



# RESP

e-ISSN: 2979-9414



## Araştırma Makalesi • Research Article

# Artificial Intelligence in a Transforming Labour Market – New Skills are Needed?

*Dönüşen İşgücü Piyasasında Yapay Zeka – Yeni Becerilere İhtiyaç Var mı?*

Tamás Kókuti <sup>a, \*</sup>

<sup>a</sup> Assoc.Prof.Dr., Department of Organisational Development and Communication, University of Dunaújváros, Hungary  
ORCID: 0009-0004-7907-2011

### ANAHTAR KELİMELER

Yapay zeka  
Gelecek  
İşgücü piyasası  
İstihdam  
Yetenekler

### ÖZ

Yapay zekanın (AI) yaygınlaşmasıyla birlikte yakın gelecekte belirli iş aşamalarının ve hatta tüm mesleklerin yerini alması ve bunun da işgücü piyasasını yeniden yapılandırması bekleniyor. Açık ve öngörülebilir bu yakın gelecek için sadece eğitim sistemlerinin değil, İK yöneticilerinin de zamanında ve bilinçli bir şekilde hazırlanmaları gerekmektedir. Dolayısıyla bu çalışma, yukarıdaki konulara odaklanarak yapay zekanın kavramsal kapsamını ve gelişimini özetlemeyi amaçlamaktadır ve ardından yenilik, yapay zeka ve istihdam arasındaki bağlantıları da kapsayarak dönüşüm sırasında değer verilen becerilere genel bir bakış sunmaktadır.

### KEYWORDS

Artificial intelligence  
Future  
Labour market  
Employment  
Skills

### ABSTRACT

With the spread of artificial intelligence (AI) certain work phases and even entire professions will be replaced in the near future, which is expected to restructure the labour market. Not only education systems, but also HR managers must prepare in time and consciously for this near future, which can be predicted with certainty and predictability. The present study therefore aims to outline the conceptual scope and development of artificial intelligence, focusing on the above topics, and then also covers the connections between innovation, artificial intelligence and employment, also to give an overview of the skills that are valued during the transformational employment.

## 1. Introduction

For Management as a profession, it is essential to accurately anticipate the future and how these changes may affect its effectiveness. In the business environment to identify and accurately plan changes in the business environment, coping with these changes will be difficult. Strategies cannot be proactive only reactive moreover they can be much more costly. Given the accelerated pace of change in today's workplace and labour market, any HR leaders who want to provide strategic support need to pay attention to the future labour market trends more accurately than ever before. There is no such thing as a glass globe and the unprecedented acceleration of digitalisation, automation, artificial intelligence and the proliferation of robots will also bring significant changes in the field of employment. The

paper's aim is to study the possible future of artificial intelligence (AI) in the labour market.

In accordance with Hungary's Artificial Intelligence Strategy, it also presents worldwide forecasts and explores the temporal waves of the application of artificial intelligence, followed by an examination of whether the application of artificial intelligence can be a solution to the shortage of skilled workers. Finally, there is an overview of the skills that are valued during the transformational employment.

In order to thoroughly examine the the background of the topic, it is first necessary to clarify the concept of artificial intelligence. Although there are several approaches in the literature, some of them synonymously scrutinize the definition of the topic. The following quote also shows the

\* Sorumlu yazar/Corresponding author.

e-posta: kokutit@uniduna.hu

Atf/Cite as: Kókuti, T. (2023). Artificial Intelligence in a Transforming Labour Market – New Skills are Needed? *Journal of Recycling Economy & Sustainability Policy*, 2(1), 21-27.

Received 18 March 2023; Received in revised form 9 April 2023; Accepted 16 April 2023

This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors.

uncertainty of the issue: *"Many studies have attempted to answer this question, but no scientific consensus has been reached. The results of these studies are varied (according to which 9-54% of jobs are at risk). The predictions are uncertain because factors other than the technical potential of automation also arise: political, legislative, economic, demographic changes, as well as social acceptability. It is not enough for a technology to be used and spread that it is advanced."* (European Economic and Social Committee /EESC/, 2018)

