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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON ROMANIA'S ECONOMY: SECTORAL IMPACTS, LABOR MARKET SHIFTS, AND FUTURE FORECASTS

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ABSTRACT. Modern technologies are continuously transforming the world, and Artificial Intelligence may be considered one of the most important discoveries of this century. The unknown nature of this technology, mixed with the rational and irrational fears of the vast majority, makes this research a must to give some order to the chaos created in the last few years. A concise and explicative explanation of Artificial Intelligence (AI) is given to understand the potential of this technology. Many workers perceive this technology as a threat, while their employers see it as an opportunity to cut costs. The main objective of this study is to identify the possible impact that the application of AI may have in the future, in Romania, in each economic sector (primary, secondary, and tertiary). This will lead to an in-depth analysis of the transition that AI will force on these sectors.

Keywords: Artificial Intelligence, labor market, productivity, economic sectors

JEL classification: E24, J29, O39, L86

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Introduction

Technology represents the engine that helps an economy grow and evolve. This impacts productivity by making processes faster and more precise. It can be introduced through different economic channels, but the main creators and importers of technology are firms. This has an impact, especially on the lives of workers, who can access the last novelty and can increase both their welfare and their benefit. Research & Development (R&D) and accessibility to new technology represent a necessity for developing countries that want to evolve. There is no underdeveloped country in the history of economics that has advanced without investing in this sector. One of the technologies that had the highest adoption rate in the last years is Artificial Intelligence (AI). It includes a diverse range of technologies and "refers to the development of computer systems capable of performing tasks that typically require human intelligence" (Loukides & Lorica, 2016). Since the design of the Turing test proposed by Alan Turing in 1950 (Russell & Norvig, 2021), this concept has become a constant in the world of computer science. In fact, in the last years, at the global level, each industry has started to apply this technology in their manufacturing process, marketing strategy, business analytics, and most importantly in their products. By doing so, many more people started to experiment with it and realized how impactful it is on their daily lives.

What computers do best with their basic function is to perform repetitive tasks that can also be done by humans but are considered tedious. For example, a computer will easily count the distribution of letters in a book but will hardly recognize all the elements in a simple picture. At the same time, a human will be able to instantly identify all the elements in the same picture but will need a countless amount of time to enumerate all the apparencies of a defined letter in a book. AI tries to take the best characteristics from both humans and computers, by using more complex algorithms in a way that resembles human thought. However, the goal of achieving a fully functional AI that replicates a real brain is far from being reached. This can be noticed just by analyzing the development and classification of AI.

Review of Literature

According to (Joshi, 2019), AI technology can be classified based on capabilities in: Artificial Narrow Intelligence, Artificial General Intelligence, and Artificial Superintelligence.

Artificial Narrow Intelligence (or "Weak AI") excels in performing specific tasks with a high level of accuracy and efficiency, in a way that equals or exceeds human intelligence. They represent the current state of most AI systems and are applied in a wide range of cases from self-driving vehicles to spam filters. (Joshi, 2019). There are millions of narrow AI applications: digital voice assistants (Siri, Alexa), expert systems, speech recognition, computer vision (Sharda et al., 2021).

Artificial General Intelligence (or "Strong AI") possesses human-level intelligence or surpasses it in a wide range of tasks. Artificial Super Intelligence represents the last known stage of the evolution of AI. It is a hypothetical machine intelligence that can surpass the human brain in all aspects (Joshi, 2019).

Based on their resemblance to the human mind and their ability to "think" and "feel" like humans, AI systems can be classified into four categories: reactive machines, limited memory machines, theory of mind, and self-aware AI (Joshi, 2019).

Over time, globally, many companies discovered AI and started to invest more in R&D. Corporations like Google, OpenAI, IBM, and Microsoft started to work on their AI solutions, and many others followed them. This created a fast-paced run to create the most versatile and precise Large Language model. Those models have become a major force shaping the world and affect every market that exists. On 30 November 2022 OpenAI first released an early demo of the ChatGPT and only in five days the chatbot had attracted over one million users (Marr, 2023). These weren't the first AI solutions released, but they created a turning point in modern history. After their general release to the public, many other companies followed and published their own models. This created curiosity, especially among business-related people who see this as a revolution and who saw a possibility of cutting costs. At the same time, workers, especially from the service sector are seeing it as a threat. This dual divided the public into two factions. On the one hand, one can see the ones that are ready to automate their work, are overly excited about this technology and are ready to delegate their tasks to AI. On the other hand, there are the scared ones, that fear an AI war in the style of a science fiction film and want to stop the development of this technology.

This behaviour was explained by (Acemoglu & Restrepo, 2018) who provided a theoretical framework to understand the impact of new technologies on the labor market. This can also be seen in the current literature about the implications that AI brings in the labor market. In general, two broad categories can be found, one positive and the doomsayers (Acemoglu & Restrepo, 2019).

