Artificial Intelligence and Sustainable Development: Policy Approaches from Visegrad Group Countries

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Abstract: The rapid rise of artificial intelligence (AI) presents both opportunities and risks for sustainable development. AI has the potential to transform industries, enhance resource efficiency, and tackle environmental challenges. However, it also poses significant risks, such as higher energy consumption and growing socio-economic inequality through job displacement. Without proper regulation, AI may further contribute to environmental degradation and social disparities. This paper employs a qualitative comparative policy analysis approach to examine AI strategies in Visegrad Group countries, focusing on environmental sustainability and labour market protections. The findings reveal that the Czech Republic leads with a comprehensive strategy, integrating measurable ecological targets and clearly defined responsibilities for implementing these objectives across relevant government bodies. Slovakia, by contrast, is the only country in the Visegrad Group without a dedicated AI strategy, relying instead on a broader digitalization framework that fails to address the specific challenges and opportunities associated with AI. Poland and Hungary demonstrate notable strengths, such as promoting energy-efficient AI technologies and implementing detailed reskilling programs; however, their goals remain overly general and vague, lacking clear specificity. It is unclear who holds responsibility for achieving these objectives or how their implementation will be monitored. By identifying key policy interventions, this study offers insights into aligning AI development with sustainability objectives to foster a more equitable and environmentally responsible future.

Keywords: AI regulation, Visegrad Group, Sustainable Development, Socio-economic Inequality.
JEL Classification: O38, L50, O14, Q56

1 Summary

This study explores the alignment of artificial intelligence (AI) strategies in Visegrad Group countries (Poland, the Czech Republic, Hungary, and Slovakia) with sustainability goals, focusing on two key areas: environmental sustainability and labor market protections. Using a qualitative comparative policy analysis, the paper examines the unique strengths and limitations of each country's AI policies, shedding light on regional approaches to balancing technological innovation with ecological and socio-economic priorities.

Key findings reveal a mixed landscape of progress. Czech Republic: Emerges as a regional leader, demonstrating a proactive approach to integrating AI with environmental and socio-economic objectives. Slovakia lags behind, hindered by the absence of a targeted AI policy. Poland: Promotes energy-efficient AI technologies and reskilling programs but lacks explicit carbon reduction targets or a clear accountability structure, leaving significant room for improvement in policy specificity. Hungary: Focuses on worker adaptation through extensive training programs and the development of energy-efficient AI technologies. However, its framework for environmental metrics remains underdeveloped. Slovakia: The only country without a dedicated AI strategy, relying instead on a broader digitalization framework. While it emphasizes education reform and workforce adaptation, the lack of specificity in addressing AI's unique challenges weakens its overall approach.

The comparative analysis underscores that while the Visegrad countries share a commitment to sustainability, there is significant variation in the depth and focus of their policies. The paper also highlights global AI governance trends, such as the emphasis on "green AI" and workforce adaptability, situating the Visegrad countries within the broader international context. Practical policy recommendations include adopting measurable sustainability targets, strengthening accountability frameworks, and fostering inter-country collaboration to enhance AI governance. This study contributes

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https://doi.org/10.32725/978-80-7694-102-1.36

to the understanding of how regional AI strategies can support sustainable development, offering actionable insights for policymakers aiming to align technological advancement with environmental responsibility and equitable growth. It concludes with a call for more quantitative analysis and cross-regional collaboration to refine and expand the applicability of these findings.

2 Introduction

Artificial Intelligence (AI) continues to improve rapidly, advancing in decision-making, language processing, and pattern recognition, boosting productivity and opening new opportunities across industries (Sunita, 2024). AI-driven automation enhances production processes, making them faster and often more cost-effective, with potential to increase labour demand in non-automated sectors or in roles complementing automated systems (Goralski & Tan, 2020). Moreover, deepening automation—where AI systems become increasingly efficient—creates a productivity effect that benefits both industry output and non-automated tasks (Marr, 2020). However, these benefits come with notable risks. This study focuses on risks related to environmental impact and labour market disruptions.

One pressing environmental concern is the significant energy consumption required by advanced AI technologies and computational facilities. AI processes, such as machine learning and data storage, rely heavily on high-powered data centers, potentially accounting for up to 20% of global electricity demand by 2030 (Jones, 2018). For example, Google has partnered with Kairos Power to construct small nuclear reactors that will supply carbon-free energy specifically for its AI technologies (Morris, 2024). This challenge is exacerbated by applications like cryptocurrency mining, where power consumption rivals that of entire nations, threatening climate action and sustainable energy goals (Truby, 2018). Without efficient energy solutions—such as advanced cooling systems or renewable energy sourcing—AI's environmental footprint could undermine sustainability initiatives and the pursuit of a low-carbon economy (Xiang et al., 2021).

