues in the context of European Union and Ukraine. The present work is one of the few that addresses three issues: climate change, the growing influence of artificial intelligence, and the possibility of legal regulation of the use of AI to solve urgent environmental problems without threatening the fundamental human rights and freedoms.

Keywords

Climate change; Artificial intelligence; Environmental policy; EU law; Adaptation of Ukrainian legislation

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Introduction

Climate change is among the most urgent global problems of the present. The founder of Microsoft Bill Gates declared climate change the main threat to humanity after the COVID-19 pandemic, which can cause even higher death rates (Gates, 2020).The United Nations Intergovernmental Panel on Climate Change (IPCC) issued a Special Report in October 2018 about global warming, identifying its catastrophic consequences, such as rising levels of seas and oceans, melting glaciers and flooding coastal areas and islands, abnormal events such as hurricanes, floods, more frequent and intense droughts and storms, desertification of land and a decrease in crop yields due to the depletion of water supplies, which, in turn, will exacerbate regional tensions and conflicts (IPCC, 2018).

In order to avoid the extreme impacts of a 2°C global temperature rise, the IPCC calls for a 45% decrease of greenhouse gas emissions by 2030 and 100% by 2050, which can be done only by unprecedented changes in all aspects of social life. The case of the United States of America should be highlighted. It has the highest carbon emission from transport (29%), energy (28%), industry (22%), commercial and residential construction (12%), and agriculture (9%) (United States Environmental Protection Agency, 2020). Thus, certain options of reducing negative consequences and adaptation to them were proposed by the joint effort of experts and politicians (Mulvaney, 2019).

Several international negotiations on possible solutions of the climate change problem have taken place together with the framework international laws have been adopted. In 1992, the United Nations Framework Convention on Climate Change (UNFCCC) laid the foundation for international cooperation to minimize extent of the climate change. In 1997, the Kyoto Protocol on the Reduction of Greenhouse Gas Emissions was approved (United Nations, 1997). In 2015 the Paris Agreement was adopted (the first universal instrument in order to transit to a low-carbon global economy), where from 2020 a global action plan was fixed in order to limit the warming, which is a lot below 2°C (United Nations, 2015). In 2019, the World Meteorological Organization published a report on state of the climate from the period of 2015 till 2019.It clearly demonstrated that countries are not meeting their international commitments to reduce greenhouse gas emissions, and climate change is happening faster than scientists have predicted (WMO, 2019).

The current search for the solution for the climate change, which is happening in information society (Raban, Gordon and Geifman, 2011; Duff, 2015; Martins *et al.*, 2019; Filippova, 2021), is impossible without the development of cognitive bases and systemic technologies of AI, including the field of ecology, environmental policy and law. The EU High-Level Expert Group on Artificial Intelligence declare that the artificial intelligence is "a software (and possibly also hardware) systems designed by humans that, given a complex goal, act in the physical or digital dimension by perceiving their environment through data acquisition, interpreting the collected structured or unstructured data, reasoning on the knowledge, or processing the information, derived from this data and deciding the best action(s) to take to achieve the given goal. The AI systems can either use symbolic rules or learn a numeric model, and they can also adapt their behavior by analyzing the environment which is affected by their previous actions". Moreover, "AI refers to systems that display intelligent behavior by analyzing their environment and taking actions with some degree of autonomy to achieve specific goals. The AI-based systems can be purely software-based, acting in the virtual world (e.g., voice assistants, image analysis software, search engines, speech and face recognition systems) or the AI can be embedded in hardware devices (e.g., advanced robots, autonomous cars, drones or Internet of Things applications)" (European Commission, 2019).

Considering the civilization significance of the AI and its growing role in solving the key problems facing mankind nowadays, it is vitally important to legally define the status of AI for ensuring its effective management system and regulate its functions. Legitimization of the AI as a new level of social organization presupposes its unconditional control by the society with a continuous legal and technical correction of the virtual reality, which has become its derivative. It is undisputable that AI should be trustworthy as it has

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enormous social impact and, thus, it is a matter of great importance that the use of AI is grounded on fundamental human rights and values. It is also necessary to analyze the problem of climate change and the way the AI technologies affect it. There are many different ways AI can be used for combating climate change. However, a number of environmental, ethical and political issues arise. One of the key issues that will be reviewed in this article is the need for an integral system of legislative acts that should regulate a universal conceptual and categorical apparatus, fundamental principles and rules of the creation, testing, implementation, application and closing of such projects and the establishment of legal responsibility for possible negative consequences.

Methodology

This article presents an analysis of publications on various aspects of the AI use for combating climate change and the implementation of behavioral models that optimize the relationship between humankind and nature, minimizing the negative impact of AI. The examples of successful use of artificial intelligence to deal with the urgent issues of climate change are provided. This is followed by an overview of the challenges of AI use in the context of environmental protection, with an emphasis on those factors that directly affect the climate, as well as the political and ethical issues related to the problem of climate change. This research is based on the general scientific methods of analysis, systems approach, synergetic and modelling. Finally, the issue of legal regulation of the AI use in the European Union and Ukraine and the development prospects of legislation in this area are considered in detail. Particular scientific methods of specific sociological research and comparative legal research were used in order to collect, analyze, and process the legal information and to optimize the legislative regulation of the AI's use for solving current environmental issues.

Results and Discussion

Using the Artificial Intelligence to Tackle the Problem of Climate Change

The Artificial intelligence is considered the most important game-changing factor in global politics and economics. The results of 2017 Geneva UN Artificial Intelligence Summit revealed that the AI may cause positive changes to all aspects of human life. Additionally, it has been proposed to reorient AI's application options used for self-driving car, smart phones with voice and face recognition. This is seen as a means for fundamental improvement of mankind supporting comprehensive actions to eradicate the lack of the food and essential commodities, and to safeguard the natural environment (Muraleedharan, 2021). AI can predict climate and provide global and individual weather reports more precisely by covering vast challenges such as forecasting hurricanes, floods, droughts, simulation of former climatic situation and their social and economic consequences. Recent research (Rasp, Pritchard and Gentine, 2018) showed that the artificial intelligence and artificial neural networks successfully help in regulating difficult and local atmospheric processes. For example, processes taking place at the origin and development of convective clouds and, consequently, help with clarifying details, which ongoing models of climate metrics do not consider.

AI opens up some new possibilities for understanding the vast array of data obtained from many component modellings of climate. Monteleoni *et al*. (2011) and McQuade and Monteleoni (2012) combine the predicted situation of about 30 climate models the IPCC uses via computer learning algorithms. Improving the accuracy of global climate simulations, the AI algorithms reduce and manage natural disaster (such as extreme atmospheric events) risks, which are predicted to become more frequent and severe (McGovern *et al.*, 2017). Better forecasts are needed to develop effective climate policies, enable governments to adapt to change and identify opportunities to cope with negative impacts. The AI algorithms increase preparedness for environmental risks when quick and smart decisions are critical. The AI algorithms are used not only for local natural events, but also for more global ones, as predicting coordination of the measures taken at actual 2°C increase in global temperature. For example, Ise and Oba (2019) described the results of

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providing a neural network with global monthly temperatures over the past 30 years. The neural network successfully predicts the changes of heat over the next 10 years with an accuracy of 97%. AI may also be used to clarify the causes of climate change. Thus, in case of using satellite images, it is possible to identify and map significant sources of CO_2 emissions in countries that do not have reporting obligations.

One other sphere of using AI is managing droughts and other hydrological risks. UNESCO's G-WADI Geoserver application uses an artificial neural network (ANN) algorithm to obtain the value of precipitation for current moment. This product is called 'Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks – Cloud Classification System' (G-WADI PERSIANN-CCS). It is used for informing, emergency planning and managing hydrological risks of natural causes. One can enter the system by means of the iRain mobile application, which was designed to facilitate citizens' participation to collect local data for global rainfall monitoring (UNESCO, 2019). This application shows rainfall satellite observations in real time, tracks extreme rainfall around the world, and gives local rainfall information by using crowd sourcing data augmentation. AI can also be applied for demonstrating extreme weather effects (Snow, 2019). In order to demonstrate comfortably visualized form for the community, experts at the Montreal Institute for Learning Algorithms (MILA), Microsoft, and Conscient AI Labs used a GAN (a kind of the AI) to model the probable looks of houses after damages by the sea level rise and more severe storms. The plan includes launching an application in order to show people what their homes and neighborhoods might look like in the future, with the various impacts of climate change.

