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The Dynamics of the ICT Workforce and the Effects on the Use of Artificial Intelligence Technologies in the European Union

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Abstract. *This paper represents an analysis made using statistical methods of the influence of the number of Information and Communication Technology (ICT) specialists on the number of businesses that use and invest in technologies based on artificial intelligence (AI). Throughout the article, the authors analyze two sets of statistical data collected by Eurostat: the share of ICT specialists in the overall active population and the number of companies that use and invest in AI technologies, both datasets referring to the European Union. Using several statistical methods, such as normality tests, correlation analysis and regression analysis on the datasets, the results show that the relation between the number of ICT specialists and the number of businesses that use and invest in AI technologies is a positive one, which means that the bigger the share of ICT specialists in the overall active population, the more businesses will adopt and use AI technologies. Therefore, the conclusions emphasize the important role that ICT specialists play when discussing about raising the rate of adoption of newer technologies, based on AI and the content of the paper underlines the fact that the more businesses and companies use and invest in AI, the more these technologies will be used in other industries as well, such as finance and education, the least playing a critical role in forming the next generation of ICT specialists with a strong knowledge in the AI field. The role these specialists play in growing the rate of adoption of AI technologies is also confirmed by the literature review. Moreover, the paper also presents a series of conclusions relevant to entrepreneurs and teachers that are willing to include these kind of technologies into their daily activities and also a series of measures to stimulate the rate of adoption of artificial intelligence based technologies in the European Union.*

Keywords: Artificial intelligence, Information and Communication Technology (ICT), Correlation analysis, ITC Workforce dynamics

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Introduction

The key of the educational sector in AI adoption

In all the countries that are part of the European Union, the usage rate of technologies based on AI in education is tightly coupled with the dynamics of the ICT sector. A key indicator of this relationship is represented by the correlation of the share of ICT specialists in the overall active population and the number of businesses and companies that use and invest in AI. This correlation underlines the connection between the technological progress and the quality of the educational process and how these two are mutually reinforcing. The whole ICT sector in the European Union has all the necessary means to accelerate innovation in the AI field by providing knowledge and skills that can be put to work in the educational field. We can divide ICT specialists into smaller categories such as software developers, data scientists and statisticians, each of them contributing to the projection and development of modern solutions based on AI technologies that satisfy the needs in the educational sector by making the learning activities more efficient, relevant and interactive.

Our Hypothesis is that the higher the ratio of ICT specialists to the overall working population the more businesses are adopting AI technologies in the EU. As we are making the assumption that the higher the efforts are made by educational institutions on forming ICT professionals, the more workforce will work in the ICT sectors, then, we can assume that the efforts in ICT education can lead to the growth of AI in private sectors.

The private sectors' investments in AI leads to benefits for the educational institutions

Investments in AI play an important role in the educational field, on the one hand through immediate improvement of educational tools and platforms and on the other hand, they play a significant role in shaping the future of education. These type of investments contribute to the development of modern educational platforms based on artificial intelligence which in turn improve the learning activities and make the educational process more efficient and relevant. Therefore, we can state that companies that invest in technologies based on artificial intelligence play an important role in the evolution of educational systems.

This study aims to analyze the relation between the workforce in the ICT sector and the rate of adoption of technologies based on artificial intelligence within the European Union.

Literature review

AI technology impact in private sectors

The paper (Lan, 2021) discusses the impact the technologies based on artificial intelligence have on financial management. The study presents a series of main functions of these types of technologies, such as anthropomorphic operation, intelligent computing and automatic adjustment and it also discusses the growing rate of usage of these technologies in several fields.

Moreover, the authors present the way management activities have changed with introducing artificial intelligence-based solutions. In the context of financial management, the study presents the way these practices can be improved by using artificial intelligence, more specific through enhancing intelligent data analysis.

In the article (Ma, 2021) the authors discuss the potential applications of artificial intelligence technologies in the financial sector. Throughout the article, the authors analyze empirical data that was obtained by the usage of a financial robot in an enterprise and also describe four aspects of financial intelligence applications, such as basic functionalities, intelligent data

processing, statistics and risk management. The study helps with understanding how these types of technologies can improve several activities in the financial sector.

The research paper (Naved, 2023) represents an analysis of how artificial intelligence-based technologies influence different business domains, such as supply chain management, financial management and performance management and demonstrates that adopting and using these technologies offers a significant advantage in these domains. The authors present how enterprises can benefit from adopting and using artificial intelligence-based technologies and discuss about the ability to analyze complex sets of data in a continuous manner and automating different business processes. Therefore, the authors conclude that several fields and sectors can have their business processes improved by using new technologies based on artificial intelligence.

