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ITALIAN STRATEGY FOR ARTIFICIAL INTELLIGENCE 2024-2026

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INTRODUCTION

Artificial Intelligence (AI) technologies have long revealed their pervasive impact and transformative potential on social and productive dynamics. Artificial Intelligence is revolutionizing the world we live in and the ways in which we create value across all sectors, profoundly impacting the education system, professional activities, and industry. The roots of this revolution date back to the mid-20th century, but the advent of machine learning in the early 2000s, and more recently, deep learning techniques have marked a true turning point, centered on their ability to extract value and knowledge from the analysis of massive data sets.

The arrival of generative systems has, in the past year, made even more evident the innovative and transformative force of AI, enabling the development of automation processes characterized by unparalleled ease of use. Driven by unprecedented international investments in the history of computing, this revolution has quickly transcended the academic world and research centers, taking on the characteristics of a genuine social phenomenon. The launch of ChatGPT by OpenAI has significantly contributed to creating widespread awareness, never seen before, about the potential of a digital paradigm capable of creating, in the very near future, a new model of support for individual activities in a multitude of areas, content, and applications. All this within a cognitive framework that naturally fuels debate and reflection, in relation to the limits and risks associated with the use of such platforms. In its strong and entrenched industrial tradition, Italy has always been able to interpret the opportunities offered by new technologies, standing out as a pioneer in the development and adoption of automation solutions for products and processes. The Italian productive fabric is articulated in a wholly unique ecosystem, animated by a significant core of large enterprises and a widespread network of small and medium-sized enterprises, whose manufacturing vocation probably represents its most distinctive trait. The innovation capacity of this supply chain has accompanied, from the post-war period to today, the economic and social development of our country, from the adoption of the first large industrial machinery and the definition of the first automated production lines to the era of robotics and digital solutions that have enabled the Industry 4.0 paradigm. The Artificial Intelligence revolution is taking root within this fertile and receptive ground, which knows how to delve into tradition with creative verve and a push for innovation. It is not surprising, therefore, that Italy began addressing the significant challenges posed by Artificial Intelligence as early as 2018, defining (by the Agency for Digital Italy) an analysis on the impact of AI technologies in society, particularly in Public Administration. In 2020, the Ministry for Economic Development then produced a document of "Proposals for an Italian Strategy for Artificial Intelligence," drafted with the aim of defining a strategy focused on supporting the country's productivity, in line with the sustainable

development goals set by the United Nations Agenda 2030. These strategic indications finally converged in 2021 within the "Strategic Program for Artificial Intelligence" (by the Ministry of University and Research, the Ministry of Economic Development, and the Minister for Technological Innovation and Digital Transition) with actions planned in the time horizon 2022-2024.

The horizon of the strategic program has, therefore, now come to an end; but, especially, since 2021 to today, the context of reference has significantly changed: a profound revolution has occurred in recent years in the field of Artificial Intelligence. The regulatory context has changed, technology has innovated, with the arrival of generative systems and the development of so-called Foundation Models, and a new sensitivity towards Artificial Intelligence has emerged, a sensitivity that firmly embraces the need for an ethical vision to innovation, which places people and their needs at the center.

Within such a complex and dynamic scenario, it is now time to update our strategic vision on Artificial Intelligence, defining a new program that builds on previous experiences, sharing the principles of reference for an Italian Artificial Intelligence that fits into a European context and promoting the development of anthropocentric, reliable, and sustainable solutions. In revisiting the Italian strategy, it is simultaneously essential to seize the necessity for innovation, reading and analyzing the changed conditions of the context, and valuing the matured awareness (i) of the strategic importance of enhancing our capacity to realize and promote the use of AI solutions in the productive, entrepreneurial, educational, and social fabric, as well as in Public Administration, and (ii) that promoting the distinctive traits of our country will increasingly pass through the encoding and availability of AI data and models capable of representing and enhancing its specificities. To realize this vision of development, the strategy aims to pursue the following strategic macro-objectives:

- Support the creation and adoption of AI applications to support management practices, production models, and innovation projects. In particular, it will be relevant to carry out project activities and data infrastructure aimed at developing AI systems from a country-specific perspective, capable of preserving the competitive differentials of our excellences, avoiding their dilution due to the importation of systems developed in other countries.
- Promote foundational and applied scientific research, encouraging the connection of our research units operating on a national scale with major development platforms operating internationally, and fostering the development of AI applications consistent with the competitive needs of the country system; concurrently promote the development and use of AI to support initiatives aimed at social well-being, with applications,

for example, in the welfare system, in the protection of the Italian environmental and cultural heritage, in educational processes, and in health.

- Create favorable contextual conditions to enhance the potential in terms of AI value generation. In particular, the focus, through a training system aiming at excellence, on growing talents with skills consistent with the emerging scenario and improving public administration services through the introduction of AI solutions, represents cross-cutting and enabling priorities.

The planning and implementation of projects that can guide the country with respect to these cardinal points requires an awareness of: (i) the key role played by AI in the geopolitical landscape, and (ii) the absolute necessity of launching a unified project capable of coordinating and focusing the efforts of all stakeholders. From this perspective, it is firstly essential to manage the trade-off between the “risk of inaction” and the underestimation of ethical implications resulting from an opportunistic use of AI systems.

It is indeed clear that, on one hand, it is highly appropriate to support a rapid process of introducing AI into the Italian socio-technical system to avoid significant competitive penalties. However, on the other hand, it is crucial to operate in close coordination with the international community to promote a system of rules consistent with a principle of comprehensive social responsibility (right to privacy, gender balance, transparency in the data value chain, etc.). Defining the strategy indeed requires considering a range of interconnected factors, including social impact, privacy, security, impact on gender issues, environmental themes, and sustainability.

