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# THE SAFE USE OF ARTIFICIAL INTELLIGENCE IN ROMANIAN BUSINESS

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**Abstract**
*Artificial Intelligence (AI) is rapidly transforming global industries, offering unprecedented opportunities for efficiency, automation, and innovation. However, in Romania, the adoption of AI technologies remains limited and uneven. The local economic system is still developing, and many Romanian businesses – particularly small and medium-sized enterprises (SMEs) – lack the digital infrastructure, skilled workforce, and strategic frameworks needed to fully embrace AI. While some sectors such as banking, telecommunications, and retail have started integrating AI solutions, the majority of the business environment continues to operate using traditional models. This paper addresses a fundamental question: How can AI be used safely and effectively in Romania's emerging economy, while ensuring ethical, legal, and social responsibility? The safe use of AI implies not only technical robustness but also alignment with European regulatory frameworks such as the General Data Protection Regulation (GDPR) and the forthcoming EU Artificial Intelligence Act (European Commission, 2021). It also requires awareness of issues such as data privacy, algorithmic bias, cybersecurity threats, and the explainability of machine learning models (Floridi and Cowls, 2019). The article proposes a multi-dimensional framework that includes organizational readiness, regulatory compliance, ethical AI principles, and public-private cooperation. It also emphasizes the importance of employee digital upskilling and the creation of transparent AI governance models at the company level. Drawing on both international best practices and local realities, the paper outlines strategic recommendations tailored to Romania's current digital maturity. In doing so, it contributes to the broader academic and policy debate on how emerging economies can leverage AI responsibly, avoiding digital divides while fostering innovation. The aim is to offer actionable insights for business leaders, policymakers, and educators interested in accelerating Romania's digital transformation in a way that is secure, inclusive, and sustainable.*
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## 1. INTRODUCTION

Artificial Intelligence (AI) has emerged as a cornerstone of global economic and technological progress. As AI systems increasingly permeate sectors such as healthcare, manufacturing, finance, and logistics, they bring with them promises of efficiency, productivity, and transformative innovation (Brynjolfsson and McAfee, 2017; Russell and Norvig, 2021). In the European context, AI is recognized as a critical driver of competitiveness and sustainable development, with initiatives like the European Commission's Coordinated Plan on AI (2021) aiming to strengthen AI capabilities across member states.

In Romania, however, the path toward AI integration is more complex. Despite being home to a robust IT workforce and a growing ecosystem of tech start-ups, Romania ranks consistently low on the Digital Economy and Society Index (DESI), particularly in categories related to digital public services, the use of internet services, and human capital (European Commission, 2023). These deficits reflect deep-rooted structural, infrastructural, and educational challenges that constrain the country's ability to adopt AI at scale.

The Romanian business environment – especially among small and medium-sized enterprises (SMEs), which comprise over 99% of the business sector (INSSE, 2022) – faces several obstacles in harnessing AI, including inadequate infrastructure, limited AI expertise, insufficient digital skills, and a lack of alignment with evolving regulatory frameworks. Although larger firms in banking, telecommunications, and retail have started leveraging AI tools for tasks such as fraud detection, customer service automation, and supply chain optimization (PwC Romania, 2021), these examples remain the exception rather than the norm.

The concept of "safe AI use" encompasses more than just minimizing technological risks. It also includes ensuring compliance with ethical standards, legal obligations – such as the General Data Protection Regulation (GDPR) – and the forthcoming EU Artificial Intelligence Act (European Commission, 2021), while also promoting public trust and transparency (Floridi *et al.*, 2018; Mittelstadt, 2019).

Thus, this study seeks to explore how Romania can achieve safe, inclusive, and effective AI adoption. The central research questions include:

- What are the structural and organizational barriers to safe AI adoption in Romanian businesses?
- How can Romania align its AI strategies with EU ethical and legal frameworks?
- What role should education and public policy play in fostering AI-readiness?
- How can AI be used to reduce rather than widen the digital and economic divide in Romanian society?

By addressing these questions, this article contributes to the growing body of scholarship on responsible AI implementation in emerging economies and offers policy and business recommendations tailored to Romania's unique socio-economic context.

