

Highlight 2. Potential Impact of Artificial Intelligence on Economic Development in Serbia

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The highest percentage of work tasks that will be exposed to the possibility of automation by AI technology is found in the group of occupations of Administrative officers (82%), Engineers, professional associates and technicians (27%), and Experts and artists (26%).

Occupations with the highest potential for complete automation by AI are Typists and text processors, Tourist agency officials and related occupations, Scribes, Officials for requests and complaints, Information centre officials, Banking and related counter officers, and Surveyors.

It is estimated that the total number of jobs in Serbia that will be subject to complete automation by AI generative technology is 70,000, while the number of those whose activities AI is expected to significantly assist is just under 400,000, i.e. 17% of total registered employment.

Women are at a significantly higher risk of job loss due to AI than men.

Given the extremely low percentage of elderly people with basic or above-basic level of digital skills, special attention should be paid to analysing the level of digital skills within occupations that will be significantly affected by AI advancements, particularly those where the participation of older individuals in the total number of employees is high or where the total number of elderly working in these occupations is high, in order to successfully adapt to the changes AI will bring.

To provide a complete analysis of the probable impact of artificial intelligence on the labour market in Serbia, and define public policies needed, it is first of all necessary to obtain data on the number of employees based on the 4-digit International Standard Classification of Occupations. This data should be provided by the Statistical Office of the Republic of Serbia based on information from the Central Register of Compulsory Social Insurance, but such data does not exist in Serbia.

Introductory remarks

Artificial Intelligence (AI) technology refers to the simulation of human intelligence by machines. A unique definition of AI technology does not exist, and its development often leads to changes in the concept. Currently, AI technology essentially refers to a combination of machine learning and the advanced use of algorithms that tell computers how to learn and operate independently, in order to perform tasks that require human intelligence, namely a combination of learning, reasoning, perception, understanding abstract concepts, and decision-making.

The concept of artificial intelligence has been known since the 1950s, but its development into the technology we speak of today has intensified in the last decade. The basic difference between previous technologies and the technology available in the last less than a year, which primarily includes models such as ChatGPT, is the introduction of Natural Language Processing (NLP).

The introduction of natural language processing has enabled easy communication with AI models due to their understanding of natural human communication and their ability to formulate responses in natural language. This change has made the possibilities of artificial intelligence accessible to a large part of the world's population that possesses basic computer skills, something that until now was only available to people with specialized skills.

In the coming period, it is expected that AI technology will significantly automate a large number of tasks performed by humans, making a considerable number of those that cannot be automated easier. Although interest in AI technology among the general public has only grown in 2023, it is important to note that AI technology is not new but has reached a level of development in the past year that allows for its wider application, while the infrastructure for such application largely exists. Accordingly, this technology should not be seen as something that will require a lot of time for more significant integration into economic flows, as was the case with the development of personal computers. It is already present in economic flows, and its current development only expands the possibilities of use and the speed of integration.

AI has the potential to lead to significant increases in productivity and the creation of new jobs. However, there are also risks of job losses, the creation of socio-economic disparities, and a decrease in the quality of jobs, or a sense of insecurity. In such conditions, recognizing and exploiting advantages and managing risks is of great importance for both decision-makers and actors in the economic sector.

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“Artificial Intelligence has the characteristics of a general-purpose technology, like the steam engine, the railway, or electricity, because its application permeates all areas of the economy and society, and it brings revolutionary changes in many of them.”²

The Impact of AI Technology on Economic Development

The impact of AI technology on economic development is still unknown, as it is a technology in the initial stage of wider implementation. However, the development of technology in 2023 indicates the real possibility of automatization of a large number of activities currently performed by humans in the next decade, thereby significantly impacting economic development.

The difficulty in predicting the pace of AI technology development is also illustrated by the fact that, according to 2017 estimates by the McKinsey Global Institute, the first application of natural language processing by AI was expected in 2027, or 10 years after the estimates were made. The application of natural language processing began already in 2023, just 6 years later. According to the same estimate, the level of creativity of AI technology, which is now achieved by platforms such as Midjourney and Photoshop Beta, was not expected until 2030.