Globally, the impact of AI on the labor market will be considerable, as this is different from any other technology introduced in the past. The first reason is strictly related to the ability of AI to adapt beyond repetitive and noncognitive tasks. This means that also those sectors with a higher rate of uncertainty, including less repetitive jobs, could be affected. This leads to the second reason or the fact that AI is a general-purpose technology, in other words almost every sector can be affected, including low-skilled, middle-skilled, and high-skilled jobs. The last reason is the unprecedented speed of development (OECD, 2023).

All sectors can benefit from the use of AI. Viewed through the branch structure, the economy is divided into the following: primary sector - focussing on extracting or harvesting natural resources directly from the earth, including agriculture, fishing, forestry, and mining; secondary sector, transforming raw materials into finished goods or intermediate products, including construction, manufacturing, energy production, and processing industries; tertiary sector - focusing on providing services, including retail, hospitality, healthcare, education, finance, transport, communication, IT, and tourism. The *quaternary sector* is based on knowledge and includes ICT, R&D, consulting, financial technology, innovation, and intellectual property (IMF, 2024).

In the primary sector AI can improve crop yields, optimize resource usage (e.g., water and fertilizers), and predict events like floods or pest invasions. AI-powered systems can monitor the health of livestock health and reproductive cycles using image recognition. Smart-crop monitoring, drone farming, smart-livestock monitoring, and autonomous farming machinery have the potential to radically transform many aspects of farming (Goedde et al., 2020).

Secondary sector can benefit from AI to enhance production processes, for quality control, and for equipment failure prediction. However, the applications are not only limited to the manufacturing fields but also to the extractive ones. Analyzing geological and seismic data for resource identification, using AI (machine learning and deep learning) can improve the efficiency, accuracy, and effectiveness of exploration processes (Daramola et al., 2024). In energy production, AI can forecast demand, optimize power generation, and support self-healing grids.

In the tertiary sector (services) AI is widely applied in customer service (e.g., chatbots), marketing, and dynamic pricing optimization. Banks and insurance companies use AI for fraud detection (Finance Talks, n.d.), risk analysis, and

personalized plans. Not only the private sector but also the public one will be able to benefit from AIs. Public healthcare can benefit from AI's predictive analysis of symptoms based on past and current history of patients. Industry 4.0 is widely recognized as the driving force behind the current wave of technological transformation, integrating advanced technologies like AI, robotics, the Internet of Things (IOT), autonomous vehicle, 3-D printing, etc. into every facet of the economy (Schwab, 2024). In IT and software development, AI is used for automation, cybersecurity, and operational efficiency. AI drives innovation in software development automating tasks and boosting productivity in different areas: code generation, testing, bugs detection and fixing, project management, security, UX design and improves IT operations (Finio & Downie, 2024). Industry 4.0 supports the creation of advanced tools for other industries, making it a key player in technological advancement.

AI technologies can help companies in the quaternary sector increase innovation, optimize their processes, optimize innovation strategies, extract insights form data for better decisions, and provide products or services tailored to market demands. By using AI, companies can improve the R&D cycle and reduce the time it takes to bring new products to market (Rout et al., 2024).

Each sector benefits differently, with the tertiary and Industry 4.0 sectors experiencing the most immediate and significant impact due to their adaptability and reliance on technology.

People are insecure about their future and don't know how to behave in front of so much novelty brought by this technology. From employees to business owners, and wealthy to poor countries all will be affected by the AI revolution. According to World Economic Forum (2025), over the next five years, 170 million new jobs are projected to be created (equivalent to 14% of today's total employment), while 92 million existing jobs are expected to be displaced (8% of total employment). Li (2022) emphasises that the new digitalization revolution will have a significant impact on employment in the years to come. Almost every job will change, and many employees will need to acquire new skills to adapt to changes (Li, 2022).

Nonetheless, Romania seems to have embraced this reality in a more conciliative way, if compared to other countries. According to an IPSOS survey conducted in 2023 in 31 countries, Romanians seem to be more receptive to the advantages of AI and less concerned about the disadvantages. Around 77% of Romanians seem to know what AI is, compared to the global average of 67% (IPSOS, 2023). Furthermore, almost three-quarters (73%) of the Romanian respondents seem to be aware of the changes that AI will bring to their daily life over the next 3-5 years. However, not all people are positively seeing these changes, especially if they are asked about the jobs. However, 30% responded

that AI will positively impact their jobs and 44% consider that nothing will change. Around 37% of the Romanian participants are sure that this technology will hurt the labor market. On the contrary, 33% expect the impact to be positive, and 25% believe that there will be little or no changes. This general attitude seems to differ depending on the context in which AI is applied. People appear to be aware that their daily lives will change but are still disturbed by the idea of the changes that will be brought into the labor market (IPSOS, 2023).

In Romania people think of having understood what AI is, but the reality is that not many are considering all the real implications, both positive and negative. This attitude will almost certainly bring an unpreparedness of the workforce in the future labor market. Based on a global study done by PWC in 2024, on 56 thousand workers in 50 countries and regions, including more than 500 Romanians, half of the Romanian workers believe that there is too much change at work happening at once, and 41% do not understand why things need to change at all. Workers also consider that their workload has increased significantly in the last 12 months (50%) and they had to learn to use new tools/technologies in order to do their job (45%). However, there are also strong signs of optimism and engagement. Most of the employees (87%) say they are ready to adapt to new ways of working. Many are eager to upskill and see potential in using GenAI to increase their efficiency (PWC, 2024).

