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Article

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PARTICIPATION OF ARTIFICIAL INTELLIGENCE IN ECONOMIC GROWTH IN ROMANIA

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Abstract

The purpose of this article is to demonstrate that it is necessary to model the connections of the Romanian economy for growth with the help of Artificial Intelligence (AI). That is why it is useful to align with the trends in the EU economy and on a global level to use innovative technologies, with the domestic economy having the opportunity to become excellent. It is a moment of opportunity for commitment in this regard, considering that Romania already has the IT infrastructure and the human resources with a real predisposition to AI. The article reports on the research carried out, by way of example, on a number of AI companies, and from the answers received and processed, real values emerge that reflect the potential of contributing to economic growth through AI. Our article presents a first-of-its-kind view of how AI investment and participation relate to domestic economic outcomes. It is estimated that, mainly, in Romania in the coming years, the expected economic growth can be registered on account of the activities coming from small and medium enterprises dominated by AI. As such, it is considered that the new AI economy will be able to be built and engaged in Romania to the extent that small and medium enterprises will show “constructive behaviour, with evolutions based on innovation with the help of AI”.

Keywords: Artificial Intelligence (AI), economic growth, AI variables, AI growth modelling

JEL Classification: C15, E17, O11, O47

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Introduction

Currently, the idea of an almost continuous influence on the economy coming from the ranks of Artificial Intelligence (AI), which can be defined as a competitor for authority, is suggested. The promoters of general economic science believe that “the economy cannot be separated from AI” which proves, mainly, useful in identifying alignments to minimise risks, increase productivity and incomes. Romania has an annual economic growth in the last period (“in 15 years, the GDP increased 4 times, and the GDP per inhabitant increased 2.3 times” (Georgescu, n.d.)), but it lags behind the levels reached in the EU by developed countries or most OECD countries. The levels of poverty and non-fulfilment are visible, and the speed of progress towards upper limits is still low (increased budget deficit, high external debt, low productivity, etc.). Added to this is the large emigration outside the country, the lack of feasible and sustainable strategies in the medium and long term in some branches of economy, the lack of competitiveness of industry and agriculture, etc. However, we believe that there is a chance to reconceptualise the economic growth of the country with the consolidated emergence and manifestation of AI in all sectors of activity nationally and, by extension, globally.

The purpose of this article is to demonstrate to official decision-makers, developers of strategies, tactics, and programmes that the economy in Romania will have real growth based on the use of AI. The lack of commitment or firm immersion in the field of AI can lead Romania’s current economy to stagnation, or, when adhering to this flow results in alignment with operational trends in the EU and the global economy, or the autochthonous economy “becoming” an advanced field of excellence, an example worth following by other state entities. In the article, we resort to modelling the links of the Romanian economy to growth with the help of AI. It is a moment of opportunity, an occasion for commitment in this regard, especially since Romania already has the starting IT infrastructure and the human resources with a real predisposition to work in the field. The research is carried out, for example, on 72 AI companies and from the answers received it follows that the variables (activities) are of high resolution, the subjects/themes in which the companies are engaged for processing demonstrate attractiveness for the Romanian area from the large foreign investors in the field and, equally, it reflects the potential to contribute to economic growth. In our present assessment, AI becomes a subdiscipline of general economic science and we consider that the heterogeneity of national interests, with extension in the European one, should occupy a central place in the general economic picture, including the one of Romania. With the help of AI, it is possible to manifest in the new economy rules such as: realism, agenda with content of majority interest, adaptation to circumstances, pronouncement in real time based on transmitted information, influence from multi-principle mediation of economic decisions. Moreover, an inclusive world based on AI is envisioned, and the requirement for a global approach to data in the digital age is emerging, encouraging competition and stability in the digital economy. It is positive that the Industrial Monetary Fund (IMF) has already established an AI Readiness Index that measures readiness in areas related to each country’s digital infrastructure, human capital and labour market policies, innovation and economic integration, regulation, and ethics. So, in the presence of AI there is a shift towards global principles.