Regarding the controversy that artificial intelligence-based technologies could replace people, the study (Prasanth et al., 2023) undoubtedly denies it and presents why these technologies represent a valuable asset when talking about making decisions. The authors state that with the help of artificial intelligence-based technologies, complex volumes of data could be analyzed in real time and insights can be generated in order to help people in decision-making roles. Moreover, the authors raise a warning regarding the fact that artificial intelligence technologies need to be used in a fully responsible and open manner.

In the paper (Bharadiya et al., 2023), the authors state that in present, artificial intelligence-based technologies reshape both business processes and the overall society and these types of technologies have the potential to change the way individuals and entities interact with each other. Moreover, in order to remain competitive, it is necessary for businesses to adopt and discover ways of using artificial intelligence in order to ease business activities and processes. Moreover, the authors underline the importance of businesses being open to new opportunities generated by artificial intelligence.

In the paper (Kutza et al., 2023), the authors propose to analyze research regarding trust in the usage of artificial intelligence technologies in healthcare and also analyze the comparison with several other subjects related to artificial intelligence in this domain. Therefore, the authors underline the fact that the research related to trust in the usage of artificial intelligence-based technologies is not enough represented in the actual research in comparison to other subjects. Moreover, the authors emphasize that systematic approaches related to the usage of artificial intelligence-based applications should also include research related to both characteristics of the users and these applications that could influence the development of trust.

The main goal of the research is to understand how trust has been addressed in artificial intelligence healthcare studies, comparing its emphasis against other topics related to artificial intelligence. Through a bibliometric analysis of nearly 13,000 article abstracts, the authors created a network that shows how often and in what context trust is discussed in scientific research on artificial intelligence in healthcare.

The use of AI in education

The study (Wong et al., 2020) analyzes the ways in which the education can be improved using artificial intelligence starting from kindergarten to 12th grade (K-12). The authors underline that, being in the same timeframe as the fourth industrial revolution, which is characterized through the development of artificial intelligence, internet of things and autonomous cars, we are required to include artificial intelligence solutions in schools in order to improve the educational process.

Another paper covering the subject of AI in education, (Ali et al., 2019) focuses on the development of K-12 AI education curricula. The paper addresses the important question of how

to prepare the students to excel in the era of artificial intelligence, considering that the children growing up in this era have a fundamentally different relationship with technology, being exposed to gadgets and tools from young ages.

The authors of (Polak et al., 2022) present a preliminary study on middle school teachers' perspectives on teaching digital competencies for Artificial Intelligence (AI) in Bulgaria, Greece, Italy, and Romania. The study uses the Will, Skill, Tool model as a theoretical framework and aims to inform the design of educational content and online platforms for integrating AI education in classrooms.

Furthermore, in the study (Yue et al., 2022), the authors provide a comprehensive analysis of the implementation and effectiveness of artificial intelligence (AI) education programs at the K-12 level. This systematic review, which spans from 2010 to 2022, focuses on empirical studies sourced from the Web of Science database to offer a detailed overview of AI teaching and learning (T&L) in this context.

The authors of the paper (Sanusi et al. 2022) analyze the situation of students enrolled in Nigerian secondary school in order to discover a set of competencies that students need for growing the degree of literacy in artificial intelligence domain. The study starts with the increasing relevance of artificial intelligence-based technologies in K-12 systems globally and the constant need for redesigning the curricula in order to fit into the newly created standards. The authors conclude by proposing a future research agenda and putting an emphasis on the need to understand the role artificial intelligence plays in developing competencies among students, especially in underrepresented areas.

Methodology

According to (Bharadiya et al., 2023), the domain of artificial intelligence is one of strategic importance and also an influence factor for economic development, offering the possibility of finding solutions and improving activities in various sectors such as healthcare, education and transport. Artificial intelligence offers us the possibility of gathering and analyzing large sets of data in order to make decisions in an as efficient as possible manner. The developed digital infrastructure, technologic capabilities and the strong regulations represent a series of advantages that can help the European Union become the world leader in artificial intelligence. A significant number of companies that operate in the artificial intelligence sector in the European Union focus on B2B segment (Business-to-Business) which represents as much as 76% of the total turnover, compared to 24% for B2C (Business-to-Customer), according to a report (European Institute of Innovation & Technology, 2021).

In 2023, 8% of EU businesses with 10 or more employees and self-employed workers used at least one of the following AI technologies (Eurostat[1], 2023):

- text mining;
- speech recognition;
- natural language generation;
- image recognition and processing;
- machine learning for data analysis;
- process automation software.