Finally, it is important to carefully evaluate the dynamism with which AI technologies and applications evolve, a characteristic that must be reflected in the design and implementation methods of the various initiatives. Specifically, on one hand, businesses and public administrations need to respond promptly to new stimuli and competitive challenges; in these contexts, it will be crucial to promote the adoption of AI solutions already available nationally or the development of new solutions according to timelines that must be resolved in the short term, thus leading to tangible and immediate feedback. On the other hand, it will be important to open a window to the future, addressing technological challenges in basic and applied research, with the development of more complex and innovative solutions that allow us to acquire a body of knowledge and skills usable in a medium-long term horizon.

To detail the strategic actions according to the lines briefly outlined here, the document will preliminarily analyze the global context and the Italian positioning, to articulate an overall framework of the vision and the macro-objectives of the strategy. The actual strategic actions will then be defined, which will indeed be closely interconnected and related to each other; for the

sake of simplifying the presentation, such actions will be grouped into four macro areas: Research, Public Administration, Business, and Training. These areas will nevertheless be linked by some important and specific cross-cutting actions, oriented towards the definition of infrastructural elements and the policy of implementation and coordination of the entire strategy. On each area, the strategies will then be defined, also associating appropriate reference targets: the strategy will, in fact, also propose a monitoring system for its implementation, which represents an essential ingredient to ensure its success. Finally, the document will analyze the regulatory context that defines the framework within which the entire strategy must be deployed.

Artificial Intelligence in a Global Scenario

Artificial Intelligence (AI) is currently undergoing extraordinary development, emerging as a catalyst for changing the way we live, work, and interact with the surrounding world. This development is propelled by intense research activity, leading to significant advancements in AI architectures and models, supported by substantial investments, especially from private sector leaders. Corporate investments, including mergers and acquisitions, minority stakes, private investments, and public offerings, have increased tenfold over just seven years, from \$147 billion in 2013 to a peak of \$276 billion in 2021, stabilizing at \$189 billion in 2022¹. The reach of AI technology has extended well beyond academia and research institutions, significantly impacting society, especially in terms of behavioral and psychological effects.

Consider that OpenAI's ChatGPT platform, released in November 2022, reached one hundred million users within just two months, surpassing the growth records of popular social networks. More crucially, AI is profoundly affecting the global economy, both directly on markets and production processes and through enhancing innovation and digital transformation across various fields. It is estimated that generative AI alone could generate up to \$4.4 trillion in value annually²; sectors like retail, financial services, healthcare, and education are expected to benefit the most, with AI potentially increasing productivity, enhancing product quality, and promoting consumption³.

Driven by this technological revolution, a significant transformation in the labor market is anticipated. The growing discrepancy between the skills employers demand and those job seekers possess, and between the qualifications required for specific activities and those held by current workers, underscores the urgent need for upskilling and reskilling programs⁴.

Artificial Intelligence in Italy

In Italy, Artificial Intelligence boasts a robust academic tradition dating back to the early 1970s, fostering a vibrant national ecosystem.

Italian universities have actively participated in the frenzied technological innovations and the AI revolution of the past decade. Over 160 university curricula in 53 universities are now offering AI-related courses⁵. Additionally, since the 2020/2021 academic year, the National PhD Program in Artificial Intelligence⁶ has been operational, consisting of five interconnected PhD programs involving 61 universities and research institutions. Despite these efforts, there remains a misalignment between the number of AI graduates and the labor market's demands, increasingly oriented towards new technologies⁷. Italy lags behind other member states with the lowest number of ICT sector graduates (1.5%)⁸ and ranks near the bottom in basic digital skills among its citizens (45.60%), signaling a crucial need for digital citizenship education and further professional development in AI⁹.

In terms of research quality and output, Italy holds a strong international position. It ranked seventh in AI publications in 2022 with 3,261 papers, although it trails behind leaders such as China, India, and the USA¹⁰. Notably, Italian research units are involved in 12% of all European AI projects, demonstrating significant participation in the AI research landscape.

Italian research institutions are involved in all European projects under the "Center of Excellence in AI" calls of Horizon 2020. Additionally, in the Horizon CL4 2022 call for European Lighthouses in AI, Italy led the ELIAS project, which ranked first among 128 submissions. Italy is also active in European AI Associations, particularly in Eu-rAI, CLAIRE, ELLIS, and ADRA. Italy's scientific community has recently consolidated its experience through the FAIR Foundation—Future Artificial Intelligence Research, which serves as the single point of contact with the Ministry of University and Research (MUR) for the implementation, coordination, and management of the extended partnership on "Foundational Aspects of Artificial Intelligence," funded as part of the National Recovery and Resilience Plan (PNRR). FAIR involves over 350 researchers across 10 hubs, contributing to 13 Italian universities and research centers,

¹ *Artificial Intelligence Index Report 2023, Stanford University*

² *The economic potential of generative AI: The next productivity frontier, McKinsey Digital*

³ *Report on Sizing the price, PwC*

⁴ *Future of Jobs 2023, World Economic Forum*

⁵ *Offerta Didattica in Italia sull'IA 2023, Associazione Italiana per l'Intelligenza Artificiale e Laboratorio Nazionale di Artificial Intelligence and Intelligent Systems del Consorzio Interuniversitario Nazionale per l'Informatica*

⁶ <https://phd-ai.it>

⁷ *Il Futuro delle Competenze nell'Era dell'Intelligenza Artificiale, EY, ManpowerGroup, Sanoma Italia*

⁸ <https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/charts/desi-indicators>

⁹ <https://www.scimagojr.com/countrysrank.php?category=1702>

¹⁰ *Artificial Intelligence: l'era dell'implementazione, Osservatorio Artificial Intelligence del Politecnico di Milano*

including CNR, FBK, IIT, and INFN, as well as key industrial stakeholders.

Despite such a dynamic ecosystem in academia and research, the impact on the industrial and entrepreneurial fabric remains somewhat limited¹¹. Only 15% of Italian SMEs initiated an AI pilot project in 2022, a figure that, while low, represents a 9% point increase from the previous year¹². Moreover, there are about 600 AI patents and just over 350 AI startups founded since 2017, placing Italy at the tail end in Europe in this regard¹³.