Our article provides the first systematic view of how AI investment and participation relate to domestic economic outcomes. It is estimated that, mainly, in Romania in the next 15-20

years, the expected economic growth can be registered due to the activities coming from small and medium enterprises dominated by AI. Therefore, it is considered that among the methods of growth, the new economy will be able to be built in Romania to the extent that small and medium enterprises will show “constructive behaviour, with evolutions based on innovation with the help of AI”.

1. Review of the scientific literature

Most studies highlight that AI has potential and economic impact; in fact, through AI, a technological revolution is taking place, stimulating economic growth and incomes globally. Innovative AI technologies will lead to an increase in labour productivity (up to 40%), create a virtual “intelligent automation” workforce and diffuse innovation, which will generate new revenue streams. (Accenture, 2022)

Global GDP may increase by 14% by 2030 as a result of accelerating AI development and adoption. The new sense of digital revolution already unleashed with the Internet of Things (IoT) the stimulation for standardisation, automation, personalisation of products and services, bringing productivity gains. Automation of routine tasks, expansion of robotics and autonomous vehicle technologies will promote a new workforce according to PricewaterhouseCoopers (2018), and also to other important authors (Agrawal, Gans and Goldfarb, 2019; Acemoglu et al., 2022).

Hershbein and Kahn (2018) classify jobs as requiring cognitive skills only if any of them is found in at least one of the following terms: “research”, “analysis”, “decision”, “solving”, “mathematics”, “statistics”, or “thinking”. There are significant investments in software (approx. 70% of companies adopt at least one type of AI technology), and by 2030 the global GDP will increase by approx. 1.2% annually, shows Bughin et al. (2018). On the other hand, Farboodi and Veldkamp (2022) outline that AI will have positive direct and indirect effects on places of work (40% of the total), productivity and GDP, will optimise business processes and decisions, thereby increasing knowledge and access to information. There will be implications of AI in the selection of economic policies, effects on processing sectors, on companies, industries, at the level of countries generating impact and redistribution of the labour force. At the same time, Szczepanski (2019) points out that AI will be crucial for labour productivity, income distribution, and especially for economic growth itself, as supported also by Mihet and Philippon (2019) and Farboodi et al. (2019).

At the 2023 World Economic Forum (WEF), it was noted that the use of AI for common tasks has seen an increase in recent years, and ChatGPT developed by OpenAI is an example of generative AI used daily by more than 1 billion people. It is recalled that the GEF in October 2020 concluded that, while AI would eliminate 85 million jobs globally, by 2025 it would also generate 97 million new jobs in AI fields, from big data and machine learning to information security and digital marketing.

AI technologies have advanced rapidly in the last few years (Chang et al., 2023); currently, general-purpose infrastructures are available (Aghion et al., 2018; Patrick, 2018), and between 2015 and 2021 the number of AI patents increased 30 times (Ganglmair et al., 2021).

At the same time, Fiszbein et al. (2020) highlight that AI has led to rapid productivity gains. Technological changes through AI are opportunities for investment and economic growth. (Furman and Seamans, 2019).

Some authors believe that the question whether AI can transform economies and boost economic growth remains open. Brynjolfsson, Rock and Syverson (2021) and Raj and Seamans (2017) point out that there is currently a lack of relevant data on AI coverage at firm level, and Alderucci et al. (2020) believe that it is necessary to focus on companies that invent AI. The AI-trained labour shortage is another constraint to the inclusion of AI in firms (CorrelationOne, 2019).

The development of new products with the help of AI eliminates lengthy experimentation (Braguinsky et al., 2021), as AI algorithms generate accelerated learning and reduce the uncertainty of homologation. It turns out that AI is definitely stimulating economic growth, already becoming a technology of general use (Goldfarb, Taska and Teodoridis, 2023). Bughin et al. (2018) estimate that, in industry, 90% of companies' investments in AI are internal and only 10% come from acquisitions. The percentage of companies investing in AI in just one year is 29.5%, compared to 70.6% for robotics (Humlum, 2019). Globally, consistent with findings made by Caliendo et al. (2020), in practice, product quantities increase to such an extent that lower prices are charged.

