Preparing for the labour market challenges of artificial intelligence in commerce and mechanical engineering

Helping organisations preparing employees for AI in Romania and Hungary

Hope4AI – 101145603

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Executive summary

The research examines the effects of artificial intelligence (AI) on the labour market, with a special focus on the mechanical engineering and commercial sectors in Hungary, highlighting the opportunities offered by AI, the emerging challenges and the necessary adaptation strategies. AI is the ability of machines to perform tasks that require human intellect, such as sensing, learning, and problem-solving.

AI is bringing about rapid and significant changes in the labour market, especially in higher-skilled jobs. Globally, 40% of employees work in jobs with high AI exposure, this percentage reaches 60% in developed countries, and the higher the level of education, the stronger the exposure. According to the World Economic Forum (WEF) forecast, by 2027, the work of 44% of today's workers will no longer be needed in its current form due to the rise of AI, so the development of "soft skills" (e.g. resilience, flexibility, analytical and creative thinking) may be key in the future.

It's important to note that AI transforms, but does not replace work; it should be seen as a technological aid; it is about the cooperation of humans and machines; companies need to recalibrate their workforce; and will also have a strong influence on life outside the workplace.

In the mechanical engineering industry, AI is revolutionizing changes from design to manufacturing and maintenance (e.g., generative design, predictive maintenance, robotics, quality control, smart manufacturing, supply chain optimization). AI and automation are bringing about significant changes in the commercial sector. AI solutions focus on data management, personalization, automation of repetitive tasks, support for non-routine tasks, robotization (e.g. Ikea warehouse), self-driving vehicles and contactless stores (e.g. Auchan Go, Coop smart store).

According to in-depth interviews, the country is in a phase of "heightened expectations", but the concepts of digitization, automation and AI often blur. According to Hungarian experience, AI has expanded jobs rather than eliminated them, but at the same time, the majority of Hungarians continue to fear that they will lose their jobs because of AI.

According to the "skill-scape" analysis, data recorder and cashier professions are the most at risk, while jobs requiring complex human skills (e.g. window dressing, quality control) or fine motor skills (e.g. crane operator) are less so. Formal education is lagging behind, it is essential to integrate AI knowledge into education from primary school onwards, and it is necessary to teach the "correct application of AI". Both employees and employers are responsible for continuous training and retraining; "it is not AI that takes the work, but another person who can use it more skillfully".

Overall, AI will not bring about mass job losses, but a fundamental transformation of them, with an emphasis on human-machine cooperation. Lifelong learning, flexibility, and the acquisition of analytical and social "soft skills" are essential. The successful implementation of AI requires strategic, senior management commitment at both national and corporate level. In Hungary, the reform of the education system and targeted adult education are key to managing labour market tensions and maintaining global competitiveness.

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Definition of artificial intelligence

We usually believe that we are aware of the concept of artificial intelligence (AI or AI), but unfortunately it often turns out that this is not quite the case. Non-explicit experts in these fields tend to confuse AI with digitalization and robotics. Therefore, we decided to start our study with a brief introduction to the concept. For this, we used the materials of McKinsey Explainers as a [1] basis.

So let's see what WE is!

"Artificial intelligence is the ability of machines and/or programs to perform tasks that would normally require human intellect. Such as different variants of perception, vision, hearing, speech and text comprehension, reasoning, learning. interactions with the environment or problem solving."

Generative AI (such as ChatGPT) includes algorithms that *are capable of generating new, but not necessarily original, content*. These can be codes, audios, images, texts, simulations or videos.

Artificial general intelligence (AGI) is an AI system that still exists only in theory, and whose capabilities compete with those of humans, and may even surpass them. Some researchers believe that we are only a few years away from achieving this, while others see the achievement of AGI in a decades-long perspective.

Machine learning is a subset of artificial intelligence that uses techniques that allow machines to gather and use experience to solve various tasks.

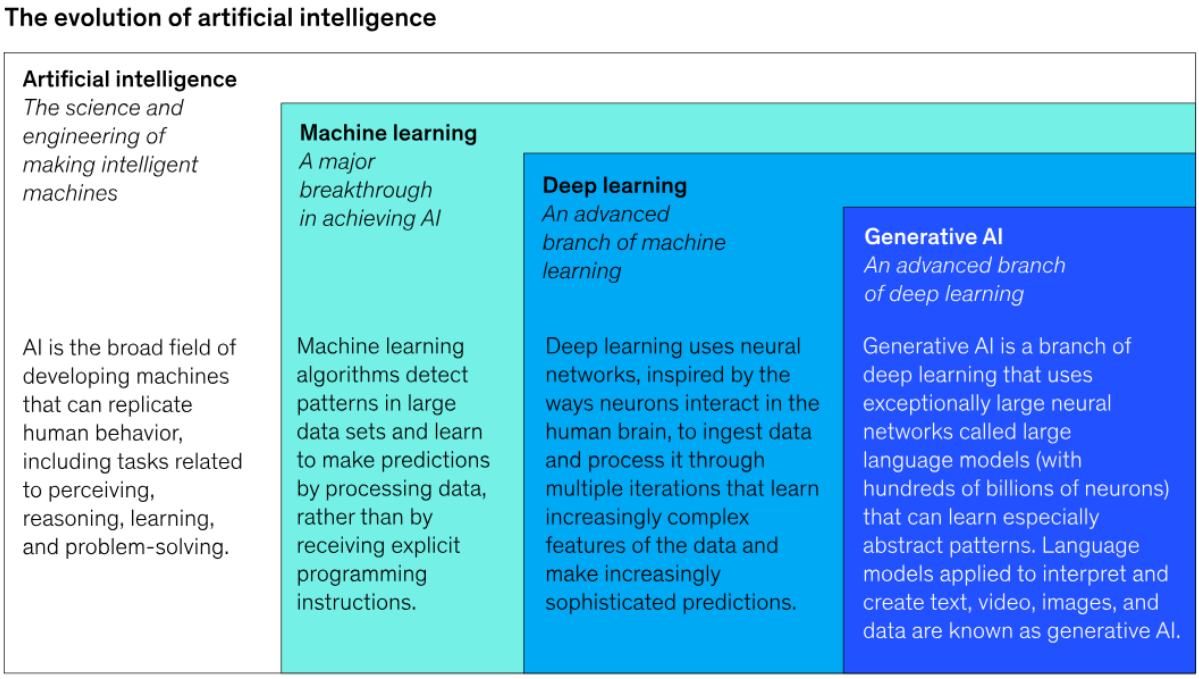
Deep learning is a subset of machine learning based on artificial neural networks that mimic a network of neurons in the human brain. These networks are made up of many layers, where each layer learns different attributes from the data, creating increasingly deep and complex representations.

Promt engineering is a methodology that provides AI systems with properly formulated questions or instructions in order for the machine to provide accurate and relevant answers. The *accuracy and performance of AI is highly dependent on the quality of the input data, so optimizing prompts is vital for running successful AI-powered systems.*

In the context of AI systems, tokenization means the breakdown of texts into their atomic elements, which is necessary for the digital representation of real things. It can be used both to protect sensitive data and when processing large amounts of information.

[1] https://www.mckinsey.com/featured-insights/mckinsey-explainers

1. Figure: Subsets of artificial intelligence



Source: McKinsey

The rise of generative artificial intelligence will bring about major changes on the workforce front. Its most important feature and strength is that it can help almost everyone in their work, however, its impact will be stronger in higher-qualified jobs. In addition, the changes generated by AI will take place at a very fast pace. McKinsey estimates that between 2030 and 2040, more than half of current jobs will be automated with the help of AI.[2]

Literature excerpts on the rise of AI

We briefly report on the expected transformation of the labour market as a result of the spread of generative artificial intelligence (GenAI) based on research by the United Nations Labour Organization (ILO [3]).

Of course, ILO staff are also aware that now that the development of generative AI is still in full swing, it is more difficult than ever to predict its effects, nevertheless, in 2023 and then further developed in 2025, a method that can be used to predict with a fairly good degree how it will affect individual professions and, in this context, individual economic sectors.

The following study was carried out for 436 of the occupations included in the ILO's International Standard Classification of Occupations (ISCO): They looked at the tasks that the practitioners of the given occupation have to perform in their work, and which of these can be replaced with generative AI received 1 point and the other did not receive 0. On the one hand, the scores achieved per task were averaged, and on the other hand, the number of tasks that the practitioner of the given occupation has to perform was also taken into account. Based on the results obtained, the sessions were divided into the following groups:

[2] https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-economic-potential-of-generative-ai-the-next-productivity-frontier#key-insights

[3] Generative AI and Jobs - A Refined Global Index of Occupational Exposure...-.. ILO Working Paper 140, May 2025 https://www.ilo.org/sites/default/files/2025-05/WP140_web.pdf

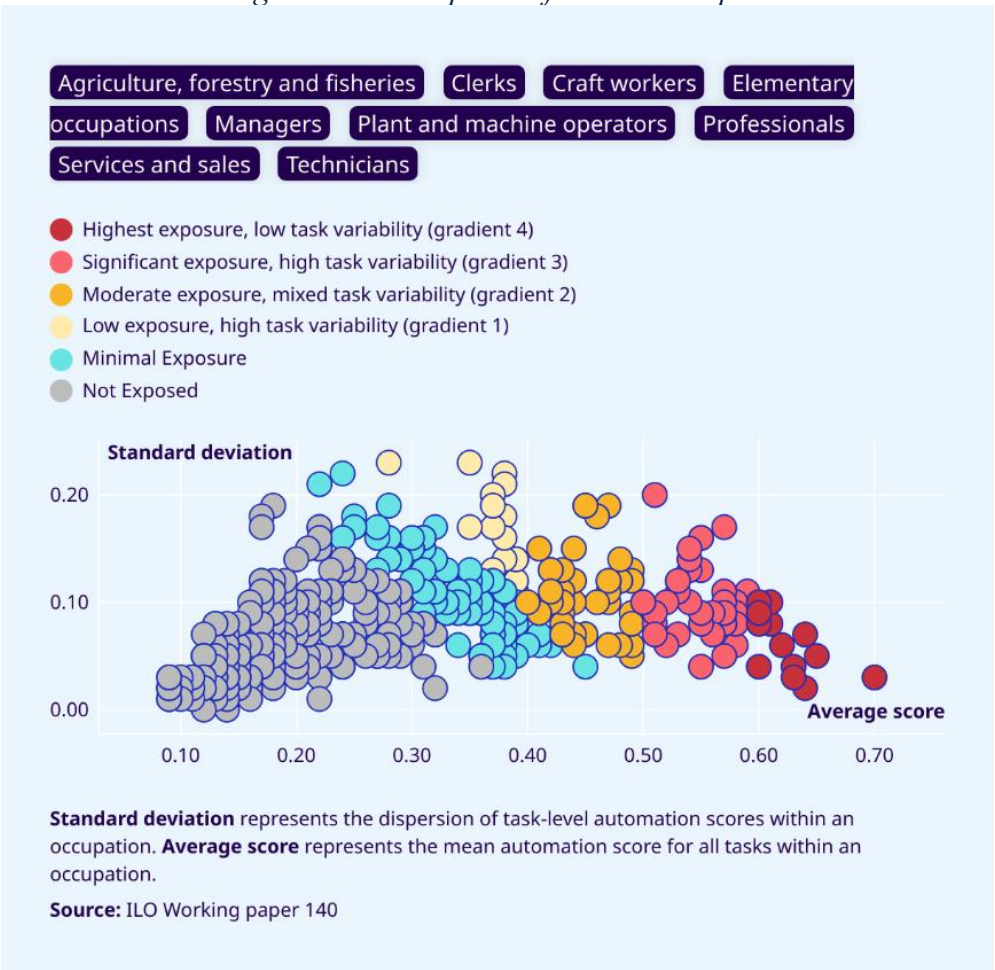
- ***Grade 4 Exposure*** (Highest Exposure, Few Tasks): The occupation is fully exposed to the need to take over its activities from GenAI.
- ***Grade 3 exposure*** (Significant exposure, multiple tasks): With a stronger than medium exposure, with the development of technology, GenAI will be able to take over more and more tasks.
- ***Grade 2*** exposure (Medium exposure, multitasking). The medium level of occupational exposure is due to activities that are highly or not at all endangered. Practitioners of the profession should pay attention to the development of GenAI and try to keep up with it.
- ***Grade 1*** exposure (Low exposure, very diverse tasks): Although the exposure of the occupation is small, over time and with the development of technology, any or even more of the many tasks can become "victims" of GenAI.
- ***Minimum exposure*** (Low exposure, few tasks): The occupation is not at risk, although some activities may be automated.
- ***No exposure:*** Occupation is not affected by GenAI.

The second figure illustrates the exposure of the 436 occupations studied to GenAI. It is clear that the largest aggregate is formed by those for which – for the time being? – artificial intelligence has no influence, and there are a good number of those who are only minimally exposed.

An interactive version of the figure is also available on the ILO website, which provides interesting information. On the one hand, we can find out from each small colored disc what occupation it represents, and on the other hand, we can also examine the data by sectors with a single click.

The most exposed occupation in the aggregate figure here is that of data recorders, and office employees and accountants are on the podium. Various administrators, customer service workers, financial analysts, web and multimedia developers, and personal secretaries are also highly positioned.

2. Figure: GenAI exposure for each occupation



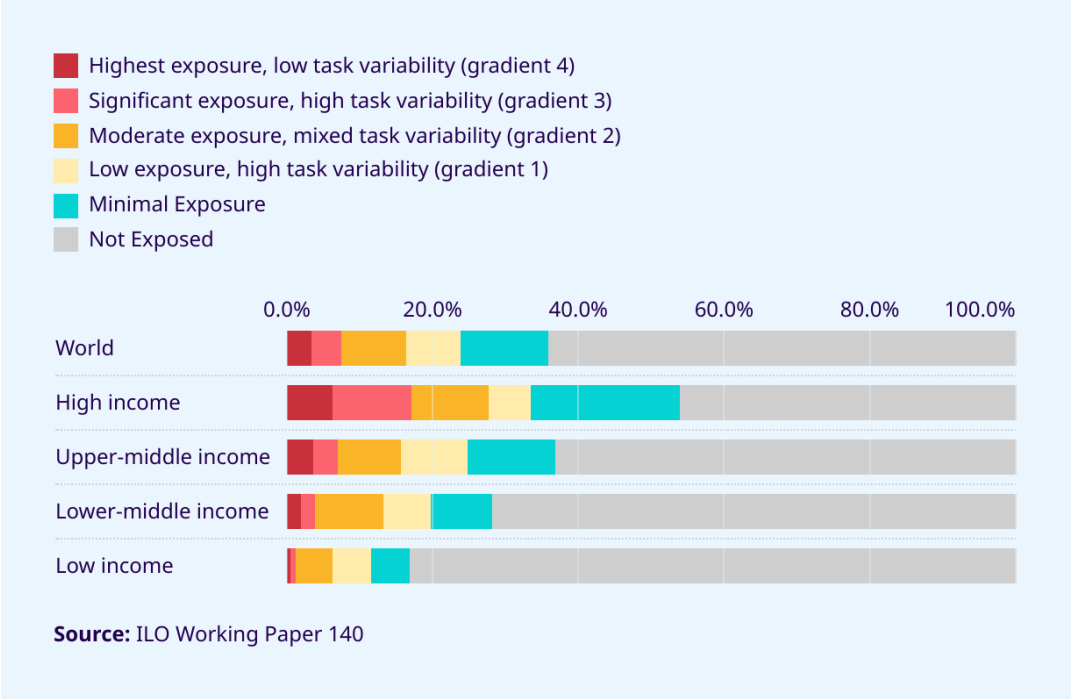
Source: ILO

With regard to the exposure of employees in the sectors examined in our study, according to ILO experts, there is only one occupation exposed to level 4 in commerce, which is the contact center salesperson. There is no level 3 exposure, and there are only three level 2 exposures: the independent retailer, the door-to-door and the in-store demonstrator. There are already examples of type 1 exposure in several professions. Such as the store security guard or the cleaning staff, but most of the occupations are not yet affected by GenAI. Of course, it should be noted that only sector-specific professions are included in this analysis. For example, the store manager, the lawyer, the HR person does not appear among the retail workers.

Among the employees of the mechanical engineering industry who have been "purged" of various managers and clerks, there are no level 4, 3 and 2 exposures at all. The exposure of professionals engaged in various assembly activities was classified as level 1, i.e. low, by ILO experts. All other workers in the sector are not classified as at risk by GenAI according to their methodology.

ILO experts also examined how the exposure of certain occupations to GenAI evolves in countries with different income levels. The overall result can be seen in the third figure.

3. Figure: Percentage of jobs potentially affected by generative AI, by income group



Source: ILO

We can see that globally, a quarter of occupations fall into one of the four levels of exposure, and a further 12% is made up of the weight of those that – for the time being – are only minimally affected by the spread of GenAI (The bar marked in green in the figure gives an indication of the weight of the latter). The weight of the first four grades is a little more than a third in the case of high-income countries, and together with those minimally affected, they already cover more than half of the occupations. It is also spectacularly perceptible in the figure that the proportion of occupations exposed to GenAI decreases in proportion to the income level of countries.

Although it is not visible in our figure, the ILO experts also mentioned in their study that *the exposure of female workers is much stronger than that of men.* Globally, 5.7 percent of female employees belong to category 4 and 4.7 percent to category 3, while the proportion of those belonging to these two categories is 3.3 percent and 4.2 percent of all employees.

The ILO experts emphasize that the data in their study are intended to illustrate potential exposure. That is, if all the conditions were met for the introduction of GenAI technology, what proportion of the employed would be affected by this process, according to their current knowledge. Among the factors slowing down the expansion, the development of infrastructure, the digital readiness of employees, and the costs of implementation and operation are of particular importance.

One of the most comprehensive analyses of the effects of the spread of generative artificial intelligence on the labour market ***was recently carried out by the IMF***'s team of experts.Below, [4] we summarize the emerging trends in this area based on[5] this article and that of one of the team members.

The impact of the spread of AI on the labour market was examined by IMF experts according to the extent to which practitioners of certain professions are – will be – exposed to the achievements of artificial intelligence (exposure) and whether they complement or support them in their work (complementarity). In areas with high exposure, there is a high probability that AI will take over more and more tasks in the human workforce, and consequently fewer workers will be needed, and their wage levels will also decrease. However, to increase productivity, or even to keep it at a high level, you will need workers who "understand" machines, who have a level of AI literacy that allows them to control processes. In addition, only those who acquire the knowledge and skills necessary to creatively accept support can feel safe in jobs that benefit from the complementary effects of AI. In other words *, in order for the beneficial effects of AI to prevail, professional training of users is needed at almost all levels*.

The IMF experts classified the sessions into three groups. These include:

- ***High exposure, strong complementarity*** – This group mainly includes highly qualified people who are required to make a series of responsible decisions in their work, such as company managers, doctors, lawyers, judges. They are the ones for whom the use of GenAI's achievements can be a huge step forward, but they will have to overcome their adherence to traditional methods of knowledge management. In this group, AI only endangers the jobs of those who are unable to adapt.
- ***High exposure, low complementarity*** – Workers in this category have a good chance of losing their jobs and employment. Examples include various officials, office workers, telemarketers, customer service administrators. In their case, too, the acquisition and practical application of AI literacy can be a way out.
- ***Low exposure*** – The jobs of various personal service providers are the least at risk from the advances of AI.

Using this grouping, IMF experts examined the expected effects of the spread of AI for more than 400 occupations in the ILO database for 142 countries. The fine-tuning was carried out for six countries that provide data at a sufficient level of detail. These are: USA, UK, Brazil, Colombia, India and the Republic of South Africa.

It has been found *that 40% of the employed person currently works in high-exposure jobs worldwide, and this proportion is as high as 60% in developed countries*. *In developed countries, the weight of both forms of high-exposure occupations is much greater than in emerging countries.* In the former, 27% of workers belong to the jobs with high exposure and strong complementarity, and 33% belong to the occupations with high exposure and low complementarity. These rates are 16 and 24 percent for emerging countries, and 8 and 18 percent for poorer developing countries.

[4] Gen-AI: Artificial Intelligence and the Future of Work .- https://www.imf.org/en/Publications/Staff-Discussion-Notes/Issues/2024/01/14/Gen-AI-Artificial-Intelligence-and-the-Future-of-Work-542379?cid=bl-com-SDNEA2024001

[5] TAVARES, Marina M*:* Artificial intelligence will limit some human roles but could make others more accessible https://www.imf.org/en/Publications/fandd/issues/2025/03/a-place-for-human-talent-in-the-ai-age-marina-tavares?utm_medium=email&utm_source=govdelivery

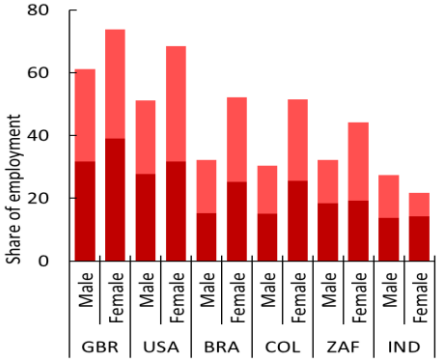
The following charts are used to illustrate how the exposure of different demographic groups develops in the case of countries that provide more detailed data. With regard to gender differences, it can be stated that in all countries surveyed, with the exception of India, the *exposure of female workers is much higher than that of men*. In the case of the UK and US, the spread of AI will soon pose a huge challenge for nearly three-quarters of female workers. In the case of Brazil and Colombia, this figure is 50%.

With regard to the level of education, it is typical of all the countries examined that *the higher the level of education of the employee, the stronger the exposure* to the spread of artificial intelligence in the workplace.

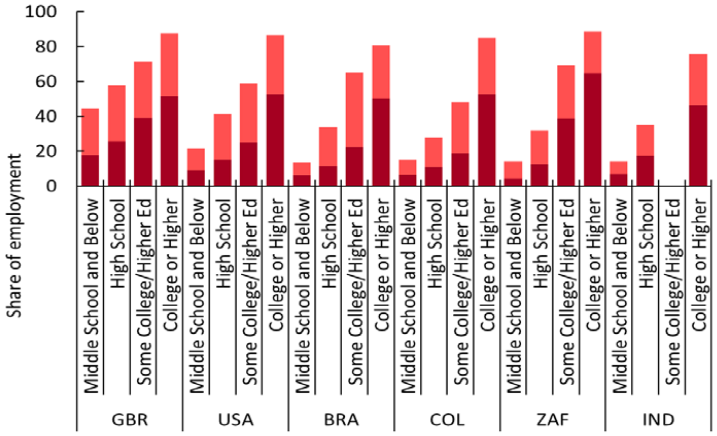
In terms of the relationship between age and exposure, a much more diverse picture emerged than the previous ones. The most at-risk age group is 25-44 year olds in the United Kingdom, Brazil, Colombia and India, while in the US and South Africa it is 60+. With the exception of Brazil, the least endangered age group was those under 25 years of age.

Based on the IMF's analysis, we can conclude that the spread of AI will take less time for jobs in developed countries than in emerging and low-income developing countries. As a result of the high proportion of highly exposed sectors, this rapid transition is likely to lead to labour market tensions, a more difficult situation for those living on wages and salaries, and many of them may lose or even temporarily lose their income. Nevertheless, there is a good chance that the *majority of the affected workers will realize that they need to retrain as soon as possible, which may mean expanding their AI user knowledge in their current field of work and the competencies necessary to serve AI systems, and learning professions that are in demand in sectors that are less exposed to AI.*
After the initial difficulties, companies in countries that face the challenges of AI early on may gain a huge competitive advantage over their peers who only join the process later, or even then only with difficulty.

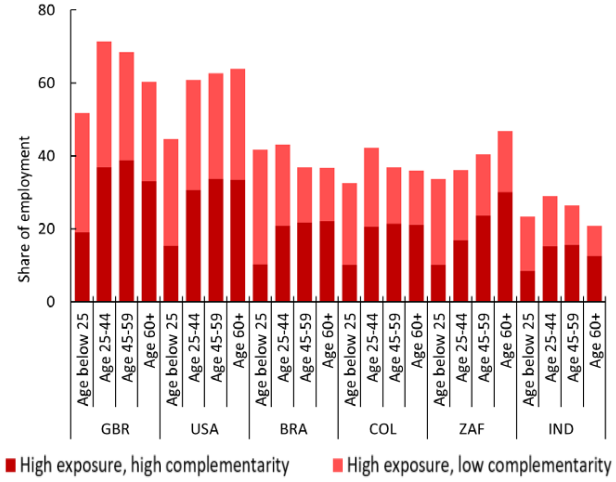
4. Figure: Employment rate in high-exposure occupations by gender



5. Figure: Employment rate in high-exposure occupations by level of education



6. Figure: Employment rate in high-exposure occupations by age



Source: IMF

In December 2024, the OECD's research group on artificial intelligence published a study that is very interesting for our project.[6] In it, it examines the role of AI in the activities of certain economic sectors in four dimensions. Their taxonomy classifies the individual sectors of the national economy based on four aspects: the intensity of the impact of AI on human capital and innovation, the sector's exposure to AI and the extent of the current use of AI.

While certain sectors, such as IT services, are at the forefront in all dimensions, in the case of others, such as the pharmaceutical industry, the different dimensions show a different picture. While the intensity of AI in this sector is high in terms of human capital, it is very low in terms of AI innovations.

Figure seven shows how each sector of the national economy "performs" in terms of the dimensions of AI. OECD experts distinguish four levels of AI intensity, which they arrived at by ranking the sectors based on their performance based on the indicators belonging to each dimension, and dividing them into quarters. The sectors belonging to the least AI-intensive quadrant are marked with a white rectangle on the figure, those in the second quarter are marked with a pale blue rectangle, those in the third are marked with a medium blue rectangle, and the sectors with the most AI intensive are marked with a dark blue rectangle.