## 2. Theoretical principles of artificial intelligence

### 2.1. The concept of artificial intelligence

Artificial intelligence is the English artificial intelligence, analogously to the common notation (AI), in many cases it is denoted by the Hungarian terminology as AI. Defining it is not such an easy task, given the approaches found in the literature. Studying the definitions, starting from engineering and mathematical foundations, conceptual networks that also process the similarity of human thinking included. If we take these approaches into account, we can be sure of only one thing, namely that the study of AI encompasses several scientific fields, i.e. its interdisciplinary feature cannot be ignored. In most cases, when studying artificial intelligence, we try to discover attributes similar to human intelligence. However, Russell and Norvig (2005) provide an interesting grouping of the definitions by processing the wording of several different textbooks, distinguishing thought processes and conclusions from behaviour. Similarity to human behaviour and ideal behaviour and rationality are considered as further organizing principles. Based on this, the following trends are distinguished.

- A system that thinks in a human way: Considers systems that model the functioning of the human mind and cognition as artificial intelligence. AI and cognitive science constantly interact, and this can be considered a strong relationship especially in the case of vision and natural language.
- A system that acts in a human way: based on the Turing-test, if the behaviour is human, then the machine is intelligent. To do this, the computer must have natural language processing, knowledge representation, automated inference, and machine learning capabilities.
- Rational thinking system: Machines and software more perfect and rational than human thinking.
- A rationally acting system: The ability to represent knowledge and draw conclusions is necessary in order to reach the right decision in a wide spectrum of situations. Then act accordingly, rationally. The authors draw attention to the fact that it is impossible to achieve perfect rationality in a complex environment.

Although all four schools of thought have followers, it should be noted that strong disagreements between their different approaches colour the research.

The mature, simplified approach to the concept of AI is given by the European Union, according to which artificial intelligence refers to the human-like abilities of machines, such as reasoning, learning, planning and creativity. It allows the tech to sense its environment, deal with what it perceives, solve problems, and plan its actions to achieve a specific goal. The computer not only receives data, but also processes it and reacts to it. It is an essential declaration that the discussed systems are capable of modifying their behaviour to a certain degree, by analyzing the effects of their previous steps and working independently (European Parliament, 2021).

Emphasizing the importance of the topic, they draw attention to the fact that artificial intelligence is a central element of today's digital revolution and one of the main priorities of the EU. Future applications are expected to bring enormous changes, but artificial intelligence is already present in our daily lives. It distinguishes between the main types of artificial intelligence in software-based and physical aspects where the software-based are categorized as virtual assistants, image analysis software, search engines, speech and face recognition systems, and the physical as robots, self-driving cars, drones, and the Internet of Things.

According to the European Parliament's resolution on the comprehensive European industrial policy for artificial intelligence and robotics, "artificial intelligence and robotics can transform several industries and lead to greater production efficiency, and also make European industry and SMEs more competitive on a global level; whereas the availability of large data sets and testing and experimental facilities is of great importance for the development of artificial intelligence" (European Parliament, 2019).

### 2.2. Philosophical development of the concept of artificial intelligence

According to Russell and Norvig's approach, we should distinguish between weak and strong artificial intelligence. Weak AI, i.e. weak artificial intelligence hypothesis systems (weak AI) that act as if they are intelligent (it is not known whether they have real intelligence). IBM's Deep Blue software managed to defeat Garry Kasparov, an international grandmaster, multiple world chess champion, eight-time team and seven-time Olympic chess champion, two-time Soviet champion, champion of Russia, 11-time Chess Oscar winner, master coach. In this, the machine was assisted by brute force, but it still worked based on algorithms with pre-stored steps (Keene & Goodman, 1997).

Strong AI, i.e. strong artificial intelligence hypothesis systems (strong AI), which really think, have an independent consciousness. The test for achieving strong AI is the Turing test, the essence of which is that a machine must answer

questions about any topic in such a way that the questioner cannot determine that it is not communicating with a human. Simply put, if the machine makes at least 30 percent of the people in the experiment believe that it is human, after it shows a level of intelligence that clearly proves that there is an artificial intelligence in which the machine thinks (Turing, 1950). Although the test was invented decades earlier, it is still not easy to pass. First, in 2014, a supercomputer with the pseudonym Eugene Goostman, who pretended to be a 13-year-old Ukrainian boy, succeeded, but this has been disputed ever since. However, in a broad presentation, Google Duplex was able to pass the test in some respects (Szilágyi, 2018).

