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ECONOMIC POLICY INSTRUMENTS FOR INNOVATIVE GROWTH IN THE EUROPEAN UNION - THE CASE OF AI

Vasil Gechev[1*]

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[1] University of National and World Economy, Department of International Economic Relations and Business, Bulgaria

[*]**Corresponding Author:**
Vasil Gechev

Email:
vasil.gechev@unwe.bg

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ABSTRACT

The recent economic (USA tariffs) and geopolitical (conflict in Ukraine) developments are creating a host of challenges for the EU, at a time when a new wave of high technology is intensifying EU's economic competition with the U.S. and China. In the last 15 years, the European economy has been lagging in both the quantitative and qualitative characteristics of growth compared with its two main rivals. Therefore, the enhancement of the EU's technological and product innovation capabilities is of critical importance for its future positions in the global marketplace.

This research focuses on the selection of adequate economic policy instruments for the establishment of an investment, R&D, and institutional environment that will enhance innovation processes in the EU, with a focus on artificial intelligence (AI) – where, currently, the EU lags behind the USA and China. An in-depth analysis outlines the key factors behind the lag and proposes specific mechanisms and instruments for catching up.

Keywords: *artificial intelligence, research and development, tech financing, competitiveness*

1. INTRODUCTION

Artificial Intelligence (AI) has the potential to deliver substantial improvements in productivity and competitiveness, and thereby enhance economic growth – at a time when it appears that the revival of protectionism and trade disputes are taking hold. This new dynamic in the global economy is exacerbating the already-daunting challenges facing the European Union, as for the last 15 years the European economy has been lagging in both the quantitative and qualitative characteristics of economic growth compared with its two main rivals – USA and China. Therefore, the EU's ability to boost its high-tech and product innovation potential is of critical importance for its competitiveness in the global marketplace and for the prosperity of EU member states and their citizens. Correspondingly, the main goal of this paper is to suggest a path toward the massive improvement of EU's capabilities in the key high-tech field of artificial intelligence.

The paper's research methodology has two main components:

1. The Problem's definition is based on comparative analyses between the U.S., the EU and China in the fields of AI investment and AI patenting. Developments in these two fields provide more than sufficient evidence of where the EU currently stands in regard

to artificial intelligence.

2. The elements of the Solution Proposal are mostly (but not exclusively) based on government policies for the high-tech sector in South Korea and China. In some respects, it seems regrettable that nowadays the top-performing industrial policies are to be found in East Asia and not in Europe.

The limitations of the research are associated with the fact that AI is a nascent industry, which inevitably results in **a.**) few authoritative papers on long-term policies and solutions, and **b.**) a lack of overviews/analyses on longer-term historical developments. Nevertheless, I consider this paper to be a notable contribution – based on solid empirical evidence – to the discussions concerning the EU's approaches to narrowing the AI gap with the U.S. and China.

2. LITERATURE REVIEW

While AI has applications in many industries, its impact on productivity depends on the specific sector – for instance, similar results cannot be expected in beauty services (hairstyling, cosmetic procedures, etc.) and automobile manufacturing. Baumol (1967), in his Theory of Cost Disease, assumes that differences in productivity dynamics lead to changes in the share of various economic sectors in GDP. For example, during the last six decades, the share of services in GDP has been steadily increasing at the expense of agriculture and industrial production. According to Baumol's Theory, the main reason behind this development is technological progress – which, alongside the reduction in the need for labor input in agriculture and manufacturing, implies a disproportionate rise in the costs of labor-intensive services (schooling, health, legal, entertainment, etc.) in relation to the costs of manufactured and farm goods. In the U.S., for instance, less than 1% of the workforce is directly employed in agriculture and farming, yet the country's food production meets its domestic demand and, also, the U.S. is among the world's leading exporters of agricultural commodities and farm products. This is made possible by the high capital intensity and high labor productivity in the farming sector. Therefore, Baumol's Cost Disease Theory should not be regarded as a negativistic economic paradigm (as the name may imply).