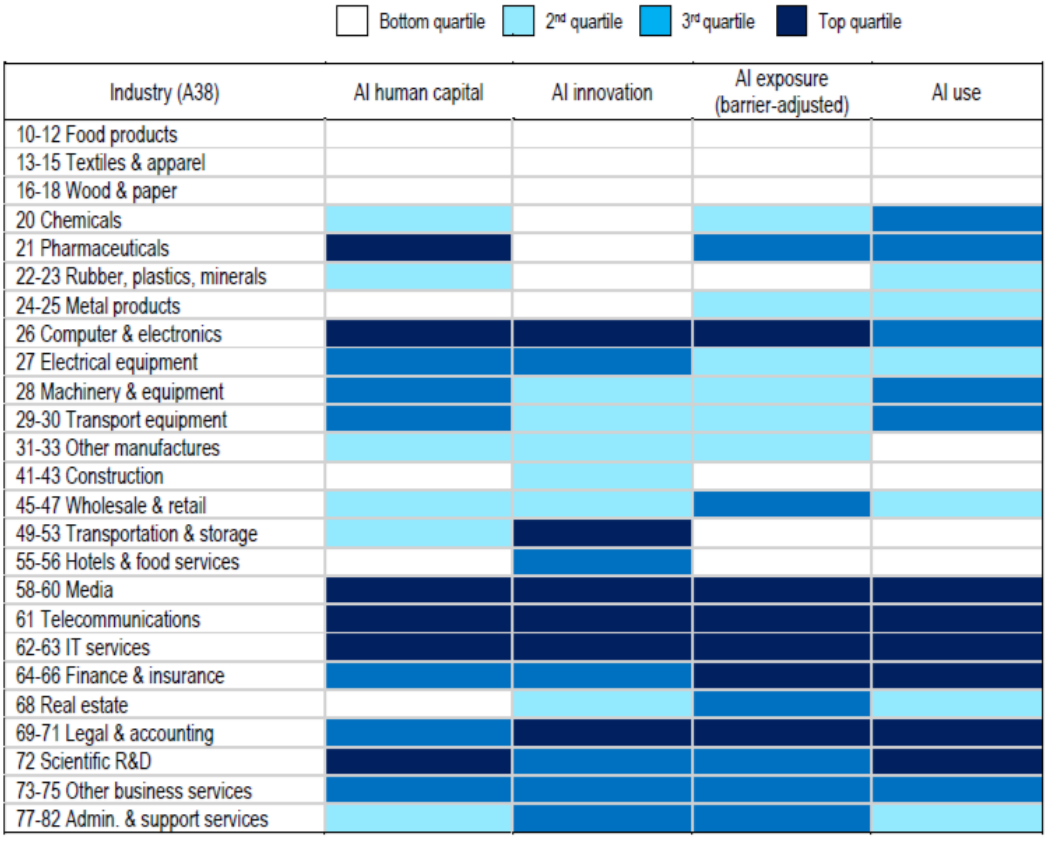
Examining the figure, we can conclude that the AI intensity of the main actors of our study, *the retail and wholesale trade and the mechanical engineering sectors, can be considered medium.* While the first three dimensions are pale blue and belong to the third, medium blue quarter only in terms of its exposure to AI, in all three sectors of the mechanical engineering industry we can find two dimensions belonging to the second and two third quarters. The manufacture of electrical equipment belongs to the third quarter in terms of AI human capital and AI innovation, while in the case of the manufacture of machinery and equipment and the manufacture of transport equipment, the medium blue color appeared in terms of human capital and the use of AI.

The "darkest" sectors were media, telecommunications and IT services, which qualified for the first quarter in all dimensions. The IT and electronics sector and the legal and accounting services sector have three first-quarter positions each.

At the other end of the scale, the sectors are the food industry, the textile industry, and the wood and paper industry. These are in all dimensions of AI – for now? - they belong to the least affected quartile.

[6] A sectoral taxonomy of AI intensity – OECD Artificial Intelligence Papers, 12 December 2024 https://www.oecd.org/en/publications/a-sectoral-taxonomy-of-ai-intensity_1f6377b5-en.html

7. Figure: Distribution of AI intensity by sector



Industry (A38)	AI human capital	AI innovation	AI exposure (barrier-adjusted)	AI use
10-12 Food products				
13-15 Textiles & apparel				
16-18 Wood & paper				
20 Chemicals				
21 Pharmaceuticals				
22-23 Rubber, plastics, minerals				
24-25 Metal products				
26 Computer & electronics				
27 Electrical equipment				
28 Machinery & equipment				
29-30 Transport equipment				
31-33 Other manufactures				
41-43 Construction				
45-47 Wholesale & retail				
49-53 Transportation & storage				
55-56 Hotels & food services				
58-60 Media				
61 Telecommunications				
62-63 IT services				
64-66 Finance & insurance				
68 Real estate				
69-71 Legal & accounting				
72 Scientific R&D				
73-75 Other business services				
77-82 Admin. & support services				

Note: The Figure reports the AI intensity of each sector according to each AI indicator (AI human capital, AI innovation, barrier-adjusted AI exposure, and AI use). All underlying indicators are expressed as sectoral intensities, where sectoral values represent averages across countries and years. The colour of the cells in the table corresponds to the quartile of the sectoral distribution to which the sector belongs. Sectors considered are manufacturing (excluding coke & petroleum), construction and business services.
Source: authors' elaboration based on Lightcast, STI Micro-data Lab: Intellectual Property Database, BTOS data, Felten, Raj, and Seamans (2021[41]), Eurostat and OECD Digital Economy Outlook 2024 (OECD, 2024[43]).

Source: OECD

Another ***notable study*** by the OECD[7] deals with the impact of the spread of artificial intelligence on the labor market, how it prefers or even affects workers with different skills. In addition to analysing statistical data, the researchers formulated their findings on the basis of an empirical study conducted in ten OECD member states. The latter meant studying and processing job advertisements of recruitment companies and portals specializing in it, as well as companies classified into different categories in terms of the adaptation of AI.

The most important message of the study is that , *contrary to popular belief, the spread of AI does not increase the demand for IT professionals to the greatest extent*. There is no doubt that an increasing proportion of employees need to have various IT competencies, but the increasing number of professionals specifically engaged in the development and operation of AI only makes up a very small proportion of the workforce of companies. Most of the employees who come into contact with AI do not/will not need to know the background processes of the operation of the given system at an expert level.

[7] Artificial Intelligence and the Challanging Demand for Skills in the Labour Market - OECD Artificial Intelligence Papers , April 2024 https://www.oecd.org/en/publications/artificial-intelligence-and-the-changing-demand-for-skills-in-the-labour-market_88684e36-en.html

The empirical study revealed that *companies in the sectors most exposed to AI are primarily looking for employees with skills related to management, managing and understanding business processes, and building and nurturing social relationships.* The most sought-after professionals are project managers, budgeting and accounting experts, process organizers, and customer service representatives.

In ***May 2025, Professor Stefano Puntoni*** of the Wharton School of the University of Pennsylvania had a very interesting conversation with Neil Hoyne, Google's chief strategy officer, about the effects of generative artificial intelligence on workplaces and the people who work there. It is worth getting acquainted with their findings and advice published on the university's website.[8] They summarized in five points what is and what is not WE.

- *AI transforms work, but it does not replace it.*

Generative AI is more of a story about human capital than a technical process.

Many people call it the development of technology, but its essence lies in how people can adapt to it. To understand how GenAI will contribute to the transformation of the future of work, we need to turn not to the potentates of Silicon Valley, but to social scientists, business school professors, and HR professionals.

AI will not eliminate but redefine many jobs. Similarly, just as photography has been transformed and taken to a higher level with the advent of digital tools, the professions involved will integrate the achievements of AI into their workflows. To ensure that employees do not feel threatened, they need to be made to understand which aspects of their activities require their personal knowledge.

- *AI should be seen as a technological aid and not as a fashion item!*

It is very important that companies only introduce AI in areas where they actually need it. AI seems to be becoming a buzzword in business, with companies increasingly using it as a branding tool rather than a true technology differentiator.

- *The essence of AI is that it is about the cooperation of humans and machines, not their hostility.*

The spread of AI depends on whether people see it as a tool that enhances rather than neglects their expertise.

[8] https://knowledge.wharton.upenn.edu/article/five-ways-gen-ai-is-changing-workplace-identity/

Instead of competing with AI, humans should focus on skills that AI can't easily replicate, such as ethics, creativity, strategic thinking, accountability, and leadership skills. AI may lead to headcount reductions in some jobs and tasks, but there will be a greater focus on expertise and innovation.

- *Companies need to recalibrate their workforce*

Since artificial intelligence primarily replaces entry-level tasks and the competencies of beginners, the traditional career path is in danger. Companies will need to find new ways to train and develop their young professionals, as it will be increasingly difficult for them to find experienced talent in the labour market in the future. Leaders need to rethink talent development so that their employees' expertise continues to grow alongside AI.

- *AI will also have a very strong influence on life outside the workplace*

AI is not only about the efficiency of work, but also about reevaluating our relationship to work itself. If AI frees up time, how will people regroup it? This can lead to a social shift where personal identity is less tied to work and more connected to family, hobbies, relationships, and creative activities.

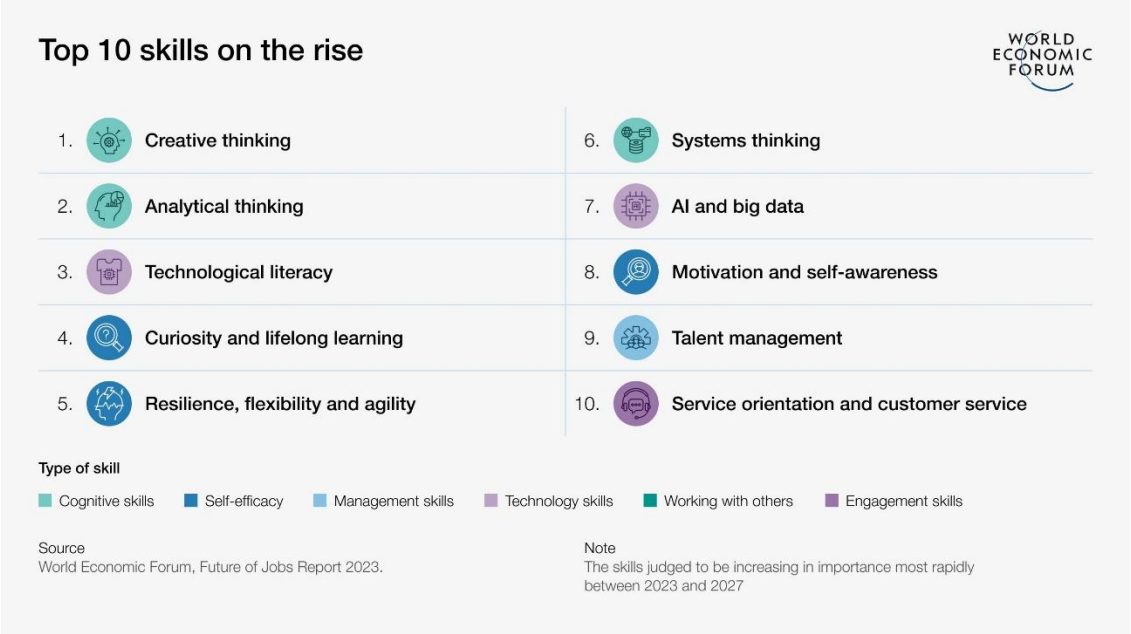
AI is also changing education. Instead of banning AI in the classroom, institutions should teach students how to use it effectively. AI is not going away, so educators need to find ways to incorporate it into learning while maintaining critical thinking and scientific integrity. AI can also serve as a great balancing tool, helping students from different backgrounds, such as those who are not native speakers of the language of instruction, to acquire skills.

The **main topic of the World Economic Forum** meeting held in Dubai in October 2024[9] was the exploration of skills and abilities characteristic of the age of artificial intelligence. The Forum's researchers predict that by 2027, 44% of today's workers will no longer need their work in its current form. All this will be largely a consequence of the rise of AI. Therefore, both employees and employers must do everything possible now to retrain employees in the direction of the needs of the new times, and to ensure that the education system releases students from institutions who are prepared accordingly.

[9] https://www.weforum.org/stories/2024/12/things-learned-ai-skilling-workers-technology/

The workers of tomorrow will need soft skills. The figure below shows that 7 of the 10 most sought-after employee skills in 2027 fall into this category.

8. Figure: The most in-demand employee skills in the near future



Source: World Economic Forum

The speakers of the Forum also placed great emphasis on the importance of education reform. They all see that formal education is light years behind the requirements required by technological advances.

In **the summary of this year's survey based on a large-scale survey**, the McKinsey Institute [10] draws attention to a very important factor. Namely, how *important it is for organizations to have a top-down process for AI adoption*. AI will only be effective if its necessity is understood by the big bosses, the so-called big bosses. C-suite, i.e. executives whose titles begin with C in English, such as CEO, CFO, CHRO, etc., initiate it and manage its implementation with the support of the board of directors.

It is a bad habit, and even today many companies are at the point where they consider the introduction of AI to be an IT task and entrust its implementation to the IT department. McKinsey's annual surveys show that these initiatives are not successful in the majority of cases. There are several reasons for this. First and foremost, the introduction of AI is not a technological process, but a transformation. Change management and the reorganization of human resources are needed in a way that is part of the competence of the C-suite. In addition, this transformation is usually expensive, involving significant financial and intellectual resources, so it can only be implemented through a series of senior management decisions. As organizations become more and more proficient in AI, it will be embedded in virtually every function, allowing leadership to focus on higher-level tasks such as impact monitoring and talent development rather than execution.

[10] https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai

Artificial intelligence in Hungary

In 2020, the government adopted Hungary's artificial intelligence strategy[11]. At that time, only a few countries had one, and even the EU's AI Act, which contains provisions that guide member states[12] , did not exist. Among other things, the strategy dealt with the field of the data economy, and the document defined the directions of R+D, i.e. how Hungary should join the AI revolution.

Dr. László Palkovics, government commissioner for AI, said the following about this heroic era: "We have completed the groundwork and created the necessary legal background for the use of data. We have established the National Data Asset Agency[13] for the economic exploitation of data. In addition, we set the goal of acquiring a supercomputer that is necessary to run AI applications, and we have also incorporated AI knowledge into the education system. We have set a goal that at least one million people should become acquainted with AI, and 100 thousand people should also obtain some kind of qualification in this field. These projects have progressed well, although they were somewhat pushed into the background in 2021-22 due to the energy crisis and the Russian-Ukrainian war.

... The revision of the previous strategy began in 2024 under the leadership of the Ministry of National Economy[14] , and we have now accelerated this process. Our most important partner in this work is the Artificial Intelligence Coalition[15], which brings together more than 500 companies. We have asked for the modification proposals of the working groups and the renewed strategy is being prepared, which a team is working on these days.

... Due to the rapid development of the field, we do not plan for five years, but we would like to review it at least annually and, if necessary, we will make the review more frequent. The development of technology is rearranging market conditions at a dizzying speed. The strategy has two main elements: the foundation pillars and the concrete projects. An example of the founding pillars *is the utilization of national data assets*. This also requires legislative amendments, for example, to make the data request automatic. And in the case of specific projects, there will be legislative amendments and tenders for companies.

… There will be specific incentives in the field of artificial intelligence, for example, we would increase the intensity of support for foreign companies settling here if they install AI systems. The goal is wide application, not just production. We would also prefer companies that use AI in SMEs. It is also important to apply it in education and state systems, and the building of a digital state can now be achieved with better tools than a few years ago. Supporting research with AI tools is also a priority area. The funds can be state, EU or private funds, we are also negotiating with banks and investors, because AI can be a good business.

… The coordinated use of existing R+D resources and the incubation of AI startups are of paramount importance. For example, by 2030, we would like to see 200 AI-based startups launched.

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[11] https://cdn.kormany.hu/uploads/document/6/67/676/676186555d8df2b1408982bb6ce81c643d5fa4ab.pdf

[12] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021PC0206

[13] https://navu.hu/

[14] https://kormany.hu/nemzetgazdasagi-miniszterium

[15] https://mik.neum.hu/

... The economic growth caused by the spread of AI use is 11.5% compared to GDP forecasts for 2030 for our region and 14% for the global level. In comparison, Hungary sets a target of 15%, i.e. growth that exceeds the regional and global levels."[16]

The explosive development of artificial intelligence is already shaping our daily lives and workplaces to a great extent.[17] Artificial intelligence is a general-purpose technology such as the steam engine or electricity, as it can be used to solve a specific problem rather than a specific problem, but can be used in several areas of our lives. In addition*, due to its extremely rapid development, a quarter of Hungarians cannot even keep up with all this*, according to the Bosch Tech Compass international survey.[18] However, the distrust of technology can be traced back to deeper reasons. "We have definition problems with the use of AI. We don't even know if many applications are AI-based or we simply don't consider them as such," said Róbert Pintér, PhD, sociologist and political scientist. These include car navigation, the determination of recommended public transport based on traffic or optimised routes, but also the use of social media or translation programs, as well as applications related to weather forecasts.

We are so afraid of the unknown that we have no experience of our own. *Although 53 percent of Hungarians believe that artificial intelligence will be the dominant technology of the next decade, according to Bosch Tech Compass research, its daily use is still negligible*: for example, only one in twenty people uses ChatGPT regularly. The survey also reveals that although few people have tried it yet, *one in two respondents is still afraid that AI will endanger or take away their jobs in the future*. In order for the process of acceptance and trust building to start, we would have to follow a similar path as when the internet was introduced, reminds sociologist Róbert Pintér, who believes that IWIW brought this breakthrough for Hungarians. Now, however, there is a lack of an entry app that would help understanding, while many people are not open enough to gain first-hand experience.

According to the respondents of the Bosch Tech Compass, companies and education also play a major role in the acceptance of AI, which was also confirmed by the sociologist. Mónika Hack, press relations officer at the Bosch Group's Corporate Communications and Government Relations Department in Hungary, said that "Bosch has had an AI Code since 2020, as AI can be found in all of the company's products or contributes to their production, following the latest international innovative trends. In addition, *continuous knowledge development is a company value*: not only the training of employees, but also of suppliers and future generations."

At the same time, not only companies, but *also employees are responsible for remaining competitive thanks to continuous training*. In answer to the question of whether it will cause inequality, who can keep up with the changes how quickly, the sociologist said that in the medium term (within 5-15 years), the vast majority of professions will be re-layered, and technological openness will become an advantage in the industry segment: "it is not necessarily the time spent at the company, experience or knowledge at work, but digital openness that will play a role in it, who can follow what career path. So in the end *, it's not the AI that takes the work, but another person who can use it more skillfully*."

[16] https://www.portfolio.hu/gazdasag/20250402/megtudtuk-a-reszleteket-igy-nez-ki-a-kormany-ai-mesterterve-751269

[17] https://autopro.hu/beszallitok/nem-az-mi-veszi-el-a-munkat-hanem-aki-jobban-hasznalja/1388503

[18] https://www.boschmediaservice.hu/sajtokozlemeny/bosch_tech_compass_hazai_felmeres_2025-438.html

"The use of AI is a huge challenge for education," said Róbert Pintér, "and the way of accountability will have to be completely transformed in the future. In order to create solutions as quickly, in better quality and as efficiently as possible, and to use the available tools in an ethical and legal way, we *need to teach the correct application of AI in schools.*"

The conversation also revealed that source control will be essential for the use of artificial intelligence in the workplace and in everyday life. In addition to the government, legislators, professional bodies and education, individuals and companies also have a great responsibility in developing cyber security awareness and critical thinking, including the recognition of fake news and fakes.

Artificial intelligence in the mechanical engineering and related sectors

Today, the industrial application of artificial intelligence is not just a futuristic concept, but a fundamental tool that has radically transformed the manufacturing industry and achieved significant productivity growth. Its effect can be compared to the steam engine of the 19th century industrial revolution or the appearance of the internet, as it not only automates tasks, but in some cases is also able to perform cognitive functions, thus being able to perform complex tasks that could not be solved at all before, or only at the cost of a long time.

AI goes far beyond providing information about certain activities, as it can summarize, write code, reason, engage in dialogue, and make decisions. This capability hides a completely new way of using it, which can lead to innovations, increase productivity, and result in a functional step up the value chain.

AI is often referred to as a revolutionary breakthrough, but in technical terms, it can be considered more of an evolutionary step compared to "traditional" digital technologies, as it is mostly based on existing digitization technologies. This distinction is crucial for strategic planning and managing expectations, as over-mystifying AI can lead to unrealistic expectations or underestimation of the basic digital infrastructure needed. Although the technical foundations of AI are extensions of digital technologies, the results resulting from it and its effects on business models, workforce and operational complexity are fundamentally new.

It is important to distinguish between generative AI (such as ChatGPT) that is commonly used today and industrial AI models. The latter primarily covers the so-called predictive artificial intelligence, which has had industrial applications for decades. They are similar in structure to classical statistical models, their purpose is mostly the same, but they are conditioned for a special industrial environment. They are easy to understand, some of their types give well-interpretable results.

In contrast, generative AI still shows a rather "foggy" path and is still only a "beta version" for many industry players. It is an unfortunate experience that the "hype" around generative AI can distract from the proven value of predictive AI, which keeps companies away rather than trying to exploit its potential. This highlights the need for strategic clarity in AI adaptation, distinguishing between mature and still developing capabilities.

In mechanical engineering, artificial intelligence is revolutionizing the way it works from design to manufacturing and maintenance. It significantly improves the design phase by helping engineers create innovative concepts, analyze existing mechanisms, perform complex calculations, and compare alternative technologies. AI has been proven to broaden the possibilities for innovation within defined limits and performance criteria, optimizing parameters without compromising safety. Machine learning simplifies design processes, automates repetitive changes, and aids analytics processes.

For example, some AI-driven algorithms analyze sensor data from machines in real-time, predicting potential failures before they occur. This significantly reduces downtime and maintenance costs, and is typically installed by machine tool manufacturers as "standard equipment" in modern machines today.

In robotics, it enables machines to autonomously perform complex tasks and learn from their environment. Collaborative robots (cobots) work alongside human operators, optimizing their actions based on human behavior and task requirements. AI-driven robotic systems increase factory automation, improving the efficiency of assembly lines and reducing reliance on human labor for repetitive and dangerous tasks.

AI technologies, in particular computer visualisation and deep learning, have the potential to significantly improve quality control processes. AI systems can analyze product images faster and more accurately than human inspectors, reducing the amount of waste. However, we note that the human factor cannot be excluded from quality control processes, as the performance of complex evaluations still requires the involvement of human resources.

Artificial intelligence is often integrated with the Internet of Things (IoT), so it can create interconnected systems for real-time decision-making and process optimization. Digital twins create virtual replicas for testing and optimization, allowing virtual prototyping and design testing before physical production. The combination of AI, IoT, digital twins and advanced robotics enables the creation of Industry 4.0 "Smart Factories". In these production plants, the combination of real-time data flow and AI-driven decision-making can achieve efficiency gains, enable flexibility and sustainability, moving from mass production to personalized and on-demand models.

Some applications have limited ability to predict demand, predicting bottlenecks in logistics, leading to more efficient resource allocation and lower environmental impact.

The rise of AI in the automotive industry is driven by consumers' growing demand for continuous interaction between the vehicle and the driver, the (more industrial) demand for autonomous driving, and the high level of competitiveness in the industry.

AI enables the use of functions such as lane keeping, adaptive cruise control, driver monitoring and parking assistance, among others, which form the basis of advanced driver assistance systems (ADAS). AI enables over-the-air (OTA) updates based on real-time diagnostics and driver behavior, allowing settings to be tailored to driving habits, from seating to climate control and entertainment electronics, to personalize the vehicle. AI also helps in predictive vehicle maintenance, predicting potential breakdowns and alerting owners to perform maintenance.

By using it, fleet management can be simplified; Real-time monitoring can reduce costs and improve efficiency, predictive analytics helps with route optimization but also contributes to improving traffic management, which is usually the responsibility of the road manager.

1. Table: Artificial intelligence-based applications in some sectors

Industry	**Main areas of application**	**International examples**	**Examples in Hungary**
Mechanical engineering	Generative design, predictive maintenance, robotics/automation, quality control, smart manufacturing, supply chain optimization	Siemens, Amazon/Siemens, BMW	Videoton, Semilab, 77 Electronics

Automotive	ADAS/Autonomous Driving, Vehicle Connectivity/Personalization, Software Development, Production Optimization, Fleet Management	Waymo, Tesla, Various OEMs	BMW (Debrecen), CATL, BYD

Source: Kopint-Tárki collection

Strong limits to the industrial applicability of AI

Although the accuracy and reliability of AI systems are typically good, it is not excluded that the system will make serious errors, especially if the conditions differ from the training data for some reason (see, for example, shock responses). The lack of determinism in AI models (e.g. autonomous driving) undermines the predictability that is essential for safety standards. In addition, there may be serious privacy concerns as AI systems, especially those handling sensitive data, are vulnerable to cyber threats. Since the data handled by AI is considered a business secret for the majority of factories, many companies only use closed-loop AI.

Potential biases in estimates (under- or over-fitting, or biases from input data) and the lack of interpretability of processes and results are also significant challenges in the application, as AI models can amplify the biases in the training data. The "black box" nature of some AI can hinder decision-making, as it is not known how the system came to the conclusion on which it formulated proposals.

In addition to technical issues, ethical concerns may arise such as data liability, privacy, equity, environmental sustainability (energy consumption) and the possibility of misuse. Therefore, continuous human supervision is essential.

The development and implementation of AI solutions requires a significant financial investment, which is almost unaffordable for smaller companies. As a result, there is a huge gap between smaller companies and large companies in the use of AI, giving typically multinational manufacturing companies an unfair competitive advantage in some respects. This problem can be helped primarily by start-up companies and their community initiatives that offer free or cheap solutions.

