

**International Economics**

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**INNOVATIVE STARTUPS
AND THE CHALLENGE
OF ARTIFICIAL INTELLIGENCE:
SOME INSIGHTS FROM ITALY AND ROMANIA**

Abstract

The combination of innovation and artificial intelligence (AI), with reference to innovative startups, presents a challenge for firms that start operating in the market. Such a transformation in the entrepreneurial scenario, which is likely to define new business models, has been observed in two European countries: Italy and Romania. In this article, we examine the AI-induced innovations in the regula-

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tory frameworks of both countries. We then provide insights from interviews with CEOs of innovative startups, who discuss the challenges and prospects facing the industry. This paper concludes with some reflections on this evolving framework as a prelude to further studies.

Key Words:

Artificial intelligence; business models; European regulations; innovative startups; interviews; Italy; normative environment; Romania.

JEL: E23;L25; O31; O33; O38.

8 figures, 6 tables, 70 references.

Problem Statement

An *innovative startup* is a company with a very high level of technological or innovative content that is likely to grow quickly and generate value, even if only for the area where it is located and operates. The notion that innovation represents the new engine of global economic growth during times of crisis has become widely accepted (Archibugi and Filippetti, 2013; Rüdiger et al., 2014; Wenzel et al., 2021), and innovative startups demonstrate a great capacity for resilience to such events.

Although innovation strategies in startups were found to be ineffective during periods of economic prosperity, research suggests that this negative effect disappears and may even turn into a positive effect during economic crises (Peris-Ortiz et al., 2014). In fact, companies that innovate during times of crisis tend to outperform their competitors during the recovery period (Am et al., 2020).

Startups contribute significantly to local economic development (Isenberg and Onyemah, 2016; Gries and Naudé, 2009; Orlova et al., 2018), especially in emerging economies where the numbers of newly established companies are surging (Salamzadeh, 2018; Oyarzo et al., 2020; Naudé et al., 2008; Ghani and

Mukherjee, 2022; Tiwari and Dubey, 2023; Gavrilut et al., 2022; Pricopoaia et al., 2023). Their diffusion contributes to an increase in per capita income due to their ability to attract regional and foreign investment. They also contribute to the development, in terms of efficiency and effectiveness, of local labour markets, where technological innovations (for example, digitalization) have not caused the feared increase in unemployment rates. These markets, in fact, are adapting well to the transformations, while the ways in which job supply and demand meet are affected by a real revolution because of the aforementioned innovations.

Innovative startups make regions more international by facilitating the entry of foreign companies and workers. They accelerate structural change in markets and serve as connectors between local producers and international markets, facilitating the marketing of their products. For local development purposes, startups develop collaborative and cooperative relationships with larger companies through various processes such as business acceleration, tutoring, supervision, joint development, and co-branding. They also collaborate with governments, which proves crucial for the digital development of a country. Finally, they act as protagonists of green innovation, contributing to a better quality of life and the environment (Susilo, 2020).

Innovative startups are becoming increasingly important in the entrepreneurial scenario: they represent a relatively young ecosystem in the European economic landscape (Dodu-Gugea, 2020); while, for the reasons just described, policy initiatives aimed at promoting their creation are widespread throughout the world. In this regard, Audretsch et al. (2020), drawing on the GenGlobal's «Startup Nations Atlas of Policies» (SNAP), identify the most significant ones with a particular focus on innovative startups.

However, compared to older firms, these firms may face difficulties due to their unique features (Gimenez-Fernandez et al., 2020). Startups need to compete effectively with established organizations (Stinchcombe, 1965). To do so, they may need time to learn how to define efficient routines and create a solid structure (see Bruderl and Schussler (1990), who talk about the newness and adolescence of organizations and how new organizations are characterized by high death rates); moreover, they have not yet developed stable relationships and customer loyalty.

Possible barriers to startups include lack of finance, insufficient government support and lack of visibility. Furthermore, the individuals involved may not always be sufficiently aware of the opportunities, have a fear of failure, lack adequate training and suffer from «family pressure».

Nevertheless, some scholars (for example, Brynjolfsson and Petropoulos, 2021) show that in recent decades, after reaching the lowest point of a J-shaped

productivity curve, companies have turned to a productivity boom scenario.¹ Overall, innovation proves its ability to contribute to the creation of a promising environment for entrepreneurship, becoming a fundamental tool for overcoming all kinds of hindrances. It is possible to consider, for example, the extent to which digitalization has affected the methods which entrepreneurs use to obtain financing (Fortezza et al., 2021) or the digital government as an external facilitator for starting a business (Martins and Veiga, 2022).

In such a context, artificial intelligence (AI) stands in a complementary relationship, and startups using AI in their business models are expanding rapidly.

The objective of the present study is to examine the legislation pertaining to innovative startups and the potential use of AI, and to compare experiences in two different countries, specifically Italy and Romania. The joint consideration of two distinct production realities will allow us to assess whether geographical and productive contexts can influence the development of new companies.

The next section provides an overview of some literature contributions, describing the sectors in which AI technologies are used and the requirements placed on the innovative startups in two countries. Subsequently, currently available data sources are described, as well as interviews that were conducted with managers (CEOs) of innovative startups to gather evidence. Finally, the paper concludes by discussing some considerations on the possible challenges for and the development potential of not only innovative startups but also the geographical area in which they operate, laying the groundwork for subsequent analyses.

Methodology

The topic treated in this contribution sheds light on a completely new field of study, and the few studies carried out so far have been merely descriptive. The present contribution describes the situation in two European countries: it performs a comprehensive review of the legislation concerning innovation, startups and the use of AI in Italy and Romania. Furthermore, for Italy in particular, it presents a questionnaire developed to collect useful information; such a tool can be administered in different contexts than the countries for which the analysis has been accomplished, and therefore, this study may prelude to other and more detailed quantitative analyses.

¹ This situation is especially true for the last three years: after the pandemic emergency, digitalization has revolutionized production processes, and innovation is now based on digitalization.

Research Results

Startups and AI: Overview of current progress

A company that organizes and manages its production processes through AI has a competitive advantage over traditional competitors, and the possibility of increasing value for the company will obviously arise from this advantage.

The use of AI has primarily affected the internal procedural aspects (such as phases of the production process, notification of information, and new methods of interacting with customers or employees) that were previously involved in automation. Unlike standard automation, AI-powered processes can respond to unexpected changes and assimilate new information. In fact, AI algorithms are unique in that they can be «trained» to record successful procedures and self-correct in the event of errors, even before they occur.

However, it should be noted that the fear that AI could make imprecise and distorted decisions, for example in the medical field (Evans and Snead, 2024), could have a negative impact not only on the creation of company value, but also on the community, as emphasized in some institutional documents (European Parliament et al., 2022).²

Overall, artificial intelligence is a step ahead of automation and is recognized as a milestone in the development of startups, facilitating their production process. A summary of these characteristics, as suggested by McMahon (2022), is shown in Figure 1.

While automation can handle repetitive tasks, AI was designed for more complex procedures, as devices using AI improve by learning. Consequently, AI-generated results can elucidate patterns and assist in predicting responses to the environmental context.

