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The role of artificial intelligence in sustainability topics

Abstract: Artificial intelligence is a major focus of attention today. As the technological advances brought about by these developments become more widespread, the potential for their application in all areas of the economy, society and nature has been growing. The processes outlined above, the changes brought about by technological and technical progress, are having an increasingly marked impact on all aspects of our lives. This expansion also raises significant sustainability issues.
This study will explore the questions and possible answers that are now on everyone's minds in relation to these developments.
With the rise of artificial intelligence, how sustainable will the economy, society and nature be? How will the emergence of artificial intelligence affect economic, social and environmental aspects? Will AI be able to support sustainability or should other impacts be taken into account, such as the energy hunger of the new technology? In which areas can AI be most effective? We are seeking answers to these questions by exploring the views of students at our university.
Keywords: Artificial intelligence, sustainability, application advantages, disadvantages.

Összefoglalás: A mesterséges intelligencia napjainkban kitüntetett figyelmet élvez. A fejlődés okozta technológiai vívmányok egyre szélesebb körű térnyerése, alkalmazásának lehetőségei a gazdaság, a társadalom és természet minden területén megjelentek. A felvázolt folyamatok technológiai, technikai fejlődés okozta változások egyre markánsabban érzékeltetik hatásukat életünk minden szegmensében. A térnyerés következtében markáns fenntarthatósági kérdések is felvetődnek. A tanulmány kitér azokra a kérdésekre és a lehetséges válaszokra, amelyek napjainkban mindenkit foglalkoztatnak ezekkel a fejlesztésekkel kapcsolatban.

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A mesterséges intelligencia térnyerésével vajon mennyire lesz a gazdaság, a társadalom, a természet fenntartható? Hogyan alakulnak a mesterséges intelligencia megjelenésével a gazdasági, a szociális és környezeti szempontok? Vajon képes lesz támogatni a mesterséges intelligencia a fenntarthatóságot, vagy egyéb hatásait is érdemes figyelembe venni, mint például az új technológia energiaéhsége? Milyen területeken lehet a leghatékonyabb a mesterséges intelligencia? Kutatásunk kérdéseire egyetemünk hallgatói véleményét is feltárva keressük a válaszokat.
Kulcsszavak: Mesterséges intelligencia, fenntarthatóság, alkalmazási előnyök és hátrányok.

Introduction

On a global level, the development of artificial intelligence (hereinafter: AI) has become a new competitive factor. The waves of change stimulated by technological development are not abating, in fact, according to some forecasts, they will transform our future to such an extent that within 40 years, smart machines will be able to perform all work tasks currently performed by human resources, and they will do it all more economically and to a higher standard [1]. AI can support a sustainable economy in several areas. It can help optimize energy consumption in both industry and households with the help of smart grids. The importance of this also increases with the magnitude of the increasingly dominant domestic solar energy production. In the case of agriculture, AI may be able to pre-plan optimal irrigation by studying weather patterns. It can also support selective recycling in waste management. AI is able to manage the traffic load of the settlements through prevention [2]. In the case of sustainable economic decisions, it can support the operation of the companies concerned with continuous monitoring. Large technology companies are already offering economic players solutions that not only measure their carbon dioxide emissions, but also allow them to optimally plan their carbon emissions [3].

The operational elements that can be converted into data sets can be found in AI patterns. It can solve complex tasks based on evaluation trends from a lot of data. The operation of large settlements can be described with a lot of data, and by analyzing this, the planning of cities that are currently being built can result in optimally localized infrastructural solutions from the point of view of the community, but the redesign of existing settlements can also be supported [4].

[1] Berger, R. (2022): *Focus. The digital dilemma. Why companies struggle to master digital transformation.* https://content.rolandberger.com/hubfs/07_presse/Roland_Berger_Focus_Digital_Dilemma_N3XT_2022.pdf

[2] Jóźwiak, P.–Falus, O. (2022): Legal Regulations on Autonomous Vehicles in Poland and Hungary: The Issue of Criminal Liability In: Balázs László–Rajcsányi-Molnár Mónika–András István (Eds.): *Elektromobilitás és társadalom.* Dunaújváros: DUE Press, pp. 125–136.

[3] Chikán A. (2023): Fenntarthatóság a mesterséges intelligencia korában. *CHIKANSPLANET.* (21 April, 2023) https://chikansplanet

[4] Sanchez, T. W.–Brenman, M.–Ye, X. (2024): The Ethical Concerns of Artificial Intelligence in Urban Planning. *Journal of the American Planning Association,* 2., pp. 1–14.