The speed of further implementation of AI technology will primarily depend on the process of technology regulation by countries that are leading in its development and implementation. This primarily refers to the United States (USA) and China, which have invested the most money in technology development over the past decade and where the largest number of AI companies are emerging, with the USA taking the lead. China and the USA also lead in the number of AI scientific journals, conferences, and publications.

The problem of AI technology regulation will primarily be a result of the fact that the two countries leading its development, the USA and China, represent competitive markets that have often been in some form of economic conflict over the past decade. In such conditions, it is unlikely that these countries will be able to achieve cooperation in international regulation, which would undoubtedly slow down the development of the technology, and thus its impact on the economic development of these countries.

Another significant market that will define the course of regulation is the European Union (EU). The example of regulation in the EU, which was the first to start this

process, may indicate an approach to regulation on a global level. Namely, the EU plans to regulate not the type of AI technology, but the risk of its application, that is, to regulate the same AI technology more strictly if it is used in a more significant aspect of society, than if it is used in less significant aspects³.

The number of companies that in some way use artificial intelligence in their business has been increasing in the last few years. According to a McKinsey report, the percentage of surveyed companies that have adopted AI technology in at least one area of business has increased from 20% in 2017 to 50% in 2022.⁴ During the same period, the average number of possible applications of technology in these companies has doubled.

AI technology will undoubtedly have a significant impact on the labour market. From an economic development perspective, the fundamental question is whether the positive effects of productivity growth due to the implementation of this technology will outweigh the number of lost jobs, and whether the number of new occupations will compensate for the declining demand for jobs that will be automated. In other words, what will be the net effect on the labour market as a result of introducing this technology. This question is not only of long-term nature. Not only the final net effect is important, but also the question arises what will happen to the employees whose jobs will be automated in the period from job loss to the development of new jobs influenced by AI technology that will stimulate growth in labour market demand.

The ability to provide almost instant answers to complex questions, process text, conduct analytical tasks, process videos and images, support in programming and application development, will not only positively affect worker productivity but will almost certainly accelerate the innovation process.

The need for processing, analysing, and managing huge amounts of data, made possible by AI technology, will require the engagement of IT personnel with a special set of skills, thereby creating new job opportunities influenced by AI technology.

The positive impact of AI technology in certain sectors is already evident. In healthcare, AI technology is already able to successfully read scanner data without human intervention and is achieving success in research on antibiotic resistance and Parkinson's disease. According to a McKinsey & Company report⁵, the application

³ <https://artificialintelligenceact.eu/>

⁴ McKinsey & Company, 2023, The economic potential of generative AI: The next productivity frontier.

⁵ McKinsey & Company, 2023, The economic potential of generative AI: The next productivity frontier.

² Strategy for the Development of Artificial Intelligence in the Republic of Serbia for the period 2020-2025.

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of generative AI technology in drug research and development could bring an additional \$60 to \$100 billion in revenue annually. In the banking sector, this impact is estimated at \$200 to \$300 billion annually, in education at \$120 to \$230 billion annually, etc. This estimate refers only to the impact of generative AI technology on revenue growth as a result of increased productivity, while positive effects will also be reflected in customer satisfaction, reduced business risks, improved decision-making processes, etc.

The implementation of AI technology in occupations where it will enable partial automation of jobs will undoubtedly lead to an increase in productivity. On one hand, the volume of activities will be realized in less time, reducing the number of working hours per output, thereby increasing productivity. On the other hand, the number of working hours freed up by AI performing certain activities can be used to further increase output within more productive activities. The automation of routine tasks will open up opportunities for employees to use the time they spent on these activities for creative and innovative activities, problem-solving, development of new products, etc.