Additionally, AI can be used for measuring and reducing CO_2 emissions by optimizing existing systems. Carbon Tracker, an independent financial analytical tank, tracks emissions from coal-fired power plants by means of data, obtained from satellites, and convinces that such an industry is financially sub-optimal. This technology can be used all over the world in places where monitoring is not carried out and there is no need to obtain a permission. AI is also introducing new ways to measure the impact of factories by analyzing data about local infrastructure and electricity being used. It is convenient for gas-fired power plants having no readily measurable plumes like coal-fired power plants. Carbon Tracker is going to be used for analyzing emissions for 4,000-5,000 power plants and is expected to create the largest data bank making information publicly available. If a carbon tax is imposed in the future, Carbon Tracker can help set the price for emissions and can find the emission producers.

Microsoft Company has found another solution by creating autonomous underwater data centers, which are controlled by the artificial intelligence. Ocean is used for cooling, while energy of the waves is used for powering (Roach, 2020). Also, the AI can accelerate research of nuclear fusion reactors, which could provide a safe and carbon-free alternative to unsustainable power generation. The AI can regulate and optimize energy consumption with smart buildings that use built-in sensors for energy efficient consumption. Such energy consumption can be significantly reduced with the help of the AI, by taking into account the predicted weather, building congestion and other environmental conditions to adjust the needs of a local indoor infrastructure. Moreover, such buildings are capable of regulating the energy consumption if low-carbon electricity is in short supply. These innovations are especially relevant to urban spaces, as they are projected to ensure that at least 60% of the humanity in the world will live in such houses by 2050 and are extremely resource intensive. The AI is also used for optimizing electricity-required processes. One of such cases is Google's Deep Mind artificial intelligence that helped organizations reduce their data center's energy consumption by 40% and to become more energy-efficient by cutting greenhouse gas emissions. Further, the AI can be successfully used for the industrial emission control and waste management. With the help of advanced learning tolls and intellectual networks, deviations from industry standards and government regulations can be traced. For example, IoT technology has been implemented in some industrial plants, connected with low temperature keeping devices.

Other similar AI-powered Earth applications are iNaturalist and eBirds, which gather information from a wide range of experts on species' populations, ecosystems, and the ways of migration. These products are

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important for improving the findings and saving of freshwater and marine ecosystems. Intelligent agricultural solutions are also worth mentioning. Namely, the agricultural technology startup PEAT in Berlin created the Plantix application, which detects probable problems in soil. American companies AWhere and FarmShots use self-learning program in conjunction with satellites to obtain weather forecast, to investigate crop resilience, and to assess farms for disease and pests.

It is noteworthy that AI is already being used to optimize clean energy development. In the Amazon Basin, hydroelectric dam constructors usually develop one dam at a time without a long-term strategy. A group of experts created an AI simulation to find dam sites that can produce the lowest greenhouse gas emissions. The AI model has identified more complex and surprising set of proposals for reducing greenhouse gas emissions than ever before (Cornell University, 2019). In the current situation of more than one billion people having no electricity, the AI can help with electricity supply by giving the possibility to use it and organizing zero-carbon electrification by means of isolated micro-grids (Ritchie, 2019). In 2019, AI and machine learning experts published a document titled "Tackling Climate Change with Machine Learning" (Rolnick *et al*., 2019). The authors of the report were consulted by renowned experts (Hao, 2019). The document suggests 13 areas in which machine learning can be deployed: electricity systems, transportation, buildings and cities, industry, farms and forests, carbon dioxide removal, climate prediction, societal impacts, solar engineering, individual action, collective decisions, education, finance. Several points from the report are considered as under:

- *Improving energy forecasts and collecting infrastructure data* is especially relevant to the transition for more renewable energy sources. The AI can identify construction marks and properties from satellite data to use computer self-learning program to detect how much energy is consumed at the city level. These techniques can determine buildings to be upgraded in order to make them more effective.
- *Creation of the new materials.* Machine learning accelerates the development of materials that store, collect and use energy more efficiently by researching new chemical structures with the properties which are required. The AI can take into account all limits, look through all known materials and combinations and suggest the best available variation. For example, Airbus has developed a new 3D printed aircraft detail which is not as heavy as the original one, but requires less raw materials, and is stronger, and also reduces CO_2 emissions during flight (Autodesk, 2016).
- *Optimization of cargo delivery routes and supply chain.* Machine learning can help to find the ways to combine as many cargoes as possible and to minimize overall travel and some emissions. Better forecasts of supply and demand for goods may reduce wastage during their production and transportation.
- *Advancing electric vehicles.* The AI can improve battery management (charging life and fill-up times) and optimize the transportation system due to more environmentally friendly driving and cars' use for reducing carbon footprint.
- *Improving tracking of deforestation.* The satellite images and programming products may process information on tree cover loss on a much larger scale as well as chainsaw sound detection algorithms may cause the law enforcement agencies to stop illegal activities faster.

The AI is already a common thing in our daily lives, and it is already beneficial for environmental management. All of the abovementioned examples are only some of many possible ways AI can drive the transition to green sustainable development. With the growing demand for automating solutions to environmental problems, it is the obligation of the government, private and public organizations to fund research and development associated with such technologies and ensure standardization, which is required for their production and application. However, the AI is not the only universal method of combating climate change. Nevertheless, while technology is undoubtedly helping generate solutions to the climate change problem, it is not a magic wand and requires joint international action, taken by climate, technical and AI experts as well as politicians, engineers, AI specialists, entrepreneurs and

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governments. By tracking environmental impacts and linking them to human performance, the AI may be of a high importance for designing, implementing and enforcing environmental laws, regulations and policies.

Problematic Aspects of Using Artificial Intelligence in the Context of Environmental Protection

The Artificial intelligence can and must help create more nature-friendly and sustainable environment as well as combat climate change. However, this potentiality raises some questions related to ecological, political and ethical issues (Coeckelbergh, 2020b).

The problem of materials and energy consumption. Machine AI learning requires a large amount of data, and energy that is used to process it and store. Some computing types use more power than others. According to the study by the University of Massachusetts, single NLP (natural-language-processing) model can emit the equivalent of about 300,000 kg of carbon dioxide, which is five times more than a car produces in its lifetime (Strubell, Ganesh and McCallum, 2019; Matheson, 2020). Although AI has a great potential to minimize consumption and make grid-related efficiency optimized, it will still be a major consumer of electricity. According to research, data centers now require more than 2% of the world's electricity (Pearce, 2018), and scientists predict that, by 2025, this amount is expected to grow between 8% and 21% (Andrae and Edler, 2015; Andrae, 2017; Giles, 2019). A study by Belkhir and Elmeligi (2018) indicates that the estimated global footprint in 2020 may be compared to the impact of the aviation industry and greater than that of Japan (the fifth largest pollutant in the world).

In response to criticism, data centers were transformed into more efficient form and now they run, at least partly, from renewable energy sources. Google, Amazon and Microsoft have begun investing in renewable energy and AI to improve energy efficiency. The introduction of AI server farms powered by renewable resources, the development of general-purpose artificial intelligence neural networks, and more are the ways researchers are reducing their carbon footprint (Gent, 2020). But is this investment sufficient to offset the impact of these technologies on the environment and climate at all levels? The vast majority of big companies still relies on fossil fuels and is not subject to environmental control in the pursuit of efficiency. For example, the report from the "Green Peace Clicking Clean" revealed that all of the major streaming companies, namely, Amazon Prime, HBO and Netflix use less than 22% renewable energy. And Northern Virginia, being the base for the largest number of data centers on the planet, is operated by a utility company with only 1% of its electricity coming from renewable sources (Cook *et al*., 2017). With the appearance of wasteful cryptocurrency mining (Hern, 2018) and 5G networks forced on realizing the Internet of Things, data and traffic collection is already accelerating (Hazas *et al*., 2016). Moreover, production of electrical devices requires not only big energy expenditure but also intensive mining of raw materials, the same as plastic used for producing devices and its packaging.