AI requires enormous computing capacity, which has hindered its development for a long time. This demand also induces a high energy demand. So this operation also has an ecological footprint, which we usually don't talk about [5].

Legal background and recent regulations on the use of AI in the field

Although the EU has made the development of AI a top priority, it also draws attention to the dangers of its use. It is also considered necessary to take risks into account, which resulted in drafting legislation to this end.

The purpose of the AI Act is to set clear requirements and obligations for AI developers and users with regard to the different uses of AI. It also aims to reduce the administrative and financial burden on businesses, in particular small and medium-sized enterprises (SMEs).

The AI Act is the first comprehensive legal framework for AI worldwide. AI legislation will ensure that Europeans can have confidence in what AI has to offer.
The proposed rules are:
– Managing the risks created specifically by artificial intelligence applications;
– Ban AI practices that pose unacceptable risks;
– Define a list of high-risk applications;
– Set clear requirements for AI systems used for high-risk applications;
– Define specific obligations for users and providers of high-risk AI applications;
– Require conformity assessment before placing an MI system in service or placing it on the market;
– Implement enforcement after a particular MI system has been placed on the market;
– Establishing a governance structure at European and national level.

The regulatory framework for AI systems employs a risk-based approach, defining four levels of risk.

A key finding is that "Any AI system that clearly threatens people's safety, livelihoods, and rights will be banned, from social scoring systems implemented by governments to games that use audio support to encourage dangerous behavior" [6].

[5] Wang, Q.–Sun, T.–Li, R. (2023): Does artificial intelligence (AI) reduce ecological footprint? The role of globalization. *Environmental Science and Pollution Research,* 30., pp. 123948–123965.

[6] Madiega, T. (2024): *Artificial intelligence act,* Available: https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/698792/EPRS_BRI(2021)698792_EN.pdf

AI and Sustainability

Sustainable growth must be distinguished from sustainable development, because in the former we strive to be more, in the latter we are better [7].

The Sustainable Development Goals (SDGs) were unanimously adopted by the 193 member states of the United Nations in September 2015 for the period 2015–2030. However, we can interpret these development goals in a way that cannot be legally enforced, but only in the form of general political and policy-based commitments. The Sustainable Development Goals have 17 main goals and 169 related sub-goals. The main objectives are the following:

1. No poverty.
2. Zero hunger.
3. Good health and well-being.
4. Quality Education.
5. Gender equality.
6. Clean water and sanitation.
7. Affordable and clean energy.
8. Decent work and economic growth.
9. Industry, innovation and infrastructure.
10. Reduced inequalities.
11. Sustainable cities and economies.
12. Responsible consumption and production.
13. Climate action.
14. Life below water.
15. Life on land.
16. Peace, justice and strong institutions.
17. Partnership for the goals [8].

All of the 17 named goals are affected by AI. In the case of 7 goals, a commitment that is in line with the benefits offered by AI appears in relation to the sub-goals. These are: no poverty (Goal 1); quality education (Goal 4); affordable and clean energy (Goal 7); but mostly the industry, innovation and infrastructure (Goal 9); sustainable cities and economies (Goal 11), peace, justice and strong institutions (Goal 16); and partnership for the goals (Goal 17).

[7] Gyulai I. (2021): *Ökológiai Intézet a Fenntartható Fejlődésért.* www.ecolinst.hu

[8] UN (2015): *Sustainable Development Goals /SDGs/ of the 2030 Agenda for Sustainable Development.* https://www.un.org/sustainabledevelopment/sustainable-development-goals/

In the case of these sub-goals, the strong technological exposure predicts that they could be implemented much more efficiently with the involvement of AI applications [9].

The purpose of this study is not to present the application possibilities of AI in relation to all sustainability goals [10], but to serve the student attitudes that are the focus of our research we cite some examples from the literature.

The responsible use of AI (and the possibility of human control) is of key importance. Uncertainty is present in all AI applications, as a result of which an unfavourable AI development scenario can adversely affect the Development Goals. If the appropriate guarantees are not created by the states through legislation or if the interested actors do not act accordingly during the practical implementation, this can easily happen [9].

Nowadays, artificial intelligence is used to solve problems, especially to reduce the use of labour, to increase the efficient use of resources and to promote sustainable business processes [11].