Sectoral changes and productivity growth are further analyzed by Baslandze (2016) and Alvarez-Cuadrado, Long, and Poschke (2017). For instance, the model of Alvarez-Cuadrado, Long, and Poschke (2017) shows that sectoral differences in the degree of capital ↔ labor substitutability are a driving force for structural change. When the flexibility to combine capital and labor differs across sectors, a factor rebalancing effect is operative. Here, in the context of AI, the relevant question might be how far the substitution effect can extend. Although the capabilities of AI are significant, it seems impossible for AI to replace a very large number of services such as home repairs, car repairs, gardening, entertainment, etc. Specifically for education, I would argue that AI – while capable of offering education and training services – has significant disadvantages over class lectures and discussions due to its lack of human-to-human interaction. Thus, we may actually end up in a situation where Baumol's Cost Disease Theory is re-validated, and AI contributes to or even accelerates wage increases in labor-intensive services. Baslandze (2016) is exclusively focused on the role of information technology (IT) in the reallocation of knowledge diffusion and innovation. One of his key findings is that industries whose innovations rely more on external knowledge benefit greatly from knowledge externalities and expand, while more self-contained industries are more affected by intensified competition and shrink.

Nordhaus (2021) provides elaborate argumentation in support of his Singularity Hypothesis, which states that rapid growth in information technology and artificial intelligence will cross a certain boundary, after which economic growth will rise rapidly as an ever-increasing pace

of improvements cascade through the economy. Gupta (2025) suggests that the impact of AI is varied across industries. In some cases, it lowers barriers to entry, but in other cases, it may increase these barriers. I agree with his findings that some negative effects and challenges are underestimated and need further detailed analyses. The AI-induced higher productivity lowers the average and the marginal costs of production both in the short-term and long-term periods – an opportunity to lower prices and/or boost profits. At the same time, AI can boost non-price competitiveness by improving product quality or by creating new (including unique) products or services. Because of its multifaceted impacts on economic processes, AI may be regarded as the Third transformation of the world economy, following the Industrial Revolution in the 19th century and the introduction of computing in the 20th century.

According to Malik, Muhammad, and Waheed (2024), AI creates benefits in terms of reduced energy consumption, induced cost-effectiveness, reduced operational risks, and increased performance matrices. They claim that AI is revolutionizing the food, pharmaceuticals, e-commerce, and chemical industries and that AI can improve industries as diverse as textiles, cosmetics and tourism. Overall, the main transformational power of AI lies in innovative solutions that enhance productivity, efficiency, and customer experience. The authors, however, seem to be somewhat over-enthusiastic as they conclude that '*AI-based industrial applications have transformed the world with paradigm-shifting through the automation of different processes.*' While it is true that AI is in the process of transforming industrial production and there is great potential for expanding its application, there is no empirical evidence for such a complete transformation across many industries in the world economy.