The artificial intelligence and the fossil fuel industry. Some large tech companies are selling their carbon-intensive AI services designed to do easier and more efficient oil and resource production. Amazon attracts new clients through programs such as Predicting the Next Oil Field in Seconds with Machine Learning. Microsoft hosted "Empowering Oil & Gas with AI" (Microsoft News Center, 2018) and Google Cloud works with companies in fossil fuel field. C3 IoT, an artificial intelligence actor, that initially helped drive the transformation to a renewable energy society, is now helping major oil and gas companies accelerate fossil fuel extraction (C3 AI, 2019). The Guardian recently explored the role of large technologies in supporting the fossil fuel market, highlighting that the huge recourses technology companies are investing into actions that oppose climate legislation and advocate climate change denial (Kirchgaessner, 2019).

Non-transparency of information. When researchers and policymakers tried to account for the impact of technology on climate, they faced the problem of extremely small amount of available information. The authors of the Greenpeace report (Cook *et al*., 2017) say that very few companies are revealing new metrics

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concerning the use of dirty and clean energy. Amazon WebServices serve nearly 50% of the global cloud services market. The report stated that the company remained "almost completely opaque about the energy footprint of its massive operations." This gives millions of organizations using AWS the ability to measure and report their own energy and carbon footprint. This non-transparency not only makes it difficult to hold large companies accountable, but also creates a critical barrier for efficient energy in all fields where digital technology is used.

As the AI has to be more ecologically responsible and safe for the climate it is required to increase awareness among its users and data working specialists to support additional method surveys, which will make an ecosystem of energy around the AI more visible. Wolff-Anthony, Kanding and Selvan (2020) have suggested that energy and carbon print have to be showed together with usual producing standards. Among the ethical problems of AI use, it is the lack of privacy and protection of data security, lack of clarity about responsibility, lack of ability, and irreproachability. The ethical principles were suggested and discussed by scientists (Floridi *et al*., 2018; Dignum, 2019; Coeckelbergh, 2020a). Special consultation organizations flagged, for example, collaboration of experts in the AI and professional community (e.g., IEEE), which performed according to the global initiation in ethics. These problems have to be solved, no matter how the artificial intelligence can be used, including improving situation with climate change. Many reports emphasize that humans need to be responsible for self-learning systems. Thus, nowadays, the focus on the way the machine learning can produce or exacerbate the desired results for specific individuals and groups - the effect which is of high importance to the ethics of machines in general (Guzman, 2021). It is worth mentioning that some of the use of AI in environmental sphere can cause certain political problems, some of which are further reviewed.

Political issues regarding freedom and behavior change. The AI can "nudge" people to behave more climate-friendly, leading to a change in the "architecture of choice" (Thaler and Sunstein, 2008). Climate nudging can become the basis for improving the environmental situation in the world. However, nudging while maintaining freedom of choice does not save autonomy and rationality of people. But it is quite questionable whether society is willing to pay such a big price for the sake of the probable environmental benefits.

Using the AI to control humanity. To solve the climate change problem, it is proposed to establish a "green government" which, with the help of the AI, may manage humanity and regulate countries and individuals to achieve climate goals. This looks like a direct threat to human rights and freedoms. However, there are examples of States that have managed to introduce environmental regulation, which, to some extent, introduces certain limitation to improve the climate change situation, but leaves enough freedom. To give the exact definitions for "to some extent", "enough" and "middle" is a complicated issue when democracy determines the way of life. Especially at the global level when one deals with significant differences in understanding what are the fundamental rights and reference points for different countries. Therefore, States will have to face the challenge of human freedom and learn to combine nudging and governance. However, it may result in the situation when some States tackle climate change, while others ignore the problem. This directly leads to the global and intergenerational justice.

Political issues related to the global and intergenerational justice are also noteworthy. Globally, not everyone is under the threat of climate change, and one generation can be affected by the effects of climate change caused by a previous generation. The COMEST report shows that "failure to act can be disastrous, but responses to climate change that are not well organized, with ethical implications, can destroy entire communities, create new paradigms of inequality and uneven distribution, and make even more vulnerable those people who have already been torn away by other man-made political and ideological struggles" (COMEST, 2010). It means that the climate AI interventions need to be more than ethical and take into account the principles of justice when influencing different societies, people of different age, countries and cultures in light of political considerations.

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The Anthropocene problem. One of the reasons for climate change is associated with the desire of modern man to control everything, which was a consequence of such a planetary state as the "Anthropocene" (Crutzen, 2006). Climate change may be considered as a result of strong human grasp on the planet. Instead of increasing planetary control by using AI, it would be more reasonable to reduce the pressure when implementing existing technologies. Additionally, one should consider how climate policy may incorporate the necessary technologies. In this respect, a study by Dobbe and Whittaker (2019) deserves attention, which provides recommendations for launching and improving technology-oriented climate policies and climate-sensitive technology policies. *Mandate transparency* means that the regulators must force all actors to achieve clear and transparent documentation concerning energy and carbon emission.

Account for the "full-stack supply chain". In an essay by Crawford and Joler (2018) and a large-scale map "Anatomy of an AI System" examined one Amazon Echo and highlighted the natural and human resources, which are needed to design, manufacture, keep and at the end get rid of this simple facility. The results were not entirely optimistic. The attention should be paid not only to the possible efficiency but also to the accompanying effects. There is a danger that efforts to improve efficiency in the field of computing may result not in improving the climate, but in increasing dependency on it (Coulombel *et al*., 2019). Relative efficiency is definitely important, but for practical energy metering absolute values are required.

Making "non-energy policy" analysis standard practice. A study of non-energy sectors led Selby, Cox and Royston (2016) to conclude that the AI policy proposals in non-energy sectors often fail to account for climate impacts. Therefore, when the AI is used by usual policy domains, its impact on ecology and environment may be counted as a regular policy instrument.

Implementation of technology regulation and new ecological transactions policy. Given the impact of technology on climate, the integration of climate technology and policy is urgent and ongoing.

Restriction of AI using to speed up fossil fuel extraction. According to researchers McGlade and Ekins (2015), "one third of the oil reserves, a half of gas reserves and more than 80% of current coal reserves must remain unused from 2010 to 2050 to reach the 2°C target." Therefore, a legal regulation is needed to restrict the use of AI for the extraction of fossil fuels. If AI is implemented to neutralize the climate change, one should check and be sure that the positive impact of AI on the environment outweighs the negative one. In this aspect, two points should be considered to deal with a number of objections against AI use. The Allen Institute has proposed certification (Stein, 2020) of the artificial intelligence techniques, differing carbon-neutral from non-carbon neutral AI. However, it is important that these labels are not "green washing", which happens with some other eco-certification regimes (Vos, 2009). Standards can influence the design and deployment of specific AI systems through product certification and serve to disseminate the AI best practices, as in the case of cyber security or environmental sustainability. The "data exchange" approach is to span the exchange of data used in climate computer programs. For example, for the electricity sector, the countries may lead to minimum duplication of tasks associated with climate by using AI as a repository of open data on electricity (St. John, 2018). Centralizing these steps will allow to access data more efficiently while avoiding prohibitive costs and minimizing the impact on the AI learning environment.

Despite the growing awareness of the climate change problem, sufficiently effective solutions, needed to reduce carbon emissions, has not been found yet. Thus, AI is expected to enable the development of some climate strategies without a corrosive carbon budget. However, it is worth recognizing that the use of AI also generates negative impacts on the environment. The AI technology is still extremely energy consuming and material intensive, and the corporations, responsible for this, provide little information about the ecological footprint of their activities. It is also worth mentioning problems such as danger of data's confidentiality protection, distribution of responsibilities, explaining ability, justness, etc. Additionally, political problems related to human freedoms, global justice and fairness between generations, the impact

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of the AI on people's behavior (up to the idea of using direct coercion), as well as the problem of the "anthropogenic" are of a great concern.

Not only companies and rulers are responsible. Until consumers are buying new devices and using oil-powered transport, all economics will stay the way they are. Therefore, it is necessary to develop the climate-friendly AI, making all technological processes more efficient while meeting environmental and climate protection priorities. This will definitely transform everyday life, which will lead to the transformation of economy and society. Special attention should be given to increasing climate awareness among the AI users and technicians, and make the ecosystem of the AI energy and materials transparent.