The Turing-test is applicable only for identifying systems that imitate human behaviour however this still makes them weak AI (Eszteri, 2015).

### 2.3. Consequences of technological development

The literature on economics emphasises the significance of examining and comprehending the factors that facilitate growth, especially sustainable growth (Bayrak & Esen, 2014). There can emerge a possible future event in which the emergence of "superhuman" intelligence accelerates technological development and social change modifying the environment at a rate that pre-singularity humans cannot fathom or reliably predict. Raymond Kurzweil (2000) sees an exponential pattern of technological development in which current progress will eventually lead to the singularity.

An analysis of the history of technology indicates that technological change is exponential, contrary to current intuitive-linear views. Therefore, in the 21st century, we will not experience 100 years of development, but - at the current rate - 20,000 years. The benefit and results of development, such as chip speed and cost efficiency, will also increase exponentially. Even exponential growth will change exponentially (Kurzweil, 2014).

He generalized Moore's Law to development. Moore's Law stated the empirical observation in technological development that the complexity of integrated circuits doubles approximately every 18 months. Its generalization means that it will be true for all technologies.

It can be considered trivial that the singularity also affects society to a great extent, especially with regard to employment.

## 3. The effects of the application of artificial intelligence on employment

### 3.1. Employment forecasts

Cyber-physical systems are making millions of jobs redundant worldwide. Manual labor is rapidly disappearing from Industry 4.0. However, the spread of artificial intelligence applications affects not only blue-collar jobs, but also white-collar ones. Routine, uncomplicated

cognitive tasks will be replaced by robotic intelligence that never gets tired and communicates in natural language (Csepeli, 2020).

According to an Oxford study, about half of the workers in the United States can expect to lose their jobs in the next decade or two because artificial intelligence applications will do the work done by humans cheaper, faster and more efficiently (Frey & Osborne, 2013). The study shows with concrete numbers the impact of automation, artificial intelligence and machine learning on industries.

These technologies will affect employment not only in the case of profit-oriented companies, but also in the case of non-profit companies. 8.5% of the workforce in the global manufacturing industry, i.e. 20 million workers, will be displaced by the evolving technologies of robots by 2030 (Lardieri, 2019).

According to another study, the use of robots costs only a third as much as in the case of human labour, which is obviously an additional motivation for their use (Tilley, 2017).

It is estimated that for the 36 million jobs in the USA, more than 70% of the functions are at risk of being replaced by artificial intelligence (Associated Press, 2019).

The motivation for the use of artificial intelligence is obviously driven by profit-oriented business interests. The retail industry will spend \$7.3 billion annually on AI through 2022 (Juniper Research, 2018). In the case of the healthcare industry, this represents \$150 billion worth of AI activity by 2026 (Collier, Fu, Yin & Christiansen, 2017).

According to estimates, the rise of artificial intelligence in the world economy can result in an increase of 15.7 trillion dollars, and the benefits provided by artificial intelligence will also rearrange the balance of power in the world economy. The projected trends are as follows. North America can initially expect faster productivity growth than China, thanks to its readiness for artificial intelligence and the fact that it has many jobs that can be replaced by new, more productive technologies. After bringing in the disadvantages of slower technology adoption and lack of expertise, China will overtake the United States within ten years. Developed parts of Europe and Asia can also expect significant economic benefits thanks to artificial intelligence. (by 2030, GDP growth may reach 9-12%). Developing countries, including Latin America and Africa, can forecast a much more modest improvement (less than 6% of GDP) due to lower adoption of artificial intelligence (PWC, 2017).

It is easy to see that the above estimates always assume that automation can affect all jobs that consist of constantly repeating activities and minimal decision-making or judgment (Wheeler & Buckley, 2021).

The EU treats the development of artificial intelligence as a top priority, regardless of this it draws attention to the dangers of its use. The use of artificial intelligence is

expected to lead to the elimination of many jobs. Although it also presumably creates better jobs, 60 million new jobs could be created worldwide by 2025 thanks to robotics and artificial intelligence.

The creation of the position of the European Parliament on the regulation of artificial intelligence is currently taking place in the framework of a preparatory work of a specialist committee. The investigations focus on building trust in artificial intelligence. This also includes the management of possible effects on individuals, society and the economy (European Parliament, 2020).