Within EU Member States, large companies have used AI technologies significantly more than small and medium-sized enterprises. As shown in Figure 1, in 2023, 6.4% of small businesses (+0.3 percentage points compared to 2021), 13% of medium-sized businesses (+0.4 percentage

points compared to 2021) and 30.4% of large businesses (+2 percentage points compared to 2021) used AI technologies. This significant difference can be explained both by the complexity of the process of implementing AI technologies and by economies of scale or costs required for such investments, which are less accessible to small and medium-sized companies. Another major challenge is the number of artificial intelligence specialists. Identifying and recruiting qualified ICT specialists to develop and manage AI solutions can be difficult, especially for small and medium-sized enterprises. Moreover, employees and management within these enterprises may be reluctant to adopt new technologies due to a lack of understanding of the benefits or fear of being replaced by automated processes.

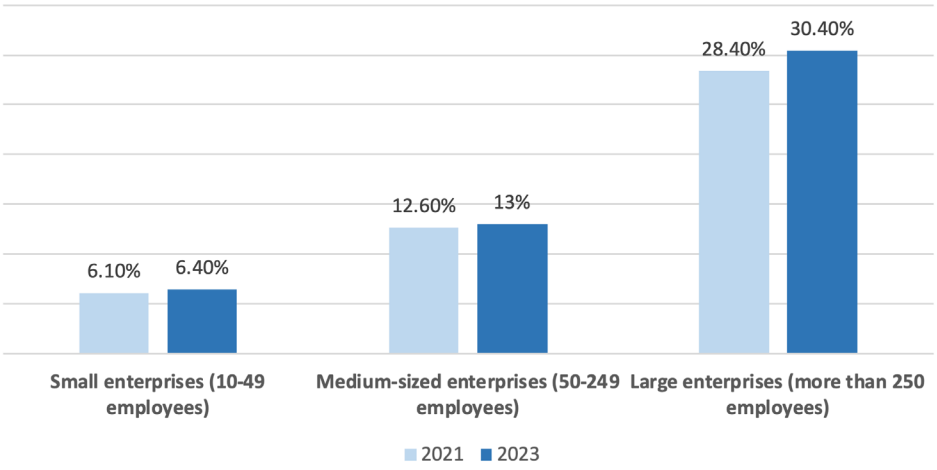

Figure 1. Small, medium, and large enterprises in the European Union using at least one AI technology (% of all enterprises)

Source: Authors' own research, based on Eurostat[1], 2023.

The share of enterprises using at least one AI-based technology among Member States in 2023 ranges from 1.5% to 15.2%, as shown in Figure 2. The highest share was recorded in Denmark (15.2%), closely followed by Finland (15.1%), Luxembourg (14.4%) and Belgium (13.8%). The countries with the lowest rate of adoption of AI technologies among enterprises were Romania (1.5%), Bulgaria (3.6%), Poland and Hungary (both with a share of 3.7%), while the EU average share was 8%, 0.4 percentage points higher than in 2021. The increase in the number of enterprises using AI solutions largely reflects the commitment and ability of Member States to accelerate digital transformation, while being an important indicator of the EU's resilience and ability to adapt to technological change and remain globally competitive.

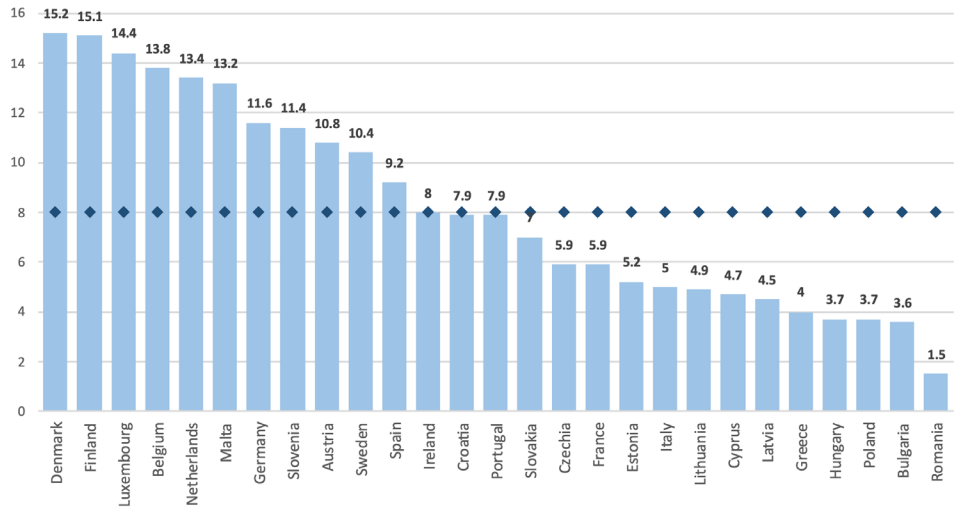

Figure 2. Enterprises in Member States using at least one A.I. technology in 2023 (% of all enterprises)

Source: Authors' own research, based on Eurostat[1], 2023.