The most common AI-supported topics in agriculture: Forecasting 40%, harvesting 31%, advanced plant care 29%, weed control 21%, supply chain 4%, management of used resources 3% and automated milking and animal husbandry 2% [12].

And by using different drones, it becomes possible to assess the exact location and extent of disaster-stricken areas – especially large-scale fires – and to plan protection measures in a more targeted manner [13].

Furthermore, a study draws attention to the possibility of predicting energy demand by using a kind of artificial neural network of the AI model through the prediction of Türkiye's energy production [14].

The above examples show the complexity of the topic. In the following chapters, we will cover the research conducted among our students.

[9] Kecskés G. (2023): A mesterséges intelligencia az ENSZ Fenntartható Fejlődési Céljai szolgálatában In: Glavanits J. (Ed.): *Fogyasztóbarát és fenntartható mesterséges intelligencia – a velünk élő AI egyes aktuális kérdései.* Győr: UNIVERSITAS-Győr, pp. 45–62.

[10] Falus, O. (2024): Thoughts on legal sustainabilty – 'Nihil sub sole novum.' *Russian Law Journal,* 12., (2.), pp. 51–59.

[11] Nagy S. (2023). Az agrobiznisz kihívásai a mesterséges intelligencia térnyerésének tükrében – szakirodalmi szintézis In: *Mezőgazdasági és vidékfejlesztési kutatások a jövő szolgálatában 4.* Szeged: MTA SZAB Mezőgazdasági Szakbizottság, pp. 159–175.

[12] Sachithra, V.–Subhashini, L. D. C. S. (2023): How artificial intelligence uses to achieve the agriculture sustainability: *Systematic review. Artificial Intelligence in Agriculture,* 8., pp. 46–59.

[13] Takáts A.–Bednárik É.–Németh N.–Koloszár, L. (2023): Drónos megfigyelések lehetőségei a katasztrófavédelem és tűzvédelem területén. In: Széles Zs.–Szőke T. M. (Eds.): *A mesterséges intelligencia szerepe a fenntartható gazdasági döntésekben.* Sopron: Sopron Egyetemi Kiadó, 72–92.

[14] Bayrak, M.–Esen, Ö. (2014): Forecasting Turkey's Energy Demand Using Artificial Neural Networks: Future Projection Based on an Energy Deficit". *Journal of Applied Economic Sciences,* 2., (28.), pp. 191–204.

The research

Research Method

In the course of our study, the involvement of the students of the University of Dunaújváros, Hungary, in relation to the spread of AI, their level of information on the topic, and their attitude towards the sustainability of AI came into focus.

To ensure the representativeness of the students, the digital survey was applied to several basic courses. Regarding the methods, we used an online survey with a questionnaire. With regard to the sampling procedure, we chose to fill in the students on a voluntary basis. We had a total of 559 respondents.

In order to research the social effects of AI, the composition of the questionnaire survey was as follows. The research is guided by 9 demographic questions, in which we also asked about the students' affinity for the topic. After that, in the case of statements related to the scope and social effects of artificial intelligence, as well as AI and sustainability, the respondents had to declare the importance of the answers based on a Likert scale from one to five. The last 2 questions were explanatory, in which the students could express themselves freely about the topic. Student values and attitudes related to the topic were brought to the surface in this way. During the research, we also used the diffusion model of innovation, so it is also necessary to discuss it.

Our preliminary assumption and hypothesis related to the study were as follows:

Hypothesis: Students are mostly informed about the effects of AI, but they are not supporters of the positive role of AI in sustainability.

Sampling

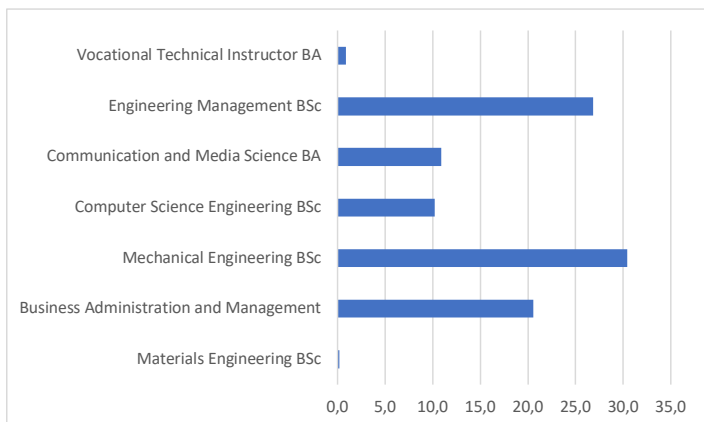
Within the demographic data of undergraduate students, the majority of respondents (68.8%) are men, 31.2% are women. Due to the characteristics of the basic population, we did not think that age differences were relevant, but they were an important attribute due to correspondence training. 23.4% of the students are under 25 years old, and another 35.6% are between 25–35 years old. Regarding the respondents, in the case of the division by department, 13.6% of the students participate in full-time and 86.4% in correspondence courses, which also presents the shift in the application rates of the last period.