To address a number of challenges in this area, researchers propose a technology-oriented climate policy strategy and a climate-sensitive technology policy. Recognizing the limitations of the AI should not lead to the exclusion of its use where it is needed to solve complex climate problems. Some tech companies are investing in the machine algorithms to create new AI products for combating climate change. The machine learning systems can improve the ability to display and understand the size and value of underground oil and gas reservoirs, which makes it easier to develop these resources at a lower cost. The AI is also used for developing principally new fuels (Kates-Harbeck, Svyatkovskiy and Tang, 2019). The same logic applies not only to traditional hydrocarbons, but also to new options for the supply of non-hydrocarbon energy. The implementation of AI products is of high importance for achieving Sustainable Development Goals and support democratic processes and social rights. Additionally, the AI technologies are the most important means of achieving the goals of the European Green Deal. It is noteworthy, that users and developers should check first and be sure that results obtained from the AI are understandable and verifiable, unbiased and trustworthy. As well, as a new technology, AI should withstand tests and initial unprofitability.

Legal Regulation of AI Use in the EUand Ukraine

For the effective, understandable and safe use of AI, an integral system of legislative acts is needed. Such acts would regulate a single conceptual and categorical apparatus, fundamental principles and rules for the creation, testing, implementation, application and closure of such projects, the establishment of legal responsibility for possible negative consequences and the procedure for compensation for possible damage.

First studies and activities devoted to various features and peculiarities of the AI and law appeared in the 1970s-1980s. Anne Gardner's thesis "Artificial intelligence approach to legal reasoning" (Gardner, 1984) is a remarkable work in this field. In addition to individual studies, the scientific cooperation in this area emerged. In 1987, the first International Conference on the Artificial Intelligence and Law took place. In 1991, the International Association for Artificial Intelligence and Law was established. In 1992, publishing of "Artificial Intelligence and Law" was started (Rissland, Ashley and Loui, 2003). However, the legal framework in this area has begun to form only recently in the most progressive countries, where the rapid development of information technologies is taking place and requires appropriate regulation. For example, in countries of East Asia, the EU and the United States of America. Notably, the most efficient legal measures in this area are being taken in the European Union.

The AI products and services are the object of many areas of law, including privacy, data security, product liability, intellectual property, and antitrust laws. In addition, these areas of law are expected to be modified according to the new circumstances connected with the AI. As the AI is a principally new technical application and the diligence on legal risks has not become a commonplace yet, the efforts to comply require non-standard approach and the drive to understand what society needs at the moment. A sign of acceptance of exceptional capabilities of AI is the creation of regulatory framework on the AI, which some leading businesses are actually demanding. For now, the proposals are grouped as principles and guidelines, but a regulatory framework should merge to be followed. Progress towards building the structure is taking place fast, though in slightly different ways for different industries and in different jurisdictions (Mitchell *et al*.,

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2020). Despite the fact that AI is used in various fields, there should be a single legislative foundation for all with further industry development. Unified legislation should establish a regime for the creation and use of AI, which ensures human rights, protection of confidentiality, compliance with all ethical standards, open access to information on the impact of AI on humans and the environment.

The European Parliament Resolution on Civil Law Rules on Robotics. On February 16, 2017, the European Parliament adopted a resolution on legislative initiative, according to which a number of legislative and non-legal initiatives concerning construction, operation, and application of robots and artificial intelligence was advised to the European Commission. The Resolution, among other things, encouraged the European Commission to adopt a proposal for a legislative instrument, that would provide civil law rules on the responsibility of robots and AI, "to propose common Union definitions of cyber physical systems, autonomous systems, smart autonomous robots and their subcategories" a special EU agency for robotics and artificial intelligence prepared a charter which includes a code of conduct for robotics engineers, a code for research ethics committees at reviewing robotics, protocols and model licenses for designers. Additionally, the Commission is addressed to "create a specific legal status for robots in the long run, so that at least the most sophisticated autonomous robots could be established as having the status of electronic persons responsible for making good any damage they may cause, and possibly applying electronic personality to cases where robots make autonomous decisions or otherwise interact with third parties independently".

The Resolution highlights the need for legal regulation in order to create predictable and clear conditions for enterprises to develop their own projects and plan their own business models; ensure that control over the setting of legal standards is maintained so that the EU and member States are not forced to adapt and live by standards set by other States. The document emphasizes that such regulations "should not influence the processes of research, innovation and development" and that future regulatory initiatives about construction and use of robots and AI "do not restrict innovation in the field". The Resolution can be divided into several main blocks: social, economic, ethical and legal issues and issues with the development of robotics and AI; regulation of the development and use of robotics at the present stage; requirements for standardization in the development of relevant technologies; issues of controlling how actors make their decisions concerning using robotics and AI technologies; creation of an institutionalized control system in the field of robotics and artificial intelligence; issues of civil liability concerning the development and use of robotics and AI; ensuring the protection of personal data exploitation and application of robotics and AI. It is worth noting that the Resolution is one of the first real steps towards legislative consolidation of standards for the development and use of AI. Despite the fact that Resolution is advisory in nature, it provides an opportunity to form an idea of what will underlie the rules that will regulate the relevant activity in the near future (European Parliament, 2017).

In 2018, the European Commission adopted the Artificial Intelligence for Europe (Communication), by which the approach of the EU to harnessing and addressing the AI was contoured (European Commission, 2018a). From 2014 to 2017, the EU invested € 1.1 billion in the AI research and innovation through the Horizon 2020 program. The Communication highlights that AI is being created and used on the grounds of the EU values and fundamental rights. It also revises existing safety and civil liability regulations. The Commission later released a further communication and adopted a plan based on the initial communication in 2018 (European Commission, 2018b, 2018c).

In 2019, the European Commission published Ethics Guidelines for Trustworthy Artificial Intelligence, which sets out a framework for developing and using the trusted AI (European Commission, 2019a). The guidelines set out requests that AI must respond to be considered trustworthy. The set of assessments is intended to help verify meeting each of the key requirements: human agency and oversight, privacy and data governance, robustness and safety, diversity, nondiscrimination and fairness, societal and environmental well-being, transparency, accountability. The AI must "respect fundamental rights,

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applicable regulation and core principles and values, ensuring an ethical purpose and be technically sound and reliable, since even with good intentions, lack of technological prowess can lead to unintended harm". These Guidelines, together with the General Data Protection Regulation, give to the EU the possibility to establish high standards for business in the EU and possibly worldwide.

The European Commission also created the Robotics and Artificial Intelligence Unit, which aims to develop a competitive robotics and artificial intelligence industry in Europe. In April 2018, the EU member States signed a Declaration of Cooperation on Artificial Intelligence to develop a European approach to AI (European Commission, 2018b). In February 2020, the European Commission (2020b, 2020c) published the "White Paper on Artificial Intelligence: a European approach to excellence and trust", which outlines and identifies the standard form of the regulatory framework. The aim of the book is to seek information and suggestions for the creating a common EU field for AI regulation. Due to the high-level nature of AI White Paper, the following important questions remain unanswered: 1. The exact legal violations, which AI Whitepaper is intended to eliminate, are not clearly stated; 2. It is suggested to divide AI applications into high and low risk categories, but very often companies do not know which category is applied until this happens; 3. There is a significant risk of regulatory overlap with existing laws that are already applied to many AI technologies (for example, GDPR).

The Commission's report on safety and liability implications of the AI, the Internet of Things and robotics has been published, which gives more information on the gaps the Commission has detected in existing laws (European Commission, 2020a). The Commission Report identified legal gaps, which include security risks due to connectivity and openness of AI systems; a certain autonomy of the AI decisions; the need of neural and accurate data for the AI training; the complexity of products, systems and of value chains; the opacity of operating systems; gaps in product liability laws; general fault-based liability rules, which don't fit autonomously deciding the AI systems (Feindor-Schmidt, 2020).If the White Paper is implemented, companies will have to deal with a number of challenges. However, there are some positive outcomes. The White Paper states that AI may be a benefit for society and ensuring AI coherence in the EU can reduce compliance with the requirements that companies currently face due to different requirements from one EU member state to another (Mitchell *et al.*, 2020).

After identifying the gaps, the EU intends to release a comprehensive AI legislative package that will include new rules for those who create and implement the AI. A part of this package may include 3 resolutions adopted by the European Parliament on October 20, 2020: Framework (Basis) for ethical aspects of artificial intelligence, robotics and related technologies; civil liability regime for artificial intelligence and intellectual property rights for the development of artificial intelligence technologies, the Framework of ethical aspects of artificial intelligence, robotics and related technologies; the Civil liability regime for artificial intelligence and the intellectual property rights for the development of artificial intelligence technologies (European Parliament, 2020a, 2020b, 2020c).