However, literature on the impact of AI on innovative startups remains rather limited, with few contributions from the past three years.

² The document «Artificial intelligence in healthcare: Applications, risks, and ethical and societal impacts», addressed to the Members and staff of the European Parliament, warns of the main clinical, social and ethical risks posed by AI in the healthcare sector, more specifically: potential errors and harm to patients; risk of bias and increased health inequalities; lack of transparency and trust; and vulnerability to hacking attacks and data privacy breaches.

Figure 1

Characteristics of automation and artificial intelligence

Automation	Artificial Intelligence
<ul style="list-style-type: none">• Designed for simple, repetitive tasks• Cannot evolve or learn• Rule-based operation• Generates data but cannot analyze it	<ul style="list-style-type: none">• Designed for more complex, non-repetitive tasks• Designed to analyze and react to its environmental data• Evolves or learns based on previous and current data• Helps organizations analyze data• Can identify patterns

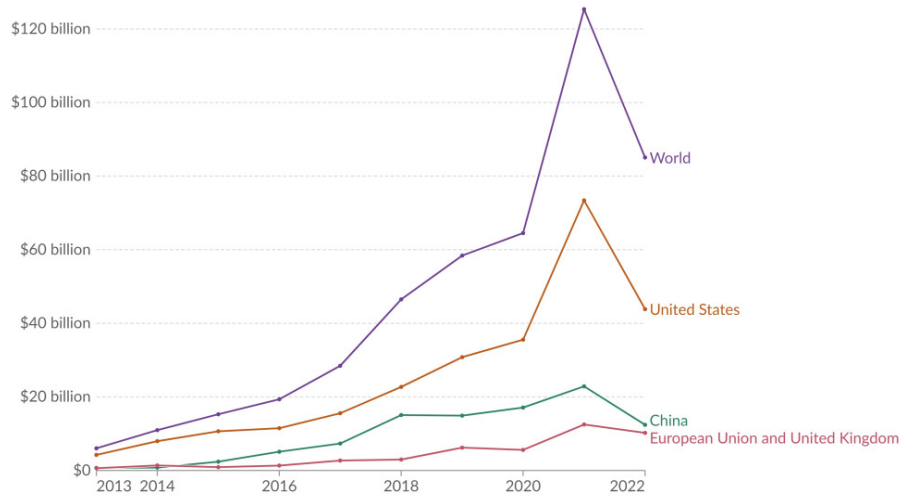
Source: McMahon (2022).

Widayanti and Meria (2023), using a sample of 162 startups worldwide that utilize artificial intelligence, identified 4 business models: deep technology researcher, data analytics provider, AI product and service provider, and AI development facilitator. The authors believe that their proposed taxonomy has enabled a clear distinction between the potential business models of global startups and traditional IT-related business models, and that their findings are destined to have an impact on the entrepreneurial behavior.

According to sources in *Our World in Data*, private sector investment in AI was relatively low until a few years ago. The greatest growth was recorded starting from 2018, and in 2021 it was approximately 30 times higher than just 8 years earlier. The majority of private investment was concentrated in the United States, while that of China, the European Union, and the United Kingdom was more limited.

Figure 2

Annual private investment in artificial intelligence (in \$)

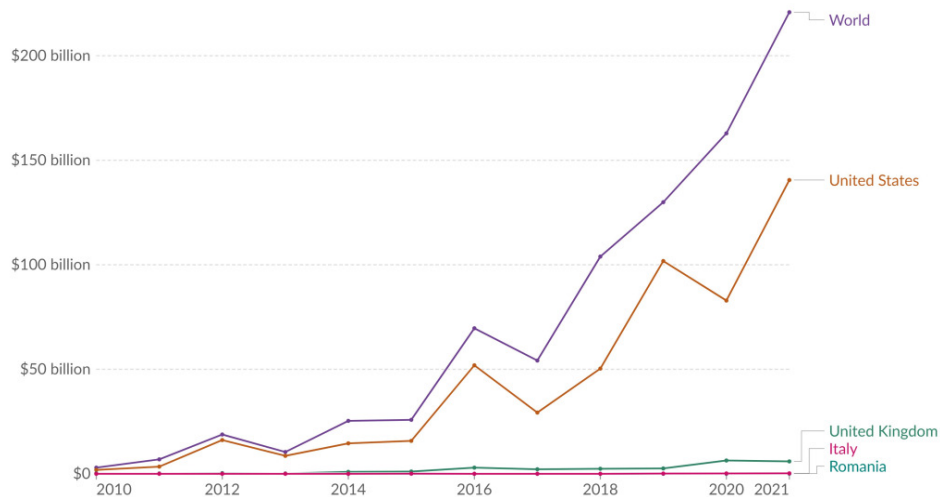


Note: Includes companies that received more than \$1.5 million in investment. Data is expressed in constant 2021 US\$. Inflation adjustment is based on the US Consumer Price Index (CPI). Source: NetBase Quid via AI Index Report (2023) – data processing by *Our World in Data*.

Again, with reference to 2021, against the total global private investment of \$220.83 billion (including \$140.54 billion in the United States, \$22.98 billion in China, and \$5.93 billion in the United Kingdom), private investment in AI was only \$205 million in Italy and just \$39 million in Romania.

Figure 3

Annual private investment in artificial intelligence (in \$, adjusted for inflation)

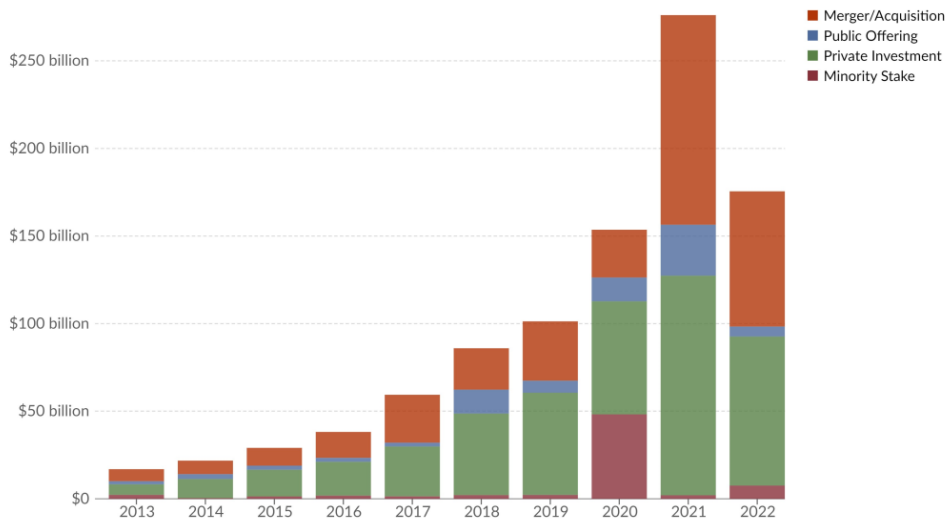


Note: Data is expressed in constant 2021 US\$. Inflation adjustment is based on the US Consumer Price Index (CPI). Source: Center for Security and Emerging Technology (2023) – data processing by *Our World in Data*.