## 2. METHODOLOGY

To investigate the safe use of AI in Romanian business, this study adopts a qualitative, exploratory research design, grounded in a multidisciplinary review of literature, policy documents, and case studies. The methodology involves the following components:

1. Literature Review. The theoretical foundation of this study is based on existing literature concerning AI ethics, digital transformation, and innovation in emerging economies. Sources include peer-reviewed journals, policy reports from the European Commission, and technical guidelines from standards bodies such as the OECD and UNESCO. The literature review enables the identification of key variables such as "digital readiness," "ethical AI," and "regulatory compliance" (Jobin *et al.,* 2019; OECD, 2020).

2. Policy and Regulatory Analysis. A critical analysis of European and national legislation – such as the GDPR, the EU AI Act proposal, and Romania's National Digital Strategy – is conducted to understand the legal context in which AI technologies must operate. This ensures that the article aligns its recommendations with existing and forthcoming regulatory structures (European Parliament and Council, 2016; Romanian Government, 2022).

3. Case Study Sampling. The study draws on illustrative case studies from Romanian enterprises (both SMEs and large firms) that have begun implementing AI technologies. These cases are selected based on accessibility and relevance and aim to highlight both successful practices and encountered challenges. Sources include industry white papers, interviews, and secondary data from consulting firms like Deloitte, KPMG, and PwC.

4. Stakeholder Perspective. The views of business leaders, educators, policymakers, and IT professionals are integrated through a secondary analysis of interviews and surveys published in Romanian digital transformation studies (Digital Nation, 2022; ANIS, 2023). This enriches the analysis with context-specific insights on perceived risks, organizational culture, and readiness levels.

5. Framework Development. Based on the above data, the study proposes a multi-dimensional framework for the safe use of AI, integrating organizational, regulatory, ethical, and educational components. This framework is evaluated in light of international best practices and adapted to Romania's socio-economic realities.

By triangulating across these data sources and analytical methods, the study ensures a comprehensive understanding of Romania's AI landscape and the mechanisms through which AI can be safely and effectively adopted.

## 3. CONTEXT AND CHALLENGES IN THE ROMANIAN BUSINESS LANDSCAPE

Romania's trajectory toward digital transformation and AI integration reflects a paradoxical landscape – one characterized by both high potential and significant systemic obstacles. On one hand, Romania boasts one of the highest percentages of ICT graduates in the EU and a thriving tech services sector, concentrated in urban hubs like Cluj-Napoca, Bucharest, and Timișoara (Eurostat, 2022). On the other hand, the broader business ecosystem, especially SMEs, remains digitally underdeveloped, with a low rate of technology adoption, limited innovation capabilities, and persistent regional disparities (European Commission, 2023).

One of the foundational challenges facing Romanian businesses is the uneven distribution of digital infrastructure. While urban areas enjoy relatively robust internet penetration and access to cloud services, rural regions still struggle with connectivity and basic digital services (European Commission, 2023). According to the Romanian Digital Transformation Strategy (Romanian Government, 2022), fewer than 40% of SMEs have adopted cloud computing, big data, or AI solutions. The lack of enterprise resource planning (ERP) systems and integrated platforms limits the ability of companies to process large datasets, a prerequisite for effective AI use (World Bank, 2020).

This infrastructure gap significantly constrains the development of intelligent automation or data-driven business strategies. Without the technological backbone required to support AI systems – such as cloud computing, secure data storage, and reliable networks – AI remains inaccessible to a large portion of the Romanian business community.

Despite a strong output of STEM graduates, Romania faces a critical mismatch between academic training and labour market needs, especially in AI-specific domains like data science, machine learning engineering, and AI ethics (Bălan, 2021; Petre *et al.*, 2022). The National Authority for Qualifications (ANC) notes that while programming and basic IT skills are widespread among young professionals, competencies in AI architecture, algorithm design, and data governance are scarce.

Furthermore, digital illiteracy remains high among the general population. According to Eurostat (2023), only 28% of Romanians possess above-basic digital skills – well below the EU average. This deficiency extends to management levels: business leaders often lack a strategic understanding of digital technologies, impeding informed decision-making regarding AI investments (PwC Romania, 2021).

The integration of AI must be situated within a framework that ensures compliance with European regulatory standards. The GDPR mandates data privacy and informed consent, while the proposed Artificial Intelligence Act introduces tiered risk classifications for AI systems and enforces stringent

obligations for high-risk applications (European Commission, 2021; Veale and Borgesius, 2021).