Generative AI could be a significant accelerator, potentially increasing Italy's GDP by up to 18.2% annually, offering a unique opportunity to strengthen the national economy¹⁴. Indeed, 78.2% of Italian companies plan to use generative AI techniques in the short to medium term, particularly for information retrieval, virtual assistants and chatbots, process optimization, creative support, and scenario simulation and modeling.

An initial push towards adopting innovative solutions, including AI, in the productive and entrepreneurial context dates back to 2018 with the National Industry 4.0 Plan, which established 8 national competence centers. The ministerial decree of March 10, 2023, extended the funding of these centers until 2025, also providing for the financing of 40 European Digital Innovation Hubs as per Article 16 of EU Regulation 2021/694. Alongside the Digital Innovation Hubs (established under the National Industry 4.0 Plan) and often focused on delivering services based on AI techniques, the EDIHs offer subsidized services for the digitalization of not only SMEs but also Public Administration.

In fact, the use of AI in Public Administration is one of the main directions for innovation to radically transform the image of citizen services, making them more effective and immediately accessible. Several significant experiences have already been gained in this direction.

Among these, notable projects include the design of the national AGENAS platform to support primary healthcare (currently, the procurement procedure with the largest amount worth €57.57 million); the PRODIGIT project, involving the Department of Finance and the Council of Presidency of Tax Justice, aims to adopt innovative tools for tax judges' activities; the INPS's experimentation with a generative AI system that allows users accessing the portal to interact with a smart virtual assistant after making a search query; and the use of an anti-evasion software by the Revenue Agen-

cy, which analyzes data from the Tax Registry and the Archive of Financial Relationships.

¹¹ *Il Digitale in Italia 2023 Vol. 1, Anitec-Assinform*

¹² *Artificial Intelligence: l'era dell'implementazione, Osservatorio Artificiale Intelligenza del Politecnico di Milano*

¹³ <https://sifted.eu/articles/which-european-countries-have-the-most-ai-startups>

¹⁴ *AI 4 Italy: impatti e prospettive dell'Intelligenza Artificiale generativa per l'Italia e il Made in Italy, The European House – Ambrosetti, Microsoft*

PRINCIPLES OF THE STRATEGY

General Vision

Artificial Intelligence (AI) offers a wide range of technologies that, within a short to medium-term horizon, can be utilized to stimulate and accelerate the development of our country. AI is increasingly effective, for instance, in enhancing business productivity and public administration efficiency by optimizing processes, reducing errors, and improving the quality of products and services. It is enabling innovative approaches in health and medical care, ensuring more comprehensive prevention, earlier diagnoses, and more effective treatments. AI improves citizens' experiences in their interactions with institutions; it provides valuable support in educational and learning processes; it is a valuable ally in enhancing the quality of life for individuals and the sustainable management of resources, optimizing the use of energy and raw materials; it is a crucial element in ensuring national security and the defense of the country. The development of AI technologies has had, and will increasingly have in the near future, rapid rates that will open up opportunities and changes that need to be well-managed. It is in this dynamism that much of our competitiveness will be decided: the ability to face changes not only as passive spectators of a historical revolution but as conscious and careful actors, capable of using and producing new technological solutions, conceived and developed in harmony with our values and the peculiarities of our country-system.

From the analysis of the state of the art of Artificial Intelligence in Italy, there emerges a strong need to consolidate and strengthen our significant scientific positions globally, with the awareness that any downturn in such a dynamic system would quickly dissipate the valuable set of skills acquired over the years. At the same time, there is a need to interpret these technologies as an opportunity to enhance our strong industrial tradition, innovating in line with the peculiarities that make us unique internationally. It is an opportune moment to reflect on oneself, to embrace change, and to shape the future with an awareness of our own distinctive identities and potentials.

Italy is a major industrial country, whose production system—firmly anchored to a vision of excellence in production and products—can leverage the new potential offered by Artificial Intelligence to enable new and more effective solutions to enhance the country's competitiveness. On the other hand, Artificial Intelligence can and must also be oriented to support the social well-being of Italians. Significant impacts could be seen in the welfare system, in the protection of environmental and cultural heritage, in educational processes, and in health, intensively across a broad spectrum, not only as an individual right but as a collective inte-

rest in support—especially—of the weaker sections of society. It could, for example, become a valuable tool to address the issues of an ageing society (connected with demographic decline) by proposing a better quality of life. The perspective of Artificial Intelligence as a lever for intervention that rests on the peculiarities of our country-system to improve competitiveness and quality of life necessitates initiating processes that allow Italy to build technologies of its own interest, not merely to import and use generic solutions that are poorly adapted to our context. It's not just about the need to define solutions more in line with the productive fabric and our Public Administration, but also about shaping a vision where Italy—at least on certain specific verticals—can play a leading role in the international AI ecosystem. This vision also allows for the internalization of our values and the sentiments of our community within technology, an aspect that will become increasingly significant in the coming months considering the growing diffusion of generative technologies. Remaining merely as users of AI would indeed mark, in the long term, not only a strategic dependence on solutions that might not provide adequate guarantees, but would even lead to a homogenization and cultural stereotyping given the impact these technologies have on our society.

To steer towards this new direction, we must be able to support both foundational and applied research, creating virtuous synergies with public-private partnerships; we must continue to invest in increasingly efficient infrastructures for computing and increasingly dedicated to AI applications; and we must increasingly recognize the importance and centrality of our talents, aiming for the highest quality standards for their training and actions that can then retain them in Italy with concrete prospects for personal and professional growth.