### 3.2. Uncertainties inherent in the application of artificial intelligence

The singularity also affects the evolution of society. Although this is trivial, there is not complete agreement on the details of the subject. Leaders of technology companies leading the way in the use of artificial intelligence do not agree. Tesla CEO Elon Musk thinks everyone should be concerned about the long-term effects. On the other hand, according to the founder of Facebook, Mark Zuckerberg, since they are developing this area, they can optimize it in the direction of bringing only the positives out of it. The owner of Microsoft, Bill Gates, doesn't understand how someone who doesn't worry can exist at all. According to his opinion, the application of artificial intelligence will be good at the beginning, but after that the processes can get out of control.

According to researcher and inventor Ray Kurzweil, 2029 is the date he predicts when an artificial intelligence will reach the level of human intelligence. He set 2045 as the date of the singularity, when we will multiply our effective intelligence a billion times by merging with the artificial intelligence we have created. Kurzweil believes that intelligent machines will make us smarter. Although they are not yet in our bodies, by the 2030s the part of our brain where we think can be connected to the cloud.

The idea is similar to Musk's controversial neural chip, who recently announced that in 2022, a chip called NeuroLink will be implanted in the brains of disabled people to restore the ability to walk (Futurism, 2021).

The following are the uncertainties inherent in the widespread use of artificial intelligence.

- People may lose their jobs to automation.
- People have too much (or too little) free time.
- People may lose their sense of uniqueness.
- People may lose some of their privacy rights.
- The use of artificial intelligence systems can eliminate accountability.
- The success of artificial intelligence could mean the end of the human race (Russell & Norvig, 2005).

## 4. The problem of the lack of skilled labour

### 4.1. Losses due to the lack of skilled labour

Based on research conducted by PWC, which included 2,993 structured interviews with key decision-makers of family and small businesses with a turnover of more than 10 million Euros in 53 countries, the loss due to the lack of skilled labour was mapped. According to the research results, the countries participating in the survey are affected to varying degrees. Overall, the magnitude of the losses is 12.6% of the GDP of Central and Eastern Europe. Based on the survey, Ukraine, Russia and Bulgaria are in the lead. Hungary is the least affected, but here too we can talk about a loss of 4.1%. Collectively, the losses due to the lack of skilled labour in Central and Eastern Europe exceed 2,831 billion Euros. The lack of professionals also affects growth prospects. Among the spill-over effects, the higher-than-expected increase in human capital costs, the failure to take advantage of market opportunities, the deterioration of the quality of products and services, and the related customer experience are among the most important. 79% of foreign managers and 92% of domestic managers consider the lack of professionals to be a concern. Regarding the management of the problem area, the company managers agreed that there is no quick solution, but among the current alternatives, they prefer the following resources (PWC, 2019).

**Table 1.** Ideas related to filling the shortage of professionals

Source	Hungarian answers %	Foreign answers %
from the education system	27	17
retraining/further training	23	46
from competitors	19	14
from another industry	16	18
modification of the proportion of casual labour	9	5

**Source:** Own edition based on the results of PWC (PWC, 2019).

Interestingly, the leaders do not take into account that these resources are partially exhausted, and on the other hand, cumulatively, mathematically, they result in a solution corresponding to a zero-sum game.

## 4.2. Robot technology and digital solutions in the labour market

If certain conditions are met, automation, artificial intelligence and robotisation could also be a solution to the problem of the lack of skilled workers. According to the missing skills research findings, the preferred order of occupations and skills in short supply is: technicians (37%), sales specialists (33%), engineers (31%), support staff (28%), interns (17%), digital experts (15 %), financial experts and even senior managers (10 %).

So, overall, CEE companies are mainly looking for technical specialists and sales specialists, and surprisingly, 10% of them even lack senior managers.

The research pointed out the relevant digital solutions, i.e. the special, most important "eight" such as internet devices, network of machines (IOT), the application of robots, the application of artificial intelligence, 3D printing, virtual reality, augmented reality, block-chain and drones. For Central and Eastern European entrepreneurs, the use of controllable equipment available on the Internet is the most relevant of the digital solutions.

Artificial intelligence and robotisation could also be a solution to fill the shortage of skilled workers. Among the international responses, as well as in Hungary, the majority opinion is that artificial intelligence will significantly change the business activities of companies in the next five years. Despite the optimistic views, some of the managers interviewed in the research are not currently planning any initiatives related to artificial intelligence, 35% of them are thinking about it in the next three years, but are not completely convinced (PWC, 2019).