Some authors consider AI a predictive technology (Agrawal, Gans and Goldfarb, 2019), while for others AI is a general-purpose technology (Goldfarb, Taska and Teodoridis, 2023). It is notable, however, that AI technologies have scale effects that favour large firms, which accumulate large amounts of data as a by-product of their economic activity (Farboodi and Veldkamp, 2022). The benefits of AI largely depend on who owns big data – the key input for AI technologies, according to Fedyk and Hodson (2023) and Babina et al. (2024).

However, there is no systematic data on the companies' AI investments. According to some authors, they amount to approx. 140 billion USD/year globally. We can conclude that economists, in general, do not have a strong potential to predict the future. It is estimated that in 12 developed economies, AI could double annual global economic growth rates by 2035.

2. Research methodology

Methodologically, our article presents a novel approach to demonstrate the extent to which AI contributes to economic growth, and more broadly, our method suggests that new technologies such as AI have clear and distinct advantages in the speed of positive change in the national economy. The research in this article is based on the original mathematical formalisation of modelling, systematisation, and interpretation relationships in the field.

In general, for the understanding and operationalisation of AI in the Romanian economy, we propose to go through a procedural algorithm to obtain univariate classifications (C_0). In fact, the formalisation starts from the multivariate classification (C_m) when for this conception there are a number of classes (N_c) of knowledge that enter the so-called intelligent creation.

A first step is the separation of classes/sub-classes (Δ_s), followed by transformations of/for linearisation (Δ_l) to notice the processing in question in a more simplified manner. In the end, it is a matter of metricity/ultrametricity obtained by simplifying calculations for determinations related to the identification and analysis of linear discriminants. The transformations for linearisations (Δ_l) can record relative/absolute amplitudes, highlighting the depth of refinements to eliminate reminiscences/redundancies, with reference to reducing spaces/distances between data. In the literature in the field, concerns are highlighted for the search for global classification models or for spatiality/spatialisation, respectively, the

localisation of classifications. The most important property for AI, in our opinion, in the process of searching for classifications becomes procedural adaptability, an aspect that does not introduce the obligation to establish immutable methods, procedures, techniques, etc. in the field.

As such, it can be written:

$$\begin{cases} (C_m) \xrightarrow{(s)} \{C\} \\ \forall [Max(\Delta_s) * Min(N_c)] \xrightarrow{(\Delta l)} (C_o) \\ (C_o) \in [\{C\}f(s) \subset (C_m)] \approx [\{C\}f(s) \cap (C_m)] \end{cases} \quad (1)$$

At the same time:

$$\{C\}: (R, \bar{R}) - [\Phi\{\bar{C}\} + \Phi(\varepsilon_i) + \Phi(\Delta C_m)] = (C_o)f(\Delta l) \quad (2)$$

$$\{(\Delta_s) * (N_c)\} \longrightarrow Max Min f(\Delta l) \quad (3)$$

On the other hand:

$$\begin{cases} \sum_{i=1}^k (\varepsilon_i) = Max \Phi(\varepsilon_i) \\ \sum_{i=1}^k \Delta(C_m)_i = Max \Phi(\Delta C_m) \end{cases} \quad (4)$$

and

$$[\{C\}: (R, \bar{R})] - \{\pm \sum_{i=1}^k (\varepsilon_i) \pm \sum_{i=1}^k \Delta(C_m)_i\} = (C_o)|_{(\Delta l)} \quad (5)$$

Making n observations of the type $(a_i, b_i, c_i, \dots, z_i) \in \mathbb{R}$ in the real space (Romanian companies that have AI activities), each variable provides a sub-image (SI) in the set $\{M_o\} \supset [(\text{SI})_{a_i}; (\text{SI})_{b_i}; \dots; (\text{SI})_{z_i}]$, that become correspondents, members of an incipient non-remniscent and non-redundant classification. The placement of sub-images in variance-covariance matrices depicts the dimensional and qualitative disproportions of observations made on AI in the economic productive field, in everyday life. Eliminating or reducing discrepancies means reducing the virtual weight of events found with AI in supervised/unsupervised database simulations in the real economy/new economy. In the context, the falsely appropriate and non-covariational analog set $\{\bar{M}_o\}$ appears, which is non-distanced from the set of initially identified/delimited sub-images. On this basis, AI processings that are considered untrue often appear.