Starting from 2021, the majority of annual global corporate investment in AI has originated not only from the private sector but also from mergers and acquisitions; however, the public contribution has been more limited (see Figure 4).

Figure 4

**Annual global corporate investment in artificial intelligence, by type
(in \$, adjusted for inflation)**

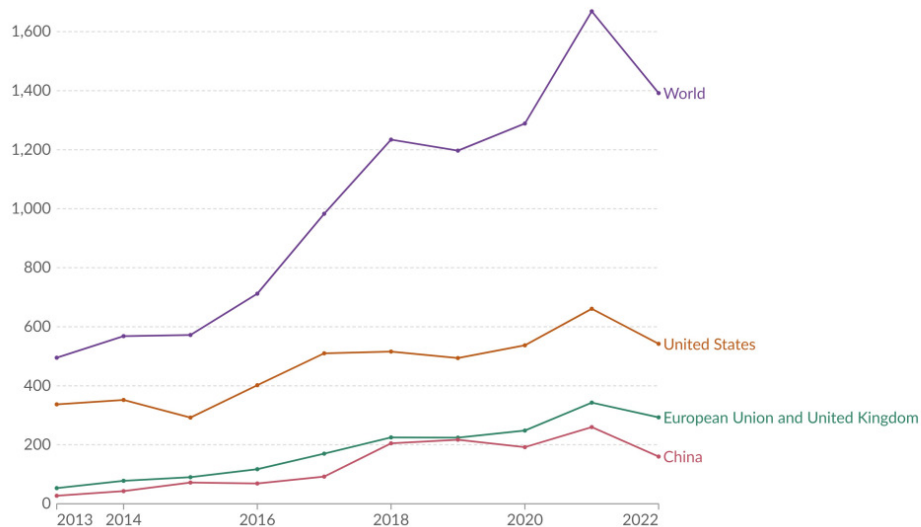


Note: Data is expressed in constant 2021 US\$. Inflation adjustment is based on the US Consumer Price Index (CPI). Source: NetBase Quid via AI Index Report (2023) – data processing by *Our World in Data*.

Since 2013, the number of newly funded AI companies has been progressively increasing, although there has been a slight decline since peaking in 2021.

Figure 5

Newly-funded artificial intelligence companies

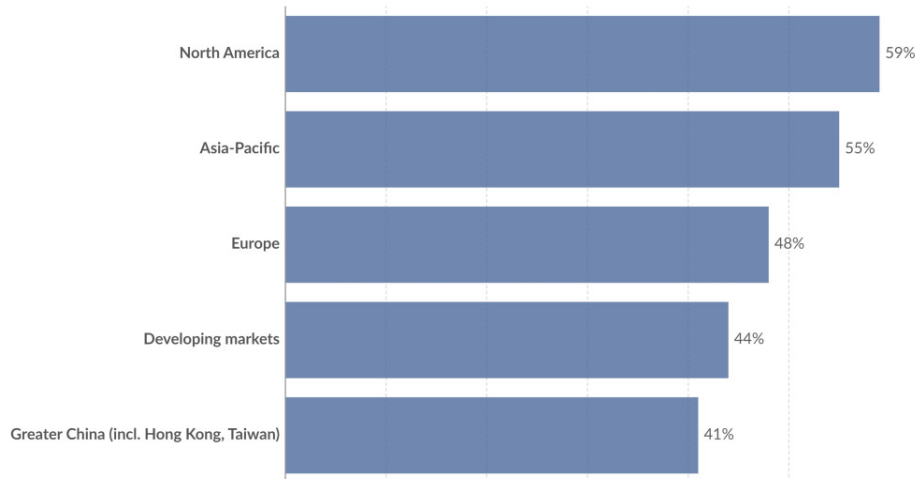


Note: Newly-funded AI companies in each year that received an investment of more than \$1.5 million (not adjusted for inflation). Source: NetBase Quid via AI Index Report (2022) – data processing by *Our World in Data*.

Finally, according to data from McKinsey and Company (2022), cited in the AI Index Report (AI Index, 2023), out of a total of 1843 companies surveyed, the percentage of those using AI in at least one business function ranges between 41% in Greater China to 59% in North America (see Figure 6).

Figure 6

Share of companies using artificial intelligence technology, 2022



Note: Share of companies using AI technology (e.g., machine learning, computer vision, or natural language processing) in at least one business function, out of 1,843 companies that responded to a global survey. Companies represent a range of industries, sizes, functional specialties, and tenures. To adjust for differences in response rates, the data are weighted by the contribution of each respondent's nation to global GDP. Source: McKinsey and Company via AI Index Report (2022) – data processing by Our World in Data.

It is possible to affirm that the intrinsic characteristics of AI technology, the pervasiveness with which it is destined to extend into various business opportunities, combined with the number of investments that AI attracts, make it an external accelerator for economic development purposes.

Significant benefits can be anticipated from the implementation of new production models utilizing AI. These include enhanced flexibility in managing production processes, reduced production costs, and subsequently, increased consumer satisfaction.

Although the areas of AI application are extremely diverse and are expected to expand in the coming years, some examples of AI implementation for innovative startups can be described. For example, Attar et al. (2023) have explored the application of AI in hardware and software systems, while contributions by Alahi et al. (2023), Arowolo et al. (2023), Bodea et al. (2019), Du et al. (2023), and Edan et al. (2023) have highlighted its use in agriculture, industry, and the service sector.

Given the limited evidence on the use of AI, each case study will contribute to building a synthesis of evidence on its application. In this sense, it is interesting to conduct international comparisons to assess how the application possibilities of AI have been received and what experiences can be reported.

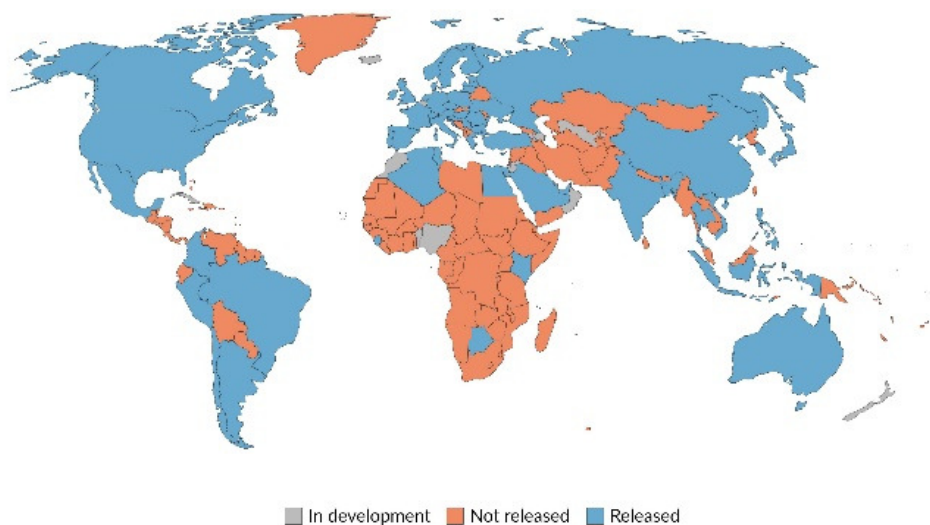
The regulatory framework

Innovation and the related ecosystems for startups are central to the political agendas of many countries (Audretsch et al., 2020). More recently, national strategies aimed at promoting growth and economic development shifted their focus to AI, presumably intending to proceed through a combined and complementary use of both.