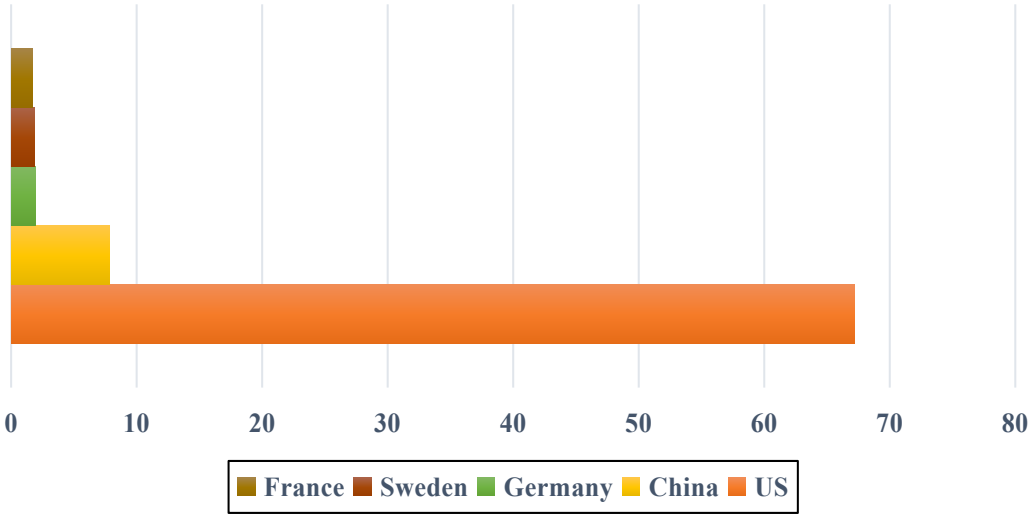
A study by Goldman Sachs (2023) reveals that AI has the potential to increase the world's annual GDP by 7% and lift U.S. productivity by around 1.5% annually over a ten-year period. Generative AI can substitute up to a quarter of the work currently performed by humans in the U.S. and Europe, while more than 300 million full-time jobs globally could be affected by AI-related automation. The study also suggests that the degree of positive impact will be higher in more developed market economies and correspondingly weaker in countries with a lower level of economic and technological development. However, I consider the latter finding to be a matter of discussion for at least two reasons: first, the lower the level of development, the easier it is to achieve higher growth dynamics with the same quantity of the same inputs; second, it depends on the model and efficiency of the economic policy model in each country.

A study of PwC (2024) shows that by 2030 the greatest economic gains from AI will be in China (26% GDP boost) and North America (14.5% GDP boost), equivalent to $10.7 trillion in total; the projected boost for the world's GDP will be $15.7 trillion, or 14%. The biggest AI impact by sector is projected to be in healthcare, automotive and financial services.

3. THE EUROPEAN UNION – AN ARTIFICIAL INTELLIGENCE LAGGARD

According to Stanford University's AI research, for the 10-year period between 2013 and 2023, AI's Top 3 private investment totals are in the U.S. ($335.2 billion), China ($103.7 billion), and the UK ($22.3 billion). In 2023 alone, U.S. corporations invested $67.2 billion in AI, compared to $7.8 billion in China, $1.91 billion in Germany, $1.89 billion in Sweden, and $1.69 billion in France.

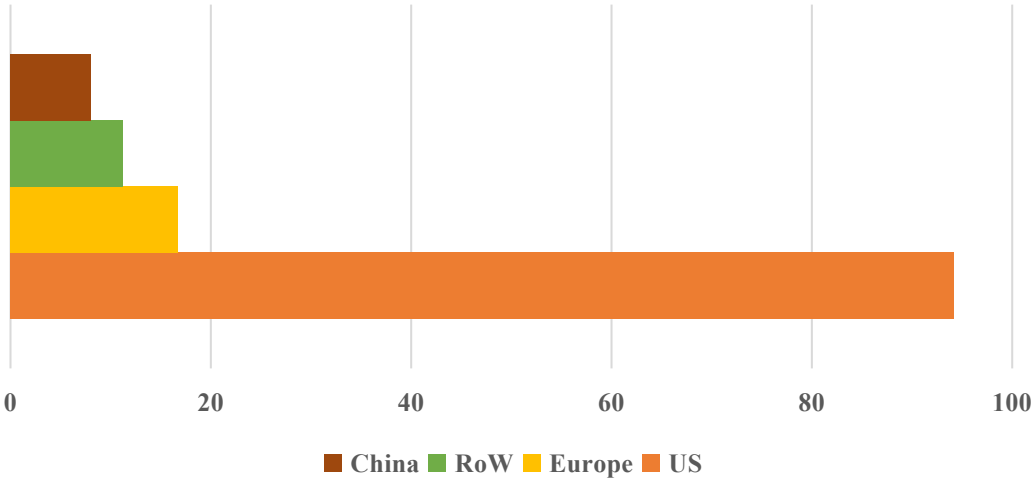
Figure 1. Private AI investment in billions of U.S. dollars, 2023



Source: Stanford University, AI Index

According to Our World in Data, in 2024 the U.S. invested $94.22 billion, Europe (EU plus all other European countries) invested $16.77 billion, China invested $8.03 billion, and the rest of the world invested $11.24 billion in AI.