Therefore:

$$\{\bar{M}_o\} \wedge \{M_o\} \quad (6)$$

Also:

$$\begin{cases} [max \Phi(\varepsilon_i)] \wedge [max \Phi(\bar{\varepsilon}_i)] \\ [max \Phi(\Delta C_m)] \wedge [max \Phi(\Delta \bar{C}_m)] \end{cases} \quad (7)$$

$$[\{\sum_{i=1}^k (\varepsilon_i)\} * \{\sum_{i=1}^k (\Delta C_m)\}] \longrightarrow (C_o) - (\Phi\{M_o\})^{(C_m)} = \{M_o\}^{(C_o)} \quad (8)$$

On the final configuration $\{M_o\}^{(C_o)}$, related to AI, infrastructures/machines show learning efforts, equally on the part of humans, understanding and perceiving or assuming the nature

and realism of the sub-images validated to be contained in a consolidated non-reminiscent and non-redundant classification of knowledge.

In this framework, we resorted to research through interviewing 72 Romanian companies with AI as a field of activity, and the answers were systematised in accordance with relations (6), (7), and (8), in tables with power allocations (coefficients of importance). In this way, the involvement of AI in the issue of the domestic economy is deduced, emphasising its possible proportional growth with computerisation, digitisation and the general increase of knowledge.

3. Results and discussion

As part of the research, responses were received from a number of 72 companies that agree to the existence of 63 “activities” type variables in the field of AI. (Table no. 1)

Table no. 1. The variables detected (received as responses) from the entities that have the formalisation and application of AI as field of activity

No. crt.	Variables	Ac	Yes	Yes/No	No	N _o	M	As
	<i>AI to extend/enhance knowledge</i>							
1.	systems and software on quality platforms;	2	0.70	1.00	1.00	2	0.35	.041
2.	customised web applications;	1	0.82	-	0.00	-	0.82	.043
3.	customised software and digital innovation;	1	0.60	-	0.00	-	0.60	.008
4.	the architecture of the digital transformation approach;	1	0.72	-	0.00	-	0.72	.042
5.	software and hardware for understanding the details;	1	0.79	-	0.00	-	0.79	.043
6.	web and mobile application software, DevOps, machine learning;	1	0.80	-	0.00	-	0.80	.043
7.	AI solutions for deep understanding of content;	1	0.56	-	0.00	1	0.56	.009
8.	AI for natural language processing (NLP), Text Analytics and Speech to Text;	1	0.53	-	0.00	1	0.53	.009
9.	software libraries for neuromorphic computer vision;	1	0.60	-	0.00	-	0.60	.008
10.	data intelligence and AI.	1	0.48	-	0.00	1	0.48	.009
	<i>AI for technologies</i>							
1.	continuous presence at the end of the best technologies;	1	0.78	-	0.00	-	0.78	.038
2.	work in a complex environment with updated technologies;	1	0.83	-	0.00	-	0.83	.044
3.	technical talent in the field;	1	0.81	-	0.00	-	0.81	.043
4.	the ability to integrate advanced technologies;	2	0.79	1.00	1.00	1	0.39	.043
5.	simplification of complex technical problems in a timely manner;	1	0.84	-	0.00	-	0.84	.044
6.	nearshoring and offshoring technologies;	1	0.69	-	0.00	-	0.69	.008
7.	deep-tech AI platform with ICT system, infrastructure, code, algorithms, scripts and technical processes;	1	0.69	-	0.00	-	0.69	.008
8.	AI template generation technology;	1	0.59	-	0.00	1	0.59	.007
9.	integration of AI technologies;	2	0.78	1.00	1.00	-	0.36	.043
10.	essential and transformative machine intelligence for enterprises;	1	0.70	-	0.00	1	0.70	.041
11.	Eye-Tracking and Brain-Computing Interface technologies, generative and parametric methods in Game Engine environments;	1	0.69	-	0.00	-	0.69	.008
12.	software robots using UipAth, Rinkt technologies.	1	0.42	-	0.00	1	0.42	.006
	<i>AI for deep/advanced services</i>							
1.	technological services in the development of customised software and IT outsourcing;	2	0.84	1.00	1.00	1	0.41	.044