The following table summarizes our findings so far on the applications of AI in the broad sense of the mechanical industry, and also contains some domestic and international examples.

Artificial intelligence in the Hungarian mechanical engineering industry and related sectors

In Hungary, the artificial intelligence market is currently on the rise, which is also encouraged by the increasing use of digital technologies and government support. Based on our interviews, the spread of AI achievements among Hungarian companies is influenced by several factors. On the one hand, Hungarian engineering (and in a broader sense other industrial) companies often cooperate with foreign-owned companies, or are themselves foreign-owned, or perhaps suppliers to foreign companies. The decision to use the achievements of AI in relation to the entire value chain is made by the owners, who generally expect all related companies to adapt to their decision, which increases the penetration of AI. The strong influence of foreign-owned value chains means that in a significant part of Hungarian industry, AI adaptation is often a top-down instruction rather than an organic, bottom-up innovation. While this may speed up adaptation, it can also lead to a "black box" understanding of technology, as even groundbreaking innovations can take place without any particular antecedents. All of this could potentially hamper true local innovation and adaptation.

In the case of other companies participating in other value chains, the spread of AI depends on whether the company management recognizes the benefits that can be exploited for them and how committed it is to the necessary reskilling and upskilling of employees. Finally, for small businesses, it is crucial whether the owner and/or employees use certain services of AI in their private lives. If they already perceive the benefits inherent in them as individuals, they are happy to try them out in a corporate environment.

Based on the interviews conducted, it can be stated that AI is widely used for secretarial or business tasks, such as comparing quotes, selecting the best offer, scheduling appointments, writing letters and texts. **Videoton** also uses these extensively in office-type jobs, where AI functions are embodied separately in the use of different programs. The company is also making intensive use of embedded AI in its production machines. This embedded AI goes beyond pre-programmed alerts; autonomously determine maintenance needs based on intensity of use, conditions (e.g. humidity) and other factors, finding patterns that one would not even think of. Videoton itself manufactures AI-capable machines that are capable of performing more complicated, complex and complex tasks than "traditional" digital technology.

Semilab, a Hungarian-owned semiconductor metrology company, in partnership with **Hiflylabs**, is using state-of-the-art AI, in particular a chatbot ("Alfred") based on a large language model (LLM), to improve internal access to their extensive knowledge base, thus increasing work efficiency. This involves feeding OpenAI models with enterprise information while ensuring data security.

77 Elektronika, also a Hungarian-owned manufacturer of in vitro diagnostic medical devices, uses AI-based technology for automated urine sediment analysis. Using image processing software (AIEM), microscopic images of urine samples are evaluated, automating traditional handheld microscopy. This significantly improves diagnostic performance.

The **BMW** plant in Debrecen, which will start series production of the all-electric Neue Klasse in 2025, is one of the most modern factories in our region in terms of flexibility, sustainability and digitalization. You'll use digital design tools (e.g., NVIDIA Omniverse) to virtually design the entire manufacturing process. AI applications will support quality assurance, optimize processes in smart and predictive maintenance, and enable the use of autonomous smart logistics systems. The Hungarian AI Strategy also treats the development of "self-driving vehicles – autonomous systems" as a top priority, and BMW's plant in Debrecen is a significant step forward for Hungarian car manufacturing in this regard

In the chemical industry, **MOL** has been a leader in the application of predictive AI in its downstream (chemical) operations for 6-7 years. The shortage of professionals is being addressed by training chemical engineers in data analysis and AI as they find this easier than training IT professionals to analyze chemical processes. In addition, there are domestically founded chemical companies, such as **Chemaxon**, which offers world-class analytical solutions using artificial intelligence.

The spread of artificial intelligence in Hungary is hampered by the fact that there is a significant shortage of IT professionals and science-specific researchers in all sectors, which is further aggravated by the rapid emergence of new technologies such as AI. AI, similarly to digitalization, is leading to the polarization of the workforce, more high- and low-skilled labor is needed, while the demand for labor with secondary education is decreasing, and the brain drain in Western Europe and the United States is also extremely strong.

In addition, in areas that require continuous work (e.g. 3-shift plants), AI and robotics are becoming the primary workforce as younger generations are increasingly less willing to work such shifts. So this is also a forced replacement of workforce, not just an increase in efficiency. The Hungarian labor market faces a dual challenge: AI-driven structural shift (polarization) and demographic pressure, which makes AI adaptation a key to survival.

The responsibility for education lies largely with adult education and higher education. Younger generations (Generation Z) are more open to AI and find it natural, while older generations, especially those with 20-25 years of experience, may resist acquiring new competencies related to AI. It is essential to incorporate AI knowledge into education from primary school onwards. Teachers need to be trained to teach effectively with AI. Currently, AI is unfortunately often used by university students without understanding the underlying processes. There is a great need to teach AI how to "ask questions". The market will increasingly demand professionals who are able to effectively use the opportunities offered by AI both in business areas and in production-related areas.

In Hungarian higher education, artificial intelligence appears in a very mixed way. There are already courses that are specifically focused on the field of data science, but we have to note that these programs started very late, so we are more than a decade and a half behind, which is not easy to catch up on. On the other hand, the use of artificial intelligence has been present in disciplines for a long time (especially in the field of natural sciences), but in a highly concentrated, field-related form, this edge is essentially missing from other trainings.

Application of artificial intelligence in commerce

The development and spread of artificial intelligence does not only affect the world of science and technology, but its impact is also felt in everyday life in the field of work and private life. Thus, in terms of the commercial sector, it can be said that the effects of artificial intelligence and automation can already be observed in Hungary, and the wider spread of AI-based solutions and technologies will continue in the coming years, presenting new opportunities and challenges for companies. The spread of AI and automation is bringing significant changes to the labor market in Hungary as well. However, instead of envisioning jobs that will be lost en masse, it is better to examine what new jobs are created by technological development and how it transforms existing jobs, which positions are really inevitable, and how AI can make the current work more efficient and easier, thereby creating value for both the employee and the employer. As in previous major technological transformations, it is important that companies and employees are prepared for the changes and receive appropriate training and support for the effective and ethical use of AI systems. However, the widespread use of AI in commerce is not only a question of a well-prepared workforce, it depends to a large extent on supportive leadership, public policy, the cost of the introduction and use of AI technologies, the human resource planning related to the introduction, the communication of the transformation, the awareness of the risks related to the use and the possibilities for managing them.

Research on the automation of commercial jobs and their involvement by AI

Studies on the impact of AI on commerce have been part of several researches and studies. Analyses and research on various commercial sectors have found that commercial jobs can be automated in different proportions. According to the ***Frey-Osborne study, which is often cited on the subject [19] , the retail sales profession can be automated with a 92% probability, and the cashier occupation with a 97% probability***. The Frey-Osborne research examined the effects of automation on the labour market based on the so-called profession-based approach, determining the probability of automation for each occupation. On the other hand, those who use a task-based approach say that the automation of individual tasks is more likely than that of entire occupations, and in addition, the tasks related to professions may vary from country to country or even from workplace to workplace (Arntz et al. 2016).[20] Task-based research estimates the degree of automation at an individual level, based on the information recorded by employees about their own tasks. In 2019, the IEER applied the profession-based approach to define occupations that could potentially be automated, addressing the inaccuracies resulting from the possible overestimation of the number of employees concerned by taking into account only existing technologies that are already used somewhere in the world. At the same time, they moved towards a task-based approach by evaluating all Hungarian professions included in the Unified Classification of Occupations (FEOR) based on whether the tasks belonging to the given profession can be automated. In the ***case of the Hungarian trade and service occupational group, the proportion of professions most affected by automation was 20% of all occupations belonging to this group, occupations that could be partially automated accounted for 30%, and the proportion of subtasks that could not be automated or could not be automated at all was 40%.*** In the main group of trade and service occupations, 18% of the employed (77 thousand persons) worked in occupations consisting of fully or mostly

[19] Frey, C. B. and M.A. Osborne (2013): The Future Employment: How Susceptible are Jobs to Computerisation? University of Oxford

[20] IEER (2019): The Automatability of Professions and the Possible Effects of Automation on the Labour Market in Hungary, www.gvi.hu/files/researches/587/ipar_4_0_feor_tanulmany_191128.pdf (Downloaded: 04/05/2025)

automatable sub-tasks, of whom 58 thousand (14% of those employed in occupations belonging to this main group) worked in occupations with a high probability of automation. Of those working in the most affected occupations, 73 thousand people were employed in "commercial and catering" occupations. Moving on to the level of professions, the research revealed that among the most affected occupations, most people worked in general office administrators, loaders, manual packers and forklift drivers in 2018. From the point of view of the commercial sector, several occupations were included ***in the list of professions that can be automated or largely automated***, in which the number of employees is over 10 thousand, e.g. ***stocker, cashier, inventory and material registrar.***[21]

A Citibank analysis ***based on the methodology of the Frey-Osborne study*** [22] showed that ***63% of sales occupations are subject to automation***, while ***McKinsey[23] calculates that 65% of grocery store hours can be automated***. However[24], the OECD study emphasizes that ***only 4% of employees working in sales do not participate in teamwork*** and personal communication.

Closely intertwined with the topic of automation and robotization, artificial intelligence is projected in the late 2010s and early 2020s to greatly transform the labor market and the competencies required for the jobs to be done in the near future.[25] According to a 2019 study by PwC Hungary, ***by 2030, the spread of artificial intelligence and automation*** will affect a total of 900,000 employees in Hungary in three waves, of which ***108.4,000 employees working in the commercial sector*** are expected to be affected ***in the second, so-called augmentation wave of the spread of AI***.[26]

The ***leading finding of the research conducted by the Trade Union of Commercial Employees KASZ in 2021***[27] is that automation and robotization will radically upset the retail sector and will also have a huge impact on the sector's labor market: the demand for labor in the domestic retail sector may decrease significantly in the medium term, according to a forecast based on research results. The remaining jobs will be partially transformed and will require new skills and skills from employees. As part of the research completed in 2021, KASZ conducted [28] questionnaires, focus groups and in-depth interviews among Hungarian retail employees and

[21] IEER (2019): Automatability of professions and the possible effects of automation on the labour market in Hungary, www.gvi.hu/files/researches/587/ipar_4_0_feor_tanulmany_191128.pdf (Downloaded: 19.05.2025.)
[22] Citibank (2017): Technology at Work v3.0: Automtating e-Commmerce from Click to Pick to Door, www.oms-www.files.svdcdn.com/production/downloads/CITI%20REPORT%20ADR0N.pdf (Downloaded: 07/05/2025)
[23] McKinsey Global Institute (2017): A future that works: automation, employment and productivity, www.mckinsey.com/~/media/mckinsey/featured%20insights/Digital%20Disruption/Harnessing%20automation%20for%20a%20future%20that%20works/MGI-A-future-that-works-Executive-summary.ashx (Downloaded: 07/05/2025)
[24] Arntz, Gregory, Zierahn (2017): The Risk of Automation for Jobs in OECD Countries: A Comparative Analysis, OECD Social, Employment and Migration Working Papers No. 189, www.oecd.org/en/publications/the-risk-of-automation-for-jobs-in-oecd-countries_5jlz9h56dvq7-en.html (Downloaded: 15/05/2025)
[25] Hungary's Artificial Intelligence Strategy 2020-2030 (May 2020), citing the study by PwC Hungary (2019): How will AI impact the Hungarian labour market.
[26] PwC Hungary (2019): How will AI impact the Hungarian labour market? www.pwc.com/hu/en/publications/assets/How-will-AI-impact-the-Hungarian-labour-market.pdf (Downloaded: 07/05/2025)
[27] KASZ (2021): The Future of Work – The Situation of Commercial Workers in the Fourth Industrial Revolution, www.kiskerdigitalizacio.hu/index.php/szakmai-anyagok/zarotanulmany (Downloaded: 07/05/2025)
[28] KASZ (2021): The Future of Work – The Situation of Commercial Workers in the Fourth Industrial Revolution, www.kiskerdigitalizacio.hu/index.php/szakmai-anyagok/zarotanulmany (Downloaded: 07/05/2025)

employers. The results showed that although the majority of retail workers believe that robotization could eliminate hundreds of thousands of jobs, only a third of them believed that this process could affect them personally. ***Of the automation trends, employees perceived self-service checkouts the most, the introduction of which did not entail major redundancies for the majority***, and checkouts were reallocated to other areas (e.g. online retail department). ***On the employers' side, the problems arising in connection with automation and robotization have affected the issues of revenue and enhancing customer experiences rather than the issue of employment.***

In-depth interviews with employers revealed that for the time being, the Hungarian retail sector is not seriously affected by the problem of job losses due to robotisation in the medium term. Around 2020, the majority of company managers still considered the general use of robots in retail, such as the spread of warehouses where driverless forklifts work, to be a long way off. However, the management of orders has already been automated in many places by answers, and records have been digitized. All this creates a good basis for the use of AI to support work, and the availability of data in digital form is a prerequisite for the use of AI-based forecasting models. On the employers' side, the spread of automatic checkouts was already a novelty mentioned as a trend in 2020, although they believed that the traditional cash register form could continue to work in smaller shops in the countryside for a long time. This is related to the development of the relationship with cash arising from generational differences, which has taken a turn compared to the previous direction with the strengthening of the right to use cash. Company executives reported that they are not planning to reduce headcount, but would like to increase efficiency with the existing headcount and achieve higher turnover, which requires technological developments. In this respect, the use of AI can therefore be considered supportive.

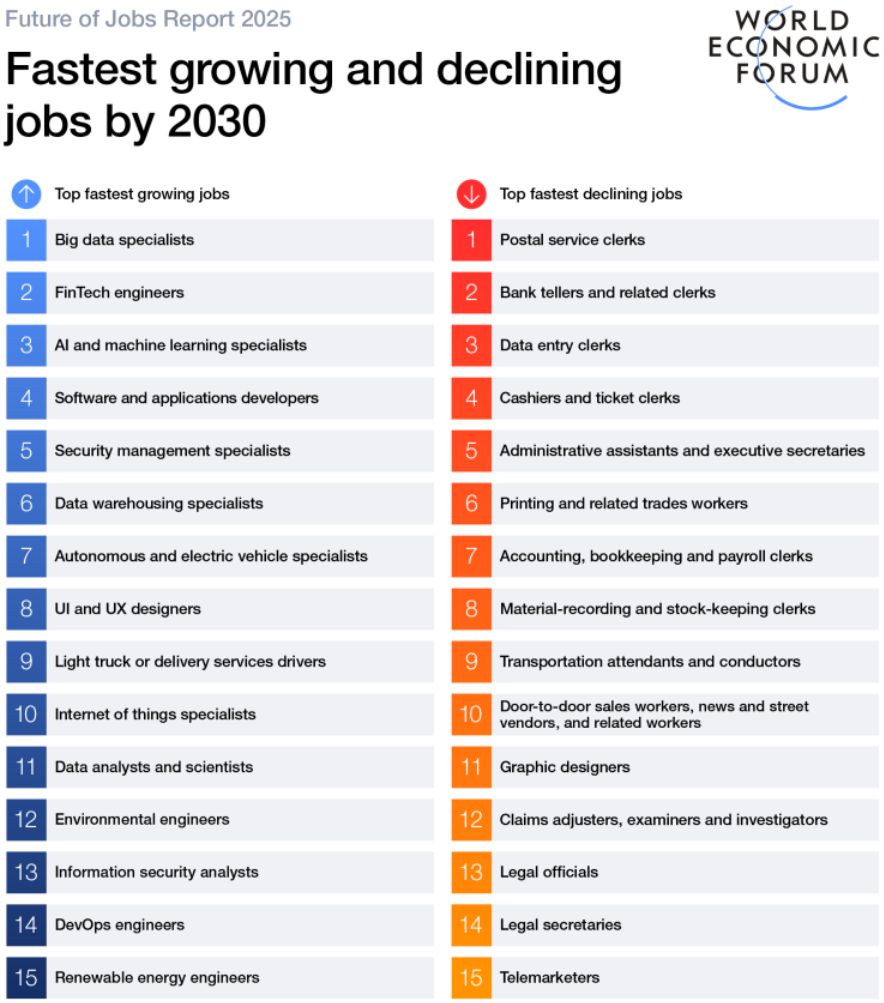
In ***its Employment Outlook 2023***[29], the OECD examined the effects of artificial intelligence on the labour market. ***Empirical research has not yet confirmed the negative impact of AI on labour demand***. AI can automate work tasks, but it can also complement human work and create new tasks. So far, it has had the most significant impact on non-routine, cognitive tasks. However, according to many studies, the highly skilled workforce has been positively affected by the introduction of AI by improving employment prospects. ***The spread of AI is not only increasing the demand for skills needed to develop AI systems, but also the demand for skills needed to use AI applications***. The study also notes that although large language models have undergone tremendous development in recent years, and this is continuous, ChatGPT sometimes provides superficial content, sometimes false information, so proper prompting and human review of the end result are definitely necessary when using it. In many cases, the increasingly widespread personalized product recommendation systems in commerce perform significantly better than humans, but at the same time, human intervention may be necessary in these cases as well, for example, when entering the parameters, and people also accept the recommendations. Since online product recommendation systems have a great influence on individual choices and consumption, moral and ethical questions also arise in connection with the freedom of individual decision. These questions can be answered by employees with special skills.

[29] OECD Employment Outlook 2023, https://www.oecd.org/en/publications/oecd-employment-outlook-2023_08785bba-en.html (Downloaded: 21.05.2025)

According to the World Economic Forum's 2023 Future Jobs Reports report[30], organizations surveyed worldwide ***predicted the loss of 26 million jobs by 2027, most of which are expected to be in administrative positions, traditional security, and factory and commercial jobs, with cashier jobs being the most affected in commerce.*** The World Economic Forum's 2025 Future Jobs Reports[31] report states that the evolution of global labor market trends will have a significant impact on jobs and skills needs in the commercial sector. The proportion of tasks related to the retail and wholesale trade of consumer goods performed mainly by human resources is estimated to decrease from 56% to 42%, 65% of the decrease can be attributed to the spread of automation, while 35% is expected to stem from human-machine cooperation. However, this does not automatically mean that the freed up workforce will be left without a task. The report concludes ***that generative artificial intelligence (GenAI) solutions and big data applications are among the most dynamically growing areas in the commercial sector***. Fast-growing jobs in the commercial sector include AI and machine learning specialists, digital marketing and strategy experts, and Big Data experts. ***Among the jobs at risk were data recorders, cashiers, administrative assistants, door-to-door salespeople, street vendors, and telemarketers.*** Among the fastest-growing jobs, the report mentions delivery drivers and shop assistants. This seems to contradict the fact that self-managing employers 40% of employers plan to redeploy employees in the positions that will be terminated to fill new and emerging positions. According to the report, the AI-based transformation of the commercial sector is hampered even more than average by the lack of skills available in the labor market to support the transformation, the lack of adequate data and technical infrastructure, and the fact that this sector is more difficult to attract talent.

[30] World Economic Forum Future Jobs Report 2023, https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf (Downloaded: 15/05/2025)
[31] World Economic Forum Future Jobs Report 2025, https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf (Downloaded: 21.05.2025)

9. Figure: Fastest growing and fastest disappearing jobs



Source: World Economic Forum

The report also summarises the most important skills for the commercial sector, which in terms of the proportion of mentions by employers (%) are: resilience, flexibility and agility (73%), leadership and community influence skills (73%), analytical thinking (71%), empathy and active listening (68%), motivation and self-awareness (64%), curiosity and lifelong learning (61%), creative thinking (60%), talent management (59%), service and customer orientation (54%), reliability and attention to detail (48%), technological literacy (47%).[32]

[32] World Economic Forum Future Jobs Report 2025, https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf (Retrieved on 21/05/2025), p. 92.

Summary of the results of the current research

The experience of the in-depth interviews conducted during the research shows that the use of artificial intelligence is already present in commerce, but it is still in the phase of heightened expectations if we take Gartner's hypercycle model as a basis. ***The stories of the companies that were the first to successfully use the technology in practice have already appeared, along with their failures. More and more companies are launching technology-related projects in Hungary as well, but many are still staying away.*** Based on the interviews and conversations, it can also be said that for the time being, the concepts of digitalization, automation, robotization and the use of artificial intelligence are quite blurred, so solutions were often mentioned that would not necessarily meet the definition given in the theoretical overview.

The integration of AI-based technologies in trade will take several years. The answers received during the research indicate that larger companies are at the forefront. Many times, the solutions come from abroad, from the global headquarters, and these are still in the experimental phase. We have received feedback that they have taken the first steps, they would like to take advantage of the opportunities offered by AI and deepen their knowledge, but they do not yet have a complex understanding of what the wider introduction of AI could mean for the company and the workforce. Small companies probably do not yet have the necessary management support, financial and human resources to explore the possibilities of using AI and to make the necessary investments.

Use of artificial intelligence solutions in the commercial sector

The ***explosion of the application of artificial intelligence solutions in commerce was primarily caused by the huge amount of data***, which "excel was no longer enough" to handle, as opposed to AI-based solutions, which allow for much more complex and sophisticated forecasting. Artificial intelligence offers the solution of complex tasks that require cognitive skills by using databases of appropriate quality, often uninterpretable for the human brain.[33] The construction of a serious database is also a prerequisite for the ability to read patterns that can be interpreted by AI applications regarding consumers, products and sales. ***At small and medium-sized companies, misunderstandings about the use of AI-based technologies are often caused by the fact that they do not have the appropriate amount of data.*** In addition to the amount of data, the quality of the data also matters, and this can be checked by human intervention.

By tracking and processing the digital footprint of consumers, "personalized offers can be made that even the consumer himself has not thought of" (e.g. Amazon's book recommendations, Netflix's movie recommendations). In order to convert the information available and processed faster by AI into commercial value, it is important to personalize and properly target personalized offers and advertisements. This ***was also confirmed by the surveyed supermarket chains, the system of customer offers, coupons and discounts was developed based on shopping habits***, but in many cases this took place in a foreign center and is also refined there.

[33] Despite the high risks, most of the leading companies are actively using artificial intelligence, https://uzletem.hu/iparitinnovacio/a-magas-kockazatok-ellenere-a-vezeto-vallalatok-zome-aktivan-hasznal-mesterseges-intelligenciat (Downloaded: 20/05/2025)

In addition to handling huge amounts of data, another area of the commercial application of AI is ***the replacement of repetitive, repetitive activities in cases where it can reduce costs and increase efficiency***. Such as the preparation, preparation and drafting of certain HR and legal documents, regularly published publications, presentations, videos. In the case of international retail chains, these solutions are often not born in Hungary, but in the center or in another center dealing with digital transformation, where there are separate teams, teams and projects dealing with AI solutions and the use of AI.

AI also plays a major role in supporting non-routine tasks, such as the preparation of decision-making materials, risk calculations, and response letters related to customer and partner inquiries. In such cases, greater creativity or subsequent human control is required to complete the tasks, so ***this workflow cannot be entrusted entirely to AI***.

Robotization ***and the use of self-driving cars*** is an area where human labor can even be replaced. It is primarily of great importance in logistics and warehousing. Complex tasks can be carried out in order picking, ordering and handling goods with the use of artificial intelligence and robots. Ikea's recently inaugurated warehouse development focused on ***robotization***, and the application of AI has not yet been introduced more widely. On the one hand, robotization could reduce the workload of employees engaged in picking, reducing their daily number of steps from 30 thousand to 10 thousand, thus more workers became able to perform this type of work. On the corporate side, the development brought an increase in efficiency. The emphasis in the project was on increasing capacity, not on reducing the number of employees. At the same time, in an economic environment where economic growth is lacking, this type of efficiency increase can cause that less of the classic light warehouse work may be needed.

Self-driving cars also have a great future, and Hungary is at the forefront of their development. However, the basic decisions have not yet been made regarding the regulation, whether to drive on their own track or in traffic.

Contactless, a store similar to Amazon Go already exists in Hungary. In April 2025, the first Auchan Go smart store was inaugurated, where shopping is done completely alone, without staff and with a digital payment system.[34] Auchan GO is an innovative trading solution that offers a simple and fast shopping opportunity 0/24 without the involvement of a salesperson or cashier. At the same time, this type of customer experience is available to those who have a smart phone and a bank account, and are not yet able to make a range of certain products available (e.g. alcohol). After Auchan, Coop has also launched its salesperson-free smart store, which can also be used with a mobile phone application and a bank card outside the usual traditional opening hours. In addition to providing a new customer experience, the management of the store chain believes that the introduction of the solution can mean savings in wage costs in small settlements where the daily turnover of grocery stores is low, but operating costs are not lower. Smart stores use dispatchers and a dispatch service if necessary during the period outside the traditional opening hours, while during the day you can still shop with the help of salespeople.[35]

[34] The user downloads an application, goes into the store, scans the selected goods, puts them in their bag and walks out, they do not have to pay at a separate cash register, the payment is made in the application. The system works with the help of AI-assisted cameras and weight sensors placed on the shelves. The camera not only records data for payment, but also helps with inventory monitoring, inventory analysis, and inventory ordering.

[35] https://telex.hu/belfold/2025/05/23/okosboltot-nyitottak-szegeden (Downloaded: 23.05.2025) and https://laurel.hu/cikk/megnyilt-magyarorszag-elso-hibrid-okosboltja-147 (Downloaded: 23.05.2025)

The smart store is equipped with an AI-supported camera system, and in the case of the product recognition scale set up in the fruit and vegetable department, an AI model also analyzes the images, but the store does not yet use artificial intelligence-based solutions more widely.