Romanians do not differ too much from the rest of the world. Still, they seem to understand the benefits, but they have quite a diverse opinion on the effects that AI will have on the national economy and the labor market in Romania. This market is evolving and progressing, adapting to a continuously growing economy. But it presents many challenges too. Unfortunately, the population of Romania decreased in 2024 by around 0.94 percent from the previous year and is currently ranked eighth in the top 20 countries with the highest rate of population decline (O'Neill, 2025a). With phenomena like the growing number of elderly and the exodus of youths to other countries, it's estimated that the population of Romania will steadily decline by about 720 thousand people from 2024 to 2030 (O'Neill, 2024b). Therefore, Romania faces a declining population due to low birth rates and emigration, continuing a long-term demographic trend influenced by an ageing population. Moreover, the Romanian labor market will also be impacted by the incoming AI revolution, which will bring both novelty and loss of jobs. In other words, this market will need to confront, both internal and external challenges.

Romania's labor market has experienced modest improvements, influenced by economic fluctuations, demographic shifts, and policy changes. The average employment rate between 2022-2024 was approximately 63%, and this rate is estimated also for 2025. As gender, the male employment exceeded the female

employment in recent years. Concerning the unemployment rate, one can highlight that youth employment and unemployment rates were the highest ones (Eurostat, 2024). The employment rates for individuals aged 15-64 years are constantly the same, while the youth unemployment rate remained high (Eurostat, 2024). According to the European Commission (2025), the unemployment rate is expected to decrease to almost 5% by the end of 2026.

In Romania, many companies started to invest in R&D when they realized that they could outsource to Europe and still have their costs under control. For this reason alone, the country is not seen as an R&D centre, but rather as an alternative to Western or Asian countries. In fact, in Romania in 2022, 29.2% of the employees were working for foreign corporations that were coming especially from Germany, France, and the United States of America. Considering those data, it's easy to observe that external companies are playing a major role in the Romanian labour market in Romania (INS, 2024a).

Nonetheless, one can state that Romania is still facing a rapid transition period, from the manual and inefficient work of the Communist era to a more automatized and productive labor force. Moreover, it's also fighting an ageing and decreasing population that tests the country's ability to adapt, by obliging it to find alternative methods to maintain its growth. Because of these very reasons, AI may be seen as one of those technologies that may help the country to continue this path and may help the transition to a developed country. Still, this will be possible only if people understand its benefits and limitations, to be able to apply it most efficiently. This is the reason why it's very important to analyze the current use of AI and how it can help Romanian economy in the future.

The remainder of this paper is organized as follows: the second section describes the research methodology that has been employed; the third section highlights the main research findings and finally, the last section underlines the most important conclusions of this study.

Material and methods

Aiming to reach the main objective of the paper, detailed work of data processing, analysis and forecast was done. For historical data (time span 2015 - 2024), this study principally used primary quantitative data that was collected nationally by the INS (National Institute of Statistics). Although INS releases quarterly and annual reports, few of them provide data that compares or illustrates evolution over time. This is precisely why extensive data collection and cleansing was carried out. The main topics of the data gathered from the INS were GDP

relative to the different sectors (primary, secondary and tertiary) including their evolution, as well as their employed labor force. Moreover, to obtain a more accurate perspective of the labor force evolution and forecast in the primary, secondary and tertiary sectors, different non-governmental reports were used. The two main ones that supplied both qualitative and quantitative data were IPSOS (2023) and PWC (2024). Although the first one provided useful insight into Romanians' perceptions on AI, the second one was essential in locating comprehensive data about the future evolution of the labor force and sectors. For the period 2025 – 2030, the data were obtained by extrapolation, using a linear regression model or an exponential one (where applicable) adjusted with a coefficient specific to each sector. The decision between exponential and linear regression was based on whether the model captured the evolution more accurately.

For the linear function $Y = (m + c)x + b$, m represents the growth coefficient (the one that can be calculated from previous years) and c represents the chosen coefficient of growth.

For the exponential function $Y = a \cdot e^{(b+c)x}$ b is the growth rate, and c remains the chosen coefficient of growth. To avoid ambiguity between the models, the R^2 coefficient was calculated for each case. The R-Squared, or coefficient of determination, represents how good a model fits the real data, by calculating the difference at each point in time between the forecasted data and the actual one.

$$R^2 = 1 - \frac{SS_{res}}{SS_{tot}}$$

where SS_{RES} is how well the data from the regression model represents the actual data and SS_{tot} represents the variation in the data used for the regression. This gives back a result between 0 and 1, where 1 is a perfect fitting model.