No. crt.	Variables	Ac	Yes	Yes/No	No	N _o	M	As
2.	virtual assistants for managing repetitive and time-consuming tasks;	1	0.73	-	0.00	-	0.73	.041
3.	clean and error-free code service;	1	0.79	-	0.00	-	0.79	.043
4.	excellent response time and quality workmanship;	1	0.84	-	0.00	-	0.84	.044
5.	independent conversational AI platform with interconnected virtual assistants;	1	0.69	-	0.00	-	0.69	.008
6.	Ressi platform of generative AI assistants;	1	0.59	-	0.00	1	0.59	.007
7.	automatic extraction, clean design;	1	0.61	-	0.00	-	0.61	.007
8.	capabilities solutions based on AI/ machine learning;	1	0.68	-	0.00	-	0.68	.008
9.	automation scenarios in environments with common solutions;	1	0.83	-	0.00	-	0.83	.044
10.	new applications and supporting their maintenance;	1	0.83	-	0.00	-	0.83	.044
11.	Wise Agent support automation platform (website chat, Facebook, e-mail, phone call), CRM integration for conversation escalation (Wisevoice Dialog Builder);	1	0.68	-	0.00	-	0.68	.008
12.	advanced solutions for visual, voice natural language search, cloud search query processing and classification;	1	0.49	-	0.00	1	0.49	.006
13.	writeGPT as web extension;	1	0.78	-	0.00	-	0.78	.043
14.	AI chatbot to be integrated on websites.	1	0.71	-	0.00	-	0.71	.040
AI for management								
1.	reducing complexity through human-centered innovation;	1	0.80	-	0.00	-	0.80	.043
2.	platform for organising the timeline of information flow;	1	0.81	-	0.00	-	0.81	.043
3.	on-time delivery and persistent risk management;	2	0.83	1.00	1.00	-	0.42	.044
4.	transparency about what can and cannot be done through AI;	1	0.83	-	0.00	-	0.83	.044
5.	team oriented towards optimal results;	1	0.80	-	0.00	-	0.80	.043
6.	organisational culture with customised software solutions, dedication and selectivity;	1	0.75	-	0.00	-	0.75	.045
7.	more for the community, not just for its own employees;	1	0.59	-	0.00	-	0.59	.007
8.	innovative, flexible and hardworking;	1	0.76	-	0.00	-	0.76	.047
9.	top communication, explicit AI data updates;	3	0.80	2.00	2.00	-	0.27	.043
10.	work ethic, quality and real-time delivery;	1	0.79	-	0.00	-	0.79	.043
11.	significant skills, high commitment and company culture;	1	0.78	-	0.00	-	0.78	.043
12.	the attention and pride the team has in the field of AI;	1	0.69	-	0.00	-	0.69	.008
13.	managing the speed of change;	1	0.68	-	0.00	-	0.68	.008
14.	quick identification of errors and fixes.	1	0.79	-	0.00	-	0.79	.043
AI for development								
1.	positive approach to AI development projects;	2	0.82	1.00	1.00	-	0.41	.043
2.	essential partners in the development of platforms;	1	0.83	-	0.00	-	0.83	.044
3.	chatbot, mobile, web and Ethereum Blockchain Smart contract;	1	0.77	-	0.00	-	0.77	.043
4.	the ability to deliver high-quality AI knowledge products;	1	0.78	-	0.00	-	0.78	.043
5.	complexes that integrate AI, big data, web or desktop solutions.	1	0.69	-	0.00	-	0.69	.008
AI for economics / business								
1.	redefining the tables of business operations through AI solutions;	1	0.82	-	0.00	-	0.82	.043
2.	AI platform for identifying payment errors;	2	0.83	1.00	1.00	-	0.42	.044
3.	alternative realities through VR, AR and AI technologies using advanced computing methods;	1	0.72	-	0.00	-	0.72	.042
4.	codeless flows, AI models with custom datasets;	1	0.78	-	0.00	-	0.78	.043
5.	large language models, Big Data Analytics, with the power of AI;	1	0.67	-	0.00	1	0.67	.008
6.	reliable and distributed nano-tasks for AI augmentation;	1	0.58	-	0.00	1	0.58	.007
7.	Hawking with intelligent AI solutions;	1	0.69	-	0.00	1	0.69	.008
8.	platform for personalised, targeted and automated experiences using data and AI.	1	0.81	-	0.00	-	0.81	.043