AI also profoundly impacts the labour market, where the efficiency and cost benefits of automation often lead to the displacement of traditional jobs. Acemoglu explains that AI-driven automation directly replaces human labour in certain industries, reducing labour's value share (Acemoglu et al., 2024). These changes reshape job availability and increase stress for workers in roles vulnerable to automation, contributing to psychological strain and social inequality. Unlike earlier technologies such as software and industrial robots, AI increasingly targets high-skilled tasks, shifting job demands and exacerbating wage inequality across skill levels (Webb, 2019). As high-skilled roles requiring advanced training replace entry-level or manual jobs, many workers face barriers to re-entering a technology-driven economy, widening disparities in wealth, knowledge, and power across regions and social groups (Nagano, 2019).

While AI enhances productivity and drives innovation across sectors, its environmental and labour-related risks underscore the need for balanced policies that support both innovation and sustainable development. Strategic action is crucial to ensure equitable access to AI-driven opportunities and promote green practices within AI technologies, aligning technological progress with sustainable development goals.

3 Methods

In this study, I adopt a qualitative comparative policy analysis approach, focusing on the AI strategies of the Visegrad Group countries, as I believe this approach is well-fitted for understanding the complexities and nuances of national AI strategies. My analysis is conducted through a review of each country's national AI policy, with particular emphasis on aspects related to environmental sustainability and socio-economic protections. Key policy documents, government publications, and relevant academic literature are examined to identify specific provisions for sustainable AI implementation.

Following the selection of countries and documents, the data for analysis is structured around three primary criteria:

- Environmental Sustainability and Resource Efficiency: The analysis evaluates how each national AI strategy addresses AI's energy demands and resource use. This includes examining guidelines or targets for reducing carbon emissions associated with AI technologies, promoting energy-efficient AI models, and providing incentives for adopting green computing practices.
- Labour Market Protections and Socio-Economic Adaptation: This criterion examines measures within each AI strategy aimed at managing AI's impact on the labour market. Key aspects include support for reskilling

programs, unemployment protections, and policies that facilitate workforce transitions into an AI-driven economy.

- Alignment with Global Regulatory Standards and Policy Trends: This criterion explores how each Visegrad Group country aligns its AI strategy with global regulatory trends and policy frameworks. By drawing insights from pioneering countries like Germany and France, as well as authoritative sources such as the Stanford AI Index Report (Stanford Report, 2024), the analysis identifies how these countries address emerging global standards that focus on the previous criteria and regulatory recommendations within their national policies.

By employing a qualitative comparative policy analysis approach, I compare and analyse the Visegrad Group countries based on the above criteria, with the aim of highlighting best practices, identifying gaps, and outlining recommendations to enhance the alignment of their AI strategies with sustainability goals. Additionally, I evaluate how these policies align with or diverge from recent global AI governance trends. In doing so, I assess how regional strategies reflect broader global shifts in AI policy from the perspective of sustainability.

4 Research results

4.1 Poland

Poland’s AI Development Policy recognizes both the potential and challenges of AI, especially regarding energy demands and labour market impacts. While the strategy lacks specific targets for reducing carbon emissions, it promotes research initiatives focused on energy-efficient AI models, particularly in manufacturing and agriculture. This support is reflected in Poland’s funding programs aimed at sustainable projects that optimize energy use across industries, aligning AI development with broader sustainability goals. On the labour front, Poland anticipates potential job disruptions due to automation, addressing these with reskilling programs targeting workers at risk of job displacement. These programs are part of a broader effort involving government collaboration with educational institutions to provide lifelong learning and digital skill development, equipping workers for the demands of a data-driven economy. Additionally, unemployment protections are in place to cushion the socio-economic impacts of job loss due to automation.

4.2 Czech Republic

The Czech Republic's national AI strategy integrates environmental sustainability with AI implementation by developing energy-efficient AI solutions and supporting eco-friendly computing practices. The strategy includes ambitious greenhouse gas emission reduction goals, positioning AI as a tool to achieve sustainability objectives, particularly in sectors like transportation and energy management. Labour market adaptation is a major focus, with proactive policies that include comprehensive reskilling and upskilling initiatives. These programs are designed for current workers and job seekers to develop competencies aligned with AI advancements, smoothing the workforce transition. Job security and adaptability are embedded in national policies, aiming to protect against unemployment risks linked to AI integration. Legal and societal protections are also in place to prevent discrimination and to uphold workers’ rights and privacy in an increasingly automated workforce.