Results from a recently published study⁶, conducted based on monitoring the work of 5,179 customer support agents, indicated a 14% increase in productivity when using an AI assistant that monitored conversations with clients and provided suggestions to agents on how to respond. Of particular importance is the fact that the study indicates a greater increase in productivity among employees with lower skill levels, reducing the skill gap in relation to more experienced employees. According to research by the developers of GitHub Copilot, a program based on artificial intelligence that provides support to programmers, the speed of task execution for programmers using this program increased by as much as 55%.⁷

According to the previously mentioned Goldman Sachs research, AI technology could contribute to a productivity growth of 1.5 percentage points annually in the USA over the next decade. On a global level, McKinsey & Company⁸ estimates that automation influenced by AI technology will contribute to a productivity growth of 0.2 to 3.3 percentage points annually from 2023 to 2040, within which the contribution of generative AI technology will be 0.1 to 0.6 percentage points. One of the potential dangers arises from the fact that the largest productivity growth is expected in developed countries,

which will consequently lead to a deepening of the gap between developed and other economies.

The positive impact on the economy is not limited to the results of workers and companies in the private sector. The implementation of AI technology will also be of great significance in creating better business conditions and supporting public administration in the economy.

The impact on the economy can also be negative, in terms of the influence of AI on the spread of fake news, whose impact will definitely be amplified by artificial intelligence technology.⁹ The development of AI technology has made creating and spreading fake images, videos, and stories very easy and accessible. This does not only refer to 'deepfakes' in terms of editing photos and videos. AI technology has a much more significant impact on the development of fake news in terms of how it creates and tailors the text, targets the desired 'buyer' of the news, in terms of the speed and volume of news it can create in a short period, as well as the ability to create other internet portals that verify fake news.

Fake news can manipulate financial markets, affecting investment choices and stock prices. False rumours about a company's performance and financial health can lead to a steep drop in stock prices, affecting investors and the entire market¹⁰.

The impact of AI technology on the labour market in Serbia

Although it is in many ways different from previous technological changes, the development of artificial intelligence has one common characteristic reflected in the division between optimists and pessimists. While optimists see the possibility of progress in artificial intelligence, pessimists place greater focus on the potential negative consequences.

The impact of artificial intelligence on jobs can be assessed in two ways. The first is through the analysis of job advertisements in terms of decreasing and increasing demand for certain professions where the potential use of artificial intelligence is estimated. The second is by analysing work activities influenced by artificial intelligence, and then the participation of these activities in individual professions and professional groups.

The limitation of the first approach is the limited number of markets where online job advertising is developed

6 Erik Brynjolfsson et. All, 2023, Generative AI at Work, National Bureau of Economic Research

7 Measured by the number of queries resolved per hour

8 McKinsey & Company, 2023, The economic potential of generative AI: The next productivity frontier.

9 Radivojević, A., 2023, "The Role of AI in the Spread of Fake News and Its Economic Consequences", Fondacija za razvoj ekonomske nauke – Faculty of Economics University of Belgrade

10 <https://cointelegraph.com/news/ai-image-pentagon-explosion-stock-market-dip>

Table 1. The share of tasks that are moderately and significantly exposed to the possibility of automation by GPT technology in the overall tasks of individual occupational groups, in %

Occupational Group	Moderately Exposed to Automation	Significantly Exposed to Automation	Total
1 Managers, officials and legislators	13	1	14
2 Experts and artists	25	1	26
3 Engineers, professional associates and technicians	25	2	27
4 Administrative officers	58	24	82
5 Service and commercial occupations	18	4	22
6 Farmers, foresters, fishermen and the like	7	1	8
7 Craftsmen and related	3	0	3
8 Machine and plant operators, assemblers and drivers	6	2	8
9 Simple occupations	3	1	4

Source: ILO Generative AI and Jobs: A global analysis of potential effects on job quantity and quality

enough for this analysis, and the fact that this approach primarily provides information about the speed of technology implementation at the time of the analysis, focusing less on the future. The second approach starts by identifying activities within professions that are, to a certain extent, susceptible to automation. The drawback of this approach primarily lies in its reliance on a large number of estimations about the impact and future development of technology. However, if the goal of the analysis is to provide information about the potential impact in order to gain insight into the significance of change and the importance of adapting to these changes, this approach represents the currently optimal solution.