The map presented in Figure 7 highlights an acceleration in the adoption of AI strategies by governments of many countries, with the data for 2022 indicating that these strategies are now widespread.

Figure 7

Countries with national artificial intelligence strategies, 2022



Note: Does not include broader innovation or digital strategy documents that do not focus predominantly on AI. Source: AI Index (2023) – data processing by Our World in Data.

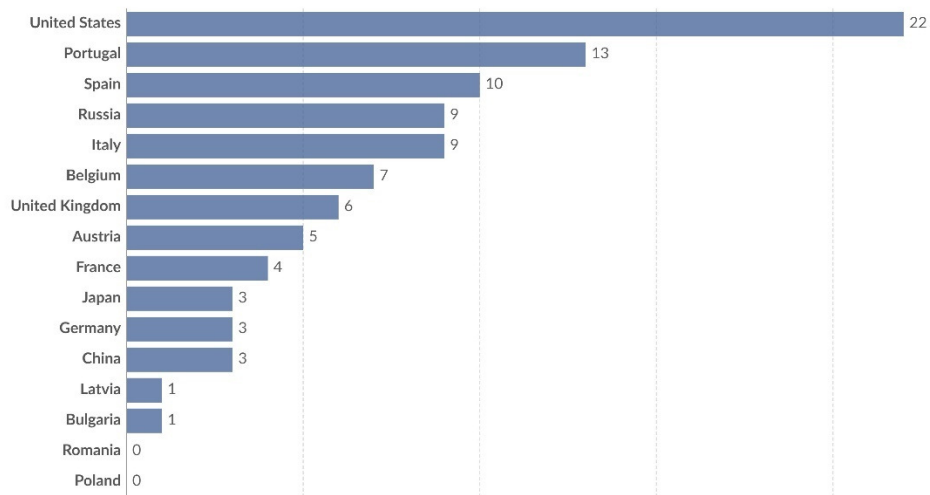
A useful indicator of this increased interest in AI within national strategies is the number of legislative bills containing references to AI that have been passed and enacted into law.

A study conducted by AI Index found that 31 out of the 127 countries surveyed have approved at least one legislative bill dedicated to artificial intelligence, out of a total of 123 bills approved since 2016 (AI Index, Stanford Institute for Human-Centered Artificial Intelligence, 2023).

The United States tops the list with 22 AI-related laws, followed by Portugal (13), Spain (10), Russia, and Italy (9). Eastern European countries are less productive, while Romania has not approved a single law on this subject (see Figure 8).

Figure 8

Cumulative AI-related bills passed into law since 2016



Note: Bills passed into law by national legislative bodies with the keyword «artificial intelligence» (translated to the respective languages) in the title or body of the bill. Source: AI Index (2023) – data processing by *Our World in Data*.

In terms of strategic planning, it should be noted that European institutions are particularly active in providing support for innovative startups across both financial (Mocanu and Thiemann, 2023) and regulatory dimensions with the aim of safeguarding their technological sovereignty.

Recently, the EIB Group (European Investment Bank, European Investment Fund) and five EU member states (Italy, Germany, France, Spain, and Belgium) launched the European Tech Champions Initiative (ETCI). In this context, the EIB Group will manage a multi-investor fund-of-funds structure aimed at supporting high-tech companies in their later stages of growth. This will bridge the financing gap and strengthen Europe's strategic autonomy and competitiveness.

The European regulatory framework for startups consists of the Digital Service Act (DSA), the Digital Market Act (DMA), the Data Act (DA) and the Artificial Intelligence Act (AIA).

While acknowledging the undeniable significance of the European principles that inspired the aforementioned interventions and other objectives (enhancing the transparency of online operations, protecting users from illegal and harmful content and fostering fairer markets), in this article, it would be worth highlighting the fundamental shared elements within the cited European legislation, in particular the DSA and the DMA.

The analysis of literature indicates that European legislators seem to navigate within a framework that aims to reconcile two levels: consolidating the principles of the Union and protecting rights (Turillazzi et al., 2022), while also prioritizing efficiency and innovation.

Innovative startups and small and medium enterprises (SMEs) can enjoy good competition environments thanks to European regulations. For example, the DMA seeks to limit the discriminatory and dominant behavior of gatekeepers toward their potential competitors, with studies proving the effectiveness of such a rule. In fact, Decarolis and Li (2023) used the Hotelling model to demonstrate the ability of the DMA to counteract the gatekeeper's action. These European regulations aim to restore competition by simultaneously targeting three dimensions – improving data portability, their quality and increasing potential users – and are mutually reinforcing.

Although innovative startups in the sector could benefit from these regulatory provisions, there are doubts about the impact of the DMA on social well-being, which may not benefit from a downsizing of the gatekeeper's position.³

Cabral et al. (2021) underscore a primary challenge in implementing DMA – the need to separate the positive efficiency and welfare benefits gener-

³ In this sense, it can be considered the conditions set by Google for using Google Ads platform, under which ads, block sites or suspend accounts for dishonest behaviour or inappropriate content can be refused.

ated by platforms (network effects) from the negative anti-competitive and welfare-reducing behavior. Reducing the information gap between regulators and gatekeepers is a question that should be addressed, as the DMA may fall short in resolving broader concerns like market tipping or the rise of other gatekeepers (Budzinski and Mendelsohn, 2023). With the DSA, on the other hand, the strengthening of competition could be made possible indirectly through improvements in privacy protection, which the law aims to achieve. Indeed, the need to comply with the new rules, which provide for greater transparency and responsibility (Savin, 2021), could allow startups to innovate, strengthen consumer trust and, as a result, consolidate their position in the market by becoming more competitive.

Finally, the DA and the AIA contextualize startups in relation to AI. Since innovation is increasingly based on data accessibility (Kong et al., 2022), the DA establishes some mandatory requirements for data sharing in favor of other companies, governments and users (Daneshjou et al., 2021).

The AIA takes a risk-based approach, focusing on the high-risk hypothesis. While reiterating its support for innovation and competitiveness in AI, it also promotes the ethical and responsible use of AI and the protection of fundamental rights. However, adopting measures to regulate the high risk associated with the use of AI may leave other types of systems to market forces. Besides, low risk does not equal to safety.