4.3 Hungary

Hungary views AI as a transformative force, especially on the labour market, where it is projected to affect up to 900,000 jobs by 2030. The strategy includes a robust framework for worker adaptation, with extensive reskilling and upskilling measures and collaboration between educational institutions and industry to develop relevant training programs. Additionally, social safety nets are emphasized to protect vulnerable workers during this transition. On the environmental front, Hungary’s strategy promotes research into energy-efficient AI technologies, supporting projects aimed at optimizing resource use and minimizing carbon emissions. While specific metrics for tracking environmental progress are still under development, Hungary’s strategy aligns with broader goals of sustainable innovation, particularly in agriculture and energy.

4.4 Slovakia

Slovakia’s 2030 Digital Transformation Strategy aims to create an AI-driven economy that supports environmental and social sustainability. Though specific carbon reduction targets are not detailed, the strategy promotes an energy-efficient AI ecosystem, with initiatives focused on addressing environmental challenges through AI. Slovakia emphasizes education reform and lifelong learning to prepare the workforce for AI-related changes, with reskilling programs tailored for adapting to digital demands, especially for workers in professions vulnerable to automation. Collaboration among ministries is highlighted as essential to identifying labour market needs and facilitating workforce transitions. Slovakia's approach reflects a commitment to both sustainable growth and the protection of labour in the digital age.

4.5 Global Trends

Global trends in AI development reveal a dual focus on environmental sustainability and workforce adaptability. Governments worldwide are increasingly emphasizing "green AI" practices, investing in energy-efficient and eco-friendly AI solutions to reduce environmental impact. Open ecological data initiatives enable broader access to critical environmental information, facilitating AI applications that optimize resource usage, integrate renewable energy, and forecast environmental risks. Examples include smart energy grids, optimized transportation systems, and projects in sectors like aviation that minimize fuel consumption and emissions, aligning technological advancement with ecological goals. In the labour market, AI-driven transformation is prompting a global focus on skill-building and lifelong learning to address shifts in job requirements. Countries are proactively implementing reskilling and upskilling programs, aiming to prepare workers for an AI-integrated workforce and mitigate the risks of job displacement. These initiatives often include digital literacy programs for vulnerable populations and advanced vocational training to close the skills gap in AI, data science, and robotics. By combining workforce adaptability with sustainable AI practices, nations are striving to ensure that AI growth is responsible, inclusive, and aligned with broader societal and ecological objectives.

5 Discussion and Conclusions

The analysis of AI strategies across Poland, the Czech Republic, Slovakia, and Hungary reveals a shared commitment to environmental sustainability and labour market adaptability, reflecting global trends in AI development. Among these countries, the Czech Republic stands out as having the most advanced and comprehensive AI strategy. Its ambitious greenhouse gas emission goals and direct linkage of AI advancements to environmental objectives set a strong example for others. This structured approach emphasizes the importance of quantifiable targets and accountability, positioning the Czech Republic as a leader in aligning its AI initiatives with global sustainability trends.

Conversely, Slovakia appears to lag behind in this regard, lacking its own dedicated AI strategy. Instead, it relies on a broader Digitalisation Strategy, which may dilute the focus on the specific challenges and opportunities presented by AI. This absence of a targeted AI framework hinders Slovakia's ability to effectively address environmental sustainability and labour market adaptation, making it the weakest among the Visegrad Group countries in this analysis.

In terms of environmental sustainability, Poland integrates energy-efficient AI technologies within its industrial framework but falls short with its lack of explicit carbon emission reduction targets. This highlights an area for potential improvement. Hungary, while supportive of energy-efficient AI technologies, is still in the early stages of formalizing its approach, suggesting a need to streamline efforts and establish clearer frameworks.

Regarding Labour Market Protections and Socio-Economic Adaptation, all four countries recognize the disruptive potential of AI on employment. Poland's strong emphasis on reskilling programs is commendable but lacks a comprehensive framework for unemployment protections, potentially leaving vulnerable workers exposed. In contrast, the Czech Republic excels with robust measures supporting workforce adaptability, demonstrating a proactive stance in identifying emerging labour market needs.

Slovakia's focus on educational reform, particularly its initiatives for lifelong learning and collaboration with industries, is notable. However, without a dedicated AI strategy, its efforts may lack the necessary specificity and coherence to be truly effective. In comparison, Hungary's detailed training programs emphasize specific competencies in AI and technology, providing an effective model for creating relevant training aligned with market needs.

To enhance their AI strategies, each country has opportunities to learn from one another. Poland could benefit from adopting the Czech Republic's ambitious carbon reduction targets, promoting accountability in AI's environmental impact. The Czech Republic should consider integrating Slovakia's initiatives to foster a vibrant AI ecosystem, including collaboration with civil organizations to maximize the societal benefits of AI technologies. Slovakia can benefit from Hungary's focus on tailored reskilling programs that address specific industry needs while also setting clear metrics for tracking progress in workforce adaptation. Lastly, Hungary should strive to formalize its approach to environmental sustainability, potentially mirroring Poland's industrial integration of AI solutions.