A premise that was considered in this forecast analysis was that Romania in the next five years will keep the RON as its currency. This is needed for two main reasons: the first is that EUR and RON have a different inflation rate; the second is more pragmatic and is related to mitigating some values that may increase to an unreasonable value until 2030. Initially, all the forecasts were calculated in RON, but then were transformed into euro at different exchange rates for each year (to simulate inflation among all the years). Therefore, the values highlighted in each chart are in EUR. After inserting all the values into a unified format (using Microsoft Excel), the data was standardized and cleaned. To give a first insight into the data a simple average was used to study the

increase in coefficient over the last 9 years. This offered help to determine whether the increase could be considered linear or exponential. Then some realistic values regarding purchasing power parity were selected. Many of them just implied that by applying AI the productivity could increase by a given value ('n' value) and did not really specify a time frame. For this reason, initially the linear increase was applied and just then boost it year by year by applying the spread values to have an 'n' increase at the end of the timeframe. Using this method, the increase would be steady and realistic and would not lead to extreme values. For the forecast in each economic sector, a simple linear regression was used. This aspect was especially considered, specifically in the IT&C sector. In the end, the yearly value of purchasing power parity was calculated for the historical years and the forecasted values were calculated with the purchasing power parity with the different coefficients (the 'n' values), that comprehended a worst, average and best-case scenario. Productivity per employee was calculated considering both the evolution of the number of employees in each sector analyzed and the volume of production.

Results and discussions

In recent years, Gross Domestic Product (GDP) breakdown was registered for agriculture, industry and services, while the quaternary sector is rising sharply. In Romania, the contributions of the primary, secondary, tertiary and quaternary sectors to the country's gross domestic product in 2023-2024 was: 3-4 % agriculture, 26-27% industry, 60-61% services, while the rest of 10-12 % was represented by the quaternary sector (World Bank Group, n.d.). At the same time, the contribution of these main economic sectors in Romania to labor market was: 22% by the primary sector, 30% by the secondary sector, and 49% by the services sector which also includes also the components of the quaternary knowledge.

Romania is a country where the difference between sectors is abysmal. For example, while companies in the service sector are helping to develop AI, many farmers in the primary sector still use the same ancient method to harvest their fields. A paradox that will create a significant digital division with far-reaching consequences, especially in the labor market. That translates into deeper challenges for the country, related to the infrastructure gap, digital literacy leaks and investment skepticism (Cibian & Dragan, 2022).

Therefore, the implementation of AI technology in different sectors in Romania will be carried out at different speeds and with different approaches. Some sectors like the tertiary one or some branches of the secondary one are already applying those technologies today, meaning that the labor shift will be more controlled in the future. Meanwhile, the primary sector will have the most uncertain future, and for many years the situation of the labor market will not change.

Furthermore, due to the increase in the use of AI in the main economic sectors in Romania, an overview and forecast of employability and productivity for the primary, secondary and tertiary sectors is highlighted.

Overview of changes in the primary sector

This sector is mainly made up of most old farmers who are working or producing for their sustainment and are not looking at profits. Many of them are still skeptical about the implementation of AI, which will not bring enough benefits compared to the risk of investment. But for the big farmers that compose less than 2% of the total number, AIs could be applied in response to the crisis that is hitting the labor market too. By increasing production and controlling it thanks to AI, it will be possible for them to control a bigger field with fewer but more prepared employees. In addition, people will need to be instructed to operate the complex structures that will run the farms of the future.

The primary sector in Romania is probably the one that will not be ready to evolve rapidly in time to apply AI. For example, for a farmer who lives in a rural area and does not have the correct infrastructure and recognition, the possibility to access AI resources will be limited. This will especially impact productivity and competitiveness. In front of a more productive farmer, the less productive ones will struggle to sell their products and sustain themselves. In fact, as productivity increases, the costs are cut and the prices are cut, too. Most small Romanian farmers will not have the possibility to compete with these players and will struggle. Many of them are still not prepared and instead of facing new technologies and competition, will prefer to sell their fields, and find other jobs. This will especially happen to those under 50 years old, especially if they have a family to support. Those will prefer to move to more rewarding sectors such as the secondary sector, but it is not yet clear if they will prefer to move from rural areas to cities. In 2024 the number of people living in rural areas has increased with 0,4% compared with the previous year (INS, 2024b). This movement is tied to three phenomena. The first one is related to the post-COVID-19 pandemic situation, as people want to recuperate all the lost experiences after great calamities. The second is related to the pollution and living conditions of

cities that are becoming increasingly overpopulated. Meanwhile, the countryside is made up of communes close to roads and is still equipped with the internet, which permits people to work from home. In the end, the third phenomenon is related to the migrations of the diaspora that come back to the country and prefer to live far from the cities in a calmer environment. This clarification is needed as the number of people living in the rural areas in Romania will grow in the next year, but this will need to be differentiated from the number of Romanians who are willing to work in the primary sector.

The technology involved in this sector varies from precision agriculture to digitalized agriculture. Those will use fewer resources and will affect the labor market, as the quantity of the workforce needed will be lower. Only the ones willing to adapt will survive and will use any means to cut costs and improve productivity. These measures will principally imply an extreme reduction in the number of unqualified workers, which will be replaced by both automatization and more qualified ones. In Romania, in this sector around 1.000.000 jobs will be lost until 2035. Because of this very reason, it will become extremely important to increase the rate of farmers who follow superior studies or are upskilled by following courses.