The rate of adoption of artificial intelligence technologies among enterprises in the European Union is a significant measure of the development of Member States' digital economies, with a direct impact on the competitiveness, innovation, and sustainability of those economies. The ICT infrastructure needs to be complemented by the right skills to benefit from the opportunities offered by the digital economy. A key element for a successful digital transformation of the European Union is represented by a set of skilled specialists with the potential to sustain and develop digital economies.

According to data presented by Eurostat2 (2023), the number of ICT specialists employed over the last decade has increased every year, despite the negative effects of the recession in most labour markets. Thus, the share of ICT specialists in total employment increased by 1.3 percentage points, from 3.3% in 2013 to 4.6% in 2022. Having a significant amount of skilled workers in ICT represents a key driver of digital innovation and plays an important role in the modern economies. Although the number of ICT specialists represents a relatively small segment of the total workforce, ICT employment has proven to be relatively resilient to the cyclical nature of economic events over the last decade (Eurostat3, 2023). As can be seen in Figure 3, annual growth rates for the number of people employed as ICT specialists have been consistently higher than those for the total workforce in the European Union: while the number of ICT specialists employed grew at an average annual rate of 4.7% (total growth of 57.8% over the period 2012-2022), total employment has grown by an average of 0.8% each year, i.e. by 8.8% over the period 2012-2022 (Eurostat3, 2023). This growth trend can be seen as a measure of the digital transformation affecting the whole European economy.

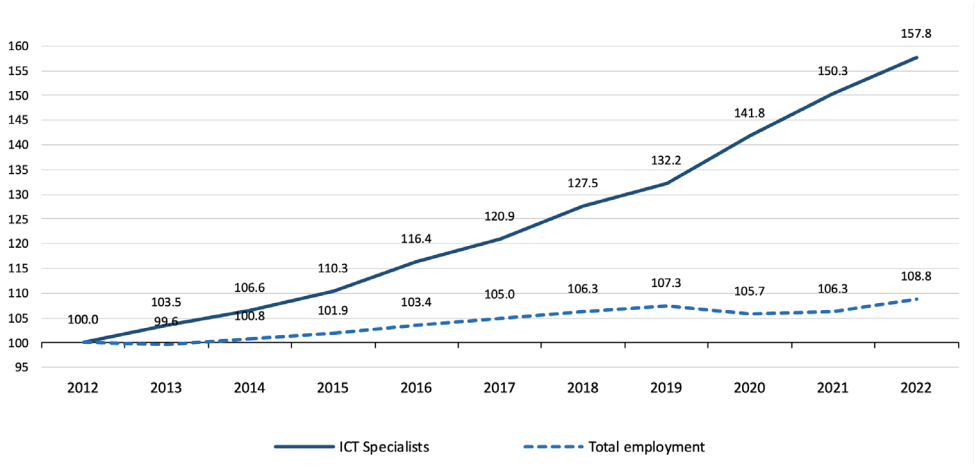

Figure 3. Index of the number of people employed as ICT specialists and the total number of employees in the European Union (%)

Source: Authors' own research, based on Eurostat[3], 2023.

In 2022, more than 9 million people were employed as ICT specialists in the European Union, representing 4.6% of the total employed population. Of these, according to Eurostat3 (2023), most were working in Germany (22.6% of all ICT specialists in the EU, i.e. 2.1 million), France (13%, i.e. 1.2 million) and Italy (9.6%, i.e. 0.9 million ICT specialists employed).

As can be seen in Figure 4, Sweden had the highest relative share of ICT specialists, accounting for 8.6% of the total employed labor force, followed by Luxembourg (7.7%) and Finland (7.6%). Relatively high shares were also recorded in the Netherlands, Estonia, and Ireland, where at most 1 in 17 of the total employed population work as ICT specialists. At the other end of the scale, ICT specialists accounted for only 2.8% of the total employed population in Romania and 2.5% in Greece.