Factors influencing the use of AI

Risks may also arise in connection with the introduction and use of certain AI-based solutions. Of these, ***data protection risks were most often mentioned during the interviews. Data protection risks relate to the protection of personal data on the one hand, and the risks related to the transfer of company data outside the company on the other. The protection of personal data*** was also listed as one of the three most important success factors in the implementation of AI solutions by those surveyed by Deloitte. One of the pillars of a reliable AI system is that ***both developers and those using AI solutions must take into account data security and data protection requirements***. The data processing operations they perform, what data they collect and for what purpose they use them must be communicated transparently to market participants. At the same time, data ***subjects must be given adequate control over their personal data.***[36] The ***security of company data can be guaranteed*** by introducing company regulations and policies, ***informing and training employees, and disabling applications that are open to the outside world, this was also indicated by the representatives of the companies participating in the research.***

Another success factor for efficient application is the ***right amount of data and strong data management skills***. The data used in projects must be of sufficient quality, consistency, and poor quality data can lead to unreliable AI models and inaccurate forecasts.

In this regard, there is the ***cost of introducing AI solutions***, which is still quite significant for small and medium-sized enterprises. The Deloitte research also mentioned the lack of budget and/or resources as one of the most significant challenges.[37] The first company to apply AI-based solutions is the one where sufficient resources and knowledge are available. For the time being, this is the case for larger companies, and also in the case of them, in such a way that the AI-based solution is developed uniformly in another country for a region.

[36] Despite the high risks, most of the leading companies are actively using artificial intelligence, https://uzletem.hu/iparitinnovacio/a-magas-kockazatok-ellenere-a-vezeto-vallalatok-zome-aktivan-hasznal-mesterseges-intelligenciat (Downloaded: 20/05/2025)
[37] Despite the high risks, most of the leading companies are actively using artificial intelligence, https://uzletem.hu/iparitinnovacio/a-magas-kockazatok-ellenere-a-vezeto-vallalatok-zome-aktivan-hasznal-mesterseges-intelligenciat (Downloaded: 20/05/2025)

2. Table: table Artificial intelligence-based solutions in each commercial area

Area	AI-based solution	Challenges
Design	- Automation of design processes - AI-assisted prototyping - AI-powered logo generation - AI-Powered Content Generation - Automated user test case generation	Creativity Human control (brand consistency, strategic fit) Data security issues Copyright
Purchase	- Forecasting and order automation: Uses machine learning to analyze order patterns and supply chains - Supply optimization - Automated orders, demand forecasts	Data security issues
Inventory management and distribution	- Automatic inventory management: with the help of predictive algorithms, demand forecasting, stock analysis, optimization of customer space, e-commerce optimization - Document processing (Optical Text Recognition (OCR) and Natural Language Processing (NLP)): Automatic processing of incoming invoices and delivery notes - Transport optimisation: optimisation of transport routes and times with AI, planning deliveries - automated warehouses (robots, drones) - automated delivery (robots, drones, self-driving cars)	Moral issues regulation a sufficiently large data set Poor quality data can lead to unreliable AI models and inaccurate predictions Human Control Implement a unified solution across the company
Operation and sales	- customer behavior analysis: camera-based surveillance, analysis of customer journeys, interests - Impulse buying incentive shelves with machine support: shelf mirror design, eye camera integrated into the shelving system - AI-Assisted Product Recognition Scale - Pricing algorithms: dynamic pricing based on demand, competition, and seasonal trends - automated replenishment, robots - self-service checkout, cashless shop, contactless, salesless shops - product tracking with QR code, blockchain system - Dynamic product marking, dynamic shelf marking: prices can be changed centrally, product information can be changed dynamically (e.g. expiration date) - Forecasting the formation of cash register lines, reducing lines - AI-Supported Algorithm-Based Sales Forecasting - support for online bidding	Data security issues Accuracy of machine product recognition a sufficiently large data set Poor quality data can lead to unreliable AI models and inaccurate predictions. Human Control Implement a unified solution across the company
Security systems	- Checking for counterfeiting with algorithms - AI-assisted cameras (e.g. to check for suspicious movements, support for anti-theft solutions)	Cybercrime Data security issues
Marketing	- Personalized product recommendation systems: recommends products based on user behavior - personalized customer experience, customer card (tracking), tracking purchase patterns - automated market research (fine-tuning the questionnaire, selecting the interviewees, sending them out) - Writing marketing scripts - AI-based content generation, advertising production - presentation and document preparation supported by a virtual assistant	Protection of personal data Appropriately sized dataset Poor quality data can lead to unreliable AI models and inaccurate predictions Implement a unified solution across the company
Customer management and support	- Chatbot and voice customer service: automated customer communication - Customer Service Automation: Chatbots, Email Answering Machines - support for online bidding	MI hallucinations Human Control Implement a unified solution across the company
HR	- Text-based AI applications, e.g. for job descriptions - AI-powered video generation (creating tutorials) - Automations supporting HR activities, e.g. screening CVs, generating job advertisements	Data protection Cost-benefit considerations
Project management	- Establishing economic calculations, risk analyses, go-no go decisions - AI-based time and cost planning	Human Control
Legal area	- text-based AI applications, e.g. for the preparation of routine contracts	Human Control
IT area	- Large language models to accelerate and support coding	Over-reliance on AI, which is time-consuming compared to searching documentation

Source: Kopint-Tárki collection

Another question related to the cost of the introduction is whether it is worth it, whether it has a return that lays the foundation for the investment. In the case of Ikea, the robotization did not

affect the entire warehouse in the Soroksári út store. In the cargo space where furniture and heavier products are stored, automation would have been more complicated and expensive, so the investment was not worth it in the light of the achievable efficiency gains, in contrast to the stores in England, where it was worthwhile to invest in a much higher cost solution based on volume and output.

At the same time, it is true not only for commerce, but also in general, that businesses that embark on the path of AI-based change can gain a huge advantage in efficiency. Compared to the average SMEs who are less experienced in digitalisation, it is an important question ***how small companies will be able to compete in order to survive or even grow***. If we look at the world's large, online, market-leading companies such as Amazon, eBay, Alibaba, there has been no movement between them in the last 10 years ("The big gets bigger, the small gets smaller.").

Another challenge is to ***apply a uniform solution within the company***. This is related to the danger that colleagues use solutions offered by different tech companies, everyone puts together low-code and no-code solutions separately, which makes it difficult to introduce a uniform good solution at the company level. This is not a great danger, but it has a negative effect on working together. This can be avoided if the company has a ***common AI strategy that is accepted and known by everyone***. The lack of a unified enterprise AI strategy was also one of the major challenges in previous research.

During the interviews, ***the challenges arising from the hallucinations of AI*** were also mentioned, which can be particularly dangerous in the field of customer service, for example. Many AI-based solutions require human control, the solution rather supports preparation, providing joint work to create the end result (e.g. text, video). This has mainly appeared in areas where it is not about solving routine tasks, but about jobs that require creative thinking, where it is important to achieve precise results.

Excessive "dependence on AI" has ***also emerged as a challenge in certain areas***. There are employees who want to solve even the smallest problem with AI, but this often means endless, time- and energy-consuming chatting instead of searching through a few minutes of documentation.

Workforce Impacts of AI Solutions

The other big question that arises in connection with the spread of artificial intelligence, beyond the competition, is how it is transforming the world of work. ***According to a thought expressed at a professional conference in 2016, "In the future, there will be two types of people: one who will control the machines, and the other who will be controlled by the machines."*** (Round, 2024)[38] The question of whether AI, algorithms and robots will take away people's jobs is a question that causes fear among both employees and employers. An important question in this regard is whether the transformation will increase productivity or have a cost-reducing effect, and how it will affect wages and macro-level employment, who will be the consumers of the products and services produced, since robots and algorithms will not be paid (Pogátsa, 2024).[39] Early predictions about the impact of artificial intelligence were often pessimistic. Many feared the widespread loss of jobs, the complete replacement of human labor by machines. ***These fears have not fully come true, the reality is more nuanced: some jobs are indeed becoming automated, but many more jobs have been expanded by artificial intelligence***. (Perry, 2024)[40]

The data collection carried out as part of the research shows that ***the respondents see a small risk of job losses. The introduction of AI-based solutions is seen as more supportive, basically used to support human work and to perform tasks that could not be performed entirely "by hand".*** Similarly, the most important goal of warehouse robotization for employees is to reduce the daily number of steps and physical strain of employees, and thus to enable a larger number of employees (e.g. older, less physically fit) to fill the position. Overall, none of the companies surveyed said that the goal of introducing AI solutions, automation or robotization would be to reduce headcount, but to support human work, provide more comfortable working opportunities, and expand capacities. However, it was said that in a less favourable economic environment, if turnover and revenue figures are significantly lower, the achieved increase in efficiency may cause that less work performed by people tied to certain positions will be needed.

At the same time, it can also be said that even larger companies are not maximizing the opportunities offered by AI-based solutions, there is room for further development. When introducing a new solution, the necessary competencies must be built up and the scepticism and resentment associated with the change must be addressed. Experience shows that with the introduction of AI-based solutions, jobs do not disappear, but are transformed and evolved. It is possible that employees either need to specialize in a certain area (e.g. data analysis), but they may also need to learn how to perform other tasks in addition to the routine tasks performed so far (e.g. replenishment and release tasks in addition to warehouse picking tasks). Of course, learning how to use technological tools and machines is basic. If employees are sufficiently open and flexible, they learn to collaborate with devices, collaboration increases productivity and creativity in many sectors. ***Developments based on artificial intelligence aim to create greater value in people's work.*** For example, replacing a very lengthy, monotonous calculation with AI frees up time for other creative work. The introduction of digital kiosks allows sellers to spend less time guiding customers, instead of upselling activities that represent greater added value for the company, and have enough time for real quality sales interactions.

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[38] István Kerek: Success Guide for AI Wave Riders, ELTE Eötvös Publishing House, 2024, p. 135.
[39] Zoltán Pogátsa: Digital Capitalism, Kossuth Kiadó, 2024, pp. 335-337.
[40] Christian Perry: AI Impact on Jobs: Future Trends, Challenges, and Solutions, 16 September 2024, https://undetectable.ai/blog/ai-impact-on-jobs/ (Downloaded: 21/05/2025)

According to industry experts***, artificial intelligence will basically gain ground where there are repetitive, repetitive activities. It will replace the live workforce in such mainly physical, middle-class professions***, in jobs where efficiency can be increased through automation and robotization, and it is an additional advantage that there are no strikes, no trade unions, and the robot can theoretically work 24 hours a day. In terms of trade***, for example, this is already clearly visible in the case of warehouse management, although the responses received currently indicate that the innovations primarily serve to increase capacity and there are no plans to reduce the number of employees. It is already a visible question what will happen to truck drivers, for example, with the spread of self-driving cars, what they can retrain them for, and where they can find jobs en***[41] masse. In order to deal with the issue, it is essential to prepare very detailed HR plans, and it is possible that public policy measures will also be needed in certain areas, and according to experts, the possibilities of introducing a basic income should also be examined.

Analyses show that, to put it simply, positions that are ***very low-skilled jobs*** on the one hand remain justified, because the cost of labor in these areas may still be lower than the costs associated with the use of artificial intelligence. The other group of remaining positions are ***highly qualified jobs and positions, where creativity and strategy-making skills are important***. At the same time, continuous learning and self-education is also necessary for those working in highly qualified positions.

How AI will affect repetitive, routine tasks that are not physical in nature is not yet clearly visible. In this regard, it is an important question whether enough new jobs will be created to ensure that people who lose their jobs can stay afloat through lifelong learning. ***In parallel with automation, commercial jobs are sure to change, and the demand for more complex, creative, customer-oriented employees who are able to cooperate with AI systems is increasing.*** Human labor will remain key mainly in customer service, in-person sales and solving complex problems, while AI will perform routine data processing and automated background processes that are difficult to solve "by hand" or even considered "painful". It should be noted that human control remains essential in addition to the use of AI systems, especially in areas where accuracy and reliability are key (e.g. handling customer inquiries, sending offers).

With the ***rise of AI, there will be an increased demand for professionals who can work with AI***, such as data scientists, AI engineers, and workers who oversee systems. To ***implement digital transformation, on the one hand, we need a supportive senior management with expertise in the subject***, and on the other hand***, digital transformation managers and project managers*** who manage the introduction and integration of AI and automation in commercial processes, ensuring the effective cooperation of technology and human workforce. Business ***analysts and strategic consultants*** analyze AI-generated data and participate in the development of new business models. Customer ***relationship and experience managers are*** professionals who provide personalized customer experiences with the support of AI, focusing on aligning technology and human interactions. Training ***and development experts*** retrain and upskill employees to meet new challenges. From the point of view of training and retaining the workforce, ***mentoring*** competencies are also becoming more valuable.

[41] 10-15 years ago, the placement of metro drivers could be solved by introducing driverless metro cars, but there are much more truck drivers.

Expected development of labour market risks in the light of AI (skill-scape analysis)

Although artificial intelligence overlaps significantly with digitalisation and automation in technical terms, it can still affect a much wider range of people than the other two in terms of its expected impact on the labour market. These effects are likely to prevail differently in different areas depending on the level of economic, technological and educational development. In economies where the pace of technological development is slower, the advance of AI makes certain stages of development skippable, especially in the field of digitalisation and automation. Of course, this is not unprecedented, as early as 2001, Lee and Kim published observations on the history of economics and technology in connection with the South Korean manufacturing industry, and identified several significant milestones when large Korean companies made a so-called "frog leap" and missed a stage of development. For example, vehicle companies essentially omitted carburetor engines and started installing fuel-injected engines (Kim and Lee, 2001).

Skipping the developmental stages basically allows for a faster catch-up, but at the same time, the opportunity to gain experience is lost, and the knowledge that would have been produced by the missed phase will not be available. The new technology requires the possession of a different kind of knowledge, or at least a little changed, that would have developed naturally during the missed development phase. However, since this has not happened, although economic and technological convergence seems to be faster, the supply of the labour market cannot always catch up with it.

Hungary and the Central and Eastern European region are also significantly affected by this phenomenon. Of course, the above-mentioned technological progress is only a small slice of this, as the labour market is also plagued by problems such as the emigration of skilled labour, population decline, the ageing of society, and the strong territorial fragmentation of the educational system of the school system (both in terms of quality and content), as a result of which supply-side deficiencies can be experienced at the level of the national economy.

Artificial intelligence has a serious impact on the labor market in several ways. As we have already mentioned in the previous chapters, there are professions that are at serious risk of closure, or at least significant restructuring. Of course, this does not mean that there will be no job opportunities for those working in the profession concerned, only that their tasks and the requirements placed on them will change.

The latter is an effect that was already present anyway, as technology has always evolved, which employees had to keep up with, but this has undoubtedly been accelerated by artificial intelligence-based solutions today. It should be noted that AI also creates new professions, so the net labour market impact is by no means unambiguously negative, although it certainly varies from sector to sector, job to job, and even from company to company.

With the decades of automation and digitalization, the changed needs of the labor market can now be clearly defined. It is known what competencies have been required by industrial development on the part of both employers and employees. The demand for scientific and informatics skills and abilities has increased, and on the other hand, the need for purely physical strength has significantly decreased compared to the conditions of a generation ago.

As artificial intelligence potentially affects a much wider segment of the labour market, it is more difficult to delineate the set of skills and knowledge involved and on the basis of our much broader and current knowledge. By its very nature, artificial intelligence has a fairly wide range of applications, which can be present almost everywhere from office work to production. Thus, almost all jobs and occupations can potentially be affected, either directly or indirectly.

For this reason, and perhaps somewhat surprisingly, as we have already mentioned in previous chapters, it is probably not possible to define a hazard of professions in which occupations with approximately similar characteristics could be found.

In our analysis, we have previously identified the professions and jobs that the literature considers potentially endangered by the spread of AI. We emphasize that this list is by no means exhaustive. Of course, endangerment is a relative concept. When selecting occupations, we relied on the pioneering study by Frey and Osborne (2013), which provided estimates for the US labor market on the risk of disappearance of certain professions due to the rise of AI. The estimates were provided by a so-called GP-based[42] classification algorithm, which is a machine learning-based procedure. In short, the essence of the method is that if there are professions that have already ceased to exist, or at least are at high risk based on professional consensus, then a risk of termination can be assigned to other professions based on them. Based on this, the positions included in the study are as follows:

[42] Gaussian Process. For more on the method, see https://scikit-learn.org/stable/modules/gaussian_process.html

3. Table: Professions involved in the research and their risk of termination[43]

Some selected retail professions are at risk of dissolution

Profession	Termination risk
Data logger (FEOR 4114)	95%
Cashier(FEOR 5117)	92%
Purchaser, inventory manager (FEOR 4131)	89%
Storekeeper (FEOR 9223)	89%
Customer Service Associate (FEOR 4224 and FEOR 4225)	80%
Shop assistant (FEOR 5113)	61%
Parcel Delivery Machine, Courier (FEOR 9234)	59%
Product Introduction, Product Recommendation Associate (FEOR 5122)	59%
Quality Control Associate (FEOR 3135)	57%
Logistics Administrator (FEOR 3623)	42%
Security personnel (FEOR 5254)	41%
Window Designer, Shop Floor Designer, Furnisher (FEOR 3716)	39%
Telemarketer, Market Researcher (FEOR 2531)	34%

Some selected mechanical engineering professions are at risk of dissolution

Administrative and Legal Assistants (FEOR 364)	88%
Metalworking and Surface Treatment Machine Operators (FEOR 8152)	86%
Electrical Equipment Assemblers (FEOR 8212)	85%
Forklift Drivers (FEOR 8425)	80%
Mechanical Machine Assemblers (FEOR 8211)	79%
Professional translators and interpreters (FEOR 2627)	70%
Cranes and material handling machinery operators (FEOR 8424)	64%
Quality Assurance Engineers (FEOR 2137)	53%
Industrial Professional Supervisors (FEOR 321)	50%
Mechanical Technicians (FEOR 3116)	41%
Maintenance occupations (FEOR 316)	35%

Source: Kopint-Tárki collection based on Frey and Osborne (2023)

Based on the third table above, it can be seen that the risks of termination are typically higher in trade than in the broader mechanical engineering industry. In both sectors, there are four professions with a risk of closure of more than 80%.

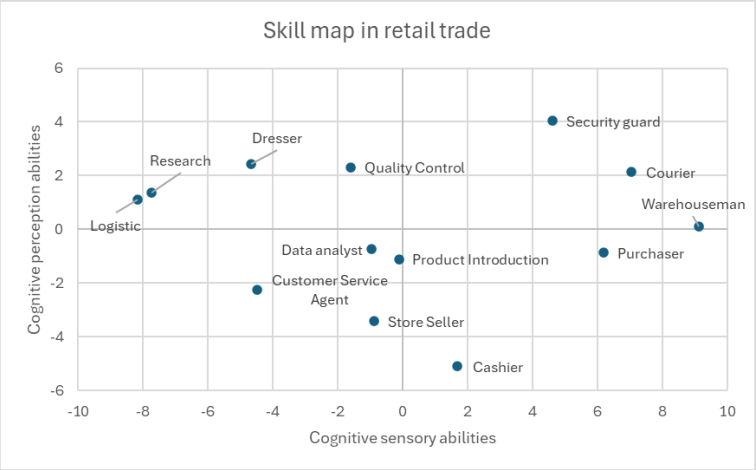
[43] Due to the overlaps, the profession found in both sectors was classified as belonging to only one of the sectors (e.g. warehouse worker)

Risks in the light of abilities, skills and knowledge in trading

Each profession can be matched with the abilities and skills required or knowledge. The source of these is the O*NET database maintained by the U.S. Department of Labor[44]. For each profession, 52 skills, 35 skills and 33 types of knowledge were paired, which can be found in the appendix.

Due to the large amount of data, we used a dimension-reduction procedure to make the sessions easier to analyze. The maps show the given professions on a standardized scale. In all cases, zero indicates the average, negative values indicate a lower than average demand, and positive values show a higher than average demand for a given ability, skill or knowledge. Professions that are close to each other indicate similar needs. First, we created a map of capabilities:

10. Figure: Skills map in commerce



Source: Kopint-Tárki based on the O*NET database

In terms of ability, it can be seen that the occupations are very different. With vertically higher values, there are mainly office jobs on the left, most of which require less cognitive sensory skills (typically, these jobs can also be performed by people with reduced working capacity). At the same time, there is a great need for evaluation skills that help problem-solving by allowing the individual to quickly and efficiently recognize anomalies, patterns, and structures, which enables him or her to solve more complex problems. And AI comes in at this point, as well-functioning algorithms are available to deal with problems that humans can solve primarily with the help of such cognitive perception skills. An excellent example of all this is the visualization ability of AI, with which it is able to recognize objects, people, and at the same time patterns and anomalies.

The other category is horizontally placed and focuses primarily on physical abilities. Shifting to the right, therefore, there are jobs that require these sensory, hard motor skills very much. These jobs are typically performed by younger employees who are in good physical condition.

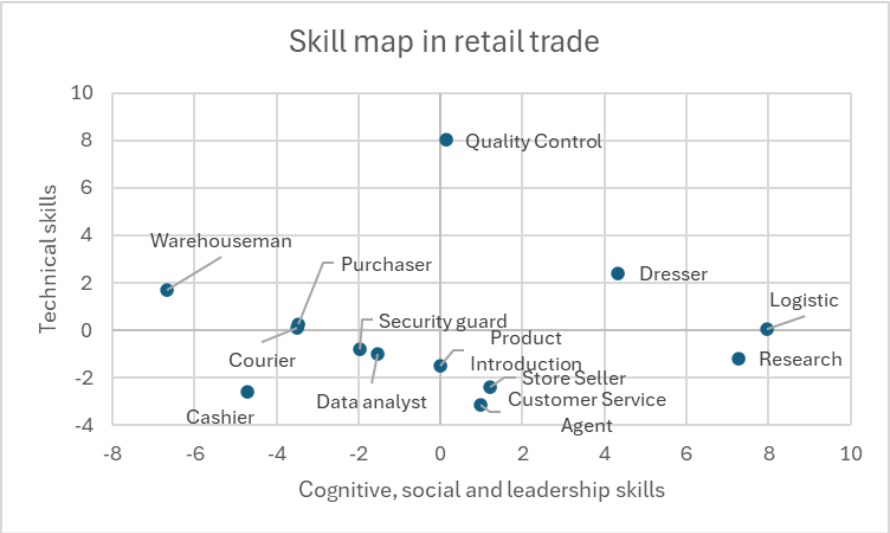
There is only one profession where, understandably, both skills are very much needed, and that is security guard and courier. Despite the fact that these are not particularly high value-added occupations, these professions rely on the full spectrum of skills. On the other hand, there is no

[44] www.onetcenter.org

profession that does not rely on either skill, although in both dimensions customer service representatives, data recorders, product presenters and shop assistants can also be found in the negative range.

The skills map paints a much more nuanced picture of jobs. Particularly high technical and technological skills are almost only necessary for quality inspectors, while in the majority of professions less than average knowledge is required. The need for cognitive and social skills for quality inspectors is average, but they are also in high demand in mainly office jobs. Such skills are less needed than average in primarily manual jobs.

11. Figure: Skills map in commerce

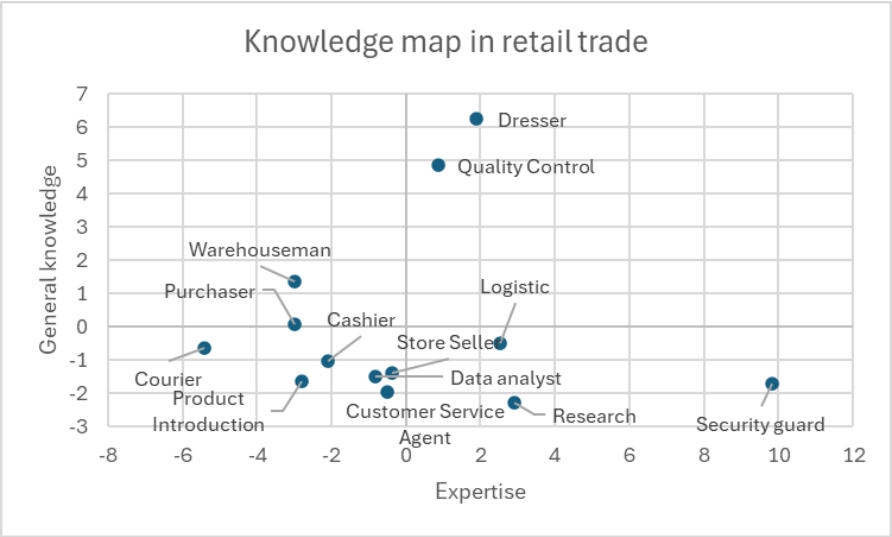


Source: Kopint-Tárki based on the O*NET database

The map shows that only one occupation stands out in terms of technological skills, suggesting that this is perhaps the area with the least risk of AI being displaced. Quality control departments do a precise job, and for a thorough inspection, it is necessary to know all the properties of the products, definitely including non-functional properties (such as color) and all of them, with the help of which the "big picture" can be evaluated. AI can only investigate with such finesse after a very long period of learning.

The third category examined is the knowledge required for the given job. Knowledge was evaluated in two dimensions: general basic knowledge, which can typically be acquired in public education, and professional knowledge, which can only be learned in dedicated trainings (be it basic, intermediate or higher). The O*NET database examines all possible categories of knowledge, but only a few of them are relevant in the professions examined. The knowledge map also reflects the added value of the analyzed jobs. For example, in the case of courier or product presentation, no special professional qualification is required at all, so this profession can be filled without training that takes a longer time, even without less basic knowledge than average.

12. Figure: Knowledge map in commerce



Source: Kopint-Tárki based on the O*NET database

Interestingly, quality control and window dressers can only be filled with a high level of basic knowledge, but at the same time, they do not require stronger vocational training or expertise, which is more or less in line with reality. Unlike other professions, security guards are the only ones that require an official license to practice and undergo strict vocational training. Depending on the degree of protection provided by the person, further specialist examinations and a medical examination (e.g. an armed security guard) are required. Jobs requiring higher education, such as market researcher, logistician (requiring higher vocational training), have a weaker indicator of professional skills than security guards, but it is important to note that the practice of the first two professions is open to almost anyone, while only persons who have passed an aptitude test can become members of the security staff (which in terms of its main category are personal and security guards).