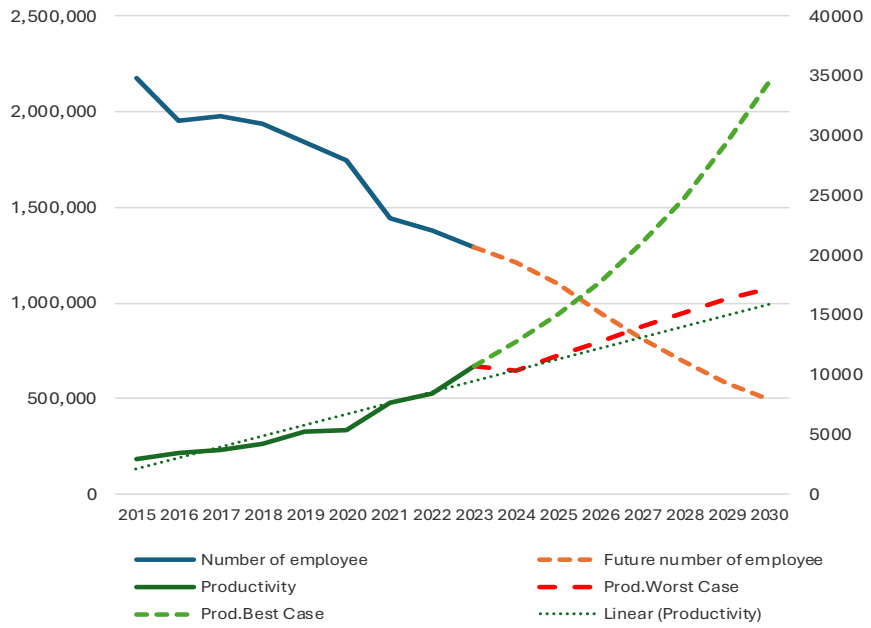

Figure 1. Number of Employees and Productivity Forecast in the primary sector
Source: Authors' own processing based on the data available at INS, 2024

Figure 1 responds better to the actual trend of the rapid reduction of self-employed people in the primary sector in Romania. Meanwhile, productivity will have two movements: one where in the future the implementation of AI will not lead in the innovation run - the linear forecast (or worst case), and another one where AI will bring, in the long run, a decisive increase in productivity - the exponential one (or best case).). Looking at the data one can notice that the number of employees will drastically fall reaching around 500.000 employees by 2030. Meanwhile, productivity will increase in an inverted proportion to the previous value. Two opposing phenomena are affecting this sector. The first one is the abandonment of the countryside by farmers, which is leading to a major productivity per worker. The second phenomenon is the adversity brought by the current farmers with their disbelief in these technologies, and climate changes, two effects that combined are slowing the increase of production, and as a result this directly affects also productivity.

Two main conclusions can be highlighted. The first is that in the future the falling number of workers will considerably influence the productivity of this sector. Because of this, the creation of big agricultural companies that will control most of the arable surface is inevitable. From here, the second point is related to the desire of those companies to implement new techniques that will involve AI too. As the quantity of fields is not infinite, and production per hectare neither, the only possible way to increase their exploitation and profitability is to use more advanced techniques and cut costs. Some examples are the use of the centralized system, which would monitor the conditions of a terrain, to control irrigation or the spreading of chemicals. Another may be the use of autonomous vehicles to cut the number of employees. Nonetheless, these choices will not affect this sector in the short run as much as they will in the long run. This is reflected also in the graph (especially in the worst-case scenario) because the possibility of expansion of the properties by buying more land will still be preferred rather than investments in R&D or new technology.

In conclusion, as much as AI systems may be seen as a response to the decreasing number of employees in the farming industry, still it represents too much of an investment for farmers. Because of this reason, in the short term, it is impossible to expect too much of an involvement of this technology in this sector. Still in the medium and long term, when the prices of the field will increase, and the one of AI technologies will decrease it is expected to see a major involvement of farmers in this field.

Overview of changes in the secondary sector

Globally, in the last few years, the number of people employed in the secondary sector has risen by around 30%. But, despite the stable number of people working in the industry and its rapid expansion, it is possible to conclude

that the changing factor was brought by the automatization of the processes. Moreover, it was estimated that the use of AIs increases the productivity in factories by 14.2% (Gao & Feng, 2023) and the costs are cut by 20%. Those permitted fewer workers to be employed in each factory, and at the same time pushed other investors to enter the market. In this way, in the last years the number of workers employed in this sector remained the same, but production per factory increased. These results can give a good insight into what will probably happen in the future. Still, those technologies are seen with skepticism, especially by medium and small companies that are concerned with the slow return of investment. For Romania, this specification is essential as most of the companies are considered micro and small (RBI, 2022).