However, Romanian businesses – especially SMEs – are frequently unprepared for these legal expectations. A survey by ANIS (2023) revealed that over 60% of companies implementing AI had not conducted a Data Protection Impact Assessment (DPIA), a key requirement for GDPR compliance. Similarly, few firms have internal structures to evaluate algorithmic fairness, explainability, or the social impact of their AI models (Floridi and Cowls, 2019).

Beyond material constraints, the safe use of AI is often hindered by cultural factors and organizational inertia. Many Romanian firms operate within rigid hierarchies and risk-averse mindsets, discouraging experimentation and innovation. Resistance to change, particularly in family-run or traditionally managed businesses, can stall digital initiatives before they begin (Mihăilescu, 2020).

Moreover, AI projects typically require cross-functional collaboration between IT, operations, legal, and human resources teams – an organizational structure that many Romanian firms lack. In environments where siloed departments and outdated workflows dominate, the holistic integration of AI technologies becomes difficult, if not impossible.

Unlike other EU member states that have articulated comprehensive national AI strategies – such as Finland, France, and Germany – Romania's approach has been fragmented and reactive. While the Romanian National Recovery and Resilience Plan (NRRP) includes funding for digital education and business support, there is still no unified national AI roadmap that defines long-term goals, ethical guidelines, investment incentives, or sector-specific priorities (Romanian Government, 2022).

As a result, Romanian businesses face uncertainty regarding government support for AI, leading to inconsistent adoption across sectors. The absence of AI sandboxes, innovation hubs, and dedicated funding channels further limits Romania's ability to scale pilot projects into commercially viable solutions.

## 4. SCHOOL: THE KEY FACTOR IN DIGITAL EDUCATION AND AI

The safe and effective adoption of Artificial Intelligence (AI) in Romania hinges not only on the readiness of businesses and regulatory frameworks but also on the preparedness of future generations to engage with these technologies. The educational system plays a pivotal role in shaping the digital skills, ethical considerations, and AI literacy of the workforce, especially at the primary and secondary school levels. The transition towards an AI-driven economy requires the cultivation of a digitally proficient and ethically informed population from a young age (OECD, 2020).

Romania's educational system faces significant challenges when it comes to supporting the country's digital transformation. These challenges range from

outdated curricula to insufficient teacher training, limited access to modern digital infrastructure, and a lack of alignment between educational outputs and industry requirements (Bălan, 2021). Nonetheless, schools remain the foundation upon which Romania's AI future will be built. Ensuring that students are equipped with the skills needed to thrive in an AI-driven world must therefore become a national priority.

One of the most glaring barriers to digital education in Romania is the significant regional disparity in access to educational technology. Rural schools are especially underserved, lacking essential tools such as computers, internet connectivity, and smartboards, which hinders students' exposure to even basic digital tools, let alone advanced AI technologies (European Commission, 2023). The Digital Economy and Society Index (DESI) report from the European Commission (2023) points out that while urban areas may have access to high-speed internet and modern learning resources, rural areas are at risk of being left behind in the digital education race.

Moreover, the existing digital curriculum in Romanian schools is outdated and fails to equip students with the competencies required for a rapidly evolving technological landscape. While the inclusion of coding and computer science has been increasingly emphasized, these subjects remain peripheral in many school curricula, often limited to a few hours per week or to specific specialized schools (Petre *et al.,* 2022). As a result, while some students may gain basic digital literacy, they are not exposed to the critical thinking, problem-solving, and ethical reasoning skills necessary for understanding the broader societal impact of AI.

The role of teachers in promoting digital literacy and AI understanding cannot be overstated. However, many Romanian educators still lack the necessary knowledge and skills to teach modern digital subjects, including AI (Benta *et al*., 2021). Teacher professional development programs focused on AI, machine learning, and data ethics are sorely lacking, and there is a need for training that goes beyond the basics of technology use. Teachers must be empowered not only to use digital tools in the classroom but also to teach students how AI works, the ethical dilemmas it presents, and how it impacts various industries and society at large.

The European Commission (2023) emphasizes the importance of comprehensive teacher training programs that integrate digital literacy and AI as part of the core curriculum. In Romania, initiatives like the "Smart Lab" program have sought to equip educators with digital teaching tools, but such initiatives need to be scaled and supported through sustainable funding and government backing. Additionally, creating a network of AI educators and fostering collaboration among schools, universities, and tech companies could significantly improve the capacity of educators to teach these complex subjects.