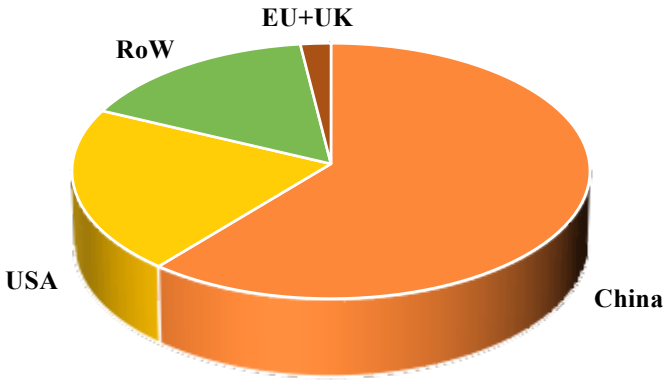
Figure 2. Private AI investment in billions of constant (2021) U.S. dollars, 2024



Source: https://ourworldindata.org/grapher/private-investment-in-artificial-intelligence

The data from Figure 2.0 does not include Big Tech spending (in-house investments), as in 2024, Amazon, Meta (Facebook), Alphabet (Google) and Microsoft invested a total of $246 billion in AI and in 2025 their projected total is expected to reach $320 billion. While U.S. private and Big Tech investment has skyrocketed beyond the reach of EU companies, the data on AI patent registration from 2010 onwards shows that China is also among the main challengers. The cumulative share of granted AI patents for the 2010-2022 period is as follows: China – 61%, USA – 21%, RoW (rest of the world) – 16%, EU & UK – 2%.

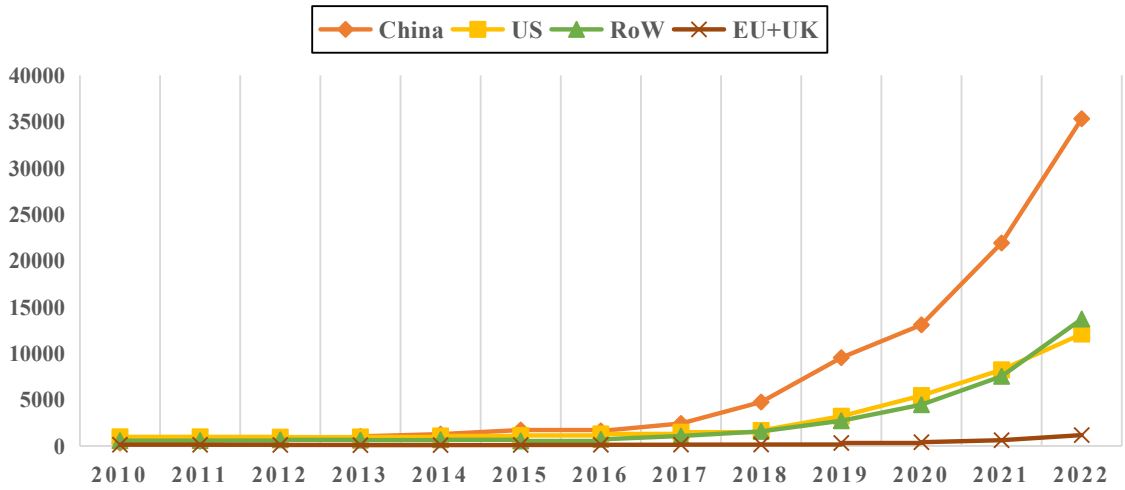
Figure 3. Share in AI patents, 2010-2022 period (cumulative)



Source: https://www.visualcapitalist.com/visualizing-ai-patents-by-country/

In 2022 alone, China registered 35315 patents, the Rest of the World registered 13699 patents, the U.S. registered 12077 patents, and the EU & UK (together) registered a mere 1173 patents. The acceleration of the AI-field patenting competition is very impressive: China overtook the U.S. in 2013 and, by 2022, established a lead with a nearly 3:1 margin.