The fourth table summarizes the most important elements, skills and knowledge required in trading by profession examined:

4. Table: The most important attributes of selected commercial jobs in the field of ability, skill and knowledge

Profession	**Ability**	**Skill**	**Knowledge**
Record	irrelevant	irrelevant	irrelevant
Purchaser	Stronger physique	irrelevant	irrelevant
Security guard	reactivity, orientation ability	irrelevant	irrelevant
Store Seller	irrelevant	Service orientation	irrelevant
Courier	reactivity, orientation ability	irrelevant	irrelevant
Dresser	problem-solving ability, flexibility	Complex mindset	Scientific knowledge
Logistic	scientific ability	Decision-making ability, financial acumen	irrelevant
Quality Control	problem-solving ability, flexibility	Technical acumen	Scientific knowledge
Cashier	irrelevant	irrelevant	irrelevant
Research	scientific ability	Analytical skills	Social Science Knowledge
Warehouseman	Stronger physique	irrelevant	irrelevant
Product Introduction	irrelevant	Service orientation	irrelevant
Customer Service Agent	irrelevant	Service orientation	irrelevant

Source: Kopint-Tárki based on the O*NET database

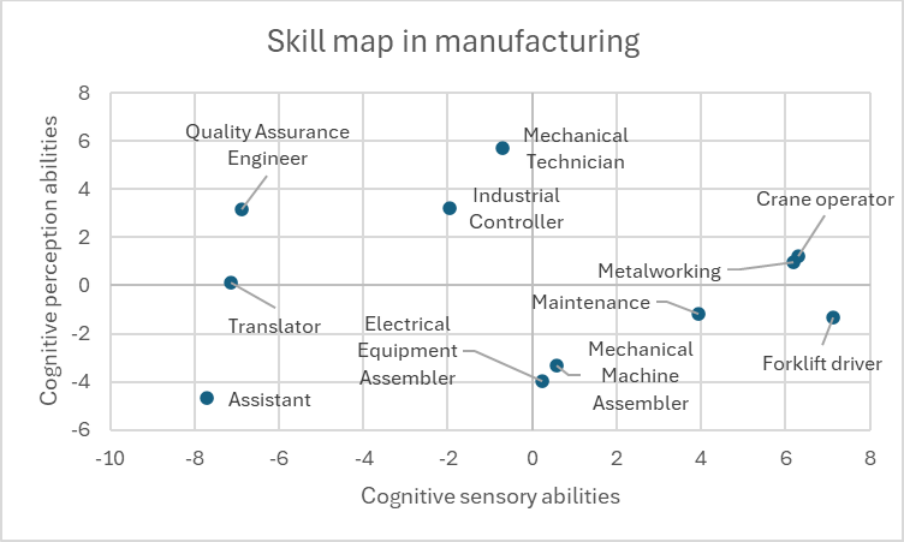
The table shows which elements are strongly built on the professions examined, so AI should target these areas in order to displace workforce. In many cases, non-"irrelevant" cell values can also be seen, in these cases there is no element that can be specifically related to this profession group.

The profession of data recorder and cashier is the only one that does not have any skills, skills or knowledge elements that would be specifically characteristic of it, so artificial intelligence can presumably have a serious displacement effect. On the other hand, in professions where there are elements in all three categories that are specifically characteristic of them, it is more difficult to displace them.

Risks in the light of abilities, skills and knowledge in the broad mechanical engineering industry

With the help of the methodology described in the previous subsection, we also carried out the examination of the professions of the mechanical industry. Since we worked with different professional groups, the categories of ability, skill and knowledge may also differ.

13. Figure: Skills map in the mechanical engineering and related sectors

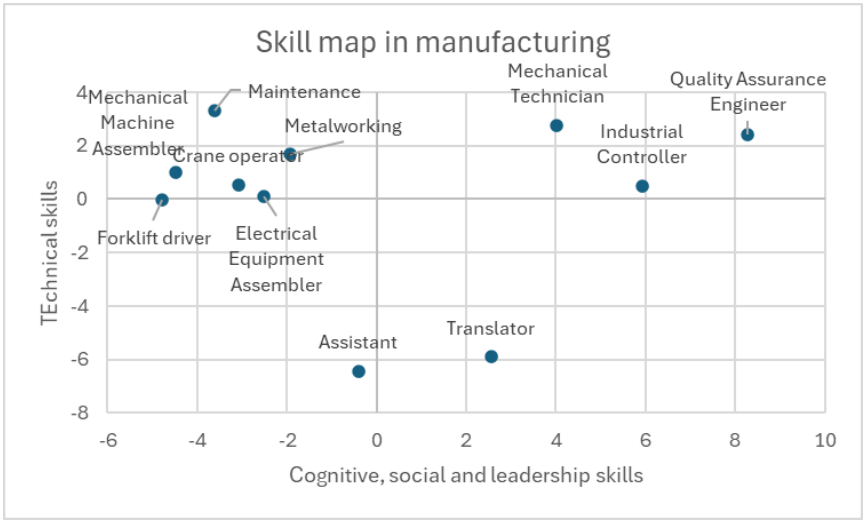


Source: Kopint-Tárki based on the O*NET database

The map clearly shows that professions that require the control of some kind of machine (e.g. crane operator or forklift driver) typically require much stronger sensory skills than those professions where it is not necessary: assistant, translator. At the same time, there are professions that require stronger than average intellectual abilities that are believed not to be learnable. Such professions are engineers and technicians, while assembly occupations require them less than average.

At the skill level, we get a map where technical and non-technical specialties are completely separated, as well as high and low value-added jobs. The professions of assistants and translators require almost no technical skills, while other jobs clearly do. In the case of professions requiring higher education, such as those requiring engineering or technician qualifications, cognitive and social skills are also required in addition to technical knowledge, as opposed to professions that typically produce low added value (machine operators, assemblers), where this is much less necessary.

14. Figure: Skills map in the mechanical engineering and related sectors

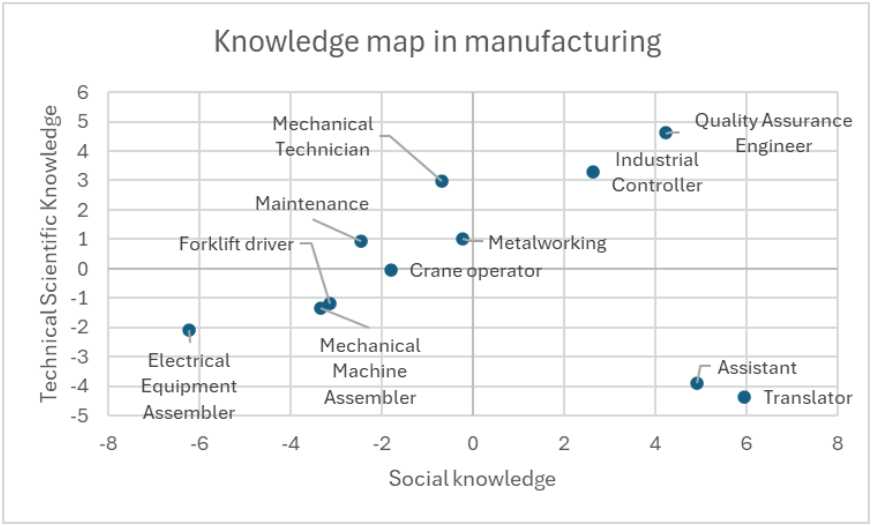


Source: Kopint-Tárki based on the O*NET database

It seems clear that AI can almost exclusively displace jobs in the mechanical engineering industry if it is endowed with the necessary technical competencies. On the other hand, special learning is presumably not necessary to perform professional translator and assistant tasks, artificial intelligence is obviously able to perform these tasks in an impersonal but acceptable way. Of course, this does not make human intervention and control unnecessary, but the professional work itself can now be done by algorithms in good quality.

We can draw similar conclusions from the knowledge map as from the previous skill map. Interestingly, assembly jobs require the least amount of technical knowledge, although still much more than the jobs of translators or assistants. As the added value produced increases, so does the necessary technical knowledge, almost in parallel with the knowledge of social sciences.

15. Figure: Knowledge map in trade and mechanical engineering



Source: Kopint-Tárki based on the O*NET database

Overall, it can be stated that the two assembly professions have very similar demands on their practitioners, as well as the forklift driver and crane professions. Typically, machine operator

jobs require more special, but not complex knowledge, which the employee can acquire even at a company course.

The fifth table summarizes the special needs by profession and by ability, skill and knowledge element.

5. Table: The most important attributes of the selected mechanical engineering jobs in the field of ability, skill and knowledge

Job	**Ability**	**Skill**	**Knowledge**
Assistant	irrelevant	irrelevant	Foreign languages
Crane	good coordination skills	irrelevant	irrelevant
Metalworking	good coordination skills	technical acumen	Technical and mechanical knowledge
Mechanical Technician	Science skills	Decision-making ability, technological sense	Technical and mechanical knowledge
Industrial Controller	logical thinking	Persuasiveness	Management Skills
Mechanical Machine Assembler	irrelevant	irrelevant	irrelevant
Quality Assurance Engineer	good writing and speaking skills	irrelevant	Management Skills, Mathematics
Translator	irrelevant	irrelevant	Foreign languages
Forklift driver	fine and hard motor skills	irrelevant	irrelevant
Maintenance	fine and hard motor skills	technical acumen	irrelevant
Electrical Equipment Assembler	irrelevant	irrelevant	irrelevant

Source: Kopint-Tárki collection

According to the table, assembly professions are those that do not require special skills, skills or knowledge, so the crowding out effect of AI is likely to encounter the least obstacles here. In the case of assistant and translator jobs, the required level of knowledge is at least at an advanced level, and the tasks can be extremely complex, which can cause difficulties for AI. In the case of crane and forklift jobs, fine motor skills are key, and here AI may still be lagging behind, not even in the field of learning algorithms, but in robotics. Of course, there are robots capable of very precise and delicate movements, but it is questionable whether they can be used profitably in the conditions in which the professions concerned work.

It can also be seen that in the professions that are in direct contact with production (industrial managers, technicians), an AI system must cover a wide spectrum, as it must not only be able to handle the given problem, but also be able to directly control other employees and teams. This is something that most engineering occupations encounter only indirectly, and although they produce higher added value, skills that technicians need are less relied on by engineers. On the other hand, of course, engineering positions require a number of knowledge and skills that are not required for technician occupations, and these knowledge elements can be acquired almost exclusively in tertiary educational institutions.

An interesting problem is whether AI is primarily dangerous for engineering or technician jobs, and the literature does not take a clear position on this either. On the one hand, technicians, as they work directly in production, can absorb a lot of knowledge from experience alone, which an AI-based system would otherwise be able to learn. At the same time, the knowledge in question accumulates over years, and a formal logic is also developed that AI cannot learn by its very nature (for example, someone who knows the given machine well can often determine the source of the problem from the sound of the vibration).

AI is breaking into engineering jobs in a completely different field and only helps the work rather than displaces it. In the case of design, research and innovation, aspects may open up that could not be handled before, thus production can become more efficient and competitive.

Summary

Artificial intelligence (AI) is the ability of machines and/or programs to perform tasks that would normally require human intellect, such as perception, speech and text comprehension, reasoning, learning, or problem-solving. The very rapid development and spread of AI is bringing about serious changes in the labor market, at a rapid pace, and affects more strongly the more highly qualified jobs.

Some of the occupations with the highest exposure include data recorders, office workers, accountants, clerks, customer service workers, and financial analysts. According to the ILO investigation, telemarketers are the only occupation in trade that is at extreme risk of closure, while in the mechanical engineering industry, the exposure of assembly professionals can be said to be rather small. Worldwide, 40% of employees work in jobs where the risk of termination is high, and this proportion reaches 60% in developed countries. According to the IMF's analysis, with the exception of India, the exposure of female workers is much higher than that of men, and the higher the level of education of the worker, the stronger their exposure.

The Hungarian government adopted Hungary's artificial intelligence strategy in 2020, which is currently being renewed. The aim is to launch 200 AI-based startups by 2030, and the spread of AI use will increase the rate of economic growth by 15%. According to the Bosch Tech Compass survey, a quarter of Hungarians cannot keep up with the development of AI, and many fear that AI will take away their jobs.

Current processes suggest that Hungary is developing in a "frog-like leap", i.e. it is catching up by skipping certain stages of development, which allows for faster progress, but takes away the opportunity to gain experience, which can cause supply failures in the labour market.

The industrial application of AI has been present in the domestic manufacturing industry for a long time. However, it is important to distinguish between predictive AI (industrial applications that have existed for decades) and generative AI (which is currently not widely used in industry):

- Generative Design: Creation of innovative concepts, complex calculations.
- Predictive Maintenance: Predict failures based on sensor data.
- Robotics/Automation: Autonomous execution of complex tasks, collaborative robots (cobots).
- Quality control: Visualization and deep learning improve accuracy.
- Smart manufacturing (Industry 4.0): AI, IoT and digital twins combine to increase efficiency.
- Supply Chain Optimization: Predict demand, forecast bottlenecks.

Hungarian examples: Videoton (embedded in AI production machines, production of AI-enabled machines), Semilab (LLM-based chatbot for internal knowledge base), 77 Electronics (AI-based automated urine sediment analysis), BMW Debrecen (digital design, quality assurance, smart logistics).

The limitations of AI's industrial applicability include the potential for error, lack of deterministic, privacy concerns, lack of bias and interpretability, ethical concerns, and significant implementation costs that create a gap between small and large companies.[1]

In the commercial sector, AI and automation have brought about significant changes and are likely to do so. According to international research, the retail salesperson can be automated with a 92% probability and the cashier with a 97% probability. 65% of grocery store working hours can be automated.

The situation and prospects in Hungary are less gloomy, although there is no doubt that AI has started to gain ground in trade in Hungary as well. According to KASZ's research, it is turning the sector upside down, but at the same time, the introduction of self-service checkouts did not entail major redundancies, but rather redistribution for the majority. Employers prefer to increase efficiency and achieve more turnover through technological developments.

Current AI solutions in commerce:

- Data management and personalization: Handling huge amounts of data, personalized offers (e.g. Amazon, Netflix, Hungarian supermarket chains).
- Automation of repetitive tasks: preparation of HR and legal documents and publications.
- Support for non-routine tasks: Decision preparation materials, risk calculations (with human control).
- Robotization and self-driving vehicles: Logistics, warehousing (e.g. Ikea warehouse development).
- Contactless stores (Contactless, Cashier-less): Unmanned, digital payment (e.g. Auchan Go, Coop smart store).

Contrary to early, pessimistic predictions, AI has expanded more jobs than eliminated. AI-based solutions are seen as more supportive, used to support human work. In areas that require continuous work (e.g. 3-shift plants), AI and robotics are becoming the primary workforce due to demographic changes.

At the same time, it can be generally said that the greatest crowding out effect can be expected where there is no need for specific abilities, skills or knowledge. On the other hand, where there are characteristic elements in all three categories (e.g. window dresser, quality control, logistician), crowding out is more difficult because either the role of human perception is too great, or the practice of the profession is subject to an official permit (e.g. security guard).

In the mechanical engineering industry, assembly professions are those that do not require special skills, skills or knowledge, so the crowding out effect of AI is likely to encounter the least obstacles here. In the case of crane and forklift jobs, fine motor skills are crucial, and here AI may still be lagging behind in robotics.

Overall, we can say that AI tends to support and complement human work, freeing up time for more creative, higher value-added tasks. The emphasis is on human-machine cooperation. Due to the polarization of the labor market and the rapid development of technology, the acquisition of lifelong learning, flexibility, analytical and social "soft skills" is essential to maintain competitiveness.

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Attachments

Annex

Transcripts of interviews

Péter Lakatos, MGYOSZ, Videoton
2025-04-30

The use of AI must be divided into two parts

1. There are the typical secretarial or business tasks that use AI very intensively: e.g. comparing quotes, choosing the best offer according to conditions of different prices, values, parameters, all in an intuitive way. Or e.g. scheduling appointments, writing letters, writing texts, etc. This is also widely used by Videoton in office-type work. Their characteristic feature is that they are embodied separately in the use of different programs.
2. The other is the professional area, i.e. the production itself. Here, AI is typically not embodied separately, but embedded in machines. *At Videoton, AI comes into play in machines*.

At the same time, AI as a technology is a bit over-mystified. In technical terms, this is only a step up from "traditional" digital techniques. Not a revolution, but an evolution. AI is 85% based on digitization technologies (in technical terms). Of course, in terms of its consequences and nature, it represents **a paradigm shift**, but we know little about it yet.
For example, digital techniques have already been built into the machines that "let you know" when it was time for maintenance, or when one of the tools needed to be replaced, etc., because this was built into the machines as standard, and the machine sounded when this command came into effect at the programmed time. AI, on the other hand, will figure out when to perform a maintenance activity based on the intensity and method of use, the combination of conditions (e.g. humidity) and other factors. Nota bene, you will do it yourself, without much comment. In addition, it invents patterns, aspects, connections that one did not even think of. So, the complexity, complexity and flexibility of the task are new in this technique.
Videoton also uses machines that already have AI technology built in. Exactly how and what the user of the machine does not necessarily know. Today, most machines are labeled as AI-based, but you don't know exactly how it is built in.
Videoton also manufactures machines that are capable of more complex, AI-based tasks than "traditional" digital technology. The number of components built into machines is constantly increasing, and complex systems have to be constructed.

Manpower
AI does not reduce the demand for labor in the same way that digitalization has not had the same effect. The structure of labor demand is changing in Inca.
In the case of AI, the same **polarization** is typical that digital technology has already brought with it. More low-skilled and more high-skilled workers are needed (lower-upper segment, the importance of the middle-educated workforce is decreasing.
The smarter a system is, the smarter it is developed and the less skilled people are to use it.
This statement is by no means a suggestion for the education system, namely that there is a need for a lot of unskilled people. On the contrary. The proportions are constantly shifting in

favour of the educated in the short term, but especially in the medium to long term. There is a great need (and shortage) for highly skilled developers. This shortage is now the main obstacle to the wider use of AI.
In response to my question, he suggests that we contact Semilab Ltd. https://semilab.com/hu (impressive company career), and/or 77 Elektronika Kft., https://www.e77.hu/
both are Hungarian-owned manufacturing companies that are at the forefront of AI application in their products.
Or Medicor, https://medicor.hu/hu it became a family business.

Tamás Székely, VDSZ

AI is indeed built into machines and systems, but it is a breakthrough in production and business. It's much more than a cooling fan in a computer, because it makes a difference in quality.
In some areas, especially in the humanities, it is already a serious challenge. At many ends, the candidate is already selected by AI and not by the HR manager: it combines all aspects (age, gender, personality traits in addition to education) and decides based on that.
We are very far behind in this. A change of attitude is necessary. Young people are more open to this and AI application will accelerate among them.
AI **will be in great need in areas where work is carried out**. Young people already don't want to work 3 shifts and they will even less in the future. So there will be a compulsion to replace the workforce with AI, because there will simply be no workforce. In robotic cycles, the work is already done by robots and human labor only supervises the machines and intervenes if necessary. This work can be taken over by AI without further ado, and then there is no need for a single person in production. If the robot overheats or scrap occurs, the AI will intervene.
You can try to use imported labor instead of AI, but it is more cumbersome and costs more.

Bosch
2025-05-29

Bosch – Artificial Intelligence

Even in the age of automation, human knowledge, creativity and teamwork are the engines of our development. Artificial intelligence (AI)-based technologies and digitalization are putting creative tasks that require strategic thinking even more in the foreground. The training and professional development of Bosch employees therefore remains strategically important.

Artificial intelligence is a key technology for Bosch

Artificial intelligence is potentially one of the most influential technologies that is already present in every aspect of our lives.
Bosch's strategic vision is clear: artificial intelligence is the defining technology of the decade ahead, driving both innovation and industry.
Bosch is fully committed to artificial intelligence: today, all Bosch products either contain artificial intelligence or AI is used in their development or production.
AI is bringing explosive development not only in the creative and knowledge sector, but is also playing a decisive role in more and more products and in the production process itself.
The change in the industry can bring higher quality and reliability, faster product development, reduced production costs, and improved sustainability.
Bosch currently has more than 5,000 experts working on AI-based solutions worldwide, almost 200 of whom work for the Hungarian group.
Bosch has filed more than 1,500 patents in the field of AI in five years, which is an outstanding number in Europe.
So far, more than 65,000 Bosch employees have received AI-related training at the Bosch AI Academy, and more than a thousand colleagues in Hungary have participated in the trainings.
At Bosch, we are also working here in Hungary to build the widest possible range of expertise and knowledge bases in the field of AI core models together with the academic sector. All of this allows us to not only keep up to date with the highest industry standards that are evolving globally through our products and solutions, but also to shape and significantly contribute to their development.

Technological advances in generative artificial intelligence and basic and large language models offer completely new opportunities. AI, especially generative AI, is changing existing job roles, creating new ones, and simplifying work tasks. AI can increase people's productivity and help them in their daily work by taking on simple, repetitive tasks, leaving more time for more complex tasks. For example, AI can summarize and organize information. In addition, the use of generative AI makes work in production safer and increases value creation – for example, even the smallest errors can be detected in production through robotic image recognition.

Artificial intelligence: the key to the future

Exploiting the opportunities offered by artificial intelligence has continued to be the focus of Bosch's strategy in 2024. According to the results of the global Bosch Tech Compass survey, technological advances and the use of AI not only increase the efficiency of production processes, but are also key to solving social and economic challenges.

In 2024, Bosch and Richter established the Industrial Innovation Award, which encourages higher education students to develop AI-based solutions in the field of healthcare and mobility. The role of AI is also becoming increasingly important at Bosch sites in Hungary: applications ranging from optimizing production processes to achieving sustainability goals prove the versatility of the technology.
In 2024, the focus continued to be on AI-based developments and future-oriented technologies.

Examples

Driver assistance systems – neuromorphic systems

Advanced Driver Assistance Systems (ADAS) are already part of most modern vehicles, but Bosch is also developing neuromorphic AI (AI) inspired by the human brain that can make ADAS systems significantly more efficient. Neuromorphic computing refers to the development of hardware and software systems that map the functioning of the human brain, with a special focus on the communication of neurons and the organization of neural networks. Neuromorphic computing can take driver assistance systems to a new level. This allows them to offer faster, more reliable, more flexible and energy-efficient solutions for real-time detection, helping to make quick decisions that are often needed within seconds. From the point of view of accident prevention, it is critical that the reaction time of the system is kept to a minimum. The vehicles use dozens of sensors (radar, lidar, camera, ultrasound, etc.). Neuromorphic architectures, which work similarly to the brain, can handle the large amounts of data generated by sensors faster and more efficiently. In addition, neuromorphic chips consume several orders of magnitude less power than processors in traditional ADAS systems. Another advantage of the developments is that neuromorphic systems are able to learn and adapt to the environment, such as traffic situations, in real time. This allows the neuromorphic ADAS systems to react dynamically to unusual or unfamiliar traffic situations.

AI can be a transparent decision support partner in smart factories

Semiconductors are present in almost every electronic device, from smartphones to vehicles. Semiconductors also play a key role at Bosch in many areas of mobility solutions and industrial technology, from controlling the engine and braking system of cars to sensors in airbags or enabling self-driving. In semiconductor manufacturing, early error detection and screening based on artificial intelligence is particularly important, as it can prevent the failure of a small but important component and later a high-value finished product. We are working on AI-based solutions that not only filter out defective parts at a very early stage of production, but also provide an explanation of the causes of defects so that they can be prevented later. For end users, this means increased safety, improved performance, greater product reliability and longer service life for automotive components. From an economic and environmental point of view, AI-based methods help to get to market faster and, by reducing the error rate, enable better production costs and more sustainable production.
Bosch's industrial AI developments are pointing in the direction of so-called explainable artificial intelligence in industrial applications, where AI can already be a reliable decision-making partner. AI solutions based on such a principle support transparent automation in smart factories, help users and engineers understand and trust AI, and more easily find and correct the cause of possible errors in AI.

Cascade (Halásztelek)

If we take it that way, artificial intelligence has been in the factory for a long time. Since the change of regime, machines (injection molding area) are already available in Hungary that already have some degree of digitization. It was interesting to see the evolution from fully mechanical machines to almost completely digitized ones. The first features may seem almost ridiculous by now, but at the time we "watched them with our mouths open".

Today, the machine really "sounds" if some of its settings are not right, and it also indicates problem areas, although this is not specifically artificial intelligence, the machines are just equipped with a lot of sensors. Unfortunately, however, the more advanced a machine is, the greater the need for professionals. Unfortunately, it happens very often that neither our own maintainers, nor even the organization sent by the manufacturer, can solve problems and does not know the machine in its entirety. There are quite a few days of downtime, because you have to call a service team from abroad.
The same goes for settings. The machine could do much more in terms of divorce, but there was no one to show it, only the basic functions were described.

Engineers now use fully digitized tools, and these software can perform quite a few calculations that used to take a long time. This accelerated the work, but it did not give us a serious competitive advantage, rather we did not fall behind.

In general, the customer has very precise instructions, so there is typically no possibility of modifications, so the management does not even prefer it. If the old machines worked, then there is no need to buy new ones, because we will not use its knowledge anyway. Then, if the customer requires it, we will buy the new one.

Lego (Nyíregyháza)

LEGO has brought the world's most advanced factory to Hungary, and the Danish factory is no more developed. At the company, we rely heavily on artificial intelligence in almost every department. The administration uses it in office software, and these applications are placed further down in such a way that they have often already "learned" from the way others have used them. The team is very innovative, they are specifically looking for new solutions, and of course, this also requires the right professionals.

AI is also used a lot in production, as machines save all data. However, these are rarely analyzed, usually when there is a problem in operation. The factory also has self-driving forklifts and autonomous robots, which greatly help the work.