Sectors and Areas of Application

To materialize the vision outlined here, investments in Artificial Intelligence must cover all areas and possible fields of application, however, particular attention should be given to those that play a prominent role in the Italian productive and social fabric. Regarding the use of AI to strengthen our country's competitiveness, areas of particular interest for developing and promoting the use of new AI solutions both in applied research and in business solutions include:

- The Made in Italy industry, with particular focus on manufacturing identity and supply chains in automation, agri-food, furniture, clothing, as well as sectors of tourism, chemicals and pharmaceuticals,

¹⁵ Do Foundation Model Providers Comply with the Draft EU AI Act?, Stanford CRFM

and aerospace;

- The Digital industry, with ICT service companies and for the development of digital network infrastructure that enable AI solutions;
- The Financial industry, where the use of AI is now a consolidated reality internationally, including banking/insurance services. Regarding the use of AI as a lever for improving the quality of life of individuals and promoting the well-being of society, areas of particular interest are:
- Health, understood in its “one health” meaning, thus not only in aspects strictly related to promoting AI digital technologies in the medical field but also for everything related to prevention, defining healthier lifestyles, and caring for the more vulnerable;
- Education, an area where AI technologies are increasingly entering with dynamics that must be guided to preserve the quality of the overall system;
- The protection of the territory, with reference to cultural and environmental assets, communities, and all factors connected with the environmental sustainability of the digital transition based on AI, thus also considering, for example, aspects related to energy management, especially from renewable sources, and sustainable mobility;
- The protection of privacy and security of individuals, also in relation to aspects that strategically affect the defense sector and national cybersecurity.

Public Administration will finally represent a privileged domain of action, due to its repercussions on both aspects outlined above, both for improving competitiveness (for example, through the streamlining of administrative procedures and in specific areas like justice) and for enhancing citizen interactions with peripheral and central structures.

Objectives and Strategic Areas

The strategic vision for a country that begins to play a leading role internationally can be implemented by defining, analytically, specific strategic actions, closely interconnected and related. For the sole purpose of defining a conceptual schematization, the strategic actions will be grouped into four macro-areas, each characterized by specific strategic objectives.

RESEARCH

Italy must strengthen investments in foundation and applied research in Artificial Intelligence, promoting the creation of research skills and technologies specifically tailored to the context of our country-system and in line with principles of reliability and responsibility (Trustworthy AI) and anthropocentric, typical of European paradigms. Scientific research must maintain and strengthen the impact of the Italian academy in the international panorama. Special attention must be paid to the public research ecosystem and, in any case, to state-fun-

ded research, which can proceed with the utmost freedom in its experimentation activities, using content and data for the creation of datasets and the training of models made available in open source.

PUBLIC ADMINISTRATION

Italy must make its administrative processes more efficient and improve the quality of services offered to citizens through the use of Artificial Intelligence technologies. Public Administrations must be guided in the acquisition of AI systems and in the design of new applications specific to their needs, through accompaniment paths that take note of the current lack of dedicated professional skills. Technologies must be deployed by identifying particularly relevant domains, with the aim of automating and streamlining processes, supporting strategic planning and the management of public resources, providing decision-making support, and ensuring the realization of secure IT infrastructures developed by highly qualified and reliable entities, also through national platforms that ensure the maximum robustness and efficiency of the technologies employed.

ENTERPRISES

Italy must facilitate the development and adoption of Artificial Intelligence solutions in businesses, with the perspective not only of streamlining current processes but also of enabling new ones that open equally new possibilities for growth. It will be necessary to define, at the country-system level, a complex of actions that facilitate and accelerate the development of businesses, including the smallest ones, taking into account the barriers of skills and infrastructure that hinder the diffusion of new technologies. Special attention must be given to personnel training and the creation of synergies with the academic and research world. Indeed, developing a strategy for businesses requires reasoning on a dual level of action. On one hand, the needs of businesses using new technologies must be intercepted, paying utmost care to the productive sectors that characterize the Italian economy and identifying the actors most capable of bridging the gap between applied research and the productive and entrepreneurial fabric. On the other, opportunities for growth of innovation process enablers, i.e., all companies with a specific ICT vocation and startups characterized by the realization of Artificial Intelligence systems, must be enhanced.

EDUCATION

Italy must promote high-quality education, aligned with the new skills required to face the challenges that Artificial Intelligence will pose in the coming years. On one side, it will be essential to encourage the teaching of the discipline at the university level in all its facets, including significant ethical issues, within a wide range of training courses, thus promoting

interdisciplinary collaboration. On the other side, it will be crucial to focus efforts on specialized technical courses, such as the National PhD in Artificial Intelligence, aimed at training researchers destined to become the true promoters of the adoption of AI in businesses and Public Administration. Given Italy's significant delay in basic digital skills and the imminent impact of Artificial Intelligence on professions, it also becomes essential to promote educational pathways for schools and the entire citizenry aimed at preparing Italian society for the Artificial Intelligence revolution, as well as initiatives for reskilling and upskilling in all production contexts, not necessarily related to the ICT world.

The four strategic macro-areas, in addition to differentiating by specific action areas, obviously have different temporal horizons of reference. Actions in the field of Research will have to be developed in a medium-long term perspective, with the ambition to explore innovative technological solutions and still little beaten paths; those instead directed to Public Administration and Enterprises will have to be oriented to provide direct and immediate responses to the pressing needs for innovation, favoring AI solutions developable in a short-term perspective. Training, finally, will express a dual nature, on one side, defining "patient" actions that aim to widely spread skills and knowledge; on the other, supporting actions that require shorter times, such as those related to reskilling and upskilling paths.

Risks of the Strategy

The surprising technological innovations of recent years continue to animate a fervent international debate on the risks associated with Artificial Intelligence, a debate that has sometimes even overshadowed reflections on the benefits that these technologies can bring not only to the economy and competitiveness, but also to the entire society and individuals. We know well—from numerous studies focused on ethical and legal issues that emerge from the use of AI—that an inappropriate management of such a transformative lever can represent a factor of acceleration of social inequalities and even a risk for democratic stability.