Figure 4. Number of AI patents granted, annual



Source: https://www.visualcapitalist.com/visualizing-ai-patents-by-country/

In September 2024, a team of experts led by the former Governor of the European Central Bank, Mario Draghi, published a report titled *The Future of European Competitiveness* (The Draghi Report). According to this report, around 70% of EU's per capita GDP (at Purchasing power parity) gap with the U.S. is due to lower productivity. Furthermore, the lower productivity in the EU resulted in a slower increase in incomes and lower domestic demand: for instance, during the 2000-2023 period, real disposable income grew nearly twice as much in the U.S. Alarmingly, the Draghi Report suggests that the EU largely 'missed out' on the digital revolution and its productivity gains: the productivity gap with the U.S. is explained mostly by the high-tech sector. As of 2024, only four out of the world's Top 50 tech companies are from the EU, and there is not a single EU company with a market capitalization of over €100 billion that has been created in the last 50 years. In comparison, all six U.S. companies with a market capitalization of over €1 trillion were created in that period. In 2021, EU companies invested

€270 billion less than their American competitors in research and innovation. During the last 20 years, R&D in the EU has been dominated by the 'classical' automotive industry, while R&D in the U.S. has shifted from classical to tech industries – such as the digital sector. The authors of the Draghi Report single out the static industrial structure of the European economy as one of the key limiting factors for technological progress. The other limiting factor is financing, especially for emerging and start-up companies: many of them prefer to seek financing from U.S. venture capitalists. During the 2008-2021 period, about 30% of EU's unicorns, start-ups with a market value of over $1 billion, have relocated their headquarters abroad, mainly to the USA.

It is obvious that the financing process in the EU needs relevant restructuring in line with the specifics of the high-tech sector. Currently, start-ups in this sector have difficulties arranging bank credits because of the challenges associated with non-material collaterals such as software, patents, know-how, etc. In contrast, U.S. start-ups enjoy easy access to financing from specialized investment funds like Sequoia Capital, Andreessen Horowitz, Benchmark and Greylock Partners. Specifically in the field of AI, S. Ganesh (2025) outlines financial constraints, market fragmentation, data availability, and regulatory challenges as a combination of factors that hinder EU's abilities to compete with the U.S. and China.

In 2025, the European Commission launched the Invest AI initiative, designed to mobilize €200 billion in AI investments. This program was presented by the EC President, Ursula von der Leyen, at the Artificial Intelligence Action Summit in Paris, France. Under Invest AI, €20 billion will be allocated for the development of AI gigafactories, with the goal of establishing the EU as global leader. However, whether these funds will be sufficient for global leadership in AI is highly debatable since U.S. tech giants are already investing hundreds of billions of dollars annually in AI. For instance, in 2025 Apple Inc. (the iPhone maker) announced an investment of $500 billion – largely related to AI software and hardware. Therefore, the announced €200 billion investment target is likely to be a partial solution, and a temporary one at that. Apart from the AI-targeted 'Invest AI' initiative, the EC has already launched the Digital Europe program, which has specific objectives in high-performance computing, AI, cyber security, and semiconductors. While the objectives look impressive, the budget is not up to the task – only around €8 billion will be allocated by 2027.

China has very ambitious plans to fund its quest for dominance in the field of AI. Government regulations, combined with massive tailor-made state financing, are projected to further accelerate AI R&D and implementation. China relies on four major fund sources: (a) large corporations, for instance, Byte Dance has announced $12 billion of AI-related investments in 2025; (b) budget expenditures; (c) financing via China's state-dominated banking system, and (d) equity markets and state-backed venture funds, such as the State Venture Capital Guidance Fund (launched in 2025) – focused on AI, quantum technology and hydrogen energy storage. The fund is expected to attract nearly 1 trillion yuan ($138 billion) in capital over 20 years from local governments and the private sector.