Notes: Ac = IA activities/company; [0.00 – 1.00] = weighting coefficients (importance).

It is stated that the companies did not fully answer all the questions in the interviews; however, the receipt of those incentives is considered representative and with the potential

for extrapolation at the macroeconomic level, demonstrating the meaning, the recommended direction to follow, namely the intensive use of AI in the current domestic economy to generate its real growth in the future stages. The activities (received through the written interviews) were systematised according to the number of entities (A_c), their confirmation in the fields of activity of the AI enterprises (Yes with a weight of 10, Yes/No/ with a weight of 5, No with a weight of 1), the number of observations (N_0), mean (M) and calculation of standard deviations (N_0).

The main goal pursued in this article refers to the elucidation of the participation of AI in the economic growth of Romania in the coming years, how AI contributes to the emergence and functioning of the new domestic economy, and through its national contribution to participate in the EU's economic security. In summary, after receiving the answers and assigning weights (importance coefficients in the survey), after examining the limits of variation of the average and standard deviations, the numerical table of the situations is outlined below. (Table no. 2)

Table no. 2. Synthesis of measured incentive values at AI companies

Total no. of AI variables/activities	63
Total no. of AI companies researched/interviewed	72
Total no. of observations (utterances) recorded about the AI	81
No. of AI companies with multiple fields of activity	8
Variable confirmation weight AI activities (integrated average)	[0.42-0.84]
Share of unrelated options on AI activity variables (integrated mean)	9 activity [0.00-2.00]
Reject variables / AI or non-AI activities	15
Standard deviations	[0.08-0.47]

The main interpretations refer to the following:

- in the researched companies, there is a number of AI activities (63) which are practical, applied topics/themes of significant resolution, a fact that can attract the attention of foreign investors relying on the actuality of commitments and challenges determined by Romanian entities in the field;
- almost all the researched companies have distinct, singular fields of activity in AI; there is no dissipation on multiple alignments, which shows increased specialisation in AI on distinctly addressed subject solutions (out of the total of 72 companies, only 8 have double or triple fields of activity);
- the integrated average of the weights of confirmed AI activities (successful, with achievements) is contained in the interval [0.42 - 0.84], which shows that more than 80% of the entities have business capability in the field;
- the integrated average of the weights of unrelated activities (unsuccessful, with failures) is included in the range that emphasises that only 9 activities (in proportion to only 13.30% of the entities) do not have business capability on some AI alignments; in the answers, 15 variables/types of activities were rejected as not being addressed by the studied entities;
- the statistical standard deviations are included in the interval [0.08 - 0.47], values that show the reduced distance (scattering) from the positive solutions given by the variables/activities; lacking large distancing, they are close to the pursued ideal alternatives.