It is also necessary to emphasize the huge role of civil society organizations (CSOs) in the creation and use of AI technologies. The White Paper on AI states that the European AI governance framework should guarantee the maximum participation of all stakeholders (including civil society organizations), as well as mandatory consultations with them on the implementation and further development of the structure (European Commission, 2020b). The CSOs should be aware of the AI potential to create new social problems in the future. By taking up the challenge now and tackling these issues, civil society organizations can play a key role: in leading the debate about developing AI while minimizing the risks of harm to society; in consultations and decision-making on the formation of the AI regulatory framework; in ensuring the ability of CSOs in the future to solve any problems that cannot be avoided. The CSOs can identify algorithmic bias issues for companies and organizations that implement new algorithms, as well as for those who are responsible for developing relevant new laws and regulations.

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The EU does not have a unified AI regulation system yet. However, there are various laws that are related to the development and implementation of artificial intelligence technologies. These laws include, but are not limited to, intellectual property law, data protection law, consumer protection or product liability laws, computer misuse laws, and human rights laws. At the same time, a number of Resolutions and AI White Paper have already been adopted, which highlight the main problematic issues that require regulation and provide a roadmap, according to which the EU legislation maybe formed. Given the ambitious pace of development in this area, it can be predicted that the EU will be one of the first to create a legislative foundation, which will subsequently be implemented by other countries, including Ukraine.

Analyzing the state of legal consolidation of the application and implementation of the AI in Ukraine, it may be concluded that such legislation is only in its infancy. The process of digitalization in various spheres has actively begun. Thus, the government faces the task of consolidating at the legislative level the strategy of formation and implementation of principally new technology transformation. It should be noted that, in 2018, the government approved the concept for the formation of Ukraine's digital economy and society for 2018-2020 and the formulation of a phased plan for its functioning (Parliament of Ukraine, 2018), and in 2020 the government approved the Concept for the development of artificial intelligence in Ukraine (Parliament of Ukraine, 2020). As the Minister of Digital Transformation points out, “Ukraine has a great potential in the field of artificial intelligence. We have the largest number of companies developing artificial intelligence technologies in Eastern Europe. Companies in the field of AI with Ukrainian roots have already acquired international corporations such as Snap, Google, Rakuten. Therefore, we are now working to create favorable conditions for AI to become one of the key drivers of digital transformation and overall growth of Ukraine's economy. After all, developing the field of artificial intelligence, we ensure the competitiveness of Ukraine in the international market” (Fedorov, 2020).

In December 2020, the Cabinet of Ministers of Ukraine approved the Concept for the Development of Artificial Intelligence in Ukraine with a plan for its implementation until 2030. According to the Concept, artificial intelligence is an organized set of information technologies by using which it is possible to a) perform complex tasks with the help of a system of scientific research methods and algorithms for processing information that was obtained or independently created, as well as b) create and use with the help of their own knowledge bases, decision-making models, algorithms and identify ways to achieve the objectives. Algorithms for processing information are obtained or independently created during the work, as well working with information and identify ways to achieve the objectives.

The goal of the Concept is to define the priority areas and basic objectives of the further use of the artificial intelligence products to meet the rights and legitimate interests of individuals and legal entities, building a competitive national economy, improving public administration a significant component of the development of socio-economic, scientific and technical, defense, legal and other activities in areas of national importance.

Ukraine, which is a member of the Special Committee on Artificial Intelligence at the Council of Europe, joined the Recommendation of the Council on Artificial Intelligence of the Organization for Economic Co-operation and Development in 2019 (OECD, 2019). The Concept enshrines the basis of further implementation and using of AI, compliance with which fully meets the requirements of the Organization for Economic Cooperation and Development on AI, including: development and use of AI systems only subject to the rule of law, fundamental human and civil rights and freedoms, values, as well as providing appropriate guarantees when using such technologies; compliance of the activity and algorithm of solutions of artificial intelligence systems with the requirements of the legislation on personal data protection, as well as observance of the constitutional right of everyone to not interfere in personal and family life in connection with the processing of personal data; ensuring transparency and responsible disclosure of information about artificial intelligence systems; reliable and safe operation of artificial intelligence systems throughout their life cycle and implementation on an ongoing basis of their assessment and management of potential risks;

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placing on organizations and individuals who develop, implement or use artificial intelligence systems, responsibility for their proper functioning in accordance with these principles.

Priority areas, in which the tasks of State policy for the development of artificial intelligence are implemented, are identified as the following: education and vocational training, science, economics, cyber security, information security, defense, public administration, legal regulation and ethics, justice. It is noteworthy that there is no environment-related area in the given list. Although almost every area, to some extent, affects the state of the environment, this issue needs further legislative clarification.

To achieve the goal in the field of legal regulation and ethics, the Concept identifies the following tasks: implementation in the legislation of Ukraine of the norms enshrined in 2019 "Recommendation of the Council on Artificial Intelligence" by OECD, subject to ethical standards set out in Recommendation CM / Rec (2020) 1 of the Committee of Ministers to member States on the human rights impacts of algorithmic systems, approved in April 2020 by the Committee of Ministers of the Council of Europe; elaboration of the issue of compliance of the legislation of Ukraine with the guiding principles established by the Council of Europe on the further implementation and use of AI technologies and its harmonization with the European one; ensuring the functioning and operation of technical committees of standardization in accordance with the requirements of relevant standards concerning AI; ensuring cooperation between the relevant Technical Committees of Ukraine and international subcommittees of standardization ISO / IEC JTC 1 / SC 42 Artificial Intelligence on the joint development of standards in the field of artificial intelligence; support for initiatives to create organizational forms of cooperation between interested legal entities and individuals in the field of AI; formulation of a Code of Ethics for artificial intelligence with the participation of a wide range of stakeholders.

Despite the fact that the first specialized normative act was adopted in Ukraine only in 2020, Ukrainian scientists have already begun to consider the problems of legal regulation of the use of AI in various areas of law and analyze EU norms in this area. Noteworthy scholar is O. E. Radutnyi, who studies criminal liability and legal personality of AI. He notes that in the future the Criminal Code of Ukraine will be supplemented by a section on the responsibility of "electronic person (identity)" for criminal offenses and thus defined AI as a subject of legal relations. According to this scholar, reflections on the liability of the AI makes sense only if humanity retains control over it (Radutnyi, 2018). In turn, N. Martsenko, studying the legal regime of AI in civil law, notes that understanding AI and work as a subject of civil law seems inexpedient and may cause the ambiguity in law. The use of definition "electronic person" in EU regulations, in author's opinion, seems premature, as the spread of this concept in the field of law does not provide a holistic legal understanding of its legal status, civil liability, user protection, data protection. The author also determines that it is more appropriate to understand work and AI as an object of civil rights. Consequently, the regulation of civil liability at the level of consumer relations gives grounds to consider AI as a product (commodity) (Martsenko, 2019). Researchers that study the prospects of legal regulation of artificial intelligence note that European Parliament resolutions serve as a kind of beacon, by highlighting those areas that require legislative regulation, and identifying prospects for such regulation not only at EU level but also for many countries, including Ukraine. The development of certain European legal standards for robotics and AI will contribute to the development of the relevant industry and ensure respect for human rights in the formation of new social relations with the participation of autonomous devices (Pozova, 2017).

It should be noted that in Ukraine the AI technologies are using in a test mode, including its use for improving the environmental situation. But, unfortunately, in Ukraine the legislative regulation concerning using of AI is absent; as well there are too few scientific works that would consider the issues of legal regulation of AI in environmental protection and could become the foundation for the creation of relevant legislation. Therefore, decisive action is needed, which will be of great importance for ensuring human rights in the implementation and exploitation of the artificial intelligence technology, environmental safety requirements and ensuring the sustainable transformation to benefit situation for the country. Taking into

account the course of Ukraine towards European integration, it is obvious that it is the EU standards in this area that will be the initial reference point for the corresponding norms of Ukrainian legislation.