4. EU CATCH-UP POLICY INSTRUMENTS

The EU's competitiveness has been deteriorating during the past two decades due to a number of institutional, economic, and geopolitical factors. According to the Draghi Report, however, the main factor is the slow adaptation of information and digital technologies – where the EU currently lags the U.S. by a significant margin. It will be very difficult to catch up with the U.S., which has a well-developed institutional set and productive interactions between high-tech companies and venture capitalists. Despite initiatives undertaken by the European Commission over the past several years, including the Digital Decade Policy Program (DDPP), the prospects for closing the AI gap soon do not look optimistic. Some chronology:

- In 2018, the Coordinated Plan on Artificial Intelligence (CPAI) was adopted – supposedly to emphasize AI's importance for the competitiveness of the European economy. So far, however, this program has not delivered the expected results, and the AI gap between the EU and its two main competitors – USA and China – is widening. Although the CPAI includes relevant strategic objectives, it does not rely on practical and efficient mechanisms and policy instruments for their fulfillment. Also, the financial framework is irrelevant – at least €1 billion annually are supposed to be allocated from the Horizon Europe and Digital Europe programs.
- In January 2024, the European Commission launched an AI innovation package to support startups and SMEs in developing trustworthy AI that complies with EU values and rules. The package includes:

  → the *GenAI4EU* initiative, which is supposed to create European champions in generative AI. The selected beneficiaries will receive favorable access to EU's supercomputing resources for the training of their large foundation models, in the context of the AI Factories – and in line with the EuroHPC regulation. In addition, they may benefit from additional actions aimed at creating strategic partnerships with major industries or attracting further capital.

  → the establishment of an AI office within the Commission, whose main objective is to foster research and innovation in 'trustworthy' AI and position the EU as a leader in international discussions. The AI office coordinates the drawing up of state-of-the-art codes of practice, conducts testing and evaluation of general-purpose AI models, requests information, as well as applies sanctions when necessary. This will be done in cooperation with EU Member States and the wider expert community. Also, the AI office has the responsibility to arrange financial support through direct equity and/or convertible bonds under the funding programs of the European Innovation Council (EIC) Accelerator. The Accelerator offers both grant funding – a lump sum of up to €2.5 million 'grant only', and an investment component (€0.5 - €10 million) with two options: blended finance (grant component + equity) or investment-only, for midcap companies and companies that have received a 'grant only'.

Notwithstanding its recent initiatives, the European Commission has not demonstrated a systemic approach towards the organization and financing of science- and technology-oriented R&D programs in the EU. Also, the success of the €200 billion-for-AI mobilization initiative is not guaranteed. In my opinion, the EU does not have a clear concept or strategy of how to support the establishment of efficient mechanisms that provide adequate stimuli for the AI catch-up process. Let me outline a few key problems and some possible solutions:

1. The existing EU R&D programs (Horizon Europe, etc.) are difficult to access (as per the Draghi Report, 2024), underfinanced, and, more importantly, do not have the necessary focus on cutting-edge technologies like AI – which is a critically important element in modern-day competitiveness. The EU must establish a special R&D fund dedicated solely to the development of AI and its implementation across European industries – Invest AI, alone, is highly unlikely to shorten the distance with China's massive patent registration lead in the field. The establishment of this R&D-dedicated fund requires: (**a**) new financial commitments from EU member states, and/or (**b**) restructuring of the various EU (scientific) programs' budgets, with prioritization of AI. The resources of the fund must be utilized primarily by public-private partnerships, as the only realistic method for mobilizing the necessary large-scale investments. The public-private collaboration platforms of China's Artificial Intelligence Industry Alliance (AIIA) are an

excellent example. By 2023, the Chinese government's Guidance Funds were able to mobilize $940 billion from public and private sources – which allowed a very substantial investment infusion into companies in the field of AI and other emerging technologies (Konaev and Luong, 2023). In South Korea, the government has just launched (January, 2025) Comprehensive Financial Support Packages for foreign investors and joint-ventures in the high-tech sector, including, among others: investment support up to $141 million; general investment tax credits of 12% and 14% for new growth sectors; extended capital goods tax exemption – for up to 7 years, with a 100% exemption for the first 5 years; loan guarantees and enhanced tax credits for R&D activities aligned with strategic industries, such as AI, future mobility and smart logistics.