Next, in our approach, we sought to define the elements that influence (+) or (-) the increase/decrease of knowledge through AI, used in research to define the independent and dependent variables, respectively, the standard deviations for the sizes of the results appreciated in the Romanian economy. (Table no. 3)

Table no. 3. Definition of met and dependent variables for estimating expected growth using AI

I) INDEPENDENT VARIABLES		N ₀	M	As
Characteristics		2015/ 2023	2015/ 2023	2015/ 2023
A. AI human capital				
- Education		59	0.72	0.45
- Experience in the same sector of activity (AI)		72	0.48	0.50
- Experience in other businesses		21	0.02	0.14
- Age of AI business owner		72	23.85	8.03
B. AI firm-level attributes (surveyed firms)				
- Export of AI knowledge (software)		72	0.69	0.50
- Bucharest area (cluster)		14	0.32	0.41
- Number of employees		72	39	0.40
- Years of experience on the specific AI market		8	4.8	0.23
C. Barriers/obstacles in promoting AI				
- Taxes		72	0.69	0.49
- Corruption		72	0.23	0.41
- Legislation		72	0.40	0.49
- Delayed payments		72	0.21	0.42
- Access to financing		72	0.30	0.46
D. Sectors in which the AI companies in the researched sample are active				
- Digitalisation		72	0.77	0.23
- Software development		72	0.78	0.41
- Software trade/sales		72	0.78	0.52
- Hardware trade/sales		72	0.08	0.69
- AI services		2	0.02	0.73
- Other sectors		0.0	0.00	0.00
II) DEPENDENT VARIABLE		N₀	M	As
The expected increase		72	3.01	0.47

Notes: N₀ = number of observations; M = mean; As = standard deviations;

Answers: Yes = 10; Abstain = 5; No = 1

The processing of the data obtained from the specific questionnaires shows that the hope for future economic growth (defined in the medium term, at most long term) is on average 3.01%, if there are no disruptions of the nature of financial-economic crises. Based on the EBRD methodology, we have tabulated the rating levels of the obstacles that stand in the way of business development, adapting a rating scale, marking with 1=no obstacles and 4=major obstacles. We reconceptualised this method also reconsidering the rating data of the obstacles calculated for Romania at the level of 2023. For the present paper, the comparative processing was carried out with the levels calculated for the field of AI compared to the levels related to the year 2015, and the conclusions can be used to formalise the course of action in the future. It should be emphasised that the growth level of 3.01% obtained through the relative processing of the data collected from the sample of the 72 companies is part of the situation articulated at the national evolutionary level, confirming the existence of obstacles in “doing business with software” for AI, given by some dysfunctional parameters such as:

- obstacles of a financial nature (3.0 in 2015, respectively 2.9 in 2023);
- obstacles derived from the infrastructure (2.5, respectively, 2.2);
- obstacles derived from the fiscal system (taxation and levy) (3.3, respectively 3.2);

- regulatory obstacles (incoherent and non-correlative legislation) (1.4, respectively 2);
- legal obstacles (2.3, respectively, 2.4);
- organised crime (2.0, respectively, 1.9);
- corruption (2.2, respectively, 2.7).

The AI-trained labor shortage is one of the most important barriers to AI adoption by firms.

Denoting with K_i the reference points for the analysis of expected growth, it is possible to obtain/formalise an ordinal estimator of future growth testing, denoted $P_e(\text{outputs} = 1)$, which expresses in a quantified manner the influences of the studied variables. In a mathematical sense, K_0 corresponds to the trend towards $(+\infty)$. Denoting by $\{M_v\}$ the matrix of explanatory column variables, characterised by vectors of coefficients on the set $\{\varphi_c\}$, the probability of obtaining an output observation i is given by the relation:

$$P_e(\text{outputs}=i) = P(K_{i-1} < \{M_v\} + \xi < K_i = \{\Phi_c(K_i - \{M_v\}) - \Phi_c(K_{i-1} - \{M_v\})\}) \quad (9)$$

with ξ = coefficient – differentiation/proportionality constant.