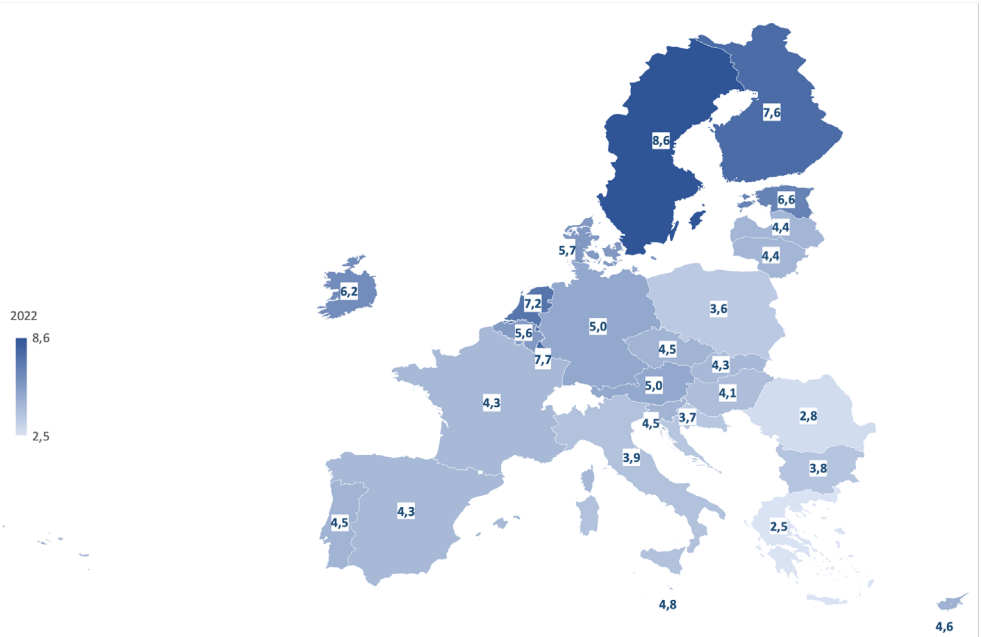

Figure 4. Relative share of ICT specialists in total EU jobs (%)

Source: Authors' own research, based on Eurostat[2], 2023.

The number of ICT specialists employed and the rate of adoption of AI-based technologies in enterprises among EU Member States are two interlinked issues that play a key role in the evolution and competitiveness of the economies of those Member States, and of the EU in general. The ICT industry is naturally at the forefront of the adoption of AI technologies, with companies in this sector often being the first to develop and implement AI-based solutions, from automation software to complex machine learning and autonomous decision-making systems based on external factors. A large number of ICT specialists employed suggests not only an economic growth of this sector, but also a broad impact on other industries, as AI-based technologies become fundamental in various fields such as healthcare, education, manufacturing, transport etc.

Consequently, we can formulate the following research hypothesis: An increased share of employed ICT specialists in the total workforce influences the adoption rate of AI technologies among enterprises, implying a faster digital transformation of Member States.

The analysis refers to the 27 Member States of the European Union, the data is presented for the year 2023 or the latest available value, and the statistical processing and analysis was carried out using the XLSTAT software (Addinsoft, 2023). The list of variables included in the analysis is presented in Table 1.

The analysis of the effects of the share of ICT specialists in total employees on the adoption rate of artificial intelligence technologies in enterprises in EU Member States will be done using correlation and regression analyses. The time difference between the two data sets is necessary to explain the deterministic relationship between them. The application of the regression method requires the prior establishment of the causal relationship, i.e. the deterministic model expressing the dependence between the variables under analysis:

$$Y = f(X) + \varepsilon = f(x_1,x_2,...,x_n) + \varepsilon \quad (1)$$

where:

$X = (x_1, x_2, ..., x_n)$ represents the exogenous variable - ICT_SP;

Y represents the endogenous variable - AI_ENT;

ε is the residual variable (random error) reflecting the influence of random factors on the model.

Table 1. Variables of the Model

Variable	Name of the indicator (link to the data source)	Source
AI_ENT	Enterprises using at least one AI technology (% of all enterprises with more than 10 employees) https://ec.europa.eu/eurostat/databrowser/view/isoc_eb_ai/default/table?lang=en	Eurostat[1], 2023
ICT	Number of ICT specialists employed (% of total workforce). https://ec.europa.eu/eurostat/databrowser/view/isoc_sks_itspt/default/table?lang=en	Eurostat[2], 2023
ICT_SP	Transforming the original data (number of ICT specialists employed as % of the total workforce) to a normal distribution using the Box-Cox transformation (Box & Cox, 1964), for $\lambda = 0$: $y(\lambda)= (y\lambda-1)/y$, if $\lambda \neq 0$ (2) $y(\lambda) = \log(y)$, if $\lambda = 0$ (3)	Authors' research

Source: Authors' own research.