Curriculum reform is essential for preparing Romania's students for a future dominated by AI technologies. Schools must offer not only technical skills but

also integrate interdisciplinary approaches that connect AI to real-world applications in fields like healthcare, business, agriculture, and social sciences. For instance, coding, algorithmic thinking, and data science should be introduced early in the curriculum, with progression toward more specialized AI topics at the secondary and tertiary levels.

Research suggests that AI education should not be confined to the sciences alone; instead, it should be incorporated into subjects like philosophy, social studies, and ethics to promote a more holistic understanding of AI's societal impact (Floridi and Cowls, 2019). Introducing AI ethics, algorithmic bias, and data privacy at the school level is crucial for fostering responsible AI use among future professionals and citizens.

The introduction of AI literacy into the curriculum should be supported by government policies that ensure equitable access to technology across all schools, especially in disadvantaged rural and urban areas (Romanian Government, 2022). The National Recovery and Resilience Plan (NRRP), which includes provisions for digital education, presents a unique opportunity to modernize Romania's educational infrastructure and integrate digital competencies into the curriculum across all grade levels. However, the success of this initiative depends on consistent implementation and monitoring, as well as collaboration between the Ministry of Education, technology providers, and local authorities.

An effective approach to AI education involves collaboration between educational institutions, the private sector, and government bodies. Public-private partnerships (PPP) can bridge the gap between educational outcomes and industry needs, ensuring that students are prepared for careers in AI and other digital sectors.

Private companies in Romania, especially in the tech sector, can play an important role in providing resources such as internships, mentorship programs, guest lectures, and AI learning materials. Companies like Endava, UiPath, and Bitdefender are already engaged in educational initiatives, offering training and support to help students understand AI's real-world applications (Cârstea, 2022). These partnerships can also foster innovation hubs where students and teachers collaborate with industry experts on AI projects, thereby gaining hands-on experience that directly translates into workplace competencies.

Furthermore, universities and research institutions must be involved in curriculum development, ensuring that the courses offered are not only scientifically rigorous but also aligned with the ethical and social implications of AI technologies. Such collaborations between academia and industry will create an ecosystem where the skills taught in schools are aligned with future job market demands.

While preparing students for careers in AI is important, fostering AI literacy at all levels of society is equally crucial. AI is not just for technologists – its impact extends to everyday life, from automated healthcare tools to personalized

shopping experiences. Ensuring that Romanian citizens understand how AI works and how it impacts their lives is key to maintaining an informed, empowered public that can engage with and shape AI technologies responsibly (OECD, 2020).

Public awareness campaigns, community engagement programs, and lifelong learning opportunities can help adults and older generations acquire the necessary digital competencies to interact with AI systems safely and effectively. These efforts must be coordinated with educational initiatives to ensure that digital literacy is not restricted to youth but is embraced by the wider population, thus fostering an AI-savvy society.

## 5. TOMORROW'S AI NEEDS: BASIC DIGITAL SKILLS FROM THE PRIMARY SCHOOL PUPIL

The future of Artificial Intelligence (AI) relies not only on the integration of advanced technologies in various industries but also on the ability of the future workforce to interact with these technologies effectively. As AI becomes an increasingly ubiquitous part of daily life, it is essential that the foundations for a digitally literate society be laid at an early age. In Romania, this means equipping primary school pupils with the basic digital skills necessary to thrive in an AI-driven world. This approach is not just about teaching students how to use computers; it is about fostering the critical thinking, problem-solving, and ethical understanding that will be essential as they grow into the AI-savvy professionals of tomorrow (OECD, 2020).

The skills required for engaging with AI are no longer limited to those involved in computer science or engineering fields. They are becoming universal competencies that all students will need to master, irrespective of their future career paths. AI technologies are embedded in nearly every aspect of modern life – from social media algorithms to personalized healthcare recommendations, smart devices, and even transportation systems (OECD, 2020). As such, the importance of providing foundational digital skills to children in primary school cannot be overstated.

At its core, basic digital literacy includes understanding how technology works, how to use digital tools safely, and developing early computational thinking. However, the future workforce will also need to be equipped with deeper knowledge about how AI systems operate, how data is processed, and how algorithms make decisions. These competencies, while advanced, can be introduced gradually starting from the earliest stages of education. The European Commission (2023) acknowledges the need for early AI education, advocating for the introduction of digital and computational thinking skills from primary education onwards.