While it is true that the European Commission appears to rely on the existing regulatory framework in this context, it is essential that citizens of the European Union are adequately informed, mainly for the interference that information asymmetries exert on market efficiency. In this regard, Stuurman and Lachaud (2022) observe that this information could be conveyed through two channels. The first channel, already provided for by the AIA, involves mandatory labeling for AI-related systems. However, there is a risk that consumers may interpret these labels as quality marks that positively define a particular type of system compared to others. Therefore, it would be necessary to introduce additional information labels aimed at promoting the education of citizen-consumers in this field, similar to those seen in areas such as food, energy consumption and sustainable development. By making informed choices, consumers would themselves become actors and drivers in the design, development and use of AI. This approach would also present an opportunity for companies to strengthen trust with consumers by leveraging their informed decision-making (Meiseberg, 2015; Assyne and Adjei, 2017).

Keller et al. (2024) continue by discussing the systemic financial risk posed by AI, particularly its international dimension. They note that this risk is not covered by any existing or proposed macroprudential instrument, including the AIA. Implementing more specific regulations targeting this risk would enhance stability

in the financial system, also in light of macroeconomic events such as financial crises that have occurred over time.

In the provisions of the European legislation, and at the push of the European Commission, innovation also passes through regulatory sandboxes. These sandboxes, as foreseen in Articles 53 and 54 of the AI bill, serve as spaces for regulatory experimentation, allowing for varying degrees of control over AI technology (Truby et al., 2022; Yordanova and Bertels, 2024). They would also make it possible to think about an expansion of innovation in safe conditions.

A very recent study by Zheng and Wu (2024) applies the sandbox approach to the financial sector to show that the effectiveness of these tools is linked to the collaborative commitment of all interested parties (government, Fin-Tech enterprises, and the public). On the contrary, Laurent (2024) critically hypothesizes that those who use sandboxes are more interested in freeing innovation from legal constraints than in controlling it, while Koycheva and VandenBroek (2024) emphasize the need to think about the impact that experimentation in sandboxes has on the real world.

Finally, Ranchordas and Vinci, (2024), with specific reference to the case of «Sperimentazione Italia» – a sandbox designed for responsible innovation in the public sector – underline as critical issues limited information, transparency, imposition of numerous burdens on applicants and the general intervention, which did not allow the market to fully exploit the expected advantages.

As with the impact of AI on business models, everything remains to be built on the regulatory front. The contribution deriving from European legislation will be crucial for the future.

Normative environment in Italy and Romania

Looking at the situation in the countries considered in this paper, the following findings were derived. In Italy, there were 14,621 innovative startups as of July 2022, according to the latest quarterly report by the Italian Ministry of Economic Development (MISE) in collaboration with UnionCamere and InfoCamere (Ministero dello Sviluppo Economico, 2022). Italian startups are typically micro-enterprises, with an average turnover of about €200,000. Companies are often founded by individuals under the age of 35 (see www.business-plan.it, 2023).

As concerns Romania, although the legislation at the national level does not differentiate between startups and newly established companies, innovation stemming from the private sector has experienced growth in the past few years. According to data from the National Institute of Statistics, 10.7% of all active en-

terprises in Romania were considered innovative in 2022 (Romanian National Institute of Statistics, 2023).

According to private group ROTSA, there are around 500 startups operating in the Romanian landscape (ROTSA, 2021). The startups with the largest number of employees are those in the fintech (35.2%), automation (35.2%) and marketing (14.2%) categories. The startups with the highest revenues are found in the same categories: automation (38.1%), fintech (31.8%) and marketing (12.1%). Out of 132 economies studies, Romania ranks 49th out of 132 economies in the Global Innovation Index (GII) and 31st out of 39 states in Europe (World Intellectual Property Organization, 2022).

The normative environment in Italy

In 2012, the Italian Government issued a legislative decree that facilitates the creation of innovative startups (Art. 25 Decreto Legge, n. 179, 18 October 2012).

Innovative startups are defined as having three distinct features:

- 1) Innovativeness: the company has developed and applies a revolutionary product or process;
- 2) Scalability: the company is experiencing rapid growth that traditional companies cannot keep up with;
- 3) High-impact: the company has the potential to influence the lives of many people through its new product or service.

To earn the status of an innovative startup, a company must meet two classes of requirements: objective and subjective. Objective requirements are mandatory, while subjective requirements are only partially mandatory (fulfilling one out of three is sufficient).

The objective requirements include: (i) establishment within the past 5 years; (ii) total annual production value below €5 million; (iii) headquarters in Italy or in another EU country (in this case a production site or a branch in Italy is required); (iv) the startup does not distribute profits; (v) the startup must not have been formed by merger; (vi) it is not listed on a regulated market; (vii) its activity is directed at the development, production and marketing of products with high technological value.

The subjective requirements are as follows: (i) the company's R&D expenditure must equal or exceed 15% of either sales or annual costs, whichever is greater; (ii) at least 1/3 of the company's total workforce must hold a PhD or at least 2/3 of the workforce must hold a Master's degree; (iii) the company must hold a patent on an innovative invention.

Being an Innovative Startup is a status granted to companies that satisfy certain requirements, allowing them to benefit from incentives for their develop-

ment provided by Italian fiscal law. However, the innovative startup status can only be recognized for a maximum of five years (duration of the company in the special section of the Business Register). Among the advantages and facilitations of this status are: (i) incentives to invest in the company's capital; (ii) free and simplified access to the «guarantee fund» (*i.e.*, a public fund that facilitates access to credit through the granting of guarantees on bank loans); (iii) specific calls for startups (including non-repayable grants); (iv) raising capital through equity crowdfunding; (v) exemptions from ordinary corporate regulations; (vi) flexible working discipline; (vii) remuneration through participation in the capital of the startup itself, etc.

Until 2021, startups could register independently through an online procedure. The *Consiglio di Stato*, the highest organ of administrative justice, eliminated this opportunity, so now it is essential to consult an auditor and a notary for registration. To maintain the status of an innovative startup and enjoy its various benefits, the company must update or confirm, at least once a year, that it continues to meet the requirements mentioned above.

In Italy, there are 14,032 innovative startups (as of the 3rd quarter of 2021, according to UnionCamere's database). The three regions with the highest numbers of innovative startups in Northern, Central and Southern Italy are: Lombardy, with 3,755 startups; Lazio, with 1,633 startups; and Campania, with 1,245 startups.

The startups in the Trentino-Alto Adige region deserve a special mention: despite numbering only 330 companies, this region has the highest percentage of startups out of the total number of joint-stock companies with less than 5 years of activity.

The potential of innovative startups to determine knowledge spillovers at the regional level has been examined in a study by Barboza and Capocchi (2020), which emphasizes the effects on youth employment, and recently in a study by Colombelli et al. (2023).

The normative environment in Romania

No delimitations exist in Romania between startups/innovative startups and newly created businesses. The most important legislative elements regarding small businesses include: the Government Strategy for SMEs and the Business Environment–Horizon 2020; the Law no. 31/1990 on SMEs; the Law no. 346/2004 regarding the stimulation of SME creation and development; the Law no. 102/2016 on business incubator; and the Law no. 120/2015 on business angels. However, no specific details regarding the difference between startups and newly funded firms exist (Romanian Ministry of Justice, National Trade Register Office, n.d.; Parlamentul României, 2004).