To enhance the significance of our results, we plan to incorporate quantitative data values in future iterations of this research, analysing metrics related to AI adoption, investment, and outcomes to provide a more robust assessment of each country's performance. Despite the positive aspects of each country's approach, it is essential to acknowledge the limitations of this research. Comparing AI strategies across different countries is inherently complex due to the diverse socio-economic contexts, regulatory environments, and cultural factors that influence policy effectiveness. Furthermore, the analysis relies solely on strategic documents, which may not reflect the actual enforcement and practical implementation of these policies. Variances in political will, public support, and funding can significantly affect the success of these strategies, potentially leading to gaps between policy intentions and real-world outcomes. In order to generalize the results for other similar groups of countries, in my next research I plan to include other EU member countries and also non-EU countries.

While the AI strategies of Visegrad Group countries demonstrate a shared commitment to sustainability, their implementation and effectiveness are significantly influenced by socioeconomic factors. These differences include disparities in funding availability, public support, and institutional capacity, all of which shape how each country navigates the challenges and opportunities of integrating AI with sustainable development goals.

Funding for AI initiatives varies widely among the Visegrad countries, impacting the scope and depth of their strategies. For example, Czech Republic benefits from higher allocations for AI research and development, enabling more ambitious projects, such as measurable carbon reduction targets and comprehensive reskilling programs. Slovakia, in contrast, faces financial constraints that limit its ability to develop a dedicated AI strategy, relying instead on a broader digitalization framework that lacks specificity. These differences highlight the need for tailored policy support, such as EU-level funding mechanisms, to reduce disparities and foster more balanced regional development.

Public attitudes toward AI adoption influence the political will and effectiveness of policy implementation. Countries with higher public trust in technology, like the Czech Republic, are better positioned to implement bold AI-driven sustainability measures. In contrast, scepticism or lack of awareness in other countries, such as Slovakia, may hinder the adoption of transformative policies. To address this, targeted public outreach and education campaigns are essential to build consensus around the benefits of sustainable AI.

Institutional differences also play a critical role. The Czech Republic's well-established administrative frameworks enable efficient implementation and monitoring of AI policies. By comparison, Poland lacks clearly defined accountability structures, weakening its ability to enforce sustainability targets. Hungary is still developing the metrics needed to track environmental progress, limiting its capacity to evaluate and refine policies effectively. Strengthening institutional capacity across the region is crucial for improving policy coherence and effectiveness. Collaborative initiatives, such as regional knowledge-sharing platforms, could help bridge institutional gaps and enhance policy design.

Economic conditions also affect the feasibility of AI strategies. Wealthier regions in the Czech Republic and Poland can more readily invest in advanced AI technologies, while less developed areas in Slovakia and Hungary face barriers to entry, such as limited access to digital infrastructure. Addressing these disparities requires targeted investments in digital inclusion, such as expanding broadband access and providing subsidies for AI adoption in underprivileged regions.

To mitigate the effects of these disparities and improve policy effectiveness, the following measures are recommended:

- Establish a regional funding pool to support AI projects in economically disadvantaged areas.
- Promote public-private partnerships to mobilize resources and expertise for AI-driven sustainability projects.
- Implement capacity-building programs to enhance institutional readiness, focusing on accountability structures and monitoring mechanisms.
- Launch public engagement campaigns to raise awareness about AI's role in sustainable development, fostering public trust and collaboration.

By acknowledging and addressing these socioeconomic differences, the Visegrad countries can create more equitable and effective AI strategies, ensuring that technological advancements contribute to sustainable development across the region.

In conclusion, while each country is making strides in its AI strategy, the inter-country comparisons reveal that the Czech Republic has the most advanced framework, while Slovakia's reliance on a broader digitalisation strategy limits its effectiveness. By embracing best practices from one another and aligning more closely with global trends, Poland, the Czech Republic, Slovakia, and Hungary can collectively foster a more sustainable and equitable AI landscape. This collaborative learning will significantly enhance their resilience to the challenges posed by AI advancements and ensure that they remain competitive in the rapidly evolving global economy.

Acknowledgement

I gratefully acknowledge the financial support from the projects: Researchers and Doctoral Candidates in the Internal Form at the University of Economics in Bratislava (I-23-108-00) ”Impact of Trade Unions on the Implementation of Automation Technologies Across European Countries”. VEGA 1/0781/21: Industrial Policy under the Conditions of Deindustrialisation and Automation.

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