The model used is a general probabilistic model for simple linear regression:

$$y_i = \beta_0 + \beta_1 \times x_i + \varepsilon_i \text{ , } i=\{1,..,n\} \quad (4)$$

where:

y_i represents the numerical values of variable Y - AI_ENT (%) recorded at the level of statistical unit *i*;

x_i represents the numerical values of variable X - ICT_SP (%) recorded at the level of statistical unit;

β_0 and β_1 represent the coefficients of the regression function;

ε_i represents the residual component for the statistical unit *i*.

For the purpose of investigating the research hypothesis, a study of the literature on artificial intelligence technologies used in companies and the number of ICT specialists employed was conducted, followed by a visual inspection and an analytical method to determine the nature of the relationship between the two variables.

Results and discussions

In order to test the research hypothesis, the correlation between the share of employed ICT specialists (variable ICT_SP) and the share of companies using artificial intelligence-based technologies (variable AI_ENT) among EU Member States in the years 2022 and 2023 will initially be analyzed.

Table 2. Data normality tests

	AI_ENT	**ICT_SP**
Shapiro-Wilk test (df = 27)		
W	0.926	0.959
P-value	0.056	0.348
α (alpha)	0.050	0.050
H_0 - Residuals follow a normal distribution. H_a - Residuals do not follow a normal distribution. As the computed P-values are greater than the significance level alpha = 0.05, one cannot reject the null hypothesis H_0.		
Skewness	0.327	0.102
Kurtosis	-1.225	0.203

Source: Authors' own research.

The normality of the data distribution was tested using the Shapiro-Wilk test (Table 2). The result shows that the variables follow an approximately normal distribution for a statistical significance level of 5%.

Correlation matrix (Pearson)

Variables	*ICT_SP*	*AI_ENT*
ICT_SP	**1**	**0.699**
AI_ENT	**0.699**	**1**

Values are different from 0, with significance level alpha = 0.05.

P-values (Pearson)

Variables	*ICT_SP*	*AI_ENT*
ICT_SP	0	0.00005
AI_ENT	0.00005	0

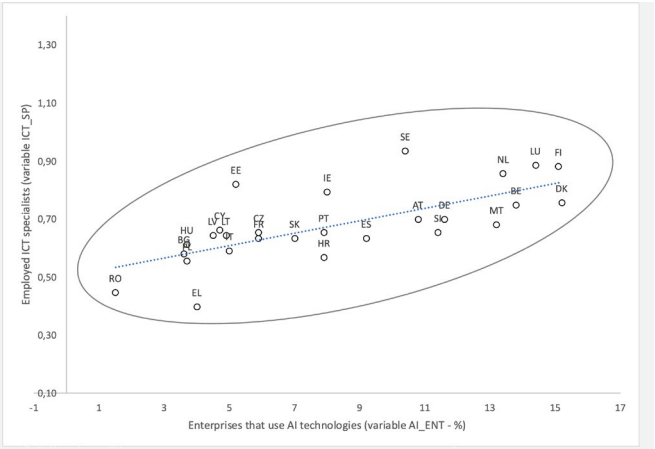

Figure 5. Correlation analysis

Source: Authors' own research (using XLSTAT).

The Pearson correlation coefficient (r = 0.7) is used to analyse the statistical correlation between the ICT_SP and AI_ENT variables and indicates a direct correlation of medium intensity (Figure 5). The correlation coefficient is statistically significant for a 5% significance level and p-value < 0.002 (Rodgers & Nicewander, 1988).

Regression of variable AI_ENT Goodness of fit statistics	
Observations	27
Sum of weights	27
Degrees of freedom (*DF*)	25
R^2	0.489
Adjusted R^2	0.468
MSE	9.105
RMSE	3.017
MAPE	39.320
Durbin Watson (DW)	2.079
Cp	2.000
AIC	61.559
SBC	64.151
PC	0.593

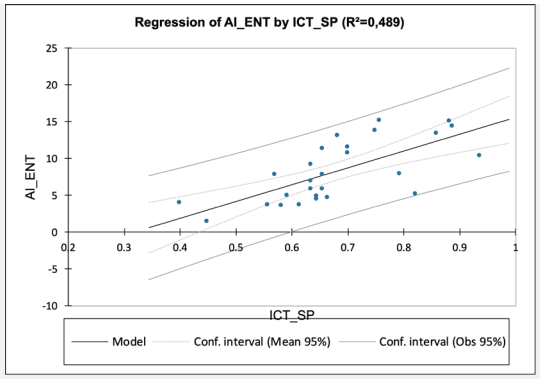

Figure 6. Regression analysis - part 1

Source: Authors' own research (using XLSTAT).