Technologies—ideally—are born to be impartial, free of biases, conditioning, or human influences; in a public context, technologies should act impartially, without favoring specific interests, social groups, or perspectives. However, a technology like Artificial Intelligence easily takes on connotations perceived as “non-neutral,” due to its intrinsic connection with the information produced by society, the human choices that guide and direct it, and the complexity of interactions it can generate. A strategy for Artificial Intelligence thus takes on a great responsibility: to direct technologies knowing that any orientation has an impact and specific risks.

Rather than developing a framework of risks linked to general and thus cross-national assessments, it is therefore essential to understand the risks of implementing our specific national strategy, outlined taking into account the specificities of our country-system and oriented on the above-outlined objectives. It is not superfluous, however, to remember that the overall context in which to place the detailed analysis remains, obviously, the comprehensive and systematic regulation of Artificial Intelligence proposed by the European Union, aimed at setting limits so that in the implementation of these technologies, the values and fundamental rights shared by the European Community are respected. This context has, moreover, been referred to, directly or indirectly, by other important international acts or declarations of commitment, such as the recent U.S. executive order (which seeks to channel the developments of Artificial Intelligence in the USA on a track of safety, reliability, and transparency of solutions) or the Bletchley declaration (signed by the European Union and 28 States committed to collaborating to mitigate the risks associated with the use of AI technologies, especially Foundation Models).

In an analysis that obviously cannot be extensive, the main risks that are foreseen are outlined below, highlighting for each the methodological approach proposed to mitigate and consciously address them. These approaches will then be subsequently internalized in the definition of specific strategic actions that will be

outlined for the areas of Training, Research, Public Administration, and Enterprises.

■ THE RISK OF “NON-ACTION”

In a country like Italy, historically resistant to information and communication technologies and slow, timid approaches to pursuing strategic objectives risk resulting in a waste of resources and a further loss of competitiveness. “Non-action” can be, in particular, fueled by an approach to innovation that limits itself to importing/purchasing existing solutions, interpreting the revolution of Artificial Intelligence as a simple challenge to create interfaces on a technological world animated by others; therefore, it is necessary to be ambitious, highlighting the economic value of the use of these technological systems in services (also public or of public interest) and in production processes.

“Non-action” can also be fueled by poorly focused actions and initiatives that are not able to respond well to the needs of the reference context; therefore, it is necessary to enhance the capacity to produce our technology tailored to the needs, values, rights, and interests of our country. Investments must be made in applications and solutions that are oriented to support the specificities of our country-system, favoring a dimension of internal application development and not as a result of an import perspective. This also considering the current geopolitical competition on technology and in particular on AI, a competition in which Italy must participate as a protagonist, also in support and stimulus of the European Union and the Member States.

■ THE RISK OF HOMOGENIZATION

Closely connected to the points highlighted above is the risk of cultural homogenization, which has begun to take shape following the significant advancements of generative AI. If on one hand the Italian strategy aims to increase the diffusion of AI systems and models, also generative, on the other hand, it must take into account that most of these systems are today produced abroad, thus reproducing in our different social context, first and foremost Italian, but also European, ideas and values often heterogeneous. This is a very relevant risk that strongly impacts our society and its rights to freedom, and of which we do not yet have a full perception of the outcomes on a global scale. Developing a system according to the values and the idea of the rights of a nation, brings with it the unavoidable interest in having a technology compliant with the constitutional values of its legal order, at the same time reaffirming and preserving them. Therefore, strategic actions aimed at promoting generative models, used in particular in

¹⁶ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A52021PC0206>

¹⁷ <https://www.whitehouse.gov/briefing-room/statements-releases/2023/10/30/fact-sheet-president-biden-issues-executive-order-on-safe-secure-and-trustworthy-artificial-intelligence/>

¹⁸ <https://www.gov.uk/government/publications/ai-safety-summit-2023-the-bletchley-declaration/the-bletchley-declaration-by-countries-attending-the-ai-safety-summit-1-2-november-2023>

the field of Public Administration and citizen services, must internalize the need to develop systems developed in respect of ethics and legislation, also in defense of the very values of democracy.

■ **THE RISK OF NATIONAL OVER-REGULATION**

Artificial Intelligence is at the center of the strategy “A Europe Fit for the Digital Age” defined by the European Commission, but it is (and will be) impacted by a copious normative production aimed at regulating the impact of the new generation of technologies: on one side, from the rules on protection, valorization, and security of data—personal and not—(GDPR, Data Act, Data Governance Act, NIS, etc.); on the other, from those aimed at regulating the role of service providers (Digital Markets Act, Digital Services Act, European Digital Identity, etc.). In this already complex regulatory framework, partly already in force, the AI Act will be inserted and its implementation will gradually affect all Member States from the next months. The AI Act will have to precisely define a harmonized regulatory framework with the boundaries within which Artificial Intelligence must be used, outlining simple but certain rules for producers and users, also with reference to the most recent technological evolutions. Bringing the European regulatory context to the national level, it will be necessary to avoid building further normative superstructures in the definition of strategic actions, instead working in the direction of promoting the AI Act with guidelines and agile paths tailored to business and citizen.

■ **THE RISK FOR THE WORLD OF WORK**

Despite the numerous sector studies conducted in recent years, there is no common vision of the impact that Artificial Intelligence systems will have on the world of work. Catastrophic scenarios imagined over the long term are probably not reliable, while more plausible are, in the medium term, the scenarios in which new skills and professionalism will replace the existing ones. A strategy that pushes the adoption of Artificial Intelligence systems will obviously accelerate this (inevitable) process of transformation. Therefore, this process must be guided and regulated, foreseeing—in its strategic actions of greater impact—the due attention to human capital and people. Crucial will therefore be the initiatives of the strategic area of Training, and more specifically the paths of upskilling and reskilling, paying great attention to preserving and improving the quality of work downstream of the adoption of AI systems and the repositioning of personnel.