Artificial intelligence can currently perform various activities such as data search, analysis, creation and summarization of textual records, text translation, voice to text conversion, analysis of information from existing images and videos, creation of new images, among others. Therefore, assessing the impact of the automation of these and similar activities on the labour market is of utmost importance for formulating public policies.

The impact of technology on the labour market is already visible in the United States, which has advanced the furthest in the development and implementation of this technology. According to a report by Challenger, Gray & Christmas¹¹, nearly 4,000 laid-off workers in the USA in May 2023 were dismissed with Artificial Intelligence technology cited as the reason by employers. This number represented almost 5% of the total number of laid-off workers in the USA for that month.

This is just the beginning of a trend of changes in the labour market influenced by this technology, and its

impact is expected to become increasingly significant. The CEO of IBM already announced in May that hiring in the company for positions expected to be automated by AI has been slowed or halted, and that a large number of jobs are expected to be automated over the next five years.

A study by the International Labour Organization (ILO), based on the second approach mentioned above, starts from the International Standard Classification of Occupations. For each occupation, the artificial intelligence model ChatGPT defined 10 tasks that best describe each individual occupation. Subsequently, each task was rated on a scale from 0 to 1 regarding the degree of potential automation through GPT (Generative Pre-trained Transformer) technology, where 0 implies no impact of GPT technology, and 1 indicates the possibility of complete automation of the activity.

Based on these ratings of all 4,360 defined activities, the participation of tasks that are moderately and significantly exposed to the possibility of automation by GPT technology in the total tasks for each occupational group was determined¹².

According to this study, as much as 82% of all tasks performed by administrative officials will be under moderate or high influence of GPT technology. This refers to the participation of tasks that are potentially moderately and significantly exposed to automation by GPT technology in the total activities defining each job category. However, each occupation involves different activities that a person performs during working hours. Therefore, some occupations within these groups contain a large number of activities that are potentially under significant influence, others have a greater proportion

¹¹ <https://www.challengergrey.com/blog/may-2023-layoffs-jump-on-tech-retail-auto-ytd-hiring-lowest-since-2016/>

¹² Tasks with a score above 0.5 are considered moderately susceptible to influence, and those above 0.75 are considered highly susceptible.

Table 2. Occupations with high potential for automation and enhancement under the influence of AI

OCCUPATIONS WITH HIGH POTENTIAL FOR AUTOMATION	OCCUPATIONS WITH HIGH POTENTIAL FOR ENHANCEMENT
<p>Administrative officers</p> <ul style="list-style-type: none"> Typists and word processing operators Officials of travel agencies and related Scribes and related Officers for claims and complaints Officials in information centers Administrative officers, not elsewhere classified Banking and related counter clerks Interviewers Personnel officers Data entry operators Accounting and bookkeeping officers Hotel receptionists Statistical, financial and insurance officers Administrative and technical secretaries <p>Experts and artists</p> <ul style="list-style-type: none"> Writers and related Librarians, documentarians and related Application developers <p>Service and commercial occupations</p> <ul style="list-style-type: none"> Catalog sellers <p>Engineers, professional associates and technicians</p> <ul style="list-style-type: none"> Financial dealers, securities dealers and brokers Civil servants for issuing permits and documents 	<p>Administrative officers</p> <ul style="list-style-type: none"> Storekeepers <p>Managers, officials and legislators</p> <ul style="list-style-type: none"> Procurement and distribution managers/directors Managers/directors in the field of mining <p>Experts and artists</p> <ul style="list-style-type: none"> Teachers of vocational studies and secondary vocational education Experts in the development and analysis of software and applications Dietitians and nutritionists Specialists in computer networks Architects Industrial designers and creators Musicians - instrumentalists, singers and composers Engineers for landscape architecture Cartographers and surveyors Doctors experts in traditional and alternative medicine Physicists and astronomers Andragogists, pedagogues and specialists in systemic issues of education and upbringing Biologists, botanists, zoologists and related specialists Teachers of secondary general and art education Pharmacists Teachers in primary education Actors Doctors of medicine - specialists <p>Farmers, foresters, fishermen and the like</p> <ul style="list-style-type: none"> Bee and silkworm breeders <p>Simple occupations</p> <ul style="list-style-type: none"> Simple occupations, not elsewhere classified Meter readers and vending machine operators Leaflet distributor Couriers, deliverymen and baggage handlers <p>Machine and plant operators, fitters and drivers</p> <ul style="list-style-type: none"> Operators of machines and devices in the pulp and paper production process Installers of electrical and electronic equipment Product installers, n.e.c Handling machinery operators Operators of machines and devices for the production of photo materials and making photographs Fitters of mechanical machines Motorcycle drivers