The regression model (Figure 6) used to analyze the relationship between the share of ICT specialists employed (variable ICT_SP) and the share of firms using artificial intelligence-based technologies (variable AI_ENT) among EU Member States involves estimating the parameters of the equation:

$$AI\_ENT(\%) = \beta_0 + \beta_1 \times ICT\_SP + \varepsilon \quad (5)$$

Analysis of variance (AI_ENT):

Source	DF	Sum of squares	Mean squares	F	Pr > F
Model	1	217.725	217.725	23.914	**<0.0001**
Error	25	227.616	9.105		
Corrected Total	26	445.341			

Note: computed against model Y = Mean (Y)

Model parameters (AI_ENT):

Source	Value	Standard Error	t	Pr > |t|	Lower bound (95%)	Upper bound (95%)
Intercept	-7.265	3.219	-2.257	0.033	-13.894	-0.635
ICT_SP	22.822	4.667	4.890	<0.0001	13.211	32.434

Equation of the model: AI_ENT = -7.265 + 22.822 × ICT_SP

Test on the normality of the residuals (Shapiro-Wilk) (AI_ENT):

W	0.961	H0: The residuals follow a normal distribution.
P-value (*two-tailed*)	0.381	Ha: The residuals do not follow a normal distribution.
α (alpha)	0.05	As the computed p-value is greater than the significance level alpha=0,05, one cannot reject the null hypothesis H0.

Figure 7. Regression analysis - part 2

Source: Authors' own research (using XLSTAT).

The model explains 48.9% of the variation in AI_ENT (Figure 7), is valid at 5% significance level and validates the proposed research hypothesis. The regression coefficient is statistically significant at 5% significance level. The regression equation of the model is:

$$AI\_ENT(\%) = -7.265 + 22.822 \times \log(ICT) \quad (6)$$

Conclusion

The results of this research paper validate the hypothesis and illustrate a positive linear relationship of medium intensity between the share of ICT specialists employed in EU Member States and the share of firms using at least one AI technology out of the total number of European firms. In general, it is likely that firms operating in the countries with the most ICT specialists employed relative to the total employed population are more active in the adoption and use of AI-based technologies. However, the correlation does not necessarily imply a causal relationship and, in order to assess the impact or practical significance of this correlation, it is important to take into account other elements that may influence the two variables. Economic, legislative, and technological innovation factors can simultaneously influence both the number of ICT specialists in relation to the employed population and the degree of adoption of AI-based technologies.

The number of ICT specialists plays an important role in digital innovation and also on the level of competitivity in modern economies. However, its concrete effects on the adoption rate of AI-based technologies have not yet been systematically investigated. When discussing about countries with a low digital performance, such as Romania and Bulgaria, we can estimate the impact of the dynamics of the ICT specialists on the rate of adoption of artificial intelligence-based technologies by looking at the results of this study. The results could be analyzed and interpreted when discussing potential decisions that could affect the number of ICT specialists.

The high percentage of employees in the ICT industry in the European Union and the rate of adoption of artificial intelligence technologies are important indicators of the direction in which EU member economies are heading. The European Union can strengthen its position in technology leadership and contribute significantly to the global digital economy by providing adequate attention to skills development, innovation and stimulating investments in artificial intelligence-based technologies.

Along with the growth of ICT specialists comes a robust digital infrastructure and the workforce will be able to project and develop new technologies based on artificial intelligence. Also, with the help of specialists, various fields and domains can be improved, including education.

Companies' investments in artificial intelligence encourage technological progress and the adoption of modern technologies by the educational institutions, the whole process leading to improved learning activities.

The relation between the business environment and educational institutions can be beneficial for both parts. Educational institutions, such as universities an schools could benefit rom the knowledge and experience of the ICT specialists in projection and development artificial intelligence-based solutions, while the companies could benefit from improving educational activities, thus creating new specialists that are more prepared to face the new challenges. Therefore, we can state that as the number of ICT specialists grows, the number of companies willing to use and invest in artificial intelligence grows as well and also there is the possibility of a growth in the rate of adoption of artificial intelligence technologies in education.