■ **THE RISK OF THE DIGITAL DIVIDE**

Italy is still characterized by an insufficient level of digitalization and digital skills, both in the public and private sectors, but particularly in the national social fabric, with also evident territorial heterogeneities between regions and cities. An ambitious program of innovation on Artificial Intelligence, if not well guided and directed, could lead to the adverse effect of increasing these gaps and these he-

terogeneities. The investments provided for by the national strategy—already mentioned above—in human capital, talents, upskilling and reskilling paths could therefore transform into heavy social boomerangs, if not defined within the framework of transparent initiatives, fully accessible and usable at any latitude of the national territory. Strategic actions—in particular those related to the world of training, including corporate training—must therefore favor system initiatives, which do not resolve in extemporaneous or localized projects. The publicization of these initiatives and the awareness of their importance must represent a strategic line transversal and common to all specific actions.

■ **THE RISK OF INEFFECTIVENESS**

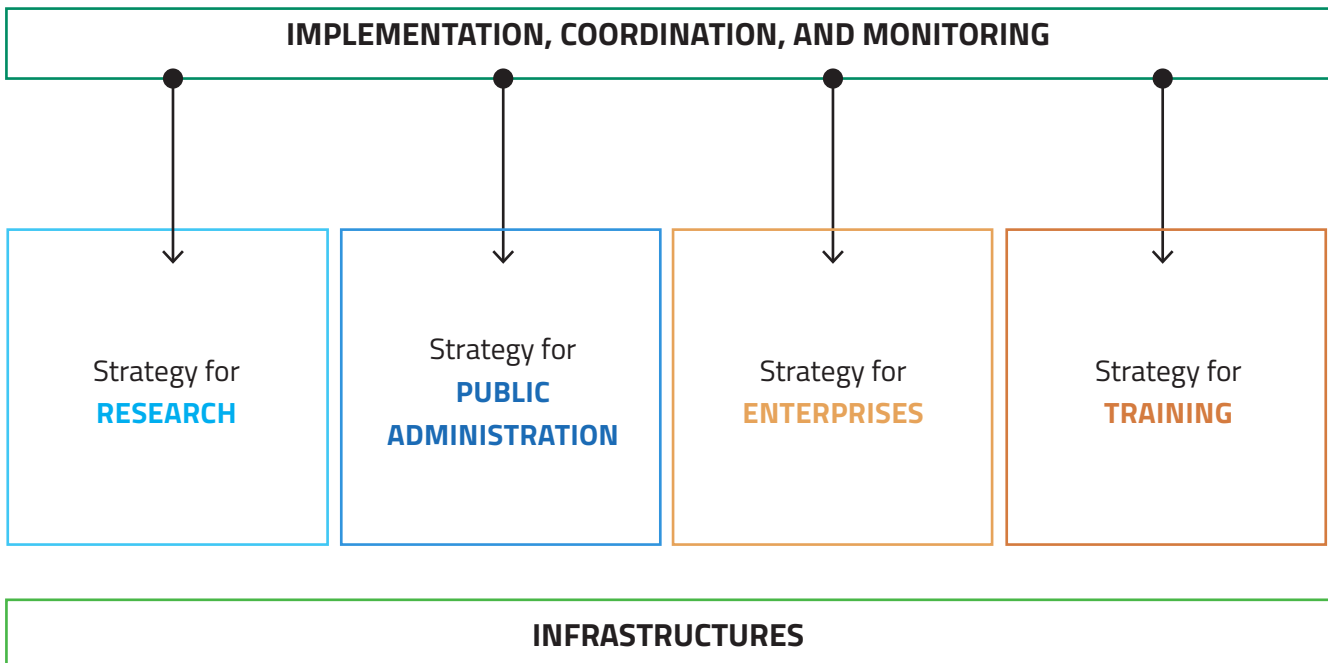
Last but not least, the risk that the national strategy lacks effectiveness in its implementation, failing to achieve the objectives it sets itself, must also be considered. This is a risk always concrete in planning, which is exacerbated in this particular dynamic scenario of Artificial Intelligence and by the contingent need to manage simultaneously numerous lines of action, which also require significant organizational and regulatory adjustments. In fact, policies for AI are characterized and will increasingly be characterized as a moving target: the speed of dynamics and changes, in fact, will require a continuous process of review, with the risk that even accurate planning quickly becomes obsolete. To minimize this risk, an appropriate mechanism of coordination of activities and an adequate monitoring system will be deployed, taking care to associate with each of the strategic actions a specific indicator and target for achieving results.

STRATEGY DESIGN

Infrastructure and Coordination

The overall vision of the strategy outlined thus far is very ambitious. Achieving the strategic objectives set out for each of the four macro-areas (Research, Public Administration, Enterprises, Training) will require considerable organizational effort and, above all, a wise and targeted coordination action, both within each individual area and across the different areas. To avoid tackling individual goals while losing sight of the overall logic that links the various areas of interest (and therefore, also to establish common good practices and promote a fruitful exchange of knowledge and skills

between academia, enterprises, and Public Administration), a defining element of the strategy is the setup of an “enabling” strategic actions context, which defines the framework within which the specific initiatives must be deployed across the different macro-areas. These enabling strategic actions are grouped into two different types (infrastructural and for the implementation, coordination, and monitoring of the strategy) as synthetically represented in the following diagram.