Romania has made some progress in advancing digital education at the primary school level, but there are still significant gaps that need to be addressed. According to the European Commission's Digital Economy and Society Index

(DESI) 2023, only a small proportion of Romanian primary schools offer structured and systematic digital competence training. Access to digital tools and devices remains inconsistent, especially in rural areas, where schools often lack adequate infrastructure (European Commission, 2023). As a result, many Romanian students still graduate from primary school without having developed the foundational digital skills needed to succeed in an AI-driven world.

Moreover, there is a significant disparity between urban and rural schools when it comes to access to technology. While larger cities such as Bucharest and Cluj-Napoca have well-equipped schools with high-speed internet and modern computer labs, rural areas are still struggling with outdated equipment and slow internet connections. This digital divide exacerbates inequalities in education and prevents many children from accessing even basic digital training. The Romanian government has recognized these challenges, but ensuring equal access to digital education across all regions of the country remains a work in progress (Romanian Government, 2022).

Primary schools are in a unique position to help children develop early digital competencies, laying the foundation for more advanced AI education later in their academic journey. Introducing digital skills at the primary school level helps ensure that all children, regardless of their socioeconomic background or geographic location, have equal opportunities to engage with technology and gain digital fluency. It also serves to demystify technology and foster curiosity, creativity, and problem-solving skills that will be essential as AI becomes a more integral part of their lives (OECD, 2020).

At the heart of AI education in primary schools should be computational thinking, which involves understanding how to break down complex problems into smaller, more manageable parts, identify patterns, and create step-by-step solutions. This skill is fundamental not only for understanding how AI systems function but also for approaching problems logically and systematically – skills that are transferable across many disciplines.

In addition to computational thinking, students should also be introduced to the basics of data literacy. For instance, they can learn how data is collected, processed, and used to make decisions. They can be introduced to concepts such as data visualization, interpretation, and basic statistics. Exposure to these topics at a young age can help build a deeper understanding of how AI systems make predictions and decisions based on data, which is crucial in a world where data-driven technologies are pervasive.

Implementing a robust AI curriculum in primary schools presents several challenges. First, there is the issue of teacher training. Many primary school teachers in Romania lack the necessary skills and confidence to teach digital subjects, particularly AI-related content. While there have been some initiatives to address this, such as the “Smart Lab” program, which provides training and digital resources for educators (Benta *et al.*, 2021), teacher preparedness remains

a significant bottleneck. Professional development programs must be expanded and include content related to AI, machine learning, and data ethics to ensure that teachers are equipped to foster digital literacy among their students.

Second, there is the challenge of infrastructure. Ensuring that all schools – particularly those in rural areas – have access to the necessary digital tools and reliable internet is critical for enabling widespread AI education. While initiatives like the National Recovery and Resilience Plan (NRRP) aim to improve digital infrastructure, the success of these efforts will depend on effective implementation and equitable distribution of resources (Romanian Government, 2022). Ensuring that all primary schools have access to the necessary tools for teaching digital and AI-related skills is an essential step in closing the digital divide.

The curriculum for primary schools should be designed in such a way that it gradually introduces children to the key concepts of AI and digital literacy, while also fostering a broader understanding of how technology impacts society. The integration of AI literacy into the national curriculum is essential for preparing Romanian students for the future. This would involve including content on the ethical implications of AI, such as bias, fairness, and transparency, as well as teaching students about the potential risks and benefits of these technologies.

Curriculum development should be guided by interdisciplinary principles, combining elements from mathematics, science, technology, and social studies. For example, lessons could teach students about the fundamentals of coding, but also encourage them to think critically about how algorithms might affect decision-making processes in areas such as healthcare, finance, and governance. By combining technical knowledge with ethical reasoning, primary school education can help create a generation of students who not only understand how AI works but also how to use it responsibly.

While schools play a central role in AI education, parents and the broader community also have a significant role to play. Parents can support their children's digital education by providing access to digital tools at home, encouraging safe internet use, and fostering curiosity about how technology works. Community-based initiatives, such as after-school programs, workshops, and online resources, can also help reinforce the skills taught in school and provide additional opportunities for children to engage with AI in a hands-on way.

Additionally, governments and technology providers should work together to ensure that educational resources – such as interactive AI learning platforms, coding tutorials, and digital games – are widely available to both students and teachers. Public-private partnerships can also play a vital role in making AI education more accessible and engaging, particularly in under-resourced areas.