However, we consider that the research can be influenced by a series of limitations, mainly related to the data that needs to be processed. The accuracy of this data can vary between countries due to differences in reporting standards, data collection methods and the definition of what constitutes an ICT employee or AI technology. This inconsistency might affect the reliability of the correlation. Moreover, a positive correlation does not imply causation. While there may be a relationship between the two variables presented, it is not possible to conclude that one directly causes the other without further analysis. There may be underlying factors or third variables affecting both, such as the overall economic development of a country, R&D investments or government policies on technology innovation.

Furthermore, the economic and political context and the international influences also represent factors to take into account when looking at these specific datasets. The economic environment and government policies vary across EU countries and not accounting for these factors might limit the understanding of the observed correlation. Global trends, multinational corporations and cross-border collaboration play a significant role in technology adoption and labor markets and the influence of these phenomena may not be fully accounted for in the analysis.

References

Addinsoft. (2023). *XLSTAT statistical and data analysis solution*. Retrieved January 24, 2024, from https://www.xlstat.com/en/>

Ali, S., Payne, B. H., Williams, R., Park, H. W., & Breazeal, C. (2019, June). Constructionism, ethics, and creativity: Developing primary and middle school artificial intelligence education. In *International workshop on education in artificial intelligence k-12 (eduai'19)* (Vol. 2, pp. 1-4).

Bharadiya, J. P., Thomas, R. K., & Ahmed, F. (2023). Rise of Artificial Intelligence in Business and Industry. *Journal of Engineering Research and Reports*, *25*(3), 85-103.

Box, G. E., & Cox, D. R. (1964). An analysis of transformations. *Journal of the Royal Statistical Society Series B: Statistical Methodology*, *26*(2), 211-243.

Eurostat[1]. (n.d.). *Artificial intelligence by size class of enterprise.* . Retrieved January 24, 2024, from https://ec.europa.eu/eurostat/databrowser/view/isoc_eb_ai/default/table?lang=en

Eurostat[2]. (n.d.). *Employed ICT specialists - total*. Retrieved January 24, 2024, from https://ec.europa.eu/eurostat/databrowser/view/isoc_sks_itspt/default/table?lang=en>

Eurostat[3]. (n.d.). *ICT specialists in employment*. Retrieved February 24, 2024, from https://ec.europa.eu/eurostat/statistics-

explained/index.php?title=ICT_specialists_in_employment#Relative_share_of_ICT_specialists_in_total_employment

Kutza, J. O., Hannemann, N., Hübner, U., & Babitsch, B. (2023). The representation of trust in artificial intelligence healthcare research. In *Healthcare Transformation with Informatics and Artificial Intelligence* (pp. 5-9). IOS Press.

Lan, W. (2021, June). Research on Financial Management Innovation Based on Artificial Intelligence Background. In *2021 2nd International Conference on Artificial Intelligence and Education (ICAIE)* (pp. 45-48). IEEE.

Lee Rodgers, J., & Nicewander, W. A. (1988). Thirteen ways to look at the correlation coefficient. *The American Statistician*, *42*(1), 59-66.

Ma, J. (2021, June). Research on the application of financial intelligence based on artificial intelligence technology. In *2021 2nd International Conference on Artificial Intelligence and Education (ICAIE)* (pp. 72-75). IEEE.

Naved, M. (2023). A Review of the Use of Machine Learning and Artificial Intelligence in Various Sectors. *Available at SSRN 4397899*.

Polak, S., Schiavo, G., & Zancanaro, M. (2022, April). Teachers' perspective on artificial intelligence education: An initial investigation. In *CHI Conference on Human Factors in Computing Systems Extended Abstracts* (pp. 1-7).

Prasanth, A., Densy, J. V., Surendran, P., & Bindhya, T. (2023). Role of artificial intelligence and business decision making. *International Journal of Advanced Computer Science and Applications*, *14*(6).

Sanusi, I. T., Olaleye, S. A., Agbo, F. J., & Chiu, T. K. (2022). The role of learners' competencies in artificial intelligence education. *Computers and Education: Artificial Intelligence*, *3*, 100098.European Institute of Innovation & Technology. (2021). *Emerging Artificial Intelligence and Data Driven Business Models in EU.* Retrieved February 20, 2024, from https://eit.europa.eu/sites/default/files/emerging_ai_and_data_driven_business_models_in_europe_final.pdf

Wong, G. K., Ma, X., Dillenbourg, P., & Huan, J. (2020). Broadening artificial intelligence education in K-12: where to start?. *ACM Inroads*, *11*(1), 20-29.

Yue, M., Jong, M. S. Y., & Dai, Y. (2022). Pedagogical design of K-12 artificial intelligence education: A systematic review. *Sustainability*, *14*(23), 15620.