At the same time, we also see the risks. For example, if a very modern machine breaks down, production in that line will stop completely. However, if the process can be replaced by people, then the manager of the given plant prefers them, for the prosaic reason that if one person cannot start working there, another colleague can simply be put in his place, so production does not stop. Therefore, it is more typical that the most modern machines are used in parallel, when the order book is high (for example, in preparation for the Christmas period).

Chemaxon (Budapest)

It is a Hungarian-founded, but already internationalized IT company that manufactures chemical applications. The opportunities offered by artificial intelligence have been used from the very beginning, and the most modern algorithms are currently running in the software sold. The development is continuous, significant results are achieved in a scientific sense, but the details are considered strict business secrets.

They are constantly struggling with a shortage of professionals, not only in Hungary, but also in other offices all over the world. Getting in is not easy, often a PhD degree is required.

Corvinus University of Budapest (not speaking on behalf of the university)

Artificial intelligence is highly over-mystified by the press, as it is not a new family of methods at all. The first machine learning algorithms appeared as early as the 1920s, and the first neural network was published in the 1950s. Further development was hindered primarily by the limited computing capacity, but after the turn of the millennium, this also began to ease, and computer science, operations research and statistics also caught up with the demands, and algorithms were born that provide acceptable answers to complex problems.

Although these problems are complex in their name, this does not necessarily mean that they are complicated, because it is also possible that we do not have enough observations to generalize or we cannot observe some important phenomenon. But of course, it is also possible that the problem itself is too complicated and there is not enough time to get good estimates. This is where the method of statistical learning comes in, which basically looks for a solution to the problem that gives an "acceptable" result. By acceptability, we primarily mean that the model will not be under- or over-fitted, i.e. there is a mistake that we tolerate and we accept to be made.

Most of the methods are really "black box" in the sense that unlike a classical model (such as a regression), where the role of the variables in it can be interpreted, in a modern machine learning-based algorithm this is not the case, we only get an end result, but the parameters are really meaningless. Although there are already algorithms that try to explain themselves, they are not yet so widespread.

Unfortunately, over-mystification also means that many researchers want to research with AI-based methods in the first place, when classical methods also give good, if not better, results. The truth is that AI can only really be used if the problem is really too complex to be solved by traditional methods.

AI has undoubtedly achieved very spectacular results, for example, in image creation or image processing, which are useful not only in the entertainment industry, but also in science. However, we should not overthink it, there is still no question of "being smarter than a human". On the one hand, he learns much more to solve a problem than a person would do in his entire life, and he still makes a lot of mistakes.

Generative AI is also a revolutionary idea, but it still draws on human knowledge, it only connects information more efficiently. It has a similar effect to Google's back in the day. It will certainly be part of everyday life, but it is not expected to take away proportionally more work than the appearance of the internet has taken away, and if it is used effectively, humanity has rather received an excellent productivity-enhancing tool.

Unfortunately, in the field of education, there is a clear tendency for students to use the tools of AI, and even want to solve more and more things with it, so the case of "cannon sparrow" often occurs. Few students want to actually understand what is going on in the background, and they do not have many opportunities to do so. In Western Europe and the Anglo-Saxon world, "Data science" or "Data mining" programs have existed for at least two decades, offering training lasting 5 years. Until 2021, there was no such training at all in Hungary, you could only hear about the methods in the framework of various courses. So our backlog is several decades long, and we cannot make up for it from one year to the next. In Western Europe, research is being carried out that is at the forefront of the world, researching problems that are of interest to

mainstream science. Compared to this, unfortunately, the Hungarian teaching staff is still very far from this, and there are only a few exceptions in the country who can write an international publication on the subject, and most of them also teach at foreign universities.

dr. Tamás Kozák, National Trade Federation
2025-05-06

There are still a lot of misunderstandings about artificial intelligence. Basically, just because someone has a good software, database or good algorithm, it is not artificial intelligence.
In order to be able to read interpretable patterns with the help of artificial intelligence, a serious, huge database must be built. In the case of small and medium-sized companies , the misunderstanding is caused by the fact that **there is often no amount of data on the basis of which interpretable algorithms could be used.**
Artificial intelligence has already been used in the following areas by larger retail chains:

- **Marketing**: ***scripts*** are now practically written with the help of artificial intelligence, thus replacing routine activities. Another major area in marketing where artificial intelligence is used is personalization. Here, too, it is a prerequisite that an understandable amount of data is available. Amazon has been ahead in this for a long time, but Google Gemini is just as good.
- **Project management**: performing calculations, economic calculations, risk analyses, laying the foundations for making go-no go decisions, for example, with Google Gemini. The results of practical experience are quite surprising. *These are basically not routine tasks, because they also require creativity, and it is important that there is human control, because misunderstandings can arise.*
  Artificial intelligence can be used very well for time planning and cost planning.
- **HR**: job ***descriptions and routine activities are already carried out using artificial intelligence. These are basically text-based AI applications.***
- **Legal field**: Preparation ***and drafting of routine contracts***, there are large law firms and law firms that experiment with the use of artificial intelligence or even use it.
- **Sales**: the *existence of a large database is a particularly important prerequisite here*. This is a basic expectation that appropriate patterns and data analyses are carried out. Sales ***forecasting*** is a good example of this, where factors can be taken into account that cannot be taken into account even with the most complicated excel spreadsheet. These sales forecasts are used for inventory orders, such as what sales will look like in the next 10 days, taking into account things like weather forecasts, seasonality, workday-to-day offs ratio, etc. Very fine algorithms can be built for this, and this is built into the logistics of larger store chains in such a way that orders are made based on them. *This is already used in practice by larger store chains, but it is not yet typical for medium-sized companies.*
  The sales forecast for a month or quarter in advance *determines many things, in addition to inventory ordering, also workforce management*.
  The application of artificial intelligence has now received quite a lot of press about Auchan GO, which was handed over about 3 weeks ago. Auchan***'s contactless shop***

works in such a way that the user downloads an application, goes into the store, scans the selected goods, puts them in their bag and walks out, they do not have to pay at a separate checkout, the payment is made in the application. The system works with the help of AI-assisted cameras and weight sensors placed on the shelves. The camera not only records data for payment, but also helps with inventory monitoring, inventory analysis, and inventory ordering. They are based on the classic Amazon go or Amazon flash business model, where there are practically no sellers in the store.

- **Logistics**: what artificial intelligence is ***robotization***. A good example of this is ***Ikea's new warehouse on Soroksári Road***, where not only robotization but also artificial intelligence is present. In the case of picking, ordering goods, and moving goods, incredibly complex tasks can be performed, up to the point where the customer enters the store, enters what they want, and with the help of robots, the package is compiled for them. Artificial intelligence also has a great future in ***the field of self-driving cars***. There are attempts to do so in Hungary as well. In Hungary, there is a separate program for this, the Pannon program, and we are at the forefront of developments. So far, the big decision has not yet been made whether these self-driving cars will drive on their own track, i.e. they will have their own infrastructure, their own quasi-fixed-track goods movement, or they will run in traffic. All kinds of experiments are underway for all 2 solutions.
  In addition to self-driving cars, the other area is ***transport optimization***. There are certainly large reserves in logistics in this area, and *significant cost reductions can be achieved.* To track the goods, you need hardware and sensors. Artificial intelligence supports analysis. There are also a lot of sensors in the case of self-driving cars, and artificial intelligence is constantly processing information.
- **In the field of warehouse management**, artificial intelligence is also present *to support optimization: where to put the goods, how much goods* to put etc., and to track them. Another area where artificial intelligence is present and tasks performed by humans can already be replaced by robots: the *movement of goods*. An example of this is Ikea's Soroksári store, where it is no longer people who go to pick up the goods, but robots take them there and take them off the shelf automatically.

An interesting issue in connection with the use of artificial intelligence is the protection of personal data in connection with personalization. It is a sensitive question where this stops. According to statistics, based on our digital footprint, we can tell with 85% probability what we will be doing in 2 weeks. With this, they not only analyze the shopping habits of a given person, but also look at the friends and microenvironment with whom they keep in touch. It's scary.

In addition to data protection as a legal issue**, moral questions** also arise: where is the individual's freedom of decision, whether he or she decides at all. It is often asked whether it is actually the individual who decides, while he is exposed to a lot of fine-tuned impulses that

affect him almost invisibly. For example, when it comes to taking moral issues into account, Google recently hired philosophers who deal with questions that a programmer, technician, or manager can't give a good answer. Such a classic example in relation to a self-driving car is when my child sits in the back and I get into such a critical situation that something comes across me and I have to decide to hit 5 people by driving up to the pavement in order to save my child and my own life. In this situation, it is difficult to know how an algorithm will decide, because it cannot be algorithmized or quantified. These are moral questions that Google has run into more and more often, and since they cannot be answered by traditional methods, *it employs philosophers for this. The application of artificial intelligence brings about the practice of the philosophical profession in a new field.*

It is also an interesting question whether **artificial intelligence can be appreciated**. Lawyers have already encountered such a question that it may be possible to make judgments with artificial intelligence, but what about appeals if there is no emotion. For example, a single mother of three children submits a request for a deferral of payment, the artificial intelligence cannot handle it, because there is emotion in it. Another question is whether artificial intelligence, if we are not talking about very high deep learning, but its classic application, will **work based on the data entered**. So, when we ask Hungarian-language artificial intelligence a question, it does not think artificially, but looks for a lot of analogies in the context. This causes great **misunderstandings.**

Artificial intelligence needs to be taught, and an important question is who **teaches it**. For example, in the United States, it was also introduced into sentencing, and in the area of administrative fines, they saw that blacks were punished to a greater extent or less favorable sentences were made. It turned out that it was because these aspects were also built into the algorithm during training.

Artificial intelligence will basically gain ground where there are repetitive, repetitive activities. It will replace the living workforce in such professions, which can be classified somewhere in the middle category, where efficiency can be increased by the fact that there are no strikes, no trade unions, and the robot can theoretically work 24 hours a day. In terms of trade ***, for example, this is already clearly visible in warehouse management.***

An important topic related to the spread of artificial intelligence is **also the issue of basic income**, especially from the point of view of people working in jobs that can be replaced. The introduction of a basic income is not so much a question of the distant future, although we are sweeping it off the table for now. Analyses show that, to put it simply, those positions remain justified, those that ***mean very low-skilled*** jobs (toilet cleaner, yard sweeper) ***because they can still be cheaper*** than the costs associated with the use of artificial intelligence. The other group of remaining positions are ***those in the top*** management***, where creativity and strategy-making skills are important***. These are positions where, on the one hand, strategic decisions are made, which will require some kind of intuition and subjectivity for a long time, and this is no longer denied by the literature. The other group of positions is where creativity is needed, in the sense

that emotions or appreciation must be taken into account. In the case of artificial intelligence, there is no emotion, artificial intelligence does not love, at most it simulates it.
Sooner or later, the topic of basic income will come to the fore due to increasing efficiency and replacing repetitive activities. With regard to repetitive activities, the introduction of artificial intelligence raises the question of what will happen to the people who end up on the streets, and they must also be provided with a livelihood. In commerce, this will be a big question.
There is a constant debate about the use of self-service checkouts and traditional checkouts, which **brings up generational differences. There is a choice, but there are consumers who cling to cash and traditional cash registers. At the same time, human control must be ensured in addition to automatic cash registers, for example, to verify age.**
Lifelong **learning** will surely be built into everyone's life. The question is how the changes that will come with the change of jobs will take place, and whether there are programs for it. Many people believe that it is true that **jobs will be eliminated, but new ones will also be created**. The question is, of course, what they can retrain truck drivers for with the spread of self-driving cars, for example. 10-15 years ago, when driverless metros were introduced, BKK was still able to accommodate employees, but if this happens en masse, it will be a good question how to deal with it.
Warehouse workers also need to be dealt with due to robotization. Where it is still needed, people are also employed.
It is true not only for commerce, but also in general, what **advantages those who embark on the path of AI-based change can gain, for example, in terms of efficiency**. Compared **to the average SME, for example, where digital deafness is still more prevalent, it is questionable how they will compete**, survive or possibly grow. If we look at **the world's big online, lucrative, market-leading big companies, such as Amazon, eBay, Alibaba, there has been no movement between them in the last 10 years** ("The big gets bigger, the small gets smaller.") In online trading, there is not much movement among the titans, it is almost impossible to get in.
The Amazon model is very remarkable in many ways. Amazon started as an online retailer, today it has evolved into a marketplace, and has also built an ecosystem that today there is Amazon financing, Amazon Health, Amazon insurance, Amazon home furnishings. It has built an entire empire in the world of commerce, but it is precisely in the context of artificial intelligence that this network effect helps the big ones to become even bigger. It is no coincidence that network research was first used in commerce by large online stores. **These network effects are very important for marketplaces**, how more sellers can influence more buyers, how more buyers can attract more sellers, and so on.

Spar (Data Science Group)
2025-05-06

One of the most important questions regarding the use of artificial intelligence is what exactly we mean by artificial intelligence. Basically, artificial intelligence is understood as the term is used more widely today, meaning generative AI models. This is important to clarify because artificial intelligence existed before them, and in this regard, **Spar has been using artificial intelligence for years. Even if it may not be called that in today's interpretation.** Artificial intelligence **is definitely used indirectly with the services they use**, as in fact, some kind of AI solution is already built into everything. It's an absolute buzzword everywhere. There are few things or events where artificial intelligence is not mentioned in some way. **It always comes up, regardless of whether there is any point in talking about it in the given topic, or whether there is a use-case behind it at all.** This often does not even matter, in general, artificial intelligence is the subject of discussion.
In his view **, Spar has been using artificial intelligence for years, not necessarily large language models or even generative models, but they use solutions that either create a workflow on their own or do a decision-making thing. Basically, it is used in collaboration with human work.**
There is no exact answer **to the** specific areas **in which it is used**, because the data science team does not have an overview of all the processes, and **artificial intelligence has gotten a little out of hand in the sense that there are a lot of services that can be purchased, a lot of services can be subscribed to, and a lot of services are available for free** (part of Copilot, for example). They also have **Copilot users**, but they can't see what all their marketing colleagues are using, for example. It is certain that **parametric automations have been running for years in a relatively wide range of applications in many areas. Machine learning models have also been used for years in various fields, e.g. marketing, logistics.**
The areas in which AI solutions are used are relatively diverse.

Generative models, which are the most popular today, are more difficult to determine exactly what other areas they are used in.
A large language model is used in the development, quasi-to speed up and support coding. Marketing also uses such a service for image generation.
There **is also some kind of access to Copilot, and generative models are** certainly used in Copilot **for summarizing letters, creating presentations, creating documentation for internal use, or supporting similar administrative tasks**.
Artificial intelligence **is used to support repetitive, routine tasks**, as they are the easiest in them. When it comes to simple automation, the solutions used may not be called artificial intelligence by definition. The definition given at the last Copilot presentation has changed compared to the definition of the concept years ago, based on which many things no longer belong to the scope of artificial intelligence. However, **automations that have been used for routine tasks for years** are definitely such an application.

There are also use cases where **a forecasting model is used**, these mostly **refer to forecasts related to some kind of sales or sales data, and are usually part of a process run by humans. Based on all this, it can be said that artificial intelligence is basically used to support human work. For the time being, there is no process that runs from start to finish based on some kind of model, and absolutely no one watches, monitors or deals with anything in it.** At the level of parameterization, there is always some human intervention in it. Obviously, the level of parameterization is not as deep as if someone were to do something by hand, but usually these processes work with human assistance or supervision.
Artificial intelligence **is used** to perform routine tasks, but **also to perform tasks that would otherwise not be possible to perform entirely "by hand".**
They use a chatbot, but basically not for their customers. **The experience of internal use is basically positive**. At the same time, chatbots are not yet widely used in production, but there are such developments and they will certainly be used in production for internal purposes. **Chatbots are one of the best uses, which basically really works, and it has added value if we are talking about a language model.** They see a perspective in internal use, and the experiences so far are positive. **However, it is doubtful whether it is good enough for customers to talk directly to a chatbot.** This is because this always carries the risk that there is control over what it says and what answers it can give, but it is not complete, and obviously, if you write in a wild way with a large number of users, it carries a risk, the **hallucinations of artificial intelligence can cause problems**. In this area**, the solution should be to have full control over the bot's answers, especially in cases where it would be better to forward the question to a real person who can consider what can be answered**, as there are topics in customer service inquiries, for example, in which it is not necessarily good for a chatbot to write something back.
In relation to customer service solutions, not only in Hungary, but also at the level of the **Spar Group, there are ideas for introducing an AI-assisted customer service operation, where practically a bot prepares the answers, and in fact, the answers are sent back to the customers by humans in the same way.** So, human resources continue to communicate with the customer, but the answers are prepared based on an internal knowledge base. This can be considered a workable use, a large language model can be quite good for it.
The HR department is also looking for possible solutions in this area. **The focus of interest is on video generation**, which has already been experimented with at the group level. The results proved promising for the translation of educational videos (e.g. translating English tutorials into Hungarian, Slovenian, Italian). The solutions can be used quite well, but there is still room for further development. **In video generation, the protection of one's own data is an important issue**, because subscriptions that guarantee that the submitted data will not be used for various trainings afterwards are relatively expensive. Obviously, the question arises here as to how much financial implications a video translated with artificial intelligence **is, and what is the return on this investment at a commercial company, where video generation is obviously not part of the main profile**.

In the field of sales forecasting, Spar has been dealing with machine learning for years, it is not a new thing that has come with the current AI boom. The initiative to use machine learning for a sales forecast was launched years ago, and **now it works operationally, it has a workflow**. **People work in the process, and part of the process is that a machine learning model makes predictions.** They have more experience with this use case. **They see that they do not yet maximize what can be done with this technique, but the use here is routine not only for sales forecasts, but also for analysis and other uses.** According to some definitions, this cannot be considered artificial intelligence in itself, regardless of whether it is machine learning. If an application is built around it that actually makes business decisions based on prediction, it would already meet the definition of artificial intelligence. According to today's interpretation, machine learning is the oldest use.

In **terms of the impact on the workforce**: the area where machine learning was introduced was practically a **new field. A process change has been carried out, where certain tasks have been centralized.** A completely new workflow has been created, which did not exist before at the company. **The necessary competencies have been built up for it**, and colleagues from both outside and inside have arrived in the new area. **During the introduction of a solution, both the company itself and the company group gain experience, since when applying a common solution for a company group, it is necessary to look at how the solution works for the specific company with the implementation and what problems arise. Such introductions take place over a period of several years.**
On the other hand, being centralized also means that the tasks in the stores will also change as a result of the new processes. **The reception of the changes is basically mixed, there is always a kind of skepticism towards them. However, this can also be partly traced back to the aversion to centralization, not necessarily caused by the change itself.** It is important to understand that such a change **always involves a compromise**: an innovative solution is never perfect, a certain kind of flexibility must be given up if we manage more than 100 stores from the center. The reception of the solution was mixed, but over time the tasks will be settled, and if a task is eliminated, there will obviously be other tasks instead. Basically, this is how a workflow develops and evolves in the headquarters, departments and shops. **Over time, the company reorganizes itself into other processes, but this does not mean that colleagues do not have to deal with the processes, but it means that the things they have been doing so far will change somewhat, and it takes time to accept and get used to them.** Here it must also be understood that the **compromises** that have been made, after revealing the seemingly negative effects that the change can cause in the store, **are important to discuss and clarify again and again**.
In practice, this should be imagined as a model having an accuracy. From a location - which should be a store - a person working there is not too reassuring that a model is good enough in the big picture, but he thinks that it has a negative effect in his store in some way, e.g. a prediction is not good enough, there are too many goods, too few goods, etc. This obviously

has a negative effect on him, and he will communicate it in some way. Basically, you can't say that he's wrong, because looking at it from his shop, through his eyes, he's probably right if he thinks that the change has made something worse than it was before, but obviously there is always another side to such a change. This phenomenon is not specifically related to artificial intelligence, but is related to change. **There are changes that will result in everything being much better, but there are also those when the effect is positive overall, but there may be sub-areas where it will be a little worse**. At the same time, looking at the whole, what the company gains in the end is that the majority of people save several hours in a workflow at each location, and this will have a positive effect on the operation overall. This example is from years ago, from that period, machine learning was not completely new even then, innovation was not something that preceded everyone in this sense, but the fact that artificial intelligence was not such a popular topic at that time made the introduction a little more difficult. Today, it would probably be easier to start such a change, as everyone everywhere has heard about artificial intelligence, a lot of things can be sold with it, obviously at the end of the day, colleagues can see if a solution brings too much or too little. **Overall, it was not specifically artificial intelligence or machine learning that was difficult in the implementation, but rather the difficulties stemmed from the change and change in the process.**

Basically **, the easier cases, either in terms of changes related to artificial intelligence or a different kind of process change, are those when the initiator of the change is the person whose area is affected by the change**. For example, an area specifically indicates that they have a process that is very lengthy, very difficult, terribly monotonous, etc., and they ask for a solution to it. In such a case, automating or providing some kind of AI-based solution creates a win-win situation, everyone is happy with a good solution.

However, in cases where the change is not initiated by the given area and professional work is also affected by the solution to be introduced, the reception is usually mixed, employees may feel that the task that belongs to their previous competence will be performed by a machine, which may not do it better, it may even do worse, but this is difficult to avoid.

It is certain that with automation and the introduction of artificial intelligence-based solutions, jobs have not disappeared. It is not that the jobs affected by the change will be eliminated and the related competencies will not have to be used at all. **In most cases, it is a matter of a change in the use of competences.**

The same is true if we look at large language models in today's interpretation: just because employees can have chatGPT write code – which they use for this because it writes faster than humans can type – humans still have to code in the same way, it doesn't mean that human coding is no longer needed. Obviously, this competence needs to be used less, but it is necessary, for example, to check and correct the codes created by the machine, so it cannot be said that it will disappear completely. **Based on experience, it is not at all typical at Spar that jobs would disappear even at the cost of automation.** At the same time, it is also true that when an area approaches the group for a solution, they typically come up with problems that really "hurt" them, and they themselves indicate that it would be good if they did not have to do that work.

Overall, experience shows that jobs are evolving, not disappearing. Artificial intelligence supports and makes work more efficient, but **when applying solutions, it must also be taken into account whether these tools solve real problems, provide solutions to real problems**, or whether the purpose of generating the problems to be solved is to encourage the use of artificial intelligence tools. **Spar strives to make developments in all areas using artificial intelligence that aim to create more value in people's work rather than eliminate jobs or reduce costs.**

In **connection with the use of generative artificial intelligence, there is a danger as to where and what employees enter**. Many people don't necessarily see how much danger their data is exposed to by typing everything into chatGPT. The same **applies to company data, although there are policies for it**. For this reason, it is **not necessarily possible to log in to chatGPT from company computers**. Regardless**, with all generative models, there is a risk that employees will share information that is the company's data, or that an internal chatbot is being created and answer questions that the person would not have the right to be answered**. These do not pose a major risk, they can basically be managed well, with proper planning, policy making, and attention during the design and operation of the systems.
From the point of view of organizational development, it is also a danger that large tech companies want to make solutions so widely available that beyond a certain point **it is very difficult to centrally coordinate who does what with what**. Colleagues who are familiar with such solutions put together codes with all kinds of low-code, no-code solutions, in fact, this narrows the possibility of having best practices at the company level. Instead, 1-1 people have a little agent that he put together in Copilot. Obviously, this is not a huge danger, but **it would be better if there was a collection of best practices and a uniform solution was used.** The other problem is caused by the extremely rapid development of the area, which is very difficult to follow. **They are constantly working on developments, for which they are doing research work, while new things come up week by week, which very quickly make existing solutions obsolete.** This is an overly fast-paced environment, which poses less danger, but has a negative impact on work. **Another danger is the complete dependence on artificial intelligence tools**, which characterizes people and colleagues who ask for quick help from these tools and thus "at some point unwind their own thinking" instead. Instead of thinking about a problem and trying to think logically and critically themselves, they prefer to ask different models. In many cases, this leads to worse results than if the colleague had thought instead. For example, in the field of coding, there may be a ready-made practice where only chatGPT is asked, while the answers could be very easily found in the documentation of the given library, or even from answers written by humans with a traditional internet search. Instead, they converse with chatGPT for minutes, who, on the one hand, hallucinates everything in a jumble because he has received a question about a relatively deep professional matter, for which he has relatively little data, he does not know the answer specifically, as he has seen very little data about the content of the question. Therefore, he writes answers that are much more typical

solutions in relation to the given thing, but at the same time they are not correct: wrong solutions, they do not work in a given case. This is practically a waste of time, while three years ago it would have been out of the question to ask chatGPT, because by default the employee would have searched the documentation and/or the internet and would have arrived at the correct solution in a few minutes using their own thinking based on the information written, instead of trying to get a large language model to say concrete answers.
By the way, employees are not specifically encouraged to use chatGPT at work due to the previously indicated data protection considerations. A narrower circle of people only has access to it in a way that data security is guaranteed. This group asks their questions arbitrarily, they don't teach them separate prompting, everyone looks at how to prompt for a given question individually, what is worth asking them.