Jobs in this sector are already being automatized, and in the future, they will improve their productivity thanks to the implementation of processes that may or may not include AI. It's important to consider, that currently, the Romanian companies in the secondary sector are still automating tedious processes thanks to the use of robots and are starting to overview their work with the use of sensors. These steps are necessary for these firms, as they represent a necessity to be able to access AI in the future.

Based on the current situation in the secondary sector in Romania it is possible to forecast that in the future productivity will grow and this change will be led by the tendency to automatize processes. Still, in the short run, the country will need to maintain the current path to be able to reach at least the level of its neighbours. To do this, many technologies will be implemented, but considering the use of AI it would be an overstatement, as the first step in this direction would be robotization. Considering this it's still safe to say that in the short run, the changes in the labor market will be limited to the automatization of robots, rather than AIs. In the next few years these technologies will not invade the secondary sector; they will rather buck it up. In fact, because of the current limitations of this sector, both economic and technological, it won't be possible to acquire and implement AIs. For these very reasons, the labor market in this sector won't be hit by an extreme event, in the next few years, and the demand will remain high. It's forecasted that until 2035 the manufacturing industry will acquire almost 500.000 new employees. Especially more qualified ones, that can operate new technologies rather than working manually. It is estimated that almost 222.000 unqualified jobs will be substituted, underlining the fact that in the future there will be a necessity to upskill the general workforce. This important aspect must be taken into consideration, as in the next few years almost 50% of workers will need to upskill (Li, 2022).

In Romania, in the secondary sector, for construction and industry, in the medium term is still possible to expect a larger adoption of AIs, as they will become cheaper and more accessible also for medium and small companies.

Moreover, it is expected that the productivity of factories that use AI is expected to increase to 28%, making it vital for the companies to be able to respond to the demand. For this very reason, considering the global impact that this technology will have, it will be almost impossible for the national industry not to adapt. As much as this automation will impact the economy positively, the destiny of the labor market is still uncertain. Starting with the medium and continuing in the long term, one of the factors that will define the trajectory will be the willingness of people to evolve. The reason behind this is related to the fact that AI technologies are made to permit humans to dedicate themselves to activities that require intellect and logical thinking and remove them from repetitive jobs. For this very reason in the medium term, there will be a higher loss of jobs among lower-skilled jobs and an increase in the demand for well-prepared and skilled workers.

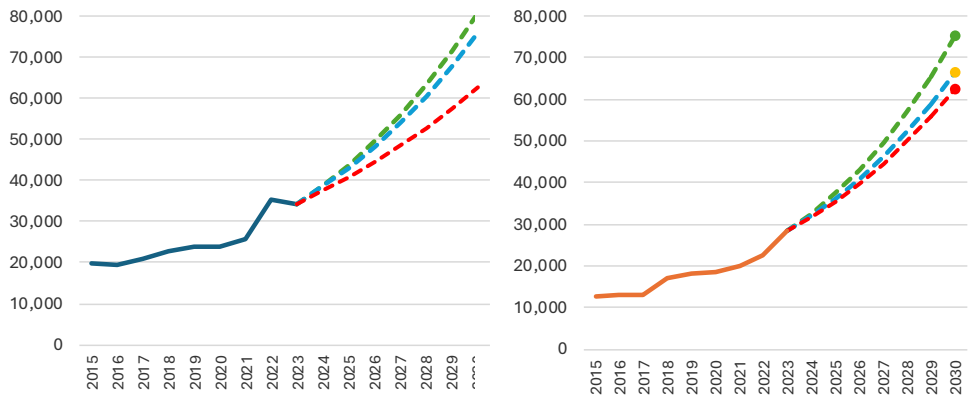

Figure 2. Productivity per Person Forecast in construction and Industry
Source: Authors' own processing

It can be noticed that productivity per person will steadily grow for both Construction and Industry at a very high rate. The reason behind these stays in the current growth rates (around 9% each) which must be summed to the forecasted productivity growth. For each, a worst, average and best case was chosen, and then the value was divided by 7 years reaching a more realistic number. It is possible to notice a very steep curve, especially for cases where AI is involved. It is also clear that if the growth continues at this pace, the productivity per person will almost double until 2035. But as much as those results may seem very high, another aspect that must be taken into consideration is the inflation rate. Considering the last available data, the current inflation rate as of the first trimester of 2025 is around 5%.

The Industry sector it's expected to adopt more new technologies because the investment has a more direct impact on the output if compared with the companies that operate in the primary sector. Meanwhile, for the construction sector, a more pessimistic approach regarding the application of AI must be considered. It is hard for AI to impact it, as the applications are not as direct as in the previous case.

Overview of changes in the tertiary sector

The tertiary sector in Romania is the greatest contributor to GDP, with a percentage of 57,61% in 2022, and also the major area for the number of people employed, with a value of 51% over the total active population (O'Neill, 2024). By looking at these data, it can be observed that this is the only sector in the country where the percentage of people employed is lower than the share of economic sectors in the GDP. In fact, in the last years, the service sector remained the main contributor to the GDP and in the future, it is easy to state that this contribution will only grow (Lloyds Bank, 2025).