Innovation can take place if discoveries and innovations can be protected. In Romania, there are 33 laws (texts) on patent and intellectual property rights, 12

texts on the implementation of rules and regulations and 3 texts on the approval of treaties (World Intellectual Property Organization, 2019). According to the information presented in the World Intellectual Property Report 2018, Romania has registered 33 patents, 37 trademarks and 32 designs. There is no unified database or public sources covering newly created innovative companies or start-ups.

Recent policy initiatives in Romania, aimed at promoting entrepreneurship through dedicated startup programs, provide an excellent opportunity to reflect on migrant entrepreneurship and their integration into the regional business ecosystems in Romania. At the Romanian national level, two parallel programs have been in existence since 2018—Romania Startup Plus and Diaspora Startup, both managed by the Romanian Ministry of European Funds (MEF) (Croitoru, 2021). Romania Startup Plus is designed for people who live in Romania, while Diaspora Startup is intended for Romanian citizens who have been living abroad for at least 12 months before joining the program. These programs should provide valuable opportunities for entrepreneurs in Romania and abroad.

Both Romania Startup Plus and Diaspora Startup were launched in 2018. Despite their establishment, no financing rounds have been organized through these programs since their inception. The Start Up Nation program is expected to continue in 2024, though there has not been any official confirmation from the government. The Ciolacu government has mentioned the possibility of launching a Start Up Nation session in the second half of 2024, with the Minister of Economy confirming that the necessary funds (€400 million in European funds) have been secured for conducting a new Start Up Nation 2024 session (Fabrica de Fonduri, 2023).

Data and case studies in Italy and Romania

In Italy, the information needed to depict the situation with startups can be found in the Business Register maintained by the Chambers of Commerce (<https://startup.registroimprese.it/isin/home>).

The data available concern the year in which the firm started its activity, the value of production, information on the amount of capital invested, the percentage of female/young/immigrant employees and the mention of whether the firm has a high technological value.

To achieve a more comprehensive view of such scenario, additional information could be collected: hence, from the Register of Innovative Startups, the data relating to those companies that mention AI in their name have been extrapolated. It was found that nine companies meet this criterion.

Interviews were conducted with the CEOs of three companies that responded to the survey invitation. A total of ten questions were asked during each interview, with the same questions being posed to all participating companies. The duration of each interview was between twenty and forty minutes. From the responses obtained, it was possible to outline profiles with common traits. Table 1 displays the items included in the survey.

Table 1

The administered survey

No.	Question	Purpose of the question
1	Three are the characteristics of innovative startups: innovativeness, scalability, high impact. To what extent [name of the firm] is representative of such characteristics?	Verifying the extent to which the company summarizes the peculiarities of innovative startups, as recognized in the economics literature.
2	When has the company been constituted? Which were its objectives and to what extent they have been achieved?	Retrieving information that may allow tracing the 'history of the company', even if the latter refers to a limited time horizon. In particular, since its foundation, have the objectives been modified in order to respond to market requests?
3	In which sectors does [name of the firm] operate?	Identifying the preferred sectors within which to operate.
4	How many people are currently working for [name of the firm]?	Getting information on the company size.
5	What are their levels of competence/education?	Knowing the likely working/educational skills that allow to the company to remain competitive in the market.
6	What have been/are the challenges for [name of the firm] activities?	Identifying the factors outlining the evolution of the sectors in which companies operate and the strategies that can be implemented.
7	What the employment of AI has allowed to realize?	Determine the role of AI in the company's production processes and how the company adapted its choices.
8	Does the legal framework facilitate the activities of innovative startups in your opinion?	Recognizing (if present) the importance of institutional framework.

No.	Question	Purpose of the question
9	Is it profitable to found and to run an innovative startup?	Advancing economic and financial observations concerning the profitability of the startup.
10	What are the next objectives of [name of the firm]?	Obtaining information on the company's strategy and the objectives to pursue in the coming short term.

Source: authors' own elaboration.

It can be noticed how the questionnaire refers to the past (objectives, information on the establishment of the company, critical aspects that the company had to deal with), to the present (staff employed, extent of AI utilization, arising difficulties), and to the future (next objectives of the company, assessment of profitability, which implies an initial assessment on likely expansion). The interviewed people were CEOs at three innovative startups: AIM, AISMA and AITEM.

AIM is an innovative startup based in Southern Italy and the smallest among those observed. It operates in the manufacturing sector, offering services to SMEs. AIM's goal is to minimize machinery faults and to enhance production efficiency. To achieve this goal, AIM uses a software system for predictive maintenance based on machine learning algorithms. Firms may benefit by anticipating interventions and developing targeted solutions: on the one hand, they reduce costs, while, on the other hand, there is a positive impact on the company's overall production.

AISMA is a company headquartered in Milan, Northern Italy, with labs and developers located abroad. It offers innovative data management solutions based on using AI and data science to cater to various business needs. The range of the company's services extends from data ingestion and preparation through AI and machine learning to customized applications in different sectors, such as marketing, finance and broadcasting. AISMA is the largest company among those interviewed.

AITEM is an innovative high technology startup that focuses on the development of artificial intelligence specifically for medical and veterinary fields. Located in Northern Italy, the company was created as a spin-off of a larger group. It is currently developing innovative products aimed at satisfying the needs of specific market segments. A summary of responses from the interviews is presented in Table 2.

Table 2

A summary of responses provided by three Italian innovative startups to the survey

Item no.	AIM	AISMA	AITEM
1	AIM fully meets the criteria for innovative startups. Concerning innovativeness, the company makes extensive use of AI. The implemented product is software capable of recognizing technical faults in the machinery to which it is connected. The connection is made through the company's servers. This is a cost-effective choice because it allows for a more agile management of applications.	AISMA's approach is extremely flexible and scalable. The aim is to develop flexible and customized solutions that can facilitate the digital transition and offer a pre-packaged product likely to adapt to the needs and demands, especially those of SMEs.	AITEM fully satisfies the three main requirements set for innovative startups. Concerning innovativeness, AITEM uses cutting edge technologies. Regarding scalability, the company works in different vertical markets, such as industrial, medical and veterinary. AITEM has high impact too: its main product is a platform to assist veterinarians in diagnosing diseases.
2	AIM was inspired by an idea of one of its founders, an automation engineer.	The company was founded in 2020.	AITEM was constituted in 2020. The first objective was to provide AI solutions, leveraging on our three main assets: Image Analysis and computer vision, Natural Language Processing, and Deep Learning & Data Analytics. The second objective (which was also reached) was to monetize those assets in two main fields (industrial and engineering) to support the ongoing development of LAIKA Pet Tech. Nowadays the aim is to grow and further develop LAIKA, bringing it to the market.