Ikea
Soroksári Road Department Store
2025-05-29

Ikea Hungary handed over the renovated store on Soroksári Road in March according to a completely new type of operation. This is the first pilot project of its kind for Ikea on a global scale. Smaller automation solutions. Obviously, they already existed in different stores and countries, but there has never been such a complex, multi-system one. What you need to know about the store on Soroksári Road is that regardless of the reconstruction, this store has been serving the entire online shopping in Hungary from the very beginning. This means that we have no other warehouse, but the warehouse is also the same building where customers come in. The warehouse of the Soroksári út store supplies online delivery orders for the entire country from the same stock. This is one of the reasons why Global Ikea chose this store to test the new type of operation here. For this reason, an increase in efficiency, especially an increase in capacity, was inevitable for the future, in order to ensure growth. Mainly because the store was not originally built for this purpose, it was built as a completely standard store, obviously larger in size than the existing two. At the same time, the operation of the warehouse and its entire structure was not designed to complicate this task, and this obviously caused more and more difficulty, especially in tighter periods, at the end of summer and at Christmas every year, to fulfill orders, such as online orders, on time so that there were no delays and there was capacity. An obvious, tangible example of this is that our colleagues have been collecting orders manually so far (obviously this is still the case). They collected small things from the marketplace, where the customers also came from. From a logistical point of view, this was terribly inefficient, as the marketplace is designed from the customer's point of view to be winding in order to show the range as much as possible and encourage purchases. However, it is a nightmare from a logistical efficiency point of view that colleagues walk on tricky routes and pick up products from the same places as customers. It was already a big problem in the operation that the company worked with one stock practically on a system level: online orders were taken from the same stock as the physical customers. Basically, this is not very healthy from the point of view of long-term operation.
Looking at the use of artificial intelligence about development, we can obviously say that **there was some AI in the development, but that part was not necessarily the focus now**. **We do not yet use specific AI solutions at the store or Hungarian level. We prefer to use AI solutions at office and other administrative levels, e.g. to create materials and content, and also in the field of data, on the one hand, to process customer feedback and on the other hand, to make forecasts. At Global Ikea, there are separate teams that deal with AI, mainly from the data side for data management, filtering lessons from data, and data-based decision-making. Obviously, there are inputs from this work for stores and countries, but classic AI has not yet spread to our daily work. At the same time, of course, digitalization is, and robotization is actually the most emphatic thing right now.**

Robotization is therefore the most emphasized at the moment, and it is now having a greater impact on the workforce.

The remodeling of the store meant a complete reconstruction of the warehouse, the entire warehouse was rebuilt, the retail area and the marketplace were also moved upstairs, unlike a normal Ikea. Practically the entire commercial area is now in half the area, everything is upstairs. An automated warehouse has moved in to replace the old marketplace, and the classic large warehouse has also been preserved. **Ikea is in a special position in that their goods (e.g. furniture) are quite large and quite heavy. Obviously, there are solutions to handle this, e.g. robots can move it on pallets, but the actual picking or order compilation cannot be solved now.** Obviously, there are solutions for it, but **from the cost-benefit side, there is no suitable solution yet.** However **, everything that is smaller goods (this is half of the selection) has practically been created there**. On the one hand, this is also salutary because there are self-propelled, small robots that load boxes. The robots move around completely independently, and no human can even enter that area, because the moment someone enters the area closed by a laser barrier, everything stops so that there is no problem. No one can even go where the robots move and there are the affected shelves, crates and boxes containing products. Obviously, the exception to this is the time of replenishment of stocks at dawn or at night, when the robots do not run because the goods are being loaded. **Replenishment is still done by human intervention, the incoming goods have to be sorted, sorted out what goes to the store in a classic way, to the marketplace, what needs to be stored in the large warehouse, because a lot of it has arrived.** In practice, one of the biggest innovations is **that this automated warehouse replaces picking and that particular marketplace picking**. The robots receive the order data, the system is connected to other systems, where online or even offline orders are received. Although we are talking about online ordering for small things, as the offline order is still collected locally by the customer on the normal marketplace.

The goods are collected based on the article numbers, for which a lot of gray plastic boxes are used. Each box contains x pieces of a certain product. Practically, robots remove these boxes from their places, and there are stations at the end where **colleagues stand with tablets and all kinds of devices on which they can see what orders need to be** collected. The robots come one after the other, like on a conveyor belt, they arrive with 1-1 goods, e.g. bed linen, and colleagues see that they have to take 3 out of them. There, they are already sorting into boxes according to order, according to where it will go. **This is how the orders are compiled: a robot comes, the colleague knows exactly what needs to be picked out from the screen, where and to whom**.

This **work organization has several advantages**. **From the side of his colleagues, one of the most important is that in the past, the average number of steps was close to 30,000 steps a day** for the colleagues who collected the orders. In the meantime, it **was an additional physical strain that there could be furniture and other heavier goods among the products**, so collecting the goods meant not only smooth walking, but also packing heavy things. With

the new solution, the number of steps was reduced to less than 10,000, which was already more favorable from a health and ergonomic point of view.

At the same time **, the previous organization of work also limited who can do this work and who is willing to take it on. Obviously, an older colleague or someone with a not strong enough physique may have already encountered obstacles, or it could have been a reason for disqualification that he could do this job well. The goal was for robots to help the work of employees.**

Obviously**, it was also a secret goal from the corporate side that the transformation would bring a huge increase in efficiency**. The system is still quite fresh, it takes months for it to be fully established, there are sometimes shutdowns, teething problems, etc.

In the long run, the solution **was also aimed at increasing efficiency, depending on the increase in sales, sales revenue, and demand**. Basically, **the goal of the project was not to reduce the number of employees, and it is not currently the goal of the project**, because the **emphasis is more on increasing capacity**, but obviously, due to an effect outside of us, due **to the lack of growth, it may eventually bring about a phenomenon due to the increase in efficiency, where, for example, less of the classic light warehouse work will be needed**, because this new solution is so much more efficient in time because colleagues don't have to walk around. From the point of view of the impact on the workforce, there is also such a side to the innovation, but we are absolutely not thinking about it, and there is no question at all that this means downsizing from the company's side concretely, proactively.

The workers who **had light warehouse tasks took part in retraining, and there are also those who stayed in the area**. There is another important part of the order**. Not only do you have to collect the goods, but you also have to pack the products in a form that the courier service or even the big carriers can take them out**. There was and still is a separate team for this. **There was an opportunity to go there, and due to another operational change, due to the transformation of the warehouse, the proportion of goods with hearty products became much higher locally**. These are the products that you don't buy yourself, but you have to go out or go to the dealership. The proportion of such typesetting products has become much higher, so the **publisher now needs more workforce**. It was possible to regroup the workforce. At the beginning, we wrote a **very specific, detailed people plan** for this, where and how much decrease we see, and where and how much growth we see, and how to move whom. It was a fully planned process with a timeline and other indicators.

The new operating model has already brought about some restructuring, but it will not affect the total number of employees - if the turnover comes and we grow nicely. This investment was also so that we could properly serve the larger demands.

The other side is that **the scale of the classic warehouse has increased**. In this warehouse – just like in the self-service one – there are usually rows and shelves, so it is more structured. There are the furniture and boxed products, small or even heavier. **Automation has not yet been implemented in a good part of that warehouse, because it is more complicated and more expensive**. Automation would require machines of a completely different scale,

technologies that are actually a whole pallet and can move things weighing more than 50-100 kilograms, which is more of a crane-rail type system. However, on our scale, it **is simply not worth the investment for the time being**. For example, I saw it in England at the company, where there is a central warehouse that supplies the stores and also fulfills orders. There, for example, development went in this direction, because the volume and output are so much higher there that it can obviously pay off. **In the classic warehouse, the classic furniture typesetting has been retained in accordance with the option according to the restructuring. However, this is really a classic warehouse job, where you have to put and lift goods between warehouse rows**. Of course, **we wanted to help our colleagues here as well**, so here we took the step that since the proportion of this type, so-called full serve order has increased, when it is not the customer who buys it, but we take it to the dispenser, that we have purchased a lot of electronic goods movers instead of the classic goods moving frog (hydraulic pallet handler) . This was an assist, a bit like an electric bike, which actually rides with an assist, so you don't have to complicate such a force. It was very important in this regard that according to **the Hungarian rules** - even though it is a relatively simple device, so to speak, because it works the same way, you pull it behind you like a frog, but there are two buttons on it that help you lift it - **this is already subject to a forklift driver's license. So, practically all of our colleagues took the exam at the company's expense**, we sent them on a journey to be able to use these devices, regardless of the fact that they may not be sitting on a real forklift now.

There is another area of the automated warehouse, which is also fully autonomous, with independent forklifts operating there. This is the so-called part where furniture products that sell quickly and well are located. Actually, there are quite a few rows where these are neatly stacked on pallets, just like in a classic warehouse, and at the **end there are 2 rows of space where the automatic robots can deliver the goods**. Automated robots receive the information about what is needed, and practically only for that line they always bring what is needed, and the information comes down to the digital device in the same way, how much of it needs to be taken off and where. Then they take it back and bring something else instead. **Here, again, we save the fact that we don't have to walk**. **Colleagues try to plan the locations, where the different types of products are placed on the original, so that they are as logical as possible and the related categories are close to each other**. There is a team for the warehouse location, and **inventory management** deals with this.

Actually, the point here is that instead of a warehouse picker colleague zigzagging through a lot of rows, there is a long row, or maybe 2, and there you simply have to go there horizontally, because they always bring what the robots need at the moment. **At the end there is an update, they knock it down that now you can remove it from it and go back to bring the next one**. In this area, too, there is help in the case of such fast-selling, frequently rotating products, but obviously with size and other limitations, it is not possible to implement the entire large warehouse in this way, but they are like this on some 100-person item numbers, so the walking part has been saved both in time and energy there as well.

The range of products that belong to this category has been selected on a data-based basis. There are very detailed, all types of weight loss statistics, and obviously here we also react to the fact that if, for example, there is a promotion or promotion, then the affected products will obviously be included for those 2 weeks. For example, a product that is not included by default, but we know that it will work, because there is a 30% discount on the wardrobe, then it will also be included. For this, there is also a sales plan, how much sales need to increase, then they will be transferred to that product range based on that, because we know that they will buy more often.

In terms of AI, it can be said that we have just started using this artificial intelligence in the last 1-2-3 years, that various clients have come in, but for example, selling and ordering has been a fully automated process at Ikea for a very long time. Practically, stores do not place orders for products manually. Obviously, you can touch it if necessary, but by default, the system looks at the sales and trends, trends, lead time, how long it takes for a product to get here from the large central warehouses to the store and place orders every day. Based on this, the trucks arrive with the goods. **Obviously, there is a control step in automation, by one of the inventory management specialists, so that everything is fine, there is no foolishness in it, or if there is some kind of individual promotion, for example, they intervene in the fact that we already know that we will need more of a product, but often we don't need it anymore.**

The inventory management system is practically the same at Ikea all over the world. By the way, it's very interesting, because it's obviously made up of several systems, but the basic system, as usual in large trading companies, as far as I know, is still a very old, dos-based system, which works stably for the time being, it doesn't crash. Recently, the big Ikea is also working on it, but the base is stable for now. Obviously, the accompanying systems provide the inputs for e.g. ordering, arrival, etc.

By the way, a global project is currently underway**, in the framework of which the first pilot store was connected in the Netherlands** yesterday and the day before yesterday **to replace this system that has been used for a long time for the entire inventory management and transactions with a completely new, complex logistics system that will clearly use AI.** There, the system will surely be able to follow the efficiency of employees as a whole, calculate trends from it, or calculate the capacity of the store on a given day based on how many goods the employees pick up or how much they refill. **We don't know when it will reach us,** because this is a very recent project, specifically launched as a pilot in the last two days. **It will surely take a longer time and it will change our operation at its root.** What **is related to this and will have a great impact on the workforce and efficiency is the long-term idea that logistics tasks are quite separate now**: there are **goods reception**, when mainly forklift drivers pick up the goods from the incoming trucks in one go, there is a **filling team** who sorts these goods and delivers them to the right place, there are those who **collect the** goods, it's about the output, the preparation and compilation of the order, the release of goods, and there is also the **packaging**, who hand over the goods to the suppliers. The idea and direction is that if **the large complex**

system goes live everywhere, it **will bring together the entire logistics operation and process, it will be data-based and supported by AI solutions**. Even now, every colleague has a touchscreen gadget, a so-called RDT, which is practically like a touchscreen phone, only it has the internal systems and is more durable. **In the future, logistics colleagues will not belong to a dedicated department, but will be a complex operation, where employees will be given tasks according to what is the priority and what is needed**. For example, now go to the ramp and sort the two pallets, and then pick up those five orders in the next hour. Task assignment is based on what is most needed in time and how the tasks are built on each other. **In logistics, most tasks are time-bound, in the area of composing, handing over and issuing orders - since the delivery is done by an external company - there are very precise so-called cut-off times, how long the order must be handed over in order to be delivered on time.** This is already calculated and monitored in an automated way at the system level, but the increase in the efficiency of logistics is further supported by the introduction of task-based operation. Being able to be efficient throughout the entire chain will place greater demands on existing logistics colleagues, because they will have to understand a little bit about every process. What is now the task of the replenishment team, to sort a pallet properly, what goes where within the store, to which part, is now the job of the members of that team. Order picking is the responsibility of the order picking team. Later, however, it would be that there is **a logistics employee position, in which a working employee is capable of all tasks**. This also means that they **mean more qualified colleagues, if not from a school point of view**. Obviously, this will **hopefully bring a higher wage level** compared to the very standardized classic tasks, which e.g. packaging is a bit of an assembly line job, but you also have to work with machines there, because we also have packaging machines that already produce boxes and fillers, but there you need human labor because you have to put the goods in it, glue them and label them. So it's not fully automated yet.

The new direction, if it really works and increases efficiency, will be looking for a workforce with slightly higher skills, more flexibility, and a more complex understanding of tasks, but fewer. However, with this, we can provide better wages for the right people. We had a very big dilemma when we were working on the project, what we expect now and what we expect in the new world, and in fact, there will certainly be colleagues today who prefer a very standardized, slightly repetitive, very predictable type of work. They will not be able to work in a variety of ways. Employees who are more flexible, like variety, change preferences in recruitment processes and what kind of person we are looking for will be in demand. Obviously, we have already run into this, there is no colleague at Ikea who does not use some kind of screen, gadget or digital device in their work. There wasn't much of a problem with this, but there were a few colleagues, even older ones, or less flexible colleagues, who didn't want to relearn the whole thing and left. **With the introduction of the robotic warehouse, we have already gone through a transformation, and fortunately very few employees were badly affected by the logistics of almost three hundred people, in the case of the Soroksári store. We have also consciously prepared for it from the HR side.** Not only older people left, there were also

younger people who simply said that for them it is like having a brand new job, and then they would rather look at one that resembles the old one. They got used to the old tasks, and of course it was also a problem that there were very big organizational changes, they made a complete transformation, in which they had to apply for leadership positions again, because the expectations are different, the challenges are different. There were also questions about whose team I would be in, or not to be in, or how I would be transferred, but in the case of the young people, the reason for leaving was obviously more that I would not work so closely in my usual team or with the usual people. Let's say that this has also become much more flexible, obviously there is a structure, but people are much more likely to work now, so to speak, cross-functionally, or not necessarily only with members of their own team.
Another automatic solution that was built in was a special rail system on the ceiling. This is actually a goods transport system that we were able to increase efficiency and reduce walking, because where the robot warehouse and the warehouse part are located in the store, it is the left rear corner of the store, but the goods dispenser is at the front on the right, and the collected order must be delivered there. We practically built for this. An elevator wheeled rail solution: orders are placed on it in boxes. Obviously, the very big ones can't, but they collect it in the big warehouse anyway. The collected goods practically glide forward in a way that is partially visible to the customers, and things are put in their place right from the spot.

In logistics, the above mentioned are the most important impact at Ikea. Obviously **, a lot of new digital devices have been added to the store from the customer side and from the sales side as well, also in connection with this pilot project**. This was brought about very simply by the fact that the sales area has become half the size because the marketplace has moved upstairs, but we sell a full range, but it is not very possible to display it well in such a large area, because things simply do not fit. It developed for this, and obviously Ikea has now started to have smaller stores in other big cities, so let's say in malls or something like that, so it's not just the classic big box, but XS stores, where you can buy the products on the marketplace, some of the furniture is on display, there are rooms, there are some that you can order. These shops are also quite big, about 4000 sqm. Now they have started to open such facilities in the largest European cities, in London and Stockholm.
For example, Ikea digital **is a relevant solution there**, but it also exists in Hungary on Soroksári Road. In fact, the depth of the selection can be viewed virtually on a huge, vertical screen in almost live size. For example, there are 5 colors and covers of different materials from a sofa, and obviously you can't exhibit 5 of them because they don't fit. We put out what works best, next to it there is a giant screen with a touch platform. Customers can see what colors it is available in, and next to it, there is a material pattern on a stand. This other type of sales system is interesting primarily from the point of view of training. **A much higher degree of digital openness and the use of digital tools is also required from sellers**. So, we hire the type of people who are usually very open to it. Obviously, there were 1-2 very old colleagues there

who got stuck in the old, familiar system, but it didn't even occur to them that anyone didn't want to stay longer because of this.
We also have kiosks **where customers can display a product**, they don't have to go to a colleague to find this product. This also brings a bit of impact, the goal here was not to reduce the number of salespeople. The good thing here is that it frees the salesperson from a very mechanical, mechanical task. This is not the valuable customer relationship, there is no added value. The point is that sales colleagues should have much more time and capacity to talk to them properly and show them the possibilities, to explain why it costs one and a half times as much on the couch, but why is it much better? Obviously, this is **not a secret thing, because I think the upselling of every retailer is** that I come in with an idea and say that this is good for me, but if I hear that yes, by the way, that other product can even do this, and think about what will happen if a guest comes, a sofa bed that can be folded out can come in handy. If a seller explains it, maybe if I understand what the difference is and why it costs, say, 50,000 forints more, then I might buy it in the end, but if no one talks to me, then fine, I like it, I bought the cheaper one and left. **It is important to leave time for these really concrete real quality sales interactions, so that the sellers can really deal with them**.
The customer experience is also enhanced by the fact that more open customers can see what they can find where faster at the kiosk, and they don't have to stand in line. There is already navigation on where to go so that the customer can find the place where the product is. Digital has already promised that this will be included in the Ikea app, and the development will be released soon. This was a very old and long project, and it was difficult to connect very old systems in certain cases, e.g. updating product locations in the map system.

Although the robot-warehouse project has already been completed, the Hungarian Ikea is still undergoing a very big change, the changes have to mature.

Coop Szeged Zrt.
2025-05-26

At our company, we would like to take advantage of the opportunities offered by AI in the future, and we are constantly striving to deepen our knowledge.

Although we have taken the first steps, we have equipped our smart store with an AI-supported camera system and an AI model analyzes the images in the case of our product recognition scale set up in our fruit and vegetable department, we do not yet use artificial intelligence-based solutions more extensively.

Hungary's first automated hybrid smart store has started operating in the Coop Szeged store network, which is available in the 247 Shop app. The store awaits customers with traditional service during the day, and in fully automatic mode outside normal opening hours, without store staff. The existing store of Coop Szeged opened a new era in the world of retail thanks to the innovations of the Hungarian Laurel Kft. In addition, the technology can also provide a new solution for the economical operation of small shops operating in smaller settlements.

The Coop Economic Group and Laurel Kft. have been cooperating for many decades, which is connected and defined by the commitment to the development of domestic commercial culture and continuous innovation. In the vast majority of Coop's approximately 2100 stores operating in 1400 settlements, Laurel's solutions ensure the operation of the stores' cash register systems, but this year, the joint work of the parties has reached a new milestone with the handover of the automated hybrid smart store.
The hybrid model combines the familiar shopping experience with the benefits of automated technologies to give shoppers access to the full range of products in a normal-sized store, even at night or on public holidays. In unmanned mode, customers can easily and safely enter the gate of the store equipped with a camera system with the help of the 247 Shop application, and then leave using the application after self-service checkout payment. If necessary, the remote dispatcher service is able to provide immediate assistance and intervention.
Also based on international examples, hybrid operation can create the opportunity to operate a store in locations where traditional business models are not available or difficult to maintain in the current economic and labor market challenges. That is why the technology that has just debuted will contribute to the better supply of basic goods to the rural population, and thus to the fulfilment of Hungary's social and national strategic goals.

Tesco (headquarters in Győr)

- The Clubcard system was introduced about 15 years ago, when they were the first on the domestic market to develop the reward system based on shopping habits. Initially, it did not work efficiently, but then there was more and more data, and thus the estimates improved. From the very beginning, the entire algorithm ran abroad, they didn't have much to do with the system, and they don't have it now. However, the program is successful.
- They were also the first in the field of self-service cash registers and quick shopping with their own reader. However, this is not AI, only digitization.
- At present, they are struggling with a severe shortage of skilled workers, but in an area (physical work) where it is not possible or worthwhile to use AI-based solutions.
- In the back-office, software is used that is supposedly capable of using AI, but does not use it directly.
- The use of external generative AI is not allowed in principle, but its use is tolerated, but data cannot be released.
- Purchasing, stockpiling, warehousing also use their own software, in principle there is (or rather, it can be) AI, but you don't know if it is used directly?
- They use a chatbot in customer service, but customers don't really like it.

Müller (Budapest headquarters)

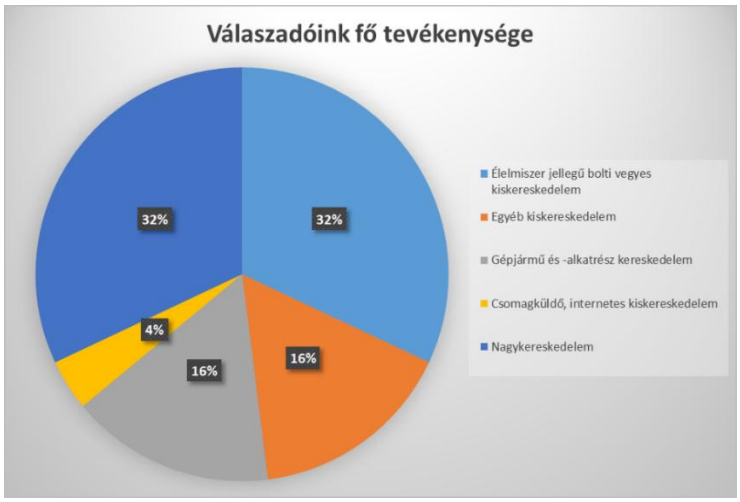
- The procurement is partly in-house, partly controlled from the center, the latter they do not really have an overview of.
- In the store, they basically work in the traditional way, there is no digital help.
- The back-office is surprisingly small compared to the turnover.
- AI is sometimes used for reports and KPIs, but it is not part of everyday life.
- There are a lot of routine tasks, sometimes they speed it up, he thinks it's AI, but based on his subordination, it's more like a code that automates processes.
- Segmentation is used during advertising campaigns, but its effectiveness is not known to the respondent.

Annex II

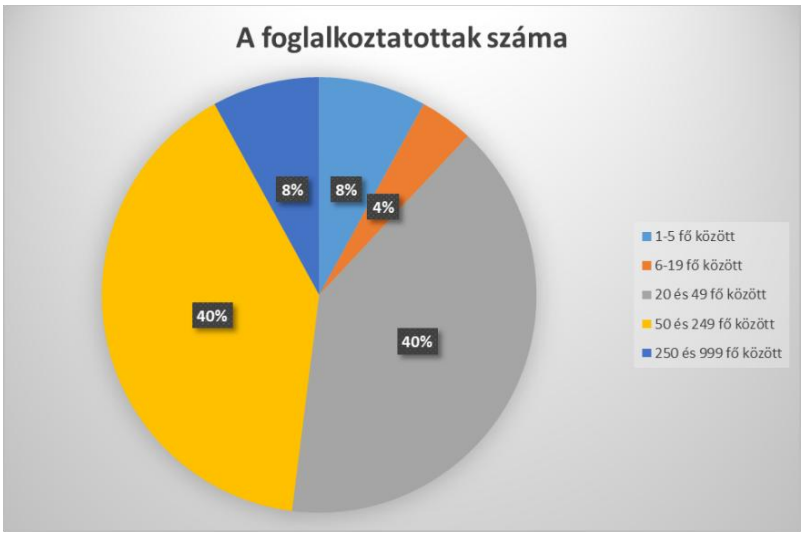
Analysis of the questionnaire research

The picture that emerges from the responses of trading companies
Briefly about the composition of our sample

Nearly one-third of our respondents were representatives of wholesale trade and mixed retail trade in food-related stores. In addition, the number of retail outlets selling other products, such as clothing, meat, perfumes and various chemicals, as well as shops dealing with motor vehicles and various components, was also significant (16%). True, only with a 4% share, but parcel delivery services also appeared in our sample.

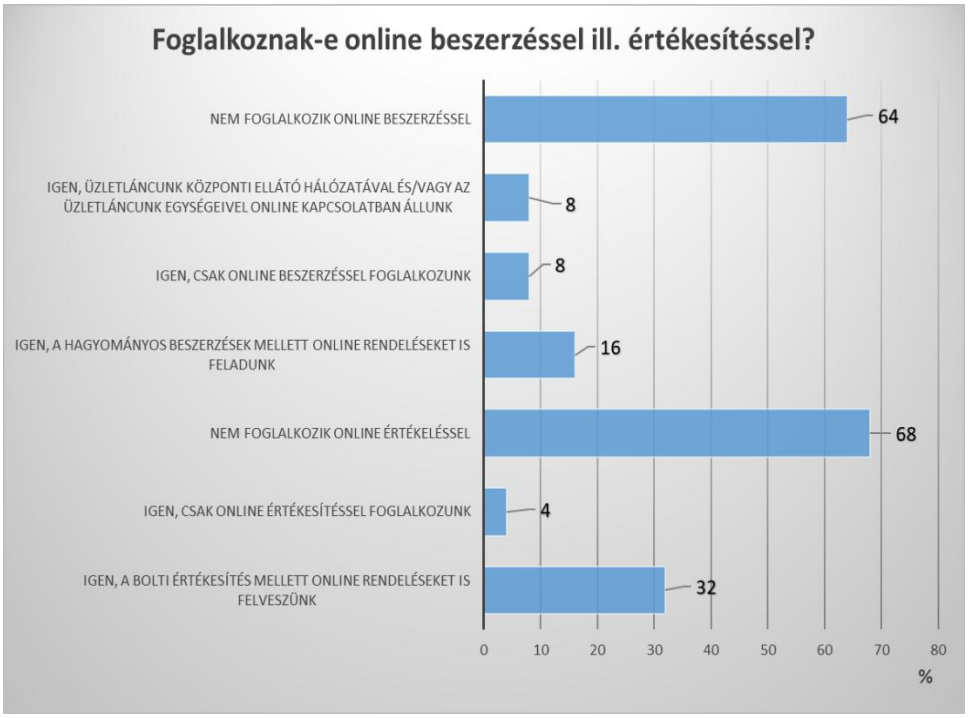


The overwhelming majority of our respondents were representatives of medium-sized companies. Our sample includes both trading companies employing 20-49 and 50-249 people with a 40% share. Large companies employing 250 or more people, as well as micro-enterprises with 1-5 employees, were represented by 8-8 percent.