This sector comprehends especially non-routine and routine cognitive jobs, two categories that in the past were hard to automatize, especially the first one, but that are targeted by AI. As much as AI may help to automatize some jobs, the demand for people who have the necessary knowledge to exploit and take care of these operations will still be high.

In this sector, one can underline the long-term trend of job substitution rather than job loss that will affect the high-skilled job market. This industry comprehends especially the IT&C workers, who will need to adapt to new technologies and acquire different knowledge from the present one, to be able to give a different value and knowledge from the one given by AI.

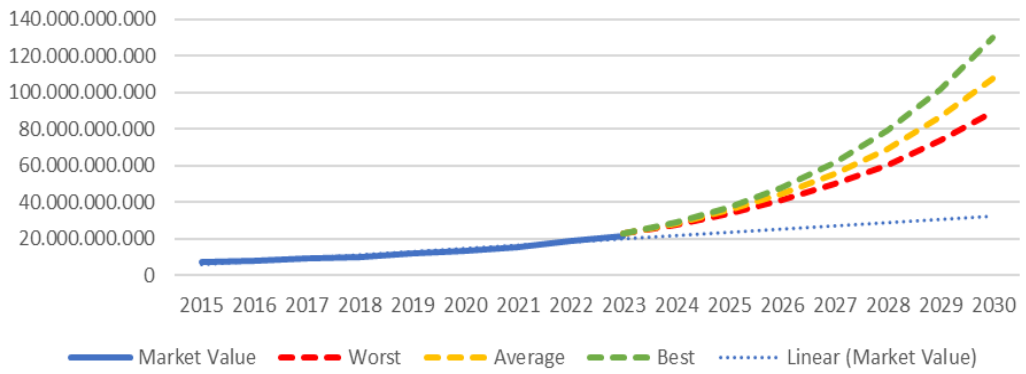

Figure 3. Future productivity per person in the tertiary sector.
Source: Authors' own processing

Depending on three possible scenarios until 2030, productivity may attain different values. Starting with the worst-case scenario where the growth will be 1%, meaning that the impact of AI will be minimal, the value will be around 150.000 euros per employee. Meanwhile, in the best-case scenario, with a value of 6,8% yearly, the productivity would reach 200.000 euros per employee, meaning that the impact would be much more considerate, and the market value would increase considerably. Moreover, the growth in the number of employees must also be taken into account, which for simplicity was set at a rate of 12%, since in the last few years its growth was almost linear. This can be translated into almost 350.000 new jobs created. By considering those factors it's possible to create three different scenarios in the future value of the IT&C market that may reach almost 130 Billion euros, in the best-case scenario, in the year 2030, and no less than 90 Billion in the worst-case one. Also, in this case, a mitigating effect is introduced by the high inflation rate that decreases those values considerably. The best case passes from the current value to 66 billion euros, meanwhile, the worst one reaches 46 billion euros. In this industry, it is possible to notice that with or without the presence of AI technologies, the growth is still steady. This behavior may be related to the fact that AI is already widely used, but also to the growing interest of the younger generations in this industry. The principal force that inflates these results is the number of new employees.

On the other industries of the tertiary sector, it is possible to notice a huge increment in productivity and the value of those markets. Still, it is important to consider that not all industries will be affected in the same way, especially public sectors such as Education and Health which will not be impacted by AI as much as the other.

Many sectors will be minimally impacted also in the long term, those comprehend especially all the jobs related to Education, Health and social care. In these industries, it won't be possible to introduce AI as the human presence, also in the long term, will be vital. AI systems still cannot be left alone to make decisions about what concerns the life of a patient or the grade of a student. Because of this very reason, AIs will be used more as a help, rather than a substitute for a medic or a professor. In the case of Health operations, AI systems will be integrated to analyze data and monitor patients, but they will not act unsupervised or with complete autonomy. In these industries, AI will still represent an important technology that will require workers to adapt. In fact, from schools to hospitals, starting from the students to the doctors, people in the medium long term will not be able to ignore it.

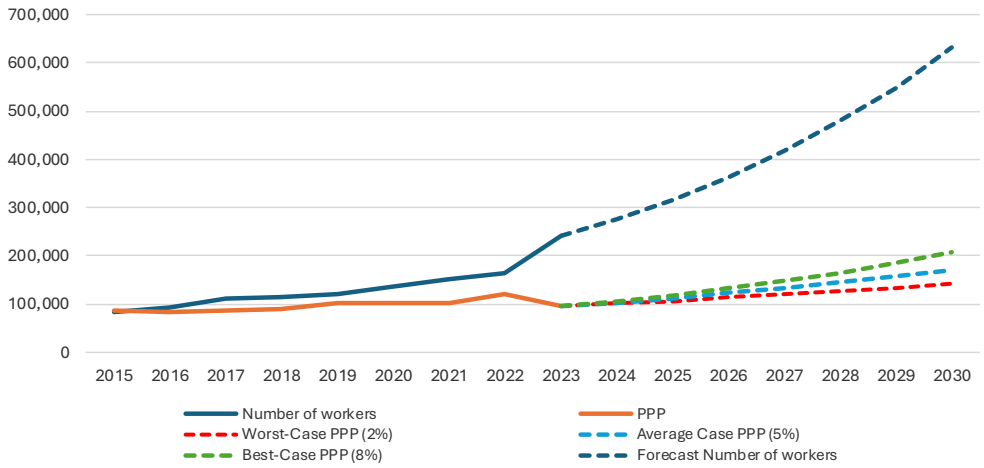

Figure 4. Future productivity per person and number of workers in IT&C.
Source: Authors' own processing