Service and commercial occupations

Sellers at stalls and markets
 Road motor vehicle driving instructors
 Conductors and controllers of driving documents
 Teaching assistants
 Housekeepers in residential and commercial buildings
 Waiters
 Ground, air and ship stewards
 Fuel dispensers
 Hairdressers and related

Engineers, professional associates and technicians

Value appraisers and damage appraisers
 Professional associates in the field of law and related
 Real estate agents
 Pharmaceutical technicians
 Medical assistants
 Interior designers and decorators
 Fitness and recreation instructors and leaders of sports activities
 Professional associates and technicians in biological sciences (except medical)
 Controllers of chemical plants and processes
 Professional associates and technicians of chemical technologies
 Sports trainers, instructors, judges and officials
 Professional associates and technicians of broadcasting and audio-visual techniques
 Professional associates and technicians for telecommunications technology
 Ship's deck officers and navigators
 Photographers
 Production supervisors in the processing industry
 Operators of energy production facilities
 Customs and border inspectors
 Professional engineers and medical laboratory technicians
 Vocational visiting nurses and visiting nurses-technicians

Source: Author based on ILO Generative AI and Jobs: A global analysis of potential effects on job quantity and quality

of activities that are moderately exposed to automation, while certain occupations do not have activities that are potentially exposed to the possibility of automation.”

To assess the level of AI's impact on individual occupations, the distribution of activities within each occupation is examined based on the ratings for automation potential. If the mean value of the distribution of activities is higher than 0.6, and the mean value minus the standard deviation is greater than 0.5, such an occupation is defined as having a high potential for automation¹³. Occupations with a mean

value not exceeding 0.4 and the sum of the mean value and standard deviation greater than 0.5 are defined as occupations with potential for enhancement through the application of artificial intelligence¹⁴.

Occupations with the highest potential for automation are usually more routine, such as performing administrative or office activities, and involve repetitive tasks. Some occupations in this group are based on basic analyses, such as database design or data analysis, trend monitoring, gathering information about goods and services, and more. Occupations with the greatest

¹³ $\mu_i > 0.6$ and $\mu_i - \sigma_i > 0.5$

¹⁴ $0.4 > \mu_i$ and $\mu_i + \sigma_i > 0.5$

potential for enhancement are those that require thinking and skills that are harder to measure, especially those involving interaction with people.

When we examine the five occupations for which business leaders worldwide have reported the greatest expected decline in demand over the next five years, as per the World Economic Forum's 'Future of Jobs' report¹⁵, we can see that three out of these five occupations are highly susceptible to automation by AI. These are Banking and related counter clerks with an expected demand decline of 41%, Data entry operators with an expected decline of 36%, and Administrative-technical secretaries with an expected decline of 34%. On the other hand, the occupation with the largest expected increase in demand, according to the same research, is specialists in artificial intelligence and machine learning, with an anticipated demand growth of 40%.

If we consider the representation of these occupations in the total employment of a country like Serbia, we get an assessment of the impact on the labour market in terms of the complete automation of occupations and the enhancement of job performance by employees. For Serbia, the share of the total number of employees who will be under potential significant influence of job performance enhancement amounts to 13.5%, or slightly more than 388,000 employees, while the percentage of those whose jobs may be completely automated is 2.4%, or slightly more than 69,000 employees.