The necessity for actions linked to infrastructure enhancement is quite evident in an application context that heavily depends on the availability of substantial computing resources dedicated to analyzing vast amounts of data. Indeed, from one perspective, the infrastructural domain involves the need to continue investing in “physical” infrastructures that enable the development of increasingly advanced Artificial Intelligence solutions, maintaining and improving competitiveness on an international level. Moreover, it is essential today to recognize that data and information repositories on which AI systems can be trained themselves represent an indispensable infrastructure in the development of these new technologies, a new infrastructural dimension that we must increasingly focus on. To materialize its ambitious strategic vision, Italy must therefore invest in promoting a major initiative of sharing and reusing datasets (and also models) acquired in specific projects and application contexts, not only within the scope of foundational research initiati-

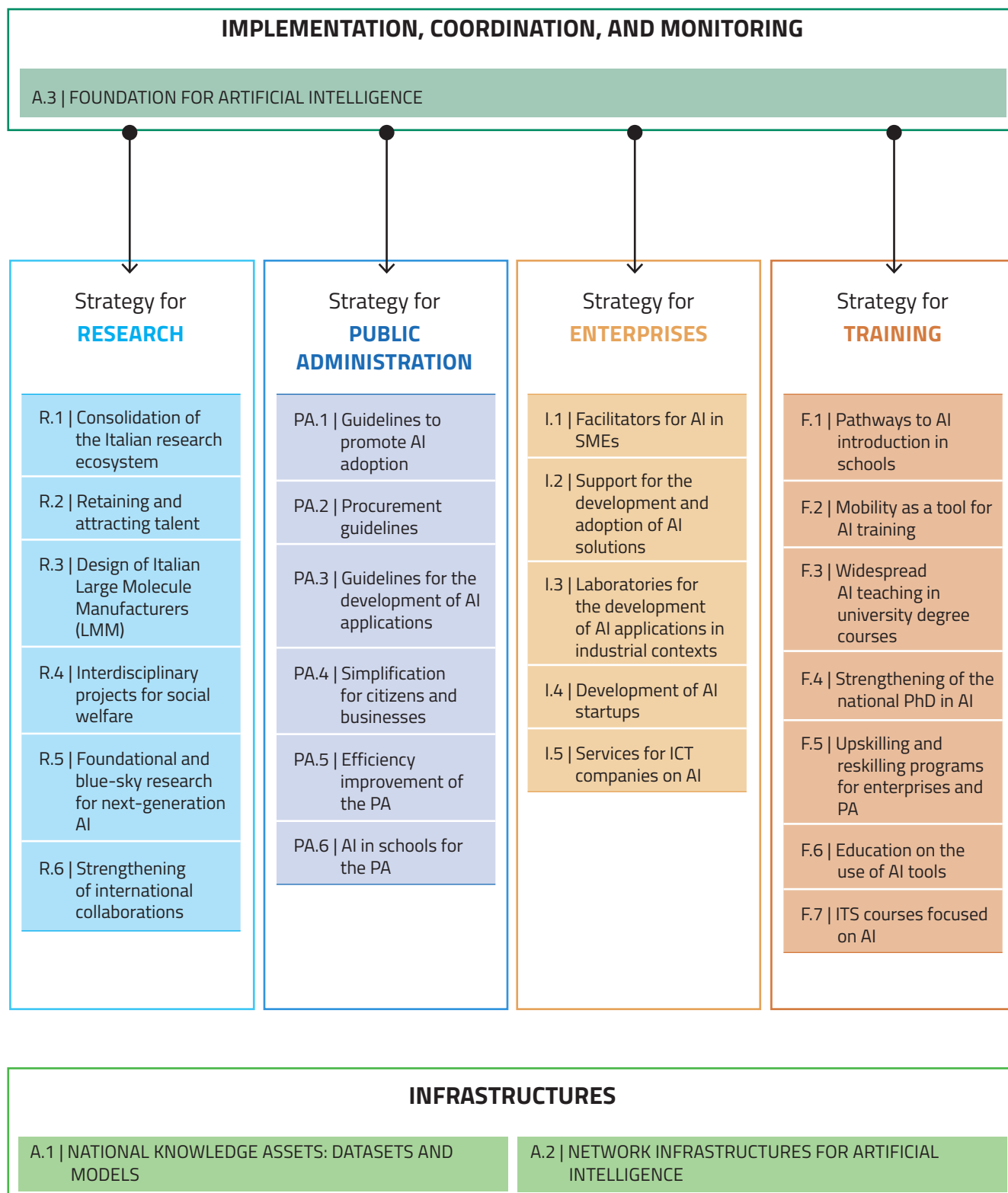
ves but also in the productive contexts of enterprises and Public Administration. The creation of a “registry” of data and models will be a prominent element of the strategy (indeed an enabling factor) that over time can foster standardization practices and can accelerate the development times of solutions, further fueled by data and models that best characterize the distinctive traits of our country and thus better reflect our peculiarities and needs.

Building on the enabling infrastructural actions, the possibility of achieving the strategic objectives outlined in Research, Public Administration, Enterprises, and Training will then depend on the ability to effectively implement various initiatives. On one hand, it will be essential to define a framework of financial resources that makes planning sustainable, through the establishment of a fund that can also be fed by any revenues from the actions themselves; on the other hand, it will be necessary to define an entity that will take on the

responsibility not only for managing this fund but also for implementing the various strategic actions, with the aim of promoting synergies among the different actors of the innovation ecosystem that revolves around Artificial Intelligence. This entity will also need to oversee

the infrastructural elements outlined above, naturally serve as the reference for monitoring the progress of the strategy implementation, aimed at continuous improvement, and manage the budget for the enabling actions.

Map of Strategic Actions



Enabling Strategic Actions

A.1 | NATIONAL KNOWLEDGE ASSETS: DATASETS AND MODELS

Description

To systematize knowledge acquired in specific projects and enable the reuse of AI artifacts, a program will be implemented to define a registry of datasets and models, constructed according to principles of transparency and fairness, ethically reliable by design, and reusable to accelerate solutions for Italian companies. The definition of the project will be articulated according to three main directions: (i) methodological, to define a national protocol to ensure that datasets are trustworthy-by-design and trustworthy-by-default both legally and engineering-wise, defining approaches for mitigating risks (in terms of ethics and cybersecurity); (ii) operational, to implement and make available a platform that integrates modern MLops approaches and data preparation; (iii) applicative, in which the platform will be specialized on specific national interest application areas. All projects funded within the national strategy or otherwise receiving public funding will be required to report the datasets used and the models produced in the registry, according to guidelines that will define access levels and reuse modalities.