The principal 4.0 industry in Romania is the IT&C one which currently has a value of 21 billion euros (Boboc, 2022) and is growing at a rate of almost 12% yearly. In the 4.0 industry, some changes may be seen already in the short term, which will especially regard the productivity of the workers rather than the jobs per se. In fact, this area includes principally nonroutine cognitive jobs, which can hardly be automatized. Still being this sector purely based on R&D and highly innovative, and being the one that creates AI systems, it's easy to state that it will also be the pioneer that will adopt it in the first place. In this industry there is no doubt that companies won't wait long before introducing new technology, creating short-term uncertainty. At this time, the demand for jobs in this sector will slow down, because people will increase their productivity, and hence new employees will be redundant. This will create a period where employees will need to upskill and, in some ways, will create competition between humans and AI. Still in the medium long term when the need for people who can understand those technologies and hence can use them to reach greater results, the demand will grow, and new jobs will be created.

Taking into consideration all these data is still hard to make an accurate future prediction especially because it is important to take all the information given with a grain of salt, as it is almost impossible to expect a 40% growth rate in productivity in just one year. The key is to take a more balanced position between the ones that see this technology as a new industrial revolution and

doomsayers that predict disasters both from an economic and social point of view. Moreover, it's also important to take the data and apply it in a context as the Romanian one, where some investments are hard to take into consideration in the current context, for example, the application of AI in hospitals and education environments, as for the moment the country must face other problems. By considering all of these it's possible to make a future prediction that still considers the capacities of AI and at the same time doesn't overvalue the potentialities of the country. As the results show the future growth in the tertiary sector, productivity and employment brought by this technology is real and feasible. It is also possible to analyze this data from different temporal points of view giving this way a more real interpretation of it. In fact, by dividing the next 7 years into short medium and long terms it is possible to notice that the principal changes will happen starting with the medium-term as the situation in the short term will be challenging and not all industries will be ready to welcome AI.

Conclusions

Undoubtedly, many variables may depend on future forecasted values concerning how much the Romanian labor market will be impacted by AI. The weight that it might have on the labor market and hence on the economy is dependent on many other terms including the psychological factor and the faith to leave a machine to do vital tasks. Another aspect that must be taken into account and that adds complexity to the prediction is related to the future improvement of AI, which may or may not be major. Considering nowadays uncertainty, the number of variables increases, and Research, Science and people are moving faster than ever. Growing industries create new opportunities for people, meanwhile the automatization of jobs is substituting them for repetitive tasks. These two trends will affect the dynamicity of the labor market making it increasingly complex and with a higher variety. Almost any sector will benefit if AI is implemented in the right way and almost all of them will be obliged to do so. Romania finds itself in a very competitive market, with innovations that come from the other side of the world but also from its neighbours.

It is considered that Romania will evolve its primary, secondary, tertiary and quaternary economic sectors, and principally the ones which represents a good amount of its GDP. There will be many challenges that will affect the workers, especially the older ones that, in the future, will represent almost one-third of the workforce. This is another reason to think that in the short term, the country will struggle as this part of the population is harder to upskill.

AI will bring benefits in the long and medium term, but Romania and its citizens, as almost all the world will do, will need to adjust to it by passing on to a short period of uncertainty.

AI impact will vary and may represent a powerful instrument for the country to enhance itself. From higher productivity to the creation of new jobs, this technology will represent a double-sided blade, that will reveal its real potential only if the people will acknowledge its potential and dangers. Still, an aspect must be taken into consideration, that when external companies start to use this technology, also internal companies will be pushed to do the same, making it more a question of time since it will be widely introduced. As for the short term, it's easy to state that the changes will be minimal and will affect especially some industries like the IT one in the tertiary sector, but for the long term it will be harder to define whatever those changes will be drastic for the country. Faith in fact will depend almost totally on the preparation that people will have and on their willingness to adapt.

AI can help Romania to grow and develop, but technological and knowledge barriers are some obstacles that must be faced before continuing this path. People must be prepared and continuously updated on the current state of technological breakthroughs, to exploit this technology at its best. By doing so, problems like ageing and the decline of the population may be resolved by replacing the missing workforce with AIs and automatized processes. Still, this process will require a lot of time and in the meanwhile will continually impact on the labor market as its adoption grows. This will create many problems, especially in the short run, because people aren't ready yet. Many will look at this technology as a labor stealer, ignoring the fact that the possibilities are infinite. In fact, the main help will be given to productivity, which will grow in response to the automatization of many processes.

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