15 World Economic Forum, 2023, The Future of Jobs Report 2023

Table 3. Share and number of jobs with high automation and enhancement potential under the influence of AI in Serbia

High enhancement potential	13,5%	388.341
High automation potential	2,4%	69.038
Total	15,9%	457.379

Source: Author based on ILO Generative AI and Jobs: A global analysis of potential effects on job quantity and quality and SORS

A characteristic observed globally is the significantly higher proportion of women compared to men employed in jobs at high risk of complete automation. Women are at more than double the risk of job loss due to automation because their participation in jobs with the potential for complete automation is higher.

Table 4. Number of jobs with high automation and enhancement potential under the influence of AI in Serbia

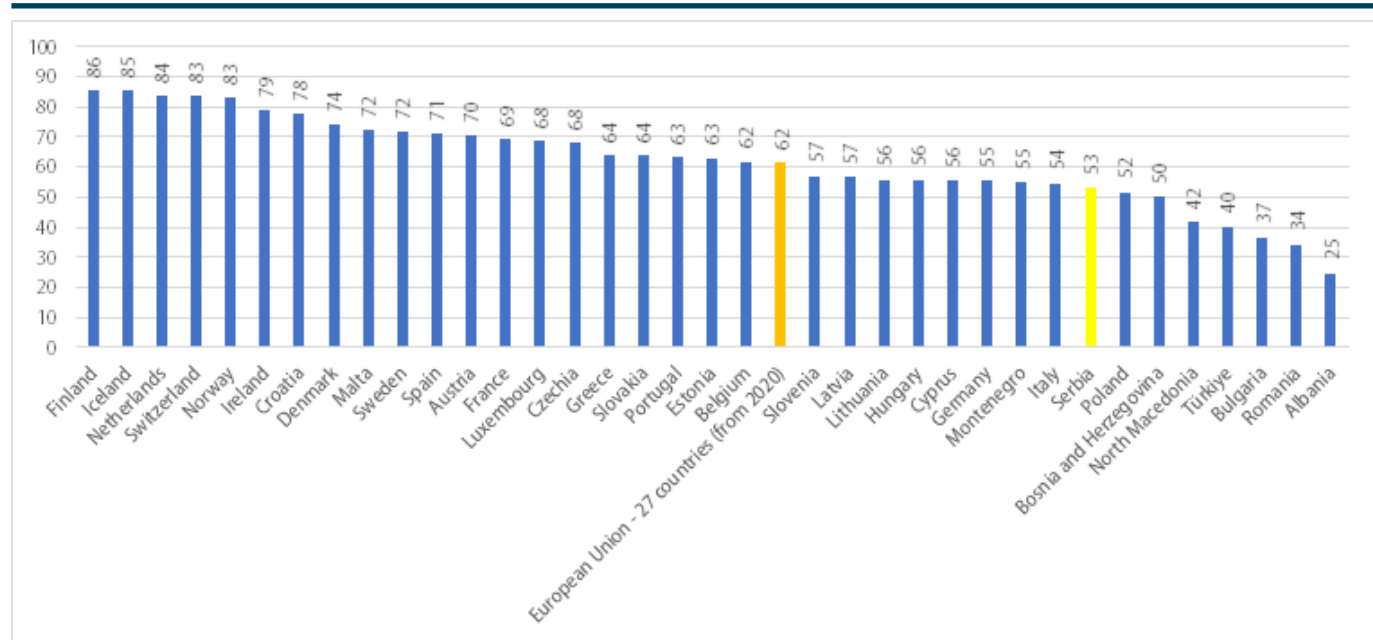
	Women	Men
High automation potential	47.929	20.555
High enhancement potential	190.423	199.231

Source: Author based on ILO Generative AI and Jobs: A global analysis of potential effects on job quantity and quality and SORS

Note: Estimates of the impact of AI on jobs in Serbia are based on a global assessment, considering that in Serbia there is no statistical data on the number of employed individuals by occupations at the 4-digit level.