## 5. Artificial intelligence and the labour market

### 5.1. Waves of the use of artificial intelligence in employment

Automation will spread in employment in three waves, which are markedly separated from each other by the degree of machine autonomy.

- First wave: Algorithmic wave (from the early 2020s)

People make decisions. Structured data analysis and the automation of simpler digital tasks (e.g. credit assessment).

- Second wave: Expansion wave (until the end of the 2020s)

Humans make decisions with the help of robots. Repetitive tasks and the automation of information exchange, drones, warehouse robots and self-driving vehicles with conditional automation (in some cases they require human intervention).

- Third wave: Autonomy wave (until the mid-2030s)

The robot makes the decisions. Artificial intelligence will increasingly be able to analyze data from multiple sources,

make decisions, and perform physical operations with minimal or no human intervention. E.g.: driverless vehicles (PWC, 2019). From a legal point of view, the question of liability appears (Józwiak & Falus, 2022/A; Józwiak & Falus, 2022/B). The regulatory background for this has not yet developed (Józwiak & Falus, 2022/B), despite the fact that, for example, in such cases, the question of intent, which is the basis for establishing criminal liability, would also reasonably arise (Józwiak & Falus, 2022/C). Jurisprudence will soon face the theoretical question of where legislation draws the regulatory boundary between real and virtual reality (Falus, Józwiak & Kóvári, 2022).

### 5.2. Hungarian forecasts

Hungary's artificial intelligence strategy defines mobilizing goals with high social utility, which bring direct benefits to all citizens. According to minister László Palkovics (2020), there can be no doubt about the fact that artificial intelligence as a technology has become part of everyday life. The integration of applications based on artificial intelligence into economic and social conditions is accelerating. "From the point of view of the future of Hungary, this strategy and the successful implementation of the social, technological, economic and personal changes included in it will be of great importance."

Hungary's Artificial Intelligence Strategy was prepared for the period between 2020 and 2030. By the end of the 2030s, automation and artificial intelligence are expected to affect 900,000 workers. According to some expert estimates, more than 40% of jobs can be automated in Hungary.

In this process, three consecutive waves can be identified as presented in the previous chapter, during which the following changes are likely.

**Algorithmic wave:** Sectors based on data processing, such as the financial sector, IT-related and administrative jobs. The affected workers are typically young and female. This wave is expected to affect 5-10% of jobs on average.

**Expansion wave:** Affects sectors that provide services and are based on office work, such as the financial sector, education, public administration and IT-based services. It will affect 15-20% of the jobs in the affected industries. The difference compared to the first wave is that the proportion of affected women and men is expected to be the same, and among those affected there will be a higher proportion of more experienced, middle-aged workers.

**Autonomy wave:** On the one hand, it will affect production, and on the other, it will also affect highly complex and responsible jobs. It is expected that this wave will have the greatest impact, affecting 25-30% of jobs, mostly men and more experienced workers. (Artificial Intelligence Strategy of Hungary, 2020).

Automation in Hungary can accelerate economic growth by 0.8-1.4% through productivity growth. With the available technologies, 49% of domestic working hours can be

automated (McKinsey, 2018).

### 5.3. Skills that will increase in value in the future

If we consider the technological applications of artificial intelligence and the possibilities of endless automation of technical tasks, the most difficult human skills to reproduce will be the “soft” skills. Unlike “hard” or technical skills, which are usually measured by the quality of work, “soft” skills are less tangible or related to personality. In some businesses and professions, individuals with strong technical skills can get away with lacking soft skills. While other businesses focus more on how things are done than just looking at the end result. Many people are willing to put up with highly productive performers, even if they don't really get along with others. The era of strong technical skills and weak “soft skills” is estimated to be coming to an end. As artificial intelligence becomes a priority, employers will value the following “soft” skills more for those who remain employed:

- Creativity
- Curiosity
- Compassion
- Cooperation
- Critical thinking (Eubanks, 2020).