Thus, the use of AI must be properly regulated by law for the benefit of the whole society. Even the legislative definition of the concept of "artificial intelligence" already opens up access to new areas and industries. However, it should be noted that primary norms, which require legal consolidation are the norms for ensuring human rights in the use of AI and the procedure for using AI for environmental purposes, taking into account the principles of expediency and efficiency.

Concluding Remarks

The Artificial Intelligence is an innovative technology that is expected to improve society, business and states. It can help find the solutions for ongoing global problems, including climate change and ecological degradation, at the same time protecting democracy and fighting crime. A human-centered approach to the AI should focus on that AI is designed, implemented, treated and controlled, provided fundamental human rights are respected. The Treaties of the European Union and Charter of Fundamental Rights of the European Union provide respect for people dignity, when a human enjoys a unique and inalienable moral status. At the same time environmental issues and a balanced attitude that ensures the prosperity of mankind in next decades and centuries are taken into account (Madiega, 2019).

There are various ways AI can be used to combat climate change, such as collecting and using data on temperature and carbon emissions, natural and ecological disasters, demonstrating how extreme weather effects on human environment, improving forecasts and energy management, processing endangered species data, transforming the transport landscape for reducing carbon emissions, tracking deforestation and industrial carbon emissions, tracking the ocean ecosystem, predicting periods of dehydration, ensuring precision agriculture, contributing to smart recycling, helping carbon capture and geoengineering, at the same time convincing consumers to be more environmentally conscious.

However, the use of the AI raises various problems concerning negative influence on the nature, which requires careful consideration. The AI technologies consume a lot of electricity and materials, accelerate the fossil fuels extraction and overuse environmentally friendly amounts of minerals, while companies provide little information about their ecological footprint. It is also noteworthy to highlight such issues as a threat to private information and other data protection. The political problems concern human freedoms, the impact of the AI on people's behavior (up to the idea of using direct enforcement), the problem of global justice and fairness between generations as well as the problem of the "Anthropocene".

From an institutional point of view, there is a need for constant interaction between technological development, political and public debate. It is due to the fact that all people make a certain contribution to climate change and have to take responsibility for the future of the planet by changing their way of life. The integral system of legislative acts is required for the effective and safe use of the AI for environmental and other purposes. Such acts will regulate a single conceptual and categorical apparatus, fundamental principles and rules for the creation, testing, implementation, application and closure of such projects, the establishment of legal responsibility for possible negative consequences and the procedure for compensation for damage. The AI products and services are the subject to many areas of the law, including privacy, data security, product liability, intellectual property, and antitrust laws. In addition, these areas of the law are expected to be modified according to the new circumstances connected with AI. As AI is a principally new technical application and comprehensive legal risk assessment has not become the common place, the efforts to comply require non-standard approach and the drive to understand what society needs at the moment. As a sign of acceptance of the exceptional capabilities of AI, some leading businesses are demanding the adoption of the efficient regulatory framework.

The EU does not have a unified AI regulation system; however, a number of resolutions and the AI White Paper have already been adopted, which highlights the main problematic issues that require regulation and provides a roadmap that will be used for the future formation of the EU legislation. According to the pace of development in this area, it can be predicted that the EU will be one of the first creators of a legislative foundation, which will subsequently be implemented by other countries, including Ukraine. In turn, Ukraine has made first legal steps in this area. However, there is no AI use legislation. Moreover, little legal scientific research that would consider the issues of legal regulation of the AI in environmental protection and could become the foundation for the creation of relevant legislation has been made yet. Thus, it is a decisive action that may require long time towards ensuring human rights-based approach to the development, deployment and use of AI in Ukraine in order to meet environmental safety requirements and achieve sustainable development. Taking into account Ukrainian course towards European integration, it is obvious that the EU standards will be a foundation for this area and serve as initial point for the corresponding norms of Ukrainian legislation in the future. This will allow Ukraine to move forward in reducing its carbon footprint and combating climate change.

References

Andrae, A. (2017). Total Consumer Power Consumption Forecast. *Conference: Nordic Digital Business Summit*. Available online: https://www.researchgate.net/publication/320225452_Total_Consumer_Power_Consumption_Forecast [Accessed on 21 June 2021].

Andrae, A. and Edler, T. (2015). On Global Electricity Usage of Communication Technology: Trends to 2030. *Challenges*, 6(1): 117-157. DOI: https://doi.org/10.3390/challe6010117

Autodesk (2016). Reimagining the future of air travel. Available online: https://www.autodesk.com/customer-stories/airbus [Accessed on 21 June 2021].

Belkhir, L. and Elmeligi, A. (2018). Assessing ICT global emissions footprint: Trends to 2040 & Recommendations. *Journal of Cleaner Production*, 177: 448-463. DOI: https://doi.org/10.1016/j.jclepro.2017.12.239.

C3 AI (2019). Baker Hughes, a GE company and C3.ai Announce Joint Venture, June 24, 2019. Available online: https://c3.ai/baker-hughes-and-c3-ai-announce-joint-venture-to-deliver-ai-solutions [Accessed on 21 June 2021].

Coeckelbergh, M. (2020a). *AI Ethics*. Cambridge, MA: MIT Press Essential Knowledge series, pp. 167-183.

Coeckelbergh, M. (2020b). AI for climate: freedom, justice, and other ethical and political challenges. *AI and Ethics*, 1(1): 67-72. DOI: https://doi.org/10.1007/s43681-020-00007-2.

COMEST (2010). The ethical implications of global climate change. Available online: http://www.gci.org.uk/Documents/UNESCO_COMEST_.pdf [Accessed on 21 June 2021].

Cook, G., Lee, J., Tsai, T., Kong, A., Deans, J., Johnson, B. and Jardim, E. (2017). Clicking Clean: Who is winning the race to build a green internet. *Greenpeace Report*. Available online: https://www.actu-environnement.com/media/pdf/news-28245-clicking-clean-2017.pdf [Accessed on 21 June 2021].

Cornell University (2019). AI helps reduce Amazon hydropower dams' carbon footprint. *Science Daily*, September 19, 2019. Available online: www.sciencedaily.com/releases/2019/09/190919134703.htm [Accessed on 21 June 2021].

Coulombel, N., Boutueil, V., Liu, L., Viguié, V. and Yin, B. (2019). Substantial rebound effects in urban ridesharing: Simulating travel decisions in Paris, France. *Transportation Research Part D: Transport and Environment*, 71: 110-126. DOI: https://doi.org/10.1016/j.trd.2018.12.006.

Crawford, K. and Joler, V. (2018). Anatomy of an AI System: The Amazon Echo as an anatomical map of human labor, data and planetary resources. Available online: https://anatomyof.ai [Accessed on 21 June 2021].

Crutzen, P.J. (2006). The "Anthropocene". In: Ehlers E. and Krafft T. (eds), *Earth System Science in the Anthropocene*. Berlin, Heidelberg: Springer. DOI: https://doi.org/10.1007/3-540-26590-2_3.

Dignum, V. (2019). *Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way. Artificial Intelligence: Foundations, Theory, and Algorithms*. Cham.: Springer. DOI: https://doi.org/10.1007/978-3-030-30371-6_5.

Dobbe, R. and Whittake, M. (2019). AI and Climate Change: How they're connected, and what we can do about it. AI Now Institute, October 17, 2019. Available online: https://medium.com/@AINowInstitute/ai-and-climate-change-how-theyre-connected-and-what-we-can-do-about-it-6aa8d0f5b32c [Accessed on 21 June 2021].

Duff, A.S. (2015). *Information Society*. *International Encyclopedia of the Social & Behavioral Sciences (Second Edition)*. London: Elsevier, pp.83-89. DOI: https://doi.org/10.1016/B978-0-08-097086-8.95017-7.

European Commission (2018a). EU Declaration on Cooperation on Artificial Intelligence. Available online: https://ec.europa.eu/jrc/communities/en/node/1286/document/eu-declaration-cooperation-artificial-intelligence [Accessed on 22 June 2021].

European Commission (2018b). Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. Artificial Intelligence for Europe. Brussels, 25 April 2018. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2018%3A237%3AFIN[Accessed on 22 June 2021].

European Commission (2018c). Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. Coordinated Plan on Artificial Intelligence, Brussels, 7 December 2018 COM (2018) 795 final. Available online: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52018DC0795[Accessed on 22 June 2021].