Item no.	AIM	AISMA	AITEM
3	AIM operates in the service sector, primarily serving the needs of manufacturing and energy companies.	Smart factoring 4.0, Industry, marketing, financing, media and information, healthcare. Clients are both public and private.	The company develops AI solutions for industrial, veterinary and medical industries.
4	There are currently 4 people working for AIM: the team consists of 4 founders, including 2 automation engineers holding a PhD in Data Science, and one software engineer. Among the previous experiences that were finalized to acquire skills for AIM, there is the activity carried out at other startups.	There are 20-25 employees and 90 collaborators in the laboratory abroad, who look after the preparation of algorithms and their training. Four people are the main referents.	10 people currently work for AITEM.
5	Automation engineers, holding a PhD in Data Science, and one software engineer. Among the previous experiences that were finalized to acquire skills for AIM, there was the activity carried out at other startups.	A very high level of mathematical-statistical training is required. However, a lot of engineers and data scientists, but also physicists and a philosopher work for AISMA.	There are sales and marketing representative and finance controller, but most of the people are AI & Machine Learning Developers with competencies in Data science and Engineering, Biomedical engineering, modeling and data science, Computer engineering.
6	Among the critical issues, there was the need to become familiar with the knowledge of the business world. In addition, the companies that AIM targets are often not ready to collaborate with startups.	Often the same customers may find it difficult to understand the innovative content of the solution that has been proposed and becoming familiar with it. The product itself may seem too innovative.	The company does not have to deal with critical issues, but rather with challenges: AITEM was part of a large multinational company. At the same time, as it aimed to enter the market with its own solutions, it had to establish a new customer base and be ready to compete with incumbent companies.

Item no.	AIM	AISMA	AITEM
7	The development of the product around which AIM's activity focuses is based on AI.	The use of AI has made it possible to carry out all the core activities of the company.	All AITEM solutions are fully based on AI methodologies.
8	There are, of course, fiscal incentives. From a legal point of view, many rules are designed for traditional companies and there is a lack of knowledge about how to adapt them for startups. For example, should the company's statute be formulated in the same manner as it would be for traditional companies?	At the regulatory level, the criteria applied to startups, for example, to obtain funding, and, also, the competences of those ones called to judge the same startups, cannot be positively evaluated. It is cumbersome to follow rules and procedures. It is often necessary to advance funding without immediate disbursement. Training and dissemination are crucial elements.	The answer is both positive and negative: there are good opportunities to participate in funded tenders, even if the process is not very lean sometimes. But in Italy or Europe in general, it is more difficult to raise funds through investor initiative, as investors are less willing to invest. Their counterparts in the United States are more open to invest (and sometimes lose) and support startups.
9	It is too early to say whether the business has been profitable or not.	Running such a business can be profitable, but it requires readiness to deal with complex issues.	Depends on the type of innovation developed: as general rule, it takes 3 to 5 years.
10	Among the next objectives, there is the creation of a product to be launched on the market; over the short term, it will be necessary to take care of the engineering of the product itself.	Proceeding with continuity on the projects already undertaken in all the sectors that are starting to embrace technology 5.0.	Next short term objectives: to fund investments to support further LAIKA development.

Source: compiled by the authors.

Table 3 summarizes the data on innovative startups that utilize AI retrieved from the Business Register of the Italian Chambers of Commerce (2021). The data include the following characteristics: (1) the legal nature of each firm according to Italian law, (2) location of headquarters, (3) date of registration in the startups section of the Business Register, (4) date of registration in the general Business Register, (5) type of activities, (6) total value of production in the past year, (7) capital worth, and (8) the number of employees. Additionally, it includes information on the prevalence of female, young, and foreign employees in the workforce structure (9)-(11).

Table 3

Italian startups utilizing artificial intelligence

Juridical nature	Head-quarters	Date of registration in the startups section of the Business Register	Date of registration in the Business Register	Activities	Production in the past year	Employees in the past year	Value of capital, euro	Female prevalence	Young prevalence	Prevalence of foreigners
LLC	РИМ	06/03/2019	01/06/2023	Software production, IT consulting	€100,001-€500,000	0-4	250000<x<500000	NO	NO	NO
LLC	ПИЗА	11/03/2020	11/03/2020	Software production, IT consulting	€1,000,001-€2,000,000	5-9	5000<x<10000	NO	NO	NO
LLC	НЕАПОЛЬ	02/10/2020	02/10/2020	Software production, IT consulting	€0-€100,000	0-4	1<x<5000	NO	YES	NO
LLC	МИЛАН	16/10/2020	16/10/2020	Software production, IT consulting	€1,000,001-€2,000,000	0-4	50000<x<100000	NO	NO	YES

Juridical nature	Head-quarters	Date of registration in the startups section of the Business Register	Date of registration in the Business Register	Activities	Production in the past year	Employees in the past year	Value of capital, euro	Female prevalence	Young prevalence	Prevalence of foreigners
LLC	ТУРИН	28/10/2020	28/10/2020	Research & Development	€100,001-€500,000	5-9		NO	NO	NO
LLC	МИЛАН	07/06/2023	21/12/2022	Software production, IT consulting					NO	NO
LLC	МИЛАН	09/01/2023	09/01/2023	Software production, IT consulting			50000<x<100000		NO	NO
LLC	МИЛАН	07/09/2023	05/04/2023	Software production, IT consulting			5000<x<10000	NO	NO	NO
LLC	РИМ	11/04/2023	27/02/2023	Research & Development			5000<x<10000	NO	NO	NO

Note: LLC = Limited Liability Company. Source: Registrolmprese.it (2021).

Romania is significantly lagging behind other European countries in technology adoption. The country's dire situation is highlighted in the *Generative-AI Global Interest Report 2023* published by ElectronicsHub (Navarro, 2023). According to the report, Romania ranks second to last in Europe by the number of Google searches for most popular generative-AI tools, with only 390 of such searches per 100,000 people per month. This report complements the findings of Eurostat (2021) concerning the use of AI by enterprises throughout Europe, as shown in Table 4.

Table 4

Share of enterprises using AI by country, in %

Country	Share of enterprises using AI, %	Country	Share of enterprises using AI, %
Denmark	24	Slovakia	5
Finland	16	Czechia	4
Netherlands	13	Latvia	4
Luxembourg	13	Lithuania	4
Slovenia	12	Albania	4
Germany	11	Bulgaria	3
Norway	11	Hungary	3
Belgium	10	Poland	3
Malta	10	Estonia	3
Sweden	10	Greece	3
Austria	9	Cyprus	3
Croatia	9	Montenegro	3
Ireland	8	Turkey	3
Spain	8	Bosnia and Herzegovina	2
Portugal	7	Romania	1
France	7	Serbia	1
Italy	6		

Source: authors' elaboration based on data in Eurostat (2021).

The figures in Table 4 indicate that Romania ranks at the bottom level among European countries. This evidence suggests that, despite recent advancements in the field of AI, this field is still in the early stages of development in Romania.

There is a need to enhance knowledge in the field of AI among the younger generation and business owners in Romania. For this purpose, an interview was conducted with a lecturer at the Faculty of Economic Sciences, University of Oradea. Specializing in Information Systems and Applications in Economics, Management Informatics, Decision Support Information Systems, Integrated Information Systems, Management Information Systems, Database Applications in Management, he has been active in academia since 1998. Throughout his career he has seen the evolution of several generations of students in terms of their understanding of and preparedness for the widespread adoption of technology. The proposed questions for discussion, along with their intended purpose, are detailed in Table 5.