## 6. Conclusions and evaluation

During the study of the main domestic and foreign literature and sources, we presented the process of the development and rise of artificial intelligence. In the study, we wanted to review the worldwide forecasts regarding the development of artificial intelligence and employment, including presenting the relevant details of Hungary's Artificial Intelligence Strategy. In accordance with all this, we explored the temporal waves of the application of artificial intelligence. We also examined whether the use of artificial intelligence could be a solution to the shortage of skilled workers. Finally, there was an overview of the skills that are valued during the transformational employment.

The transformation of the labour market and employment does not affect men and women equally. In the future, competence will determine suitability, so artificial intelligence and digitalization can reduce the gender gap. On the other hand, mathematical, physical, IT and engineering skills are currently more favourable for male employees. In jobs not affected by the transformation, compassion and solidarity will continue to be important, which is more favourable for the weaker sex than employment. Those whose workplaces are affected by the rise of artificial intelligence may not be suitable and capable of performing new types of tasks, as a result of which a large number of employees affected by the digital transformation of the economy may appear on the labour market as a surplus. The world of work will produce significantly different standards than before. Working can be freer and more flexible.

Since the development of artificial intelligence and the scope of its fields of application are rapidly growing, it can be recommended to increase also the intensity and scope of related research in the near future, in all scientific fields.

## References

- 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*. IX, (2)(28), 191-204.
- Collier, M., Fu, R., Yin, L., & Christiansen, P. (2017). Artificial intelligence: Healthcare’s new nervous system. (Accessed: 2021.12.05), [https://www.accenture.com/t20171215T032059Z\\_\\_w\\_\\_us-en/\\_acnmedia/PDF-49/Accenture-Health-Artificial-Intelligence.pdf](https://www.accenture.com/t20171215T032059Z__w__us-en/_acnmedia/PDF-49/Accenture-Health-Artificial-Intelligence.pdf).
- Csepeli, Gy. (2020). *Ember 2.0 – A mesterséges intelligencia gazdasági és társadalmi hatásai*. Budapest: Kossuth Kiadó.
- Digitális Jóléti program, Innovációs és Technológiai Minisztérium & Mesterséges intelligencia Koalíció. (2020). Magyarország Mesterséges Intelligencia Stratégiája 2020–2030. (Accessed: 2021.08.21), Innovációs és Technológiai Minisztérium: <https://ai-hungary.com/api/v1/companies/15/files/137203/view>
- Eszteri, D. (2015). A mesterséges intelligencia fejlesztésének és üzemeltetésének egyes felelősségi kérdései. (Accessed: 2021.08.21), REAL - az MTA Könyvtárának Repozitóriuma: <https://real.mtak.hu/eszteri.mi.felelosseg.final.pdf>
- Eubanks B. (2020). *Artificial intelligence for HR: Use AI to Support and Develop a Successful Workforce*. London: Kogan Page.
- European Economic and Social Committee (2018). A mesterséges intelligencia munkavégzésre gyakorolt hatásainak előrejelzése a méltányos átállás biztosítása érdekében. (Accessed: 2021.12.06), forrás: Európai Gazdasági és Szociális Bizottság: <https://eur-lex.europa.eu/legal-content/HU/TXT/PDF/?uri=CELEX:52018IE1473&from=BG>
- European Parliament (2019). A mesterséges intelligenciára és a robotikára vonatkozó átfogó európai iparpolitika (Accessed: 2021.09.10), [https://www.europarl.europa.eu/doceo/document/TA-8-2019-0081\\_HU.html](https://www.europarl.europa.eu/doceo/document/TA-8-2019-0081_HU.html)
- European Parliament (2020). A mesterséges intelligencia szabályozása: az EP álláspontja (Accessed: 2021.09.10), European Parliament: <https://www.europarl.europa.eu/news/hu/headlines/society/20201015STO89417/a-mesterseges-intelligencia-szabalyozasa-az-ep-allaspon-tja>