## 6. AI GOVERNANCE AND ETHICAL CONSIDERATIONS IN ROMANIAN BUSINESSES

As Artificial Intelligence (AI) continues to evolve, so too does the need for a robust governance framework that ensures the responsible, ethical, and transparent deployment of these technologies in Romania's business landscape. In line with the global shift toward AI regulation, Romanian businesses must recognize the importance of AI governance, encompassing legal, ethical, and social considerations, while also addressing technical aspects. This section explores the necessary steps for establishing effective AI governance in Romania's business environment.

One of the key aspects of AI governance is ensuring compliance with local, regional, and international regulations. The General Data Protection Regulation (GDPR), adopted by the European Union, has become a cornerstone for data privacy in AI systems. It imposes strict guidelines for how companies handle personal data, especially when it is processed by AI algorithms. For Romanian businesses, particularly small and medium-sized enterprises (SMEs) who are often less aware of compliance requirements, aligning AI initiatives with GDPR is a critical first step toward ethical AI deployment (European Parliament and Council, 2016).

Furthermore, the EU Artificial Intelligence Act (2021) is set to become the world's first comprehensive AI regulatory framework. This regulation aims to classify AI systems based on their risk level, with stricter regulations for high-risk applications. Romanian businesses must familiarize themselves with the provisions of this Act to ensure that their AI solutions meet the required standards of transparency, safety, and accountability (European Commission, 2021).

For businesses that adopt AI for high-risk applications, such as autonomous vehicles or AI-driven healthcare solutions, compliance with both GDPR and the AI Act is not merely a matter of legal necessity – it is essential for ensuring the trustworthiness of their systems and the safety of end-users. As AI continues to impact more sectors, the pressure on Romanian businesses to align with regulatory requirements will only grow.

AI systems must be developed and deployed in ways that promote fairness, inclusivity, and accountability. One of the greatest challenges facing AI in Romania – and globally – is the issue of algorithmic bias. AI algorithms are trained on data, and if that data contains inherent biases, the resulting AI models can perpetuate or even amplify these biases. This is particularly concerning in high-stakes areas such as hiring, credit scoring, and law enforcement (Binns, 2018).

Romanian businesses must adopt practices that ensure their AI systems are fair and transparent. This includes conducting regular audits of AI algorithms to identify and mitigate any biases present in training datasets. Moreover, it is crucial for businesses to provide clear and accessible explanations of how AI models

make decisions, particularly when these decisions affect individuals' lives. In this regard, AI explainability is a core ethical principle, and companies that can make their AI processes transparent will not only comply with regulations but also build public trust in their systems.

Developing ethical AI also requires that Romanian businesses take proactive steps to safeguard data privacy, ensure accountability, and foster responsible AI usage. Ethical AI guidelines should be integrated into business practices and decision-making processes, ensuring that companies not only avoid harm but also strive to create AI solutions that benefit society as a whole.

A central feature of effective AI governance is the establishment of robust governance structures within businesses. AI governance committees should be set up to oversee AI projects, ensuring that they adhere to legal, ethical, and regulatory standards. These committees should include a diverse range of stakeholders, including legal, technical, and ethical experts, as well as representatives from the business leadership team.

In Romania, fostering public-private partnerships is essential for building transparent and trustworthy AI systems. These partnerships can take the form of collaborations between businesses, governmental bodies, academic institutions, and civil society organizations. By engaging a wide range of stakeholders in AI development, Romanian companies can ensure that their AI solutions are not only effective but also socially responsible and ethically sound (Floridi and Cowls, 2019).

Moreover, businesses should be transparent about their AI practices, actively engaging with customers, regulators, and the public to communicate how their AI systems work, how data is handled, and what measures are taken to prevent harm. Public engagement helps build trust and ensures that AI adoption occurs in a manner that reflects societal values and expectations.

Small and medium-sized enterprises (SMEs) in Romania represent a significant portion of the national economy but often face challenges in adopting AI due to limited resources and expertise. To promote responsible AI use, Romanian SMEs must be provided with educational resources, training programs, and access to AI tools that help them implement AI systems responsibly. This is particularly important for sectors where AI adoption is still in its infancy, such as agriculture, manufacturing, and local retail.