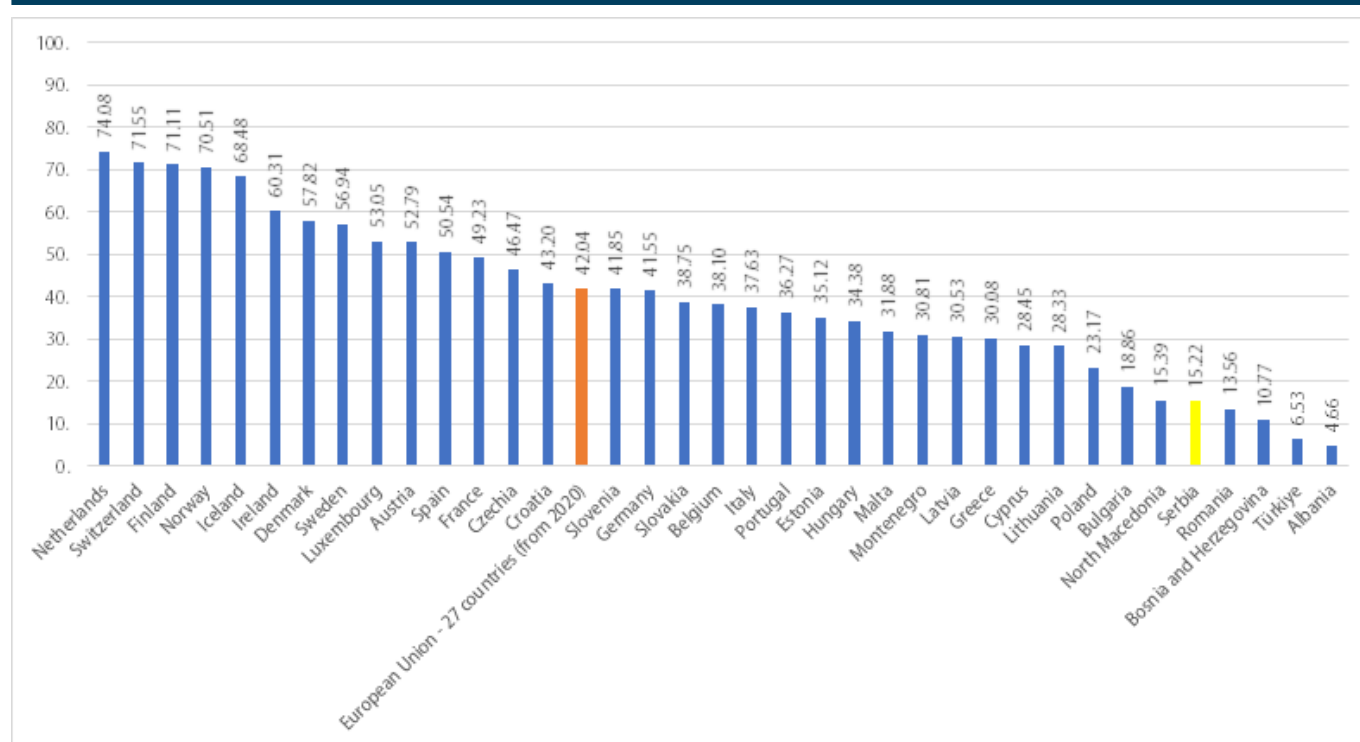
The process of job enhancement will largely involve the interaction between employees and AI technology. In this context, the level of digital skills possessed by both employed and unemployed individuals, or those

Table 5. Individuals on the labour market, with basic or above basic level of digital skills, 2021



Source: Eurostat, Individuals' level of digital skills

Table 6. Individuals in the age group 55-64 with basic or above basic level of digital skills, 2021



Source: Eurostat, Individuals' level of digital skills

seeking employment, becomes increasingly important. For Serbia, a problem arises from the relatively low percentage of the workforce that possesses basic or above-basic levels of digital skills

In Table 5, we can see that the percentage of Serbia's workforce (53%) is below the EU average (61%), and according to this indicator, Serbia ranks 29th out of the 36 countries observed. This could represent a potential challenge in adapting to changes brought about by AI.