We also asked what qualifications the students had already obtained and what work experience interval was available to them. 31.8% already have a higher education (of course, mainly in the case of correspondence courses), examining the internal distribution of this, 20% have specialized higher education courses. We also got a mixed picture in terms of work experience. Only 2% have not yet, and another 7% have less than one year of work experience.

In terms of students' residences, 23.8% live in rural areas, 61.8% live in cities, and 14.4% are students from the capital. In the case of the citizens of Budapest, we experienced marked differences in some of the results.

Regarding labour market status, 14.8% are students, 78.8% are employees, 3.9% are entrepreneurs, 1.1% of them are unemployed, and 1.4% of them are receiving childcare fee. The student status was certainly marked by those who could only interpret the answer in this legal relationship. With regard to the majors, it can be said that the distribution of those filling in is representative of our courses.

Figure 1. Distribution of respondents according to majors (%)



Source: Own edition, based on the research.

Presentation of the research results

Students' Perceptions of AI's Sustainability

In addition to the spread model, we present some answers by topic in the averages of the Likert scale. Regarding the role of AI in sustainability, we mapped student opinions based on sustainability topics. Responses are in *Table 1*.

Table 1. Students' attitudes

Question	Average (N=559)	Dispersion
AI will be able to support sustainability	3,6	1,0
AI can help end poverty	2,8	1,3
AI can help end hunger	2,7	1,3
AI can help boost health and well-being	3,2	1,2
AI can help deliver quality education	3,6	1,1
AI can help make gender equality mainstream	2,8	1,2
AI can help with clean water and basic public cleanliness	3,0	1,2
AI can help with affordable and clean energy	3,3	1,1
AI can help with fair work and economic growth	3,3	1,1
AI can help industry, innovation and infrastructure	3,7	1,0
AI can help reduce inequality	2,9	1,2
AI can help with sustainable cities and communities	3,3	1,0
AI can help in the area of responsible consumption and production	3,3	1,1
AI can help tackle climate change	3,2	1,2
AI can help protect oceans and seas	3,2	1,2
AI can help protect terrestrial ecosystems	3,2	1,2
AI can help with peace, justice and strong institutions	2,9	1,2
AI can help in the area of partnership and cooperation to achieve sustainability goals	3,2	1,1
AI can help the realization of partnership and cooperation in the field of Finance	3,3	1,1
AI can help the realization of partnership and cooperation in the field of Technology	3,6	1,0
AI can help the realization of partnership and cooperation in the field of Education and Training	3,6	1,1
AI can help the realization of partnership and cooperation in the field of trade	3,5	1,0
Other effects of AI should also be considered in Sustaina-bility, such as the energy hunger of new technology	3,7	1,1

Source: Own edition, based on the research.

In the table, marked deviations are indicated by filling. In the case of their answers to other questions, it can be stated that they have confidence in the application of the innovation in question, but they do not believe in its positive effect on GDP.

Students' Opinions Concerning Future

In relation to the students' vision of the future, a research showed the future ideas and expectations of student attitudes related to robots, artificial intelligence and their effects in employment [15]. In our current survey, as an open question regarding the level of trust, we asked in which areas the trust level of AI reached the level of human decisions.

We list some of the answers:

– "Political."
– "Financial investments, analyses."
– "Informatics."
– "Marketing."
– "Education."
– "I don't know exactly, but one thing is certain: people believe they want AI. If you want to believe AI, you will. The question is how well he does it."
– "Database Management."
– "Information flow."
– "Qualified, statistical data query."
– "Financial sector, Transportation and self-driving vehicles, Customer service and chatbots, Manufacturing and automation, Marketing and advertising optimization."
– "Customer service."
– "Also in their answer to our open question, they believe that it is worth considering the impact of AI in the case of sustainability issues in the following topics:
– "There are jobs that don't need to be done by humans, and therefore the retraining of these people should be supported."
– "Recycling."
– "Negative high energy demand, human supervision. Positive available information is a development opportunity."