Table 5

The administered survey in Romania

No.	Question	Purpose of question
1	How do you perceive the current landscape of AI adoption among startups in Romania, and what trends do you observe in terms of technology applications and industry sectors?	Understanding the current state of AI adoption among startups in Romania, including the prevailing trends in technology applications and industry sectors is essential. Providing insights into the landscape of AI innovation with emerging opportunities and challenges.
2	What are the main challenges that startups face when integrating AI technologies into their products or services in Romania, and how can these challenges be overcome?	Identify the main obstacles that startups encounter when integrating AI technologies into their products. By understanding these challenges, it should be possible to explore feasible solutions and strategies to facilitate smoother adoption of AI in the startup ecosystem.
3	Can you provide examples of successful AI startups in Romania and highlight the key factors contributing to their success in leveraging artificial intelligence?	Not really, although examining examples of successful startups may provide valuable lessons and best practices for aspiring entrepreneurs and policymakers interested in promoting AI innovation.
4	How does the availability of talent and expertise in AI technologies impact the growth and innovation potential of startups in Romania's tech ecosystem?	Understanding the talent landscape helps in identifying areas for improvement and investment to nurture a skilled workforce in AI.
5	What role do government policies and initiatives play in fostering AI innovation and entrepreneurship within the Romanian startup ecosystem?	The Government should evaluate the effectiveness of existing policies and identify opportunities for regulatory enhancements to foster a conducive environment for AI-driven startups.
6	How do Romanian startups differentiate themselves in the global AI market, and what strategies do they employ to compete with larger, more established players?	Policymakers must explore how Romanian startups may act in the global AI market and outline the strategies to employ to compete with larger players.

No.	Question	Purpose of question
7	What are the ethical considerations and implications associated with the use of AI technologies by startups in Romania, and how should these concerns be addressed?	These last four items have not received a defined answer: this is indicative that the situation is still in progress.
8	How do investors evaluate the AI capabilities and potential of startups in Romania, and what criteria do they consider when making investment decisions in this space?	
9	What opportunities do you see for collaboration and knowledge-sharing among startups, academia, and industry players to accelerate AI innovation and adoption in Romania?	
10	How can universities and research institutions support the development of AI talent and expertise to meet the growing demands of startups and contribute to the advancement of the AI ecosystem in Romania?	

Source: authors' own elaboration.

The results of the discussion underscore the urgent need for nationwide action. Currently, Romania has five national strategies that are being implemented in the context of and in relation to the widespread adoption of AI in various sectors of the economy: (I) National Strategy for Research, Innovation, and Smart Specialization 2022-2027; (II) Employment Strategy; (III) Romania's Digitalization Strategy for Education 2021-2027 – SMART-Edu; (IV) Romania's Cybersecurity Strategy 2022-2027; (V) National Defense Strategy for the period 2020-2024.

The 2023-2027 National Strategic Framework in the field of AI highlights the importance that AI holds for economic development, digitalization, workforce development, education, cyber security, and defense (Romanian Government, 2023). According to this document, the main areas of application for AI improvements include: (i) Human resources development, digital skills, and AI competencies; (ii) Data infrastructure and management; (iii) Development of AI solutions in

R&D centers and the business environment; (iv) Technology transfer, partnerships, and digital innovation centers; (v) Funding for the AI domain; (vi) Adoption of AI solutions in governance, the public sector, companies, and society (Romanian Government, 2023).

In order to achieve general societal improvements through the deployment of AI, the above-mentioned national strategy includes a list of 6 general objectives and 13 specific objectives, as detailed in Table 6.

Table 6

**General and specific objectives of the 2023-2027
National Strategic Framework in the field of AI**

General Objectives (GO)	Specific Objectives (SO)
GO1. Supporting education for R&D and the development of specific AI competencies	SO1.1. Increasing the training capacity and level of expertise of specialists in AI. SO1.2. Enhancing the basic understanding of the population regarding the benefits, use, and regulation of AI technologies.
GO2. Developing and efficiently utilizing infrastructure and datasets	SO2.1. Developing specific AI hardware infrastructure and ensuring transparent and equitable access to it, to facilitate R&D and production processes in this field. SO2.2. Expanding the use of datasets, with applications in various sectors.
GO3. Developing the national Research – Development – Innovation system in the field of AI	SO3.1. Advancing fundamental and applied scientific research in the field of AI, as well as interdisciplinary research. SO3.2. Reducing fragmentation of R&D resources in AI by coordinating and synchronizing efforts within national centers and groups of specialized innovation, connected to international AI centers and resources. SO3.3. Supporting and promoting innovation in the field of AI.
GO4. Ensuring technology transfer through partnerships	SO4.1. Improving the utilization of research results through the development of technology transfer capacities. SO4.2. Establishing and organizing a national network of testing and experimentation spaces (TEF) for solutions developed in the field of AI.

General Objectives (GO)	Specific Objectives (SO)
GO5. Facilitating the adoption of AI across society	SO5.1. Adoption of AI technology in the public sector. SO5.2. Adoption and utilization of AI technologies in priority socio-economic sectors.
GO6. Developing a governance and regulatory system for AI	SO6.1. Ensuring governance framework for AI development. SO6.2. Facilitating AI development through regulation.

Source: Authors' adaptation based on the 2023-2027 National Strategic Framework in the field of AI (Romanian Government, 2023).

The general provisions of the National Strategic Framework in the field of AI have been developed in accordance with the European legislation and framework in the field of AI. Even so, no specific information regarding budgetary allocations and sources has been included in this framework. Overall, these goals and objectives provide a structured approach to fostering AI innovation and integration in Romania, addressing various challenges and opportunities in the field. They also highlight the importance of governance and regulation to ensure responsible development and use of AI.

Conclusions

This article has examined AI and innovation for startups looking at two European countries, namely Italy and Romania. The impression is that we are already in the midst of a process known as «the innovation of innovation» (Cockburn et al., 2018).

While the study is currently in its preliminary stages, it serves as a prelude to further exploration of the topic. The contributions proposing a taxonomy of business models revolving around AI have been presented and discussed. However, such a complex phenomenon requires to be examined within a regulatory framework. The European legislator is the first to have intervened in a dimension where the necessary protection of citizens' rights must reconcile with the potential for economic growth assured by AI.

A critical analysis of recent regulations and regulatory instruments (some of which, such as the regulatory sandboxes, are regulatory innovations) has been proposed. The harmonization process, as this contribution shows, will be rather difficult due to unfair starting positions. Many innovative startups complain about

the lack of support from governments, but they are probably also lacking on the internal front (skills, capabilities, willingness to take risks).

As there is still a lack of data and evidence on startups using AI, the present paper has tried to summarize the answers given to the items of an interview directed at the CEOs of innovative startups about the perspectives and challenges facing the industry. It will be interesting to observe how the situation will tend to develop in the coming years and to verify whether the planned goals will be achieved.

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