Government programs, private-sector collaborations, and EU-funded initiatives can help SMEs overcome barriers to AI adoption. AI literacy programs targeting business owners, managers, and employees can help build foundational knowledge of AI technologies, enabling SMEs to make informed decisions and adopt AI responsibly. Additionally, establishing clear AI guidelines for SMEs will help ensure that they prioritize ethical considerations and comply with legal requirements, even as they innovate and adopt new technologies.

As AI systems become more integrated into Romanian businesses, the potential risks associated with their use – such as cybersecurity threats, data breaches, and system failures – must be carefully managed. Businesses need to adopt comprehensive cybersecurity measures to protect both their AI systems and the sensitive data they handle. AI solutions can be vulnerable to attacks, including adversarial attacks where small modifications to input data can lead to erroneous outputs (Grosse *et al.,* 2017). Romanian businesses must therefore invest in securing their AI infrastructure and ensuring that their systems are resilient against both external and internal threats.

Additionally, AI systems must be robust and capable of handling unexpected scenarios without causing harm. This requires ongoing testing, validation, and monitoring of AI models, particularly in high-risk environments. For Romanian businesses, investing in AI resilience is crucial for mitigating the long-term risks associated with the deployment of intelligent systems.

## 7. DIGITAL SKILLS AND WORKFORCE UPSKILLING FOR AI ADOPTION IN ROMANIA

The successful integration of Artificial Intelligence (AI) into Romanian businesses hinges not only on technological infrastructure and governance frameworks but also on the ability of the workforce to engage with and harness these technologies effectively. A critical barrier to AI adoption in Romania is the skills gap – the disparity between the current workforce capabilities and the skills needed to support AI development and implementation. This section discusses the necessity of workforce upskilling and how Romanian businesses can foster a culture of continuous learning to enable AI adoption at scale.

Romania has made significant strides in increasing digital connectivity and the number of skilled IT professionals, yet there remains a pronounced digital skills gap. According to the European Commission's Digital Economy and Society Index (DESI), Romania consistently ranks among the lower tiers in terms of digital skills, with many employees still lacking the necessary competencies to navigate advanced technologies such as AI (European Commission, 2023).

In Romania, the most significant skills gap is found in technical roles related to AI development, such as data scientists, machine learning engineers, and AI architects. This shortage is exacerbated by a mismatch between the skills imparted by the education system and the evolving demands of the tech industry. Moreover, there is also a gap in managerial and operational roles, where decision-makers need to understand the strategic implications of AI, data governance, and ethical concerns.

To bridge this gap, Romania’s businesses must prioritize workforce development and partner with educational institutions to ensure that employees possess the skills necessary for both AI implementation and governance. Continuous professional development initiatives, including reskilling programs

for existing employees and upskilling initiatives for young professionals, will be pivotal for ensuring that the Romanian workforce is future-ready.

Building a digitally competent workforce in Romania requires collaboration between the public and private sectors, as well as educational institutions. The National Recovery and Resilience Plan (NRRP), a governmental initiative aimed at modernizing Romania's economy, includes provisions for boosting digital skills at all levels (Romanian Government, 2022). However, to create a sustainable AI workforce, this plan must go beyond basic skills training and focus on advanced AI competencies that meet the needs of both small businesses and large corporations.

Private companies, particularly tech giants and AI start-ups, can also play a critical role by partnering with universities and vocational training centers to offer AI-focused internships, research programs, and practical training opportunities. These collaborations ensure that students gain exposure to real-world AI applications and have a deeper understanding of how AI systems are deployed in business settings. Similarly, companies should foster a culture of continuous learning within their organizations by supporting employees' participation in AI certification programs and other relevant training courses.

While advanced AI skills are essential for a select group of technical professionals, there is an equally important need to promote digital literacy across all sectors of the workforce. Every employee, regardless of their role, should be equipped with foundational digital skills that enable them to interact with AI systems, understand the ethical implications of these technologies, and navigate the opportunities and risks they bring.

Romanian businesses must invest in digital literacy programs that focus on the core competencies needed to work in an increasingly digital economy. This includes understanding data privacy, recognizing algorithmic biases, and using AI-powered tools to improve productivity and decision-making. Human resources departments must also be proactive in training staff to use AI applications ethically and effectively, ensuring that all employees – whether in marketing, customer service, or operations – are empowered to leverage AI in a responsible manner.