[15] Kőkuti T. (2021): Hallgatói munka-érték-preferenciák a digitális oktatási formák bevezetésének fázisában. In: Balázs L. (Ed.): *Digitális kommunikáció és tudatosság.* Budapest: Hungarovox, pp. 65–77.

– "They're going to lean on him too much."
– "I wouldn't use it for military purposes because it could have a more serious negative effect."
– "Like all technological advances, this will cause a lot of people to become unemployed."
– "Fewer jobs."
– "Imature."
– "Energy use, Resource efficiency, Waste reduction, Biodiversity preservation."
– "Sustainable transport."
– "Negative High energy demand monitoring, Positive Technological development opportunity, abundance of information."
– "AI can contribute to sustainability by optimizing energy and resource use, but it can also have a negative impact through energy-intensive computing operations."
– "Unfortunately, there will be/are those who use it unethically, abuse the opportunities, even to gain an advantage in political or economic competition."
– "Increasing energy efficiency, Environmental monitoring, Optimizing transport systems."
– "Negative: AI models with high energy consumption, Data collection and data protection."
– "The control of the ideology framework that determines the development directions of AI."
– "It's a tool that, if used well, will have a positive effect, if used poorly, it will have a negative effect."
– "Still, a lot of people don't have jobs and robots with AI don't require wages. However, they are faster and probably heavier than humans. In addition, we can get very comfortable using AI in any field, I think this is something worth paying attention to."
– "Regarding sustainability and AI, e.g. during the recycling of electric car batteries, during the recycling of various plastics used in the automotive industry."
– "AI is not a panacea, many things could be achieved without it, if there was a demand for it, because AI suggests it will not be possible."
– "Green energies."
– "Huge energy demand, human influences/relationships are pushed into the background."
– "Forecasts, prognoses regarding the resources used."
– "I feel that the work of the poorer, less educated class is in danger, this is a negative effect."
– "People usually stick to the usual and don't want to open up to new things."
– "Human inflexibility, fear of innovations."
– "The lack of preparation for their application and the lack of building the tools and relationships necessary for their operation."
– "Safely establishing the relationship between AI and humans."
– "Trust, to understand its purpose, how it works and what its benefits are."

Conclusion

During the changes related to technical development, we explored the opinions and attitudes of university students regarding the spread of artificial intelligence. The reception of the introduction of the innovation was assessed. During the results, we managed to represent the categories of the spread model. Innovators, early adopters, and the early majority are all overrepresented compared to the traditional model. The late majority and laggards lag behind significantly. In the case of the latter, we can only speak of 1.8%.

Based on their answers to a direct question, our students clearly believe that AI will be able to support sustainability. However, the picture is more nuanced when sustainability is broken down into thematic areas. They see that it can help in the implementation of quality education, as well as in the field of industry, innovation and infrastructure. However, students are skeptical about its role in eradicating poverty and ending hunger, as well as mainstreaming gender equality. Our second assumption was thus only partially confirmed.

The examination of the topic of partnership and cooperation to achieve sustainability goals yielded interesting results. Overall, they only see its relevance in this with an average value of 3.2, however, if we look at the details, they assign a more prominent role to AI in the case of partnership cooperation in all fields of expertise. This is true in the fields of technology, education and trade, but less so in the case of financial cooperation.

Most notably, in addition to supporting sustainability solutions for industry, innovation and infrastructure, they agreed on the question that other effects of AI should also be taken into account in sustainability, such as the energy hunger of new technology.

Only negative differences were found for questions related to workplaces. Marked differences have been marked in the table. As a result of your query, artificial intelligence or robots are used in fewer places. They do not see the social and economic usefulness of technology as significant either. In the fields of industry, the service sector and the entertainment industry, they do not consider innovations that fit the topic to be as important as in the previous survey [16]. Their opinion about school work is very decisive, according to AI, the entire vertical of education will change.

[16] Kőkuti T.–Balázs L.–András I.–Rajcsányi-Molnár M. (2023): Collaborating with Artificial Intelligence – AI in Business Communication Education. In: Óbudai Egyetem (Szerk.): *IEEE 6th International Conference and Workshop in Óbuda on Electrical and Power Engineering (CANDO-EPE 2023): Proceedings.* Danvers: IEEE, pp. 287–294.