A group in Serbia significantly at risk in adapting to changes in AI technology is the elderly, whose level of basic digital skills is low. In Table 6, we can see that only 15% of the elderly in Serbia possess basic digital skills, which is nearly three times lower than the European Union average (42%). Only 4 of the 26 countries observed have worse results according to this indicator.

In order to successfully adapt to the changes brought by AI technology, special attention should be given to analysing the level of digital skills within occupations that will be significantly influenced by AI enhancements, particularly where the participation of the elderly in the total workforce is high, or where the total number of elderly working in these occupations is significant. An example of such occupations is Elementary school teachers.

Besides the potential for complete job automation, the development and implementation of artificial intelligence will undoubtedly lead to the creation of new

jobs or professions, such as model engineers and task engineers, who will fine-tune models and develop more efficient algorithms. Interface and interaction designers will adapt systems to various user conditions, and content creators for artificial intelligence will rapidly produce diverse, in-depth content. Additionally, there are data curators and trainers who will ensure high-quality data for training AI systems, as well as ethics and governance specialists who will oversee data integrity and ensure that AI systems operate in accordance with ethical standards.

A real challenge can be anticipated in the period between job losses and the creation of new jobs, during which there is a risk of an increase in unemployment due to the implementation of artificial intelligence.

Research by the World Economic Forum¹⁶ also indicates the industries that will face the highest exposure to automation and enhancement. The ten industries potentially most exposed are:

- Financial services and capital markets,
- Insurance and pension fund management,
- Information and technology services, Telecommunications,
- Media and publishing,

¹⁶ World Economic Forum, 2023, Jobs of Tomorrow: Large Language Models and Jobs

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- Research, design, and business management services,
- Rental, booking, and leasing services,
- Retail and wholesale of consumer goods,
- Non-profit organizations, professional bodies, and unions, and
- Real estate related jobs.

When considering business functions within companies, those with the greatest potential exposure are: information technology, finance, customer sales, operations, and human resources (HR).

Conclusion

There is no doubt that the economy will undergo significant changes due to the development and implementation of AI technology. These changes will particularly impact the labour market, primarily in terms of job losses that will be subject to automation, and then the emergence of new types of jobs that will require skills to work with the new technology.

Before the advent of the currently prevalent AI technology, job automation primarily pertained to tasks performed by less qualified workers, or lower-paid workers (physical labour), and there was less inclination towards automation due to high costs of implementation and low labour costs. This rational behaviour, to some extent, led to faster implementation of robotics in developed countries where the wages of low-skilled workers are higher, making the relative cost of introducing technology lower. In underdeveloped countries, it remained more cost-effective to pay low wages to workers than to invest in expensive robots to do their work.

In terms of introducing current AI technology, the situation is not so simple. This technology will affect the automation and support of activities carried out by highly qualified workers, i.e. higher-paid workers (managers, teachers, designers, IT experts, etc.). Accordingly, it is expected that the speed of AI technology implementation will be significantly greater than previous technological changes, as the relative cost of investing in technology is lower.

The speed of implementation also brings risks to the labour market, primarily in terms of job losses and the transition of workers who lose their jobs to other positions. As in other countries around the world, public policy makers in Serbia will need to adjust workforce planning activities, education, lifelong learning processes, and social security network services to the impact of artificial intelligence to manage the evident changes.

To enable a complete analysis of the probable impact of artificial intelligence on the labour market in Serbia, and thus the definition of public policies, it is primarily necessary to provide data on the number of employees at the 4-digit level of the International Standard Classification of Occupations. These data should be provided by the Republic Statistical Office based on data from the Central Registry of Mandatory Social Insurance, but these data are not available or do not exist.

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