- European Parliament (2021). What is artificial intelligence and how is it used? (Accessed: 2021.09.10), European Parliament: <https://www.europarl.europa.eu/news/en/headlines/society/20200827STO85804/what-is-artificial-intelligence-and-how-is-it-used>
- Falus, O. & Józwiak, P. & Kővári, Attila (2022). "Gólyakalifa" a 21. században: Joghézag és analógia a virtuális valóság jogában" *JOGELMÉLETI SZEMLE* ,2, 20-32.
- Frey, C. B., & Osborne, M. A. (2013). *The future of employment: how susceptible are jobs to computerisation*. Oxford: Martin School.
- Futurism. (2021). Kurzweil Claims That the Singularity Will Happen by 2045. (Accessed: 2021.12.07), Futurism: <https://futurism.com/kurzweil-claims-that-the-singularity-will-happen-by-2045>
- Józwiak, P. & Falus, O. (2022A). Criminal liability of associations in Polish and Hungarian law. Poznan: Wydawnictwo Rys. DOI: 9788367287340
- Józwiak P. & Falus O. (2022 B). "Legal Regulations on Autonomous Cars in Poland and Hungary". *DUNAKAVICS 10* : 8, 45-58.
- Józwiak, P. & Falus, O. (2022C). "Legal Regulations on Autonomous Vehicles in Poland and Hungary: The Issue of Criminal Liability" in László Balázs, Mónika Rajcsányi-Molnár, István (eds.) *Elektromobilitás és társadalom. Dunaujváros*. 125-136.
- Juniper Research. (2018). Retailer Spending on AI to Grow Nearly Fourfold, Reaching \$7.3 Billion by 2022. (Accessed: 2021.12.07), <https://www.businesswire.com/news/home/20180131005068/en/Juniper-Research-Retailer-Spending-AI-Grow-Fourfold>.
- Keene, R. & Goodman, D. (1997). *Man Versus Machine: Kasparov Versus Deep Blue*. Cambridge: H3 Publications.
- Kurzweil, R. (2000). *The Age of Intelligent Machines When Computers Exceed Human Intelligence*. Harmondsworth: Penguin Books.
- Kurzweil, R. (2014). *A szingularitás küszöbén. Amikor az emberiség meghaladja a biológiát*. Budapest: Ad Astra.
- Lardieri, A. (2019). Robots will replace 20 million jobs by 2030, oxford report finds. (Accessed: 2021.12.06) <https://www.usnews.com/news/economy/articles/2019-06-26/report-robots-will-replace-20-million-manufacturing-jobs-by-2030>.
- Marketwach.(2019). Over 30 million U.S.workers will lose their jobs because of AI. (Accessed: 2021.12.07). <https://www.marketwatch.com/story/ai-is-set-to-replace-36-million-us-workers-2019-01-24>
- McKinsey & Company. (2018). Átalakuló munkahelyek: az automatizálás hatása Magyarországon. (Accessed: 2021.12.06), <https://www.mckinsey.com/~media/McKinsey/Locations/Europe%20and%20Middle%20East/Hungary/Our%20Insights/Transforming%20our%20jobs%20automation%20in%20Hungary/Automation-report-on-Hungary-HU-May24.ashx>.
- PWC. (2017). A mesterséges intelligencia a produktivitás és a személyre szabhatóság javításával 15,7 billió dollárral növelheti a GDP-t. (Accessed: 2021.08.21), <https://www.pwc.com/hu/hu/sajtoszoba/2017/ai.html>
- PWC. (2019). Magyarországi Vezérigazgató Felmérés A cselekvés ideje Visszafogott növekedés, fókuszban a belső folyamatok. (Accessed: 2020.12.21), [https://www.pwc.com/hu/hu/kiadvanyok/assets/pdf/PwC\\_CEO\\_survey\\_kiadvany\\_HU\\_2019.pdf](https://www.pwc.com/hu/hu/kiadvanyok/assets/pdf/PwC_CEO_survey_kiadvany_HU_2019.pdf)
- Russell, S. J. & Norvig, P. (2005). *Mesterséges Intelligencia - Modern megközelítésben*. Budapest: Panem Könyvkiadó.
- Szilágyi Sz. (2018). Átmegy a Turing-teszten a Google MI-je. (Accessed: 2021.08.30), <https://bitport.hu/atmegy-a-turing-teszten-a-google-mi-je.html>
- Tilley, J. (2017). Automation, robotics, and the factory of the future. (Accessed: 2021.12.06), <https://www.mckinsey.com/business-functions/operations/our-insights/automation-robotics-and-the-factory-of-the-future>.
- Turing, A. M. (1950). Computing Machinery and Intelligence. *Mind*. 59, 433–460.
- Wheeler A. R. & Buckley M. R. (2021). *HR Without People?: Industrial Evolution in the Age of Automation, Ai, and Machine Learning* (Future of Work). Bingley: Emerald Publishing.