European Commission (2019). A definition of Artificial Intelligence: main capabilities and scientific disciplines. Available online: https://ec.europa.eu/digital-single-market/en/news/definition-artificial-intelligence-main-capabilities-and-scientific-disciplines [Accessed on 21 June 2021].

European Commission (2019a). Ethics guidelines for trustworthy AI. Available online: https://digital-strategy.ec.europa.eu/en/library/ethics-guidelines-trustworthy-ai [Accessed 22 June 2021].

European Commission (2020a). Robotics and Artificial Intelligence (Unit A.1). Available online: https://ec.europa.eu/digital-single-market/en/content/robotics-and-artificial-intelligence-innovation-and-excellence-unit-a1 [Accessed 22 June 2021].

European Commission (2020b). White Paper on Artificial Intelligence: a European approach to excellence and trust of 19 February 2020. Available online: https://ec.europa.eu/info/publications/white-paper-artificial-intelligence-european-approach-excellence-and-trust_en [Accessed on 21 June 2021].

European Commission (2020c). Commission Report on safety and liability implications of AI, the Internet of Things and Robotics of 19 February 2020. Available online: https://ec.europa.eu/info/publications/commission-report-safety-and-liability-implications-ai-internet-things-and-robotics-0_en [Accessed on 22 June 2021].

European Parliament (2017). Resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics. Available online: https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_EN.html [Accessed on 21 June 2021].

European Parliament (2020a). Resolution of 20 October 2020 on intellectual property rights for the development of artificial intelligence technologies. Available online: https://www.europarl.europa.eu/doceo/document/TA-9-2020-0277_EN.html [Accessed on 22 June 2021].

European Parliament (2020b). Resolution of 20 October 2020 with recommendations to the Commission on a framework of ethical aspects of artificial intelligence, robotics and related technologies. Available online: https://www.europarl.europa.eu/doceo/document/TA-9-2020-0275_EN.html [Accessed on 22 June 2021].

European Parliament (2020c). Resolution of 20 October 2020 with recommendations to the Commission on a civil liability regime for artificial intelligence. Available online: https://www.europarl.europa.eu/doceo/document/TA-9-2020-0276_EN.html [Accessed on 22 June 2021].

Fedorov, M. (2020). By developing the sphere of artificial intelligence, we ensure Ukraine's competitiveness on the international market. December 2, 2020. Available online: https://www.kmu.gov.ua/news/mihajlo-fedorov-rozvivayuchi-sferu-shtuchnogo-intelektu-mi-zabezpechuyemo-konkurentospromozhnist-ukrayini-na-mizhnarodnomu-rinku [Accessed on 21 June 2021].

Feindor-Schmidt, U. (2020). Regulation of Artificial Intelligence in Europe - What's in the pipeline? Lexology, December 1, 2020. Available online: https://www.lexology.com/library/detail.aspx?g=d9f74ab9-139c-49e1-9d82-70de718af80f [Accessed on 22 June 2021].

Filippova, A. (2021). Current security issues in the information society. *SHS Web of Conferences*, 109, n. 01014. DOI: https://doi.org/10.1051/shsconf/202110901014.

Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., Luetge, C., Madelin, R., Pagallo, U., Rossi, F., Schafer, B., Valcke, P. and Vayena, E. (2018). AI4People—An Ethical Framework for a Good AI Society: Opportunities, Risks, Principles, and Recommendations. *Minds and Machines*, 28(4): 689-707. DOI: https://doi.org/10.1007/s11023-018-9482-5.

Gardner, A.V.D.L. (1984). An artificial intelligence approach to legal reasoning. Thesis (Ph.D.), Stanford University. The MIT Press, p. 239.

Gates, B. (2020). 'COVID-19 is awful. Climate change could be worse' The blog of Bill Gates, August 04, 2020. Available online: https://www.gatesnotes.com/Energy/Climate-and-COVID-19 [Accessed on 22 June 2021].

Gent, E. (2020). This 'Once-For-All' Neural Network Could Slash AI's Carbon Footprint. *SingularityHub*, May 4, 2020. Available online: https://singularityhub.com/2020/05/04/this-once-for-all-neural-network-could-slash-ais-carbon-footprint/ [Accessed on 21 June 2021].

Giles, M. (2019). Is AI the Next Big Climate-Change Threat? We Haven't a Clue. *MIT Technology Review*, July 29, 2019. Available online: https://www.technologyreview.com/2019/07/29/663/ai-computing-cloud-computing-microchips/ [Accessed on 21 June 2021].

Guzman, A. (2021). Race After Technology: Abolitionist Tools for the New Jim Code. *Information, Communication & Society*, 24:13, 1989-1990. DOI: https://doi.org/10.1080/1369118X.2020.1844269.

Hao, K. (2019). Here are 10 ways AI could help fight climate change. MIT Technology Review, June 20, 2019. Available online: https://www.technologyreview.com/2019/06/20/134864/ai-climate-change-machine-learning/ [Accessed 21 June 2021].

Hazas, M., Morley, J., Bates, O. and Friday, A. (2016). Are there limits to growth in data traffic?: On time use, data generation and speed. Proceedings of the Second Workshop on Computing within Limits, 14: 1–5. DOI: https://doi.org/10.1145/2926676.2926690.

Hern, A. (2018). Bitcoin's Energy Usage Is Huge – We Can't Afford to Ignore It. *The Guardian*, January 17, 2018. Available online: https://perma.cc/2X2H-CF9V [Accessed on 21 June 2021].

IPCC (Intergovernmental Panel on Climate Change) (2018). An IPCC special report on the impacts of global warming of 1.5°C. Available online: https://www.ipcc.ch/sr15/ [Accessed on 21 June 2021].

Ise, T. and Oba, Y. (2019) Forecasting Climatic Trends Using Neural Networks: An Experimental Study Using Global Historical Data. *Frontiers in Robotics and AI*, 6:32. DOI: https://doi.org/10.3389/frobt.2019.00032.

Kates-Harbeck, J., Svyatkovskiy, A. and Tang, W. (2019). Predicting disruptive instabilities in controlled fusion plasmas through deep learning. *Nature*, 568: 526-531. DOI: https://doi.org/10.1038/s41586-019-1116-4.

Kirchgaessner, S. (2019). Revealed: Google made large contributions to climate change deniers. *The Guardian*, October 11, 2019. Available online:

https://amp.theguardian.com/environment/2019/oct/11/google-contributions-climate-change-deniers?__twitter_impression=true [Accessed on 21 June 2021].

Madiega, T. (2019). EU guidelines on ethics in artificial intelligence: Context and implementation. European Parliamentary Research Service, pp. 1-13. Available online: https://www.europarl.europa.eu/RegData/etudes/BRIE/2019/640163/EPRS_BRI(2019)640163_EN.pdf [Accessed on 22 June 2021].

Martins, N.R.B., Angelica, A., Chakravarthy, K., Svidinenko, Y., Boehm, F.J., Opris, I., Lebedev, M.A., Swan, M., Garan, S.A., Rosenfeld, J.V., Hogg, T. and Freitas, R.A. (2019). Human Brain/Cloud Interface. *Frontiers in Neuroscience*, 13:112. DOI: https://doi.org/10.3389/fnins.2019.00112.

Martsenko, N. (2019) Legal regime of artificial intelligence in civil law. *Aktual'ni problemy pravoznavstva*, 4: 91-98. Available online: http://dspace.wunu.edu.ua/handle/316497/38382 [Accessed on 22 June 2021].

Matheson, R. (2020). Reducing the carbon footprint of artificial intelligence. *MIT News*, April 23, 2020. Available online: https://news.mit.edu/2020/artificial-intelligence-ai-carbon-footprint-0423 [Accessed on 21 June 2021].

McGlade, C. and Ekins, P. (2015). The geographical distribution of fossil fuels unused when limiting global warming to 2°C. *Nature*, 517: 187-190. DOI: https://doi.org/10.1038/nature14016.

McGovern, A., Elmore, K., Gagne, D., Haupt, S., Karstens, C., Lagerquist, R., Smith, T. and Williams, J. (2017). Using Artificial Intelligence to Improve Real-Time Decision-Making for High-Impact Weather. *Bulletin of the American Meteorological Society*, 98(10): 2073-2090. DOI: https://doi.org/10.1175/BAMS-D-16-0123.1

McQuade, S. and Monteleoni, C. (2012). Global Climate Model Tracking Using Geospatial Neighborhoods. Proceedings of the AAAI Conference on Artificial Intelligence, 26 (1): 335-341.