The set $\{\Phi_c\}$ of coefficient vectors refers to the cumulative normal-standard distribution function of the quantified values from the explanations obtained from the observations. Generalising, for all outputs ($=1$), the model has the form:

$$P_e(\text{outputs}=1) = \Phi_c(\{M_v\}) = \int_{-\infty}^{\{M_v\}} \Phi(t) dt \quad (10)$$

For the 72 studied entities, taking into account the relations (9) and (10), it was possible, thus, to draw up on statistical bases a list with the average hierarchies identified from the managers' answers regarding the barriers (obstacles) and their dimensions in Romania in business with AI.

The main obstacles in the development of AI businesses in the Romanian productive economic environment refer to: 1) too high taxes; 2) financial blockage; 3) poor access to resources (funds) of investments; 4) frequent change of charges and their growth; 5) tax ambiguity; 6) late payments from customers; 7) corruption; 8) illegal work (underground economy); 9) business legislation; 10) inability to enter new markets; 11) time spent negotiating with the officials; 12) sophisticated competitions for incorporation into legal affairs; 13) frequent changes in the business legislation; 14) other obstacles.

It follows that too high taxes, financial blockage, and poor access to investment resources (funds) represent the main barriers in the development of AI businesses in the Romanian productive-economic environment. As such, the modelling conceptualisation for the fulfillment of expectations regarding the establishment of the New Economy in Romania dominated by AI must include solutions and recommendations for overcoming the identified obstacles.

Conclusions

Economic growth remains the positive variation in the production of goods and services in an economy over a long period, with the GDP as a measurement indicator. With AI, an intensive growth would be ensured, aiming for it to be nearly uniform. In Romania, economic

growth is linked to the development strategy, the convergence and preservation of macroeconomic balances that are being pursued.

In the Romanian economy, the remodelling of work has already been witnessed, but the net effect of AI is difficult to predict. AI can develop in different directions: creative policy experiments, positive goals for what society wants. A future of high productivity, lower inequality, greater industrial concentration, and new economic and political agendas is envisioned. For now, emerging markets and developing economies face less immediate disruption from AI. Capitalising on the benefits of AI, if the domestic economy does not act intensively on this alignment, the risk will increase that, over time, the technology will worsen the inequality between Romania and other countries, and polarisation may appear between those who lag behind the use of AI.

The research in this article is based on the original mathematical formalisation of modelling, systematisation, and interpretation relationships in the field. It should be emphasised that the level of growth of 3.01% obtained by the relative processing of the data collected from the sample of companies active in the AI-related fields is part of the situation articulated at the national evolutionary level, confirming the existence of obstacles in “doing business with software” for AI, given by some dysfunctional parameters such as: too high taxes, financial blockage, poor access to investment resources (funds).

Our paper provides the first systematic view of how AI investment and participation relate to domestic economic outcomes. It is estimated that, mainly, in Romania in the next 15-20 years, the expected economic growth can be registered on account of the activities coming from small and medium enterprises dominated by AI. Methodologically, our article presents a novel approach to demonstrate the extent to which AI contributes to economic growth, and more broadly, it suggests that new technologies such as AI have clear, distinct advantages in the speed of positive change in the national economy.

AI is considered a “singularity” and together with robots it is the benefit of society. However, it can also bring dangers, such as autonomous weapons, new ways for the few to dominate the many because, in the future, AI could develop its own will, which can come into conflict with that of humans. Moreover, the process of misinformation and abusive use of generative AI in the perspective of various events is recognised. However, AI allows the definition of complex processes and supports decision-making, financial analysis, compensation, investments, performance management, and budget management.

It is also known that fact-checking organisations in the EU (for example) operate in 22 languages, while certain new AI models create realistic images based on text cues and advance for “a deeper understanding of language”. In this whole framework, the need to develop and officially assume a Real Strategy for AI in Romania is felt, as future AI-related areas are rising, on financial alignments, blockchain technologies, cyber security, and, especially, are also found in the overall economic and societal development.

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