Despite the fact that almost all counties are represented, the geographical composition of our sample is characterized by the predominance of the capital and its agglomeration. This is perhaps not surprising when you consider that the centers of the nationwide store chains are located almost exclusively here.
The answers we received to our question about online commerce activities revealed that 68 percent of companies are not present in the online space at all in terms of sales and 64 percent of companies are not present at all in terms of procurement. In addition to in-store distribution, almost a third of our respondents also sell their products online, but when it comes to purchasing, only 16% answered yes to this question.

8 percent of our respondents manage their purchases exclusively online, but in terms of sales, the proportion of online distributors was only 4 percent.
Companies belonging to large retail chains typically conduct their turnover online with their central supply unit and their permanent suppliers.



Answers to questions about AI

The first thematic question of our questionnaire was as follows:
Please tell us if you use AI-based solutions in the following areas, and if so, please describe in a few words what these solutions are. The areas we specified were:

- Design
- Manufacture
- Purchase
- Inventory management and distribution
- Operation and sales
- Security systems
- Marketing
- Customer management and support
- HR

- Other, type what

The majority of respondents indicated the "We do not use AI solution" solution. Different answers can be read in the following:

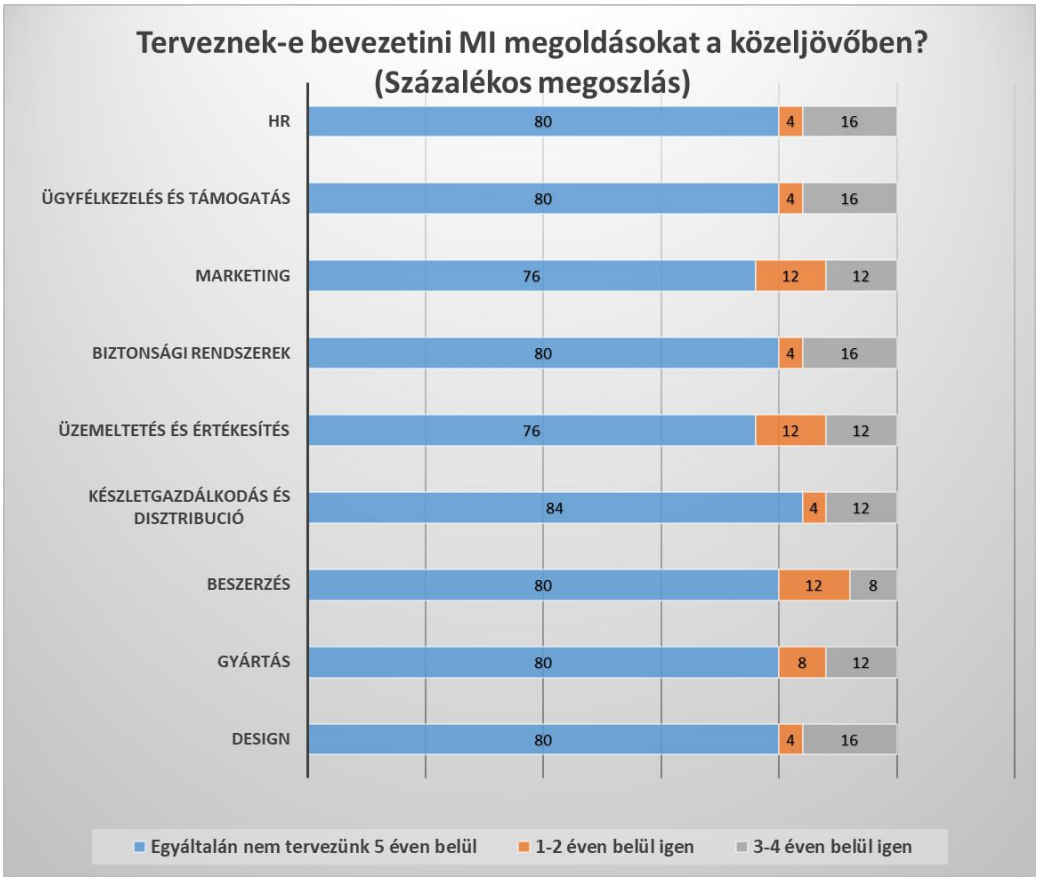
An industrial distribution company has indicated that it relies on artificial intelligence for inventory management and distribution, and it does all this in order to facilitate administrative work and operate its online store.

Regarding the support of operation and sales, we had two positive answers. One is a 100% foreign-owned, mixed-range wholesale company, whose employees use the services of AI to prepare online offers. The other is a 50% foreign-owned company dealing with the wholesale of agricultural machinery and equipment. They use AI for various complementary activities.

This wholesale company also uses AI for marketing purposes, mostly in its advertising activities. A Hungarian-owned company dealing with the wholesale of drive technology elements also indicated use for marketing purposes. They use the services of AI to operate their website.

For customer management and support, the aforementioned 100% foreign-owned, mixed-range wholesale company uses AI.

Our next question was about whether they plan to introduce (in the case of an existing AI system, expand) AI-based solutions in the near future.

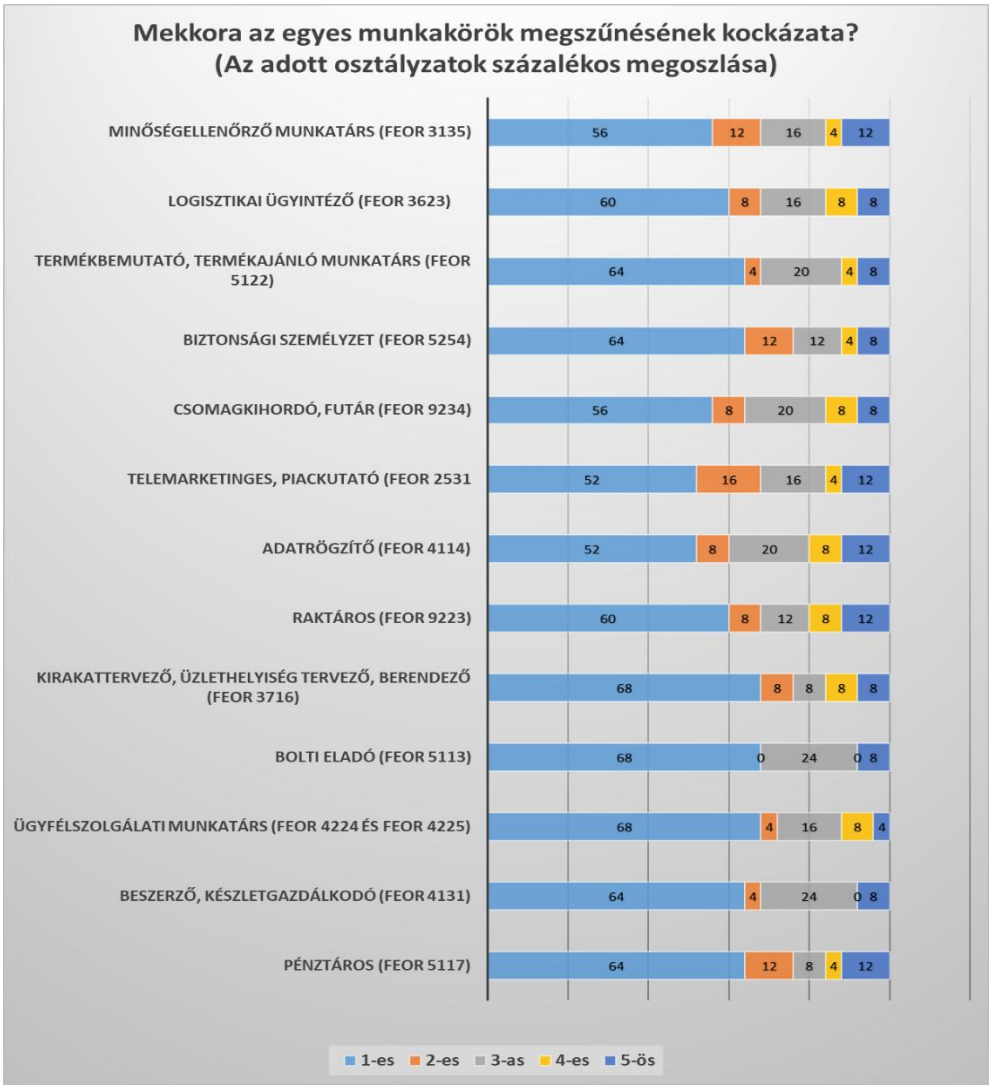


The figure illustrates that 80% of our respondents do not plan to use AI for most areas. Only in terms of marketing and operation and sales, this proportion is slightly lower. Within a year or two, 12-12 percent of our respondents want to make AI developments in three areas. In addition to marketing and operation and sales, these are also the areas of procurement.

16-16 percent of our respondents said that they would like to start AI developments in the fields of HR, customer support and design within 3-4 years.

With our next question, we asked the respondent to evaluate the medium- and long-term (within 5 or 10 years) risk of a large-scale redundancy or termination of certain jobs in commerce due to artificial intelligence. We also asked him to give his answer regardless of whether the job in question exists at his company or not. (1 means that it is not at all likely, and 5 means that it is almost certain that the job will be terminated).

The result can be seen in the figure below:



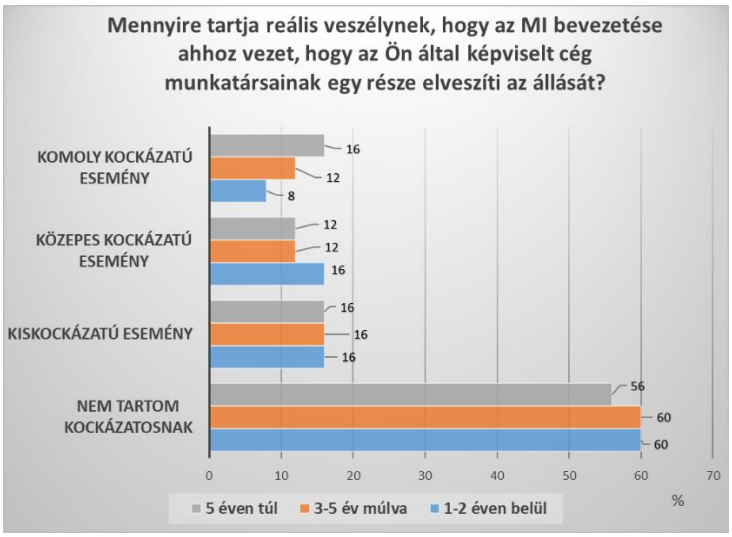
The figure clearly shows that our respondents are much more optimistic about the future than described in the international literature. I mean, regarding the effects of AI on the labor market. This is certainly due to the fact that they have not yet been reached, or if they have, they have

only slightly reached the effects of the spread of AI. Quite a few gave a grade of five and four to the probability of the loss of jobs of commercial workers.

Telemarketing, market research and data recording employees are seen as the greatest threat. They received a single grade from 52-52% of our respondents, i.e. almost half of those who filled out our questionnaire believe that they have the highest chance of losing their job.

Store assistants, shop window designers and shop fitters, and customer service employees are considered to be the least at risk.

We then asked: "How realistic is the risk that the introduction of AI will lead to some of the employees of the company you represent losing their jobs?"



As in the answers to the previous question, it is clear that *their colleagues representing retail workers in our survey are very optimistic about the future. In our view, the main reason for this is that the majority of our respondents are not really aware of the fact that AI, which is only present in traces or rather not even at all, can be found in their company, what kind of changes it can generate.*
In light of this, we should not be at all surprised by the answers to our next question.

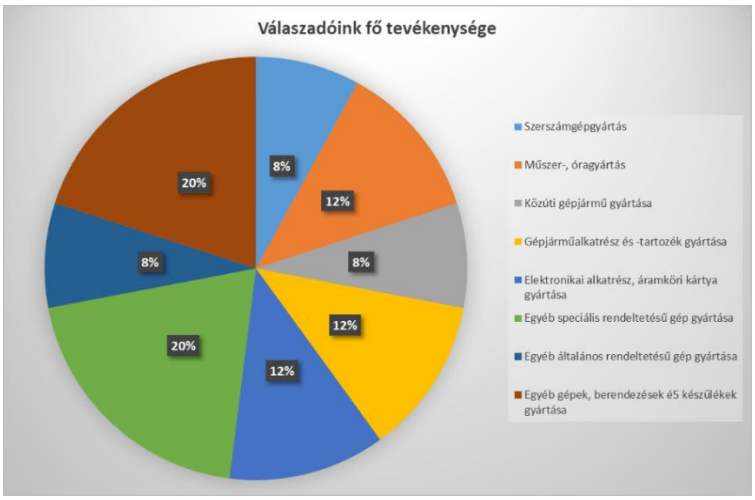
Our survey of engineering companies

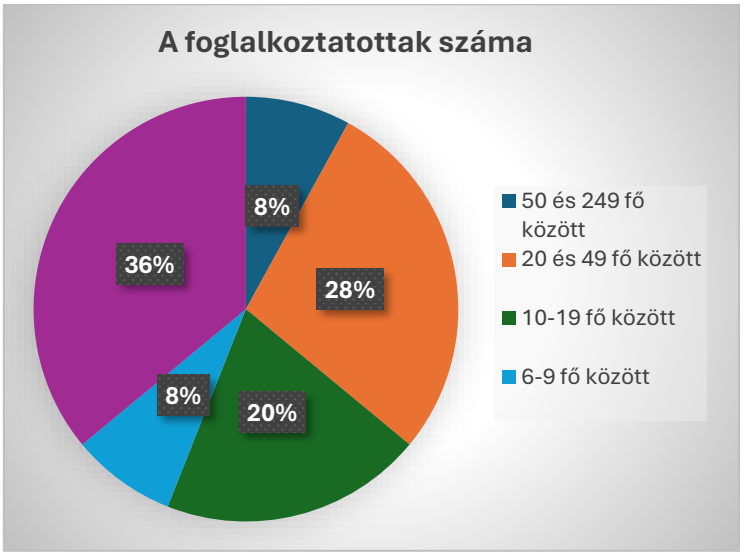
Briefly about the composition of our sample

Our figures show that almost all sectors of the Hungarian mechanical engineering industry are represented in our sample. This is despite the fact that the really big players, such as foreign-owned car assembly plants belonging to worldwide distribution chains, did not want to contribute to our work by filling out our questionnaire or giving an in-depth interview. We can only get information about the relationship between AI and these factories based on press information and various podcasts.

From our other graph characterizing our sample, we can read that our questionnaire was filled out primarily by representatives of small and medium-sized enterprises.

Micro-enterprises are particularly important. Presumably, this fact also had a serious impact on the fact that we received a plethora of answers to many of the substantive questions of our questionnaire that were difficult or impossible to depict.





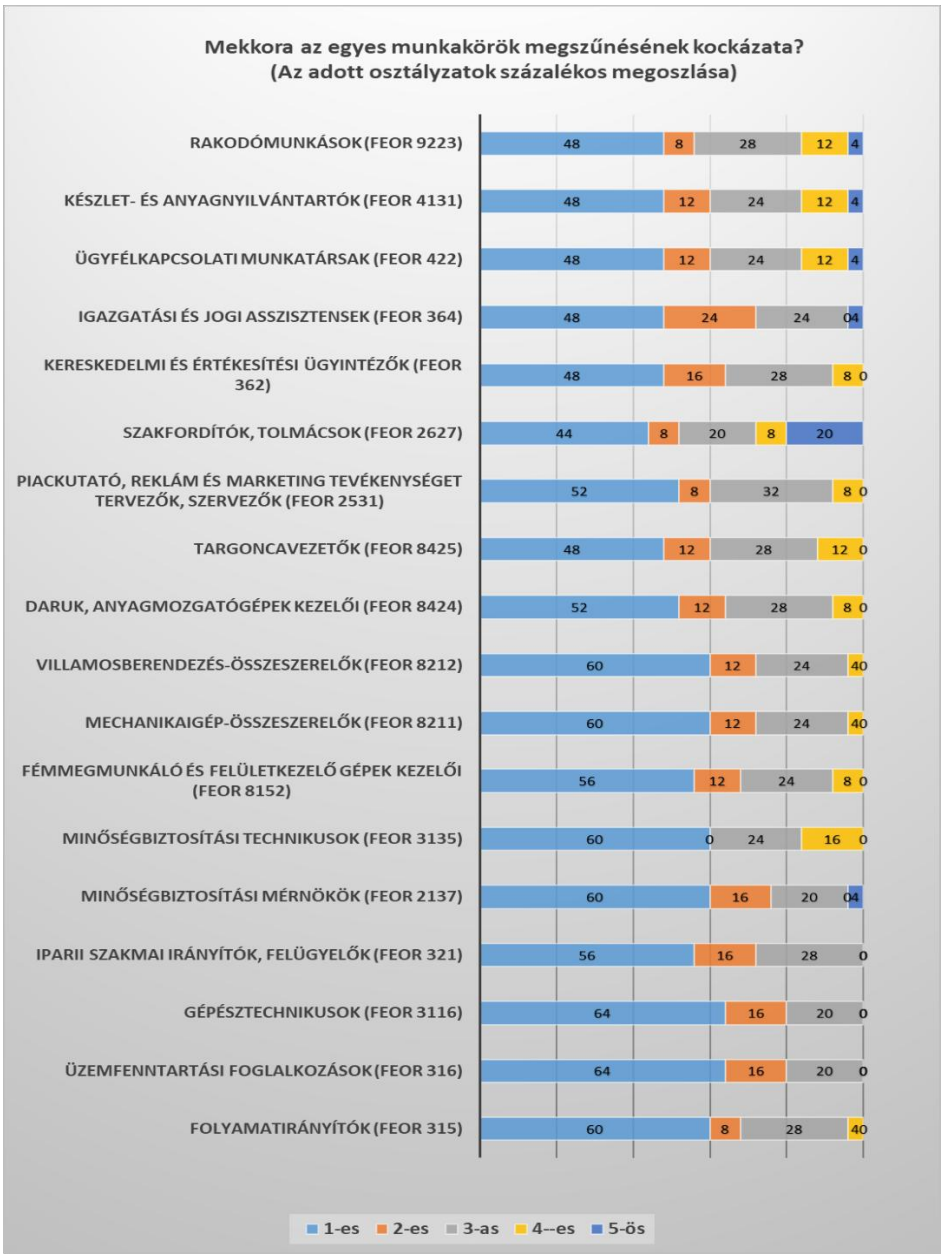
Answers to questions about AI

When asked in which areas the company uses AI solutions, there were even fewer representatives of commercial companies who did not answer that they do not use such solutions.

When asked in which areas artificial intelligence-based solutions are used, only one company manufacturing electronic components responded that they use AI solutions for marketing purposes.

Our query also paints a sad picture regarding the future. Only two companies, one that manufactures electronic components, circuit boards and one automotive parts and accessories, let us know that they plan to introduce AI solutions within 1-2 years. The others answered no to this question as well.

To our request to assess the medium- and long-term (within 5 and 10 years) risk of a large-scale redundancy or termination of the jobs listed by us in the mechanical engineering industry due to artificial intelligence, we received the answers that can be read in the figure below. We would like to emphasize that we asked those who filled out our questionnaire to give their answers in this case regardless of whether the given position exists in their company or not. (1 means that it is not at all likely, and 5 means that the termination of the given job is almost certain.)

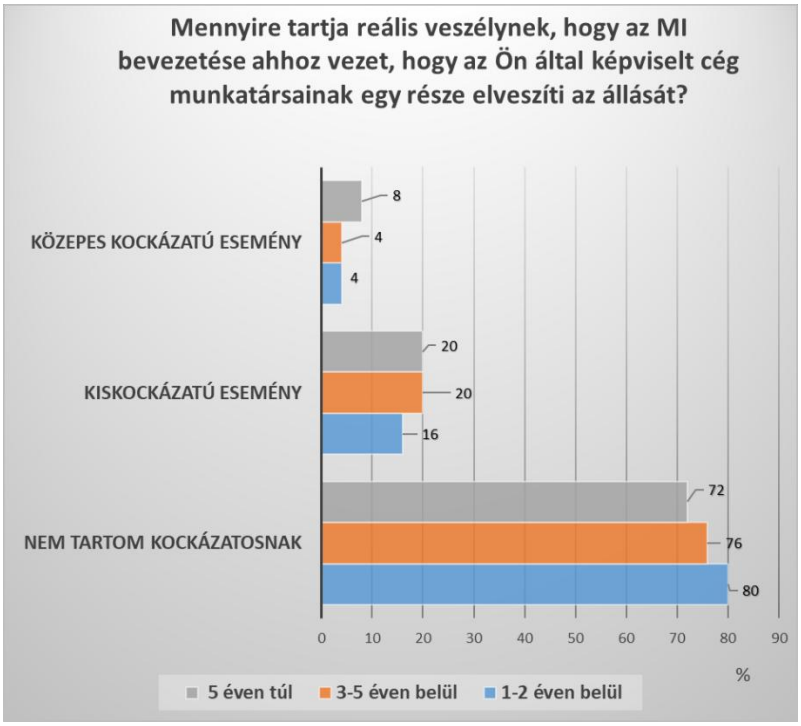


The first thing that stands out from the figure is that our respondents feel most at risk in relation to non-mechanical engineering-specific occupations. Most excellent grades were given to interpreters and translators. With the exception of loaders, the top performers are full of intellectual occupations.

It is thought-provoking that when we asked how the person who filled out our questionnaire evaluated how functionally prepared their company is for the use of modern AI-based technologies in everyday business, based on their experience so far, almost everyone replied that "At the moment, it is difficult or impossible to integrate AI-based systems into the company's workflows."

Nearly one-fifth of our respondents indicated that "The company still lacks the knowledge to introduce AI-based methods in workflows, which requires longer training and new human resources, but this can be done in a rational time."

To our next question, which was: "How realistic is the risk that the introduction of AI will lead to some of the employees of the company you represent losing their jobs?" we received the answers shown in the following figure.



Our respondents are so optimistic about their future that none of them chose our answer option, which indicated a serious risk factor. From the figure, we can see that only very few people feel that the introduction of AI is a medium and low-risk event.

In light of this, it is almost natural that almost everyone answered our last question, "Are you doing or planning to do anything to prevent them from losing their at-risk colleagues?" Some have indicated that they will not do anything for the time being, but they are also thinking about the possibility of this.

Annex III

Compiling values in the O*NET database

Skills found in the O*NET database:

English	Hungarian
Reading Comprehension	Reading comprehension
Active Listening	Active listening
Writing	Writing
Speaking	Speech
Mathematics	Mathematics
Science	Science
Critical Thinking	Critical thinking
Active Learning	Active learning
Learning Strategies	Learning strategies
Monitoring	Monitoring
Social Perceptiveness	Social sensitivity
Coordination	Coordination
Persuasion	Persuasion
Negotiation	Discussion
Instructing	Direction
Service Orientation	Service orientation
Complex Problem Solving	Complex problem solving
Operations Analysis	Operations analysis
Technology Design	Technology Engineering
Equipment Selection	Equipment selection
Installation	Installation
Programming	Programming
Operations Monitoring	Operations management
Operation and Control	Operation and management
Equipment Maintenance	Equipment maintenance
Troubleshooting	Troubleshooting
Repairing	Repair
Quality Control Analysis	Quality Control Analysis
Judgment and Decision Making	Judgment and decision-making
Systems Analysis	Systems analysis
Systems Evaluation	System evaluation
Time Management	Time management
Management of Financial Resources	Financial Resources Management
Management of Material Resources	Managing material resources
Management of Personnel Resources	Human resources management

Capabilities in the O*NET database

English
Oral Comprehension
Written Comprehension
Oral Expression
Written Expression
Fluency of Ideas
Originality
Problem Sensitivity
Deductive Reasoning
Inductive Reasoning
Information Ordering
Category Flexibility
Mathematical Reasoning
Number Facility
Memorization
Speed of Closure
Flexibility of Closure
Perceptual Speed
Spatial Orientation
Visualization
Selective Attention
Time Sharing
Arm-Hand Steadiness
Manual Dexterity
Finger Dexterity
Control Precision
Multilimb Coordination
Response Orientation
Rate Control
Reaction Time
Wrist-Finger Speed
Speed of Limb Movement
Static Strength
Explosive Strength
Dynamic Strength
Trunk Strength
Stamina
Extent Flexibility
Dynamic Flexibility
Gross Body Coordination
Gross Body Equilibrium
Near Vision
Father Vision
Visual Color Discrimination
Night Vision

Peripheral Vision
Depth Perception
Glare Sensitivity
Hearing Sensitivity
Auditory Attention
Sound Localization
Speech Recognition
Speech Clarity

Types of knowledge in the O*Net database

English
Administration and Management
Administrative
Economics and Accounting
Sales and Marketing
Customer and Personal Service
Personnel and Human Resources
Production and Processing
Food Production
Computers and Electronics
Engineering and Technology
Design
Building and Construction
Mechanical
Mathematics
Physics
Chemistry
Biology
Psychology
Sociology and Anthropology
Geography
Medicine and Dentistry
Therapy and Counseling
Education and Training
English Language
Foreign Language
Fine Arts
History and Archaeology
Philosophy and Theology
Public Safety and Security
Law and Government
Telecommunications
Communications and Media
Transportation