Microsoft News Center (2018). Microsoft demonstrates the power of AI and Cloud to Oil and Gas players, at ADIPEC 2018. November 12, 2018. Available online: https://news.microsoft.com/en-xm/2018/11/12/microsoft-demonstrates-the-power-of-ai-and-cloud-to-oil-and-gas-players-at-adipec-2018/ [Accessed on 21 June 2021].

Mitchell, A., Dokei, T., Hickman, T. and Albagli, D. (2020). Regulation of Artificial Intelligence in Europe and Japan. White & Case LLP, August 24, 2020. Available online: https://www.whitecase.com/publications/insight/regulation-artificial-intelligence-europe-and-japan [Accessed on 22 June 2021].

Monteleoni, C., Schmidt, G., Saroha, S. and Asplund, E. (2011). Tracking climate models. Statistical Analysis and Data Mining. *The ASA Data Science Journal*, 4(4): 372-392. DOI: https://doi.org/10.1002/sam.10126

Mulvaney, K. (2019). Climate change report card: These countries are reaching targets. National Geographic, September 19, 2019. Available online: https://www.nationalgeographic.com/environment/article/climate-change-report-card-co2-emissions [Accessed on 21 June 2021].

Muraleedharan, S. (2021). Role of Artificial Intelligence in Environmental Sustainability. *EcoMENA*, January 30, 2021. Available online: https://www.ecomena.org/artificial-intelligence-environmental-sustainability/ [Accessed on 21 June 2021].

OECD (2019). Recommendation of the Council on Artificial Intelligence. OECD Legal Instruments. Available online: https://legalinstruments.oecd.org/api/print?ids=648&lang=en [Accessed on 22 June 2021].

Parliament of Ukraine (2018). On approval of the Concept of development of the digital economy and society of Ukraine for 2018-2020 and approval of the action plan for its implementation. Available online: https://www.kmu.gov.ua/npas/pro-shvalennya-koncepciyi-rozvitku-cifrovoyi-ekonomiki-ta-suspilstva-ukrayini-na-20182020-roki-ta-zatverdzhennya-planu-zahodiv-shodo-yiyi-realizaciyi [Accessed 22 June 2021].

Parliament of Ukraine (2020). The concept of artificial intelligence development in Ukraine. Available online: https://zakon.rada.gov.ua/laws/show/1556-2020-%D1%80#Text [Accessed 22 on June 2021].

Pearce, F. (2018). Energy Hogs: Can World's Huge Data Centers Be Made More Efficient? *Yale Environment 360*, April 3, 2018. Available online: https://perma.cc/J2H3-EL75 [Accessed on 21 June 2021].

Pozova, D. (2017). Prospects of legal regulation of artificial intelligence under EU legislation. *Chasopys tsyvilistyky*, 27: 116-120.

Raban, D., Gordon, A. and Geifman, D. (2011). The Information Society. *Information, Communication & Society*, 14(3): 375-399. DOI: https://doi.org/10.1080/1369118X.2010.542824

Radutnyi, A. (2018). Subjectivity of artificial intelligence in criminal law. *Pravo Ukrayiny*, 1: 123-136.

Rasp, S., Pritchard, M. and Gentine, P. (2018). Deep learning to represent sub-grid processes in climate models. *Proceedings of the National Academy of Sciences*, 115(39): 9684-9689. DOI: https://doi.org/10.1073/pnas.1810286115.

Rissland, E., Ashley K. and Loui R., (2003). AI and Law: A fruitful synergy. *Artificial Intelligence*,150 (1-2): 1-15.DOI: https://doi.org/10.1016/S0004-3702(03)00122-X.

Ritchie, H. (2019). Number of People in the World Without Electricity Falls Below One Billion. *Our World in Data*, January 18, 2019. Available online: https://ourworldindata.org/number-of-people-in-the-world-without-electricity-access-falls-below-one-billion [Accessed on 21 June 2021].

Roach, J. (2020). Microsoft finds underwater datacenters are reliable, practical and use energy sustainably. September 14, 2020. Available online: https://news.microsoft.com/innovation-stories/project-natick-underwater-datacenter/ [Accessed on 21 June 2021].

Rolnick, D., Donti, L. P., Kaack, H. L., Kochanski, K., Lacoste, A., Sankaran, K., Slavin Ross, A., Milojevic-Dupont, N., Jaques, N., Waldman-Brown, A., Luccioni, A., Maharaj, T., Sherwin, D.E., Mukkavilli, S.K., Kording, K.P., Gomes, C., Ng, A.Y., Hassabis, D., Platt, J.C., Creutzig, F., Chayes, J. and Bengio, Y. (2019). Tackling Climate Change with Machine Learning. Available online: https://arxiv.org/abs/1906.05433 [Accessed on 21 June 2021].

Selby, J., Cox, E. and Royston, S. (2016). Impact of Non-energy Policies on Energy Systems. UK Energy Research Centre, London, November 2016. Available online: https://ukerc.ac.uk/publications/impact-of-non-energy-policies-on-energy-systems/ [Accessed on 21 June 2021].

Snow, J. (2019). How artificial intelligence can tackle climate change. *National Geographic*, July 18, 2019. Available online: https://www.nationalgeographic.com/environment/2019/07/artificial-intelligence-climate-change/ [Accessed on 21 June 2021].

St. John, J., (2018). Texas Takes a Big Step in Improving Access to Smart Meter Data. *Greentechmedia*, February 6, 2018. Available online: https://perma.cc/G4ZJ-L4LT [Accessed on 21 June 2021].

Stein, A.L. (2020). Artificial Intelligence and Climate. *Yale Journal on Regulation*, 37(3): 890-939.

Strubell, E., Ganesh, A. and McCallum, A. (2019). Energy and Policy Considerations for Deep Learning in NLP. Available online: https://arxiv.org/abs/1906.02243 [Accessed on 21 June 2021].

Thaler, R. and Sunstein, C. (2008). *Nudge: Improving Decisions About Health, Wealth and Happiness*. New York: Yale University Press, p. 293.

UNESCO (2019a). An Integrated System for Global Real-time Precipitation Observation using PDIR. Available online: http://en.unesco.org/news/irain-newmobile-app-promote-citizen-science-andsupport-water-management [Accessed on 21 June 2021].

UNESCO (2019b). Artificial intelligence for sustainable development: challenges and opportunities for UNESCO's science and engineering programmes. *UNESCO Digital Library*. Available online: https://unesdoc.unesco.org/ark:/48223/pf0000368028.locale=en [Accessed on 21 June 2021].

United Nations (1992). Framework Convention on Climate Change. Available online: https://www.un.org/ru/documents/decl_conv/conventions/climate_framework_conv.shtml [Accessed on 21 June 2021].

United Nations (1997). Kyoto Protocol to the United Nations Framework Convention on Climate Change. Available online: https://www.un.org/ru/documents/decl_conv/conventions/kyoto.shtml [Accessed on 21 June 2021].

United Nations (2015). The Paris Agreement. Available online: https://www.un.org/ru/climatechange/paris-agreement [Accessed on 21 June 2021].

United States Environmental Protection Agency (2020). Sources of Greenhouse Gas Emissions. Available online: https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions [Accessed 21 June 2021].

Vos, J. (2009). Actions Speak Louder than Words: Greenwashing in Corporate America. Notre Dame Journal of Law. *Ethics & Public Policy*, 23(2): 673-697.

WMO (World Meteorological Organization) (2019). The Global Climate in 2015–2019. Available online: https://library.wmo.int/index.php?lvl=notice_display&id=21522#.YNb_cmgzbIU [Accessed on 22 June 2021].

Wolff-Anthony, L., Kanding, B. and Selvan, R. (2020). Carbon tracker: Tracking and Predicting the Carbon Footprint of Training Deep Learning Models. Available online: https://arxiv.org/abs/2007.03051 [Accessed on 21 June 2021].

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Authors' Contributions (in accordance with ICMJE criteria for authorship)

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Conceived and designed the research or analysis	Yes	Yes
Collected the data	Yes	No
Contributed to data analysis & interpretation	Yes	Yes
Wrote the article/paper	Yes	Yes
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