One of the challenges facing Romania in its journey toward AI adoption is the digital divide between urban and rural areas. While cities like Bucharest, Cluj-Napoca, and Iași boast strong IT ecosystems, rural areas still face significant challenges in terms of digital infrastructure and access to quality education (European Commission, 2023). This geographic inequality further limits the ability of many individuals to acquire the digital skills necessary to thrive in a technologically advanced society.

The Romanian government, along with private sector actors, must focus on ensuring that digital upskilling efforts are inclusive and reach all regions of the country. This includes expanding internet access, improving the availability of digital devices in rural schools, and offering localized training programs that cater

to the needs of rural populations. Furthermore, mobile learning platforms and remote education initiatives can help bridge the geographical divide, ensuring that digital skills are accessible to everyone, regardless of their location.

AI itself can play a pivotal role in improving digital skills development. AI-powered educational platforms can personalize learning experiences, identify gaps in knowledge, and provide targeted feedback to students. For example, AI-driven tools can tailor educational content to suit individual learning speeds and preferences, improving engagement and outcomes. In Romania, educational institutions should explore the potential of AI to create smart classrooms, where AI assists both teachers and students in optimizing the learning process.

Moreover, AI can also be used to assess and improve the effectiveness of training programs. By analysing data on learning behaviours and performance, AI can provide insights into which training methods are most effective, helping businesses refine their upskilling initiatives over time.

## 8. AI APPLICATIONS IN KEY SECTORS OF THE ROMANIAN ECONOMY

AI is not a one-size-fits-all technology – it can be applied across a variety of sectors, each with its own set of challenges and opportunities. In this section, we explore the potential of AI in some of Romania's key economic sectors, including agriculture, manufacturing, healthcare, and retail.

Romania's agricultural sector is still heavily reliant on traditional farming methods. However, AI has the potential to revolutionize this sector by improving efficiency, reducing waste, and enhancing sustainability. Precision farming, driven by AI, involves using sensors, drones, and satellite imagery to monitor crop health, optimize irrigation, and predict harvests. Romanian farmers can leverage AI-powered tools to make data-driven decisions that increase yields while minimizing environmental impact.

For small and medium-sized farms in Romania, AI-powered platforms can offer affordable access to cutting-edge technologies, making it easier to adopt smart farming practices. Additionally, AI can help optimize supply chain management, reducing food waste and improving the distribution of products from farms to consumers. Manufacturing is a cornerstone of Romania's economy, with key industries such as automotive, textiles, and electronics driving exports. AI has the potential to enhance operational efficiency, improve product quality, and streamline production processes. Predictive maintenance, powered by AI, can reduce downtime by identifying equipment malfunctions before they occur. Moreover, AI can optimize supply chains, predict demand more accurately, and reduce energy consumption in manufacturing processes. By implementing AI-driven automation, Romanian manufacturers can increase competitiveness and reduce costs, helping them to maintain a strong position in the European and global markets.

In the healthcare sector, AI can enhance diagnostic accuracy, personalize treatment plans, and improve patient care. AI-powered medical imaging tools, for example, can analyse radiographs, MRIs, and CT scans to identify early signs of diseases like cancer. Moreover, AI can help healthcare providers predict patient outcomes, optimize resource allocation, and streamline administrative tasks, allowing medical professionals to focus on patient care. Romania's healthcare system faces challenges related to underfunding and a shortage of medical professionals. AI adoption can help alleviate some of these challenges by improving operational efficiency and enabling healthcare providers to deliver better care despite resource limitations.

Romania's retail sector has seen rapid digital transformation in recent years, with many businesses adopting e-commerce and AI-driven customer service tools. AI can enhance customer experiences by providing personalized recommendations, automating customer support through chatbots, and optimizing inventory management. As Romanian businesses continue to embrace AI in retail, the key to success lies in using AI to improve customer engagement, streamline operations, and offer personalized shopping experiences that enhance consumer loyalty.

## 9. CONCLUSIONS

Romania stands at the crossroads of a digital revolution, with AI adoption offering significant opportunities for businesses to enhance productivity, efficiency, and innovation. However, for AI to be integrated successfully, it is essential to prioritize the development of a digitally skilled workforce, establish effective governance frameworks, and ensure that ethical principles guide the adoption of these technologies. By fostering a culture of innovation and responsibility, Romanian businesses can unlock the full potential of AI and position themselves as leaders in the European digital economy.

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