2. To overcome the lag (behind China and the U.S.) in the AI field, the EU can introduce both direct and indirect fiscal and monetary stimuli: (**a**) corporate tax exemption for 5-7 years; (**b**) tax rebates, after the 5-7 year period, if certain pre-agreed objectives have been met; **(c)** co-financing of public-private initiatives in AI R&D, including a fast-track to practical applications in EU industries; (**d**) R&D performance-based rewards for universities and non-profit scientific institutions; (**e**) direct financing of private developers, up to 90% in exceptional cases; (**f**) easy access to credit lines with preferential (low) interest rates and longer grace periods; (**g**) loan guarantees. The preferential interest rates could be financed by the EU budget or by the EU's designated programs. Such a combination of fiscal and monetary stimuli should be coordinated between EU's institutions and the governments of the EU Member States.

   Van Ufford (2025) suggests an emphasis on datacenter investment plans, as high-quality datasets are increasingly considered key for breakthrough AI systems. In his opinion, EU's AI progress would be further enhanced by international cooperation – Japan, Brazil, South Korea, Indonesia, and others. This cooperation would be an important step towards the implementation of joint governance approaches and the improvement of data quality. Another important aspect, which van Ufford does not mention, is the pooling of resources and shared R&D and facilities. Over time, AI-enterprises from different countries may be compelled to combine resources in order to match the competitive potential of their Chinese and U.S. counterparts. While the EU is still the world's second-largest economy, the specifics of market fragmentation across 27 member-states and the already-mentioned rigidities and lack of focus in EU's programs create limitations for Europe's AI sector. Thus, international cooperation (outside the EU) should be considered an important option.

3. The EU Parliament adopted the world's first AI Act in June 2024 and advertised it as a great success and as an important step towards the creation of a favorable business environment for European and foreign investors. However, a thorough assessment of these regulations has resulted in rising concerns about the heavy compliance burden for companies, especially start-ups. The European AI industry lobby is pressuring EU institutions for a revision of the legislation, and it may have a point, since there should be a fine balance between AI regulations and AI development opportunities, including business interests. Also, EU's legislation in the field of AI should reflect international developments in AI regulation, as Europe must maintain a competitive local environment. For example, on January 23, 2025, President Trump issued an Order titled 'Removing Barriers for the American Leadership in Artificial Intelligence' that calls for the development of AI systems '*that are free from ideological bias or engineered social agendas*.'

5. CONCLUSION

The policies of the European Commission toward high-tech industries, especially the AI sector, are too fragmented, under-financed, and insufficiently coordinated. So far, the EU has been unable to mobilize AI investments on a par with the U.S. and is far behind China in AI patent registrations. The EU is a laggard in AI, and it seems highly unlikely that there will be a major narrowing of the gap with the U.S. and China anytime soon. It is obvious that both new approaches and more funding are necessary. According to Swedish Prime Minister Ulf Kristersson (2025), the EU has to enhance the development of modern technologies (including AI) and innovative products – or otherwise it risks becoming a museum.

The analyses in this paper suggest that the most relevant solution, in the current EU context, would be the creation of a dedicated AI R&D fund and the expansion of public-private partnerships, along with favorable business conditions for domestic and foreign companies in the AI field. Fiscal and monetary stimuli, such as tax exemptions for 5-7 years (or longer) and preferential financing (low-cost credit, loan guarantees), are suitable policy instruments for the palpable improvement of EU's AI potential. Over the long run, however, the EU should strive to create a high-tech business environment similar to the one in the U.S. – where private companies, without government help, are able to finance hundreds of billions of dollars in annual AI investment.

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