The registry will also be used in specific verticalization initiatives on Enterprises and Public Administration. The verticalization on Enterprises will focus on identifying specific productive sectors, promoting not only the sharing of real data but also the definition of approaches to the generation of synthetic datasets usable in specific application contexts. In this area, it will be crucial to promote the use of Privacy-Enhancing Technologies (PET), i.e., digital solutions that allow collecting, processing, analyzing, and sharing information while protecting data confidentiality and privacy, thus encouraging participation; such technologies will also be promoted through appropriate training and awareness initiatives aimed at creating a culture of data sharing based on trust and privacy protection. As for Public Administration, the goal will be to promote the reuse of solutions developed with public funding and to encourage the standardization of procedures and platforms. Starting from the development of local ecosystems of skills, with a bottom-up process, the solutions can indeed be disseminated on a national scale, fostering the involvement of other local communities also dimensionally different, responding to their needs, leveraging their availability and creativity to build a solution tailored to them. The issues to be addressed obviously include the heterogeneity of projects, which are linked to local contingencies and varying levels of scalability. The creation of the registry will also enable the activation of cataloging procedures for the various databases existing within the Public Administration, annotating them with quality and confidentiality factors that are also useful for defining their use outside the organization that generated the data.

A.2 | NETWORK INFRASTRUCTURES FOR ARTIFICIAL INTELLIGENCE

Description

The increasing use of solutions based on Artificial Intelligence will lead, in the medium term, to a risk of congestion of the current digital communication infrastructures, considering the significant increase in data traffic generated by the most modern technological solutions. It will therefore be necessary to plan specific strategic actions for the improvement and expansion of the current network infrastructure, especially in areas with high traffic density. Numerous actions can be deployed. The development of intelligent networks that can dynamically adapt to demand in real time will be promoted.

Collaboration between the public and private sectors will be encouraged to ensure that network operators and technology companies work together to address challenges related to Internet congestion; this partnership will include incentives for investments in infrastructure, as well as joint research and development programs for innovative solutions. There will be support for the implementation of interoperable solutions, reducing data load and mitigating congestion, and investing in the standardization of network solutions for AI technologies. Finally, awareness and education on responsible AI management will be promoted, encouraging companies to implement practices that reduce the impact on the network, such as algorithm optimization, data compression, and the use of edge computing technologies.

A.3 | FOUNDATION FOR ARTIFICIAL INTELLIGENCE

Description

To effectively pursue the objectives defined in the strategy, it will be essential to define an entity responsible for the implementation, coordination, and monitoring of individual initiatives. As far as implementation is concerned, it will obviously be necessary to plan the establishment of a fund that makes the strategic actions sustainable and that, in a prospective key, can also be fed by revenues (of various kinds) from the actions themselves. The entity can therefore well characterize itself as a Foundation which, given its centrality in the overall innovation ecosystem of innovation, can be placed under the direct control of the Presidency of the Council of Ministers. The Foundation will first take care to manage and maintain the registry of AI solutions (as per Action A.1), also enhancing it with an appropriate business model that consolidates its sustainability.

In particular, it is appropriate to anticipate forms of fair compensation for the rights holders of data and content when these are used within the registry for profit-making purposes. Furthermore, the Foundation will serve as the central node of a complex network of actors, promoting the development and adoption of Artificial Intelligence systems across various strategic macro-areas, particularly in Enterprises and Public Administration. Indeed, it is essential to recognize that AI policies will be, in the medium term, a kind of moving target: the underlying technological evolution requires continuous adaptation and/or revision of AI development trajectories and their application to support the country's competitiveness. In this perspective, the coordination of the Foundation will be characterized by activities aimed at: (i) identifying a development agenda in terms of skills, tools, processes, and products, in close synergy with all ecosystem actors; (ii) defining and promoting awareness initiatives to make stakeholders—especially SMEs—aware of the business opportunities created by AI, whose lack is one of the main

barriers to the adoption of these technologies, thus stimulating demand; (iii) defining criteria for the certification of digital and AI skills of companies; (iv) producing an annual forecasting document that outlines prospective elements on the use of AI in Enterprises and Public Administration; (v) defining and encouraging strategic initiatives for the industrial application of AI; (vi) collecting the needs of Enterprises in different sectors for various technologies; (vii) coordinating the evaluation of projects for access to specific funding for SMEs and startups proposed within the national strategy; (viii) providing support for regulatory compliance through guidelines and best practices. Finally, the Foundation will have responsibility for the entire strategy monitoring process, constantly assessing the progress of individual actions and the achievement of targets.

STRATEGY FOR RESEARCH

| | |
|--------------------------|---|
| Objectives | Invest in foundational scientific research on AI |
| | Enhance applied AI research |
| Strategic Actions | R.1 Consolidation of the Italian Research Ecosystem |
| | R.2 Retain and Attract Talent |
| | R.3 Design of Italian Large Molecule Manufacturers |
| | R.4 Interdisciplinary Projects for Social Welfare |
| | R.5 Foundational and Blue-Sky Research for Next-Generation AI |
| | R.6 Enhancement of International Collaborations |

Overview

A fundamental goal of scientific research is to improve the quality of life of people and the social context in which they live. In the near future, Artificial Intelligence (AI) will offer increasingly effective tools and techniques to achieve this goal, thanks in part to the great dynamism and speed with which research results can nowadays be transformed into services and products useful to individuals, society, and the production world. In this scenario of continuous revolution, Italy must aim to maintain and intensify its competitiveness in research on an international level. This involves both academic positioning and the capacity for technology transfer, so that foundational research can become a driving force for the creation of technologies directly applicable to the country's innovation.

Research in the field of AI necessarily transcends national boundaries and cannot be exempt from large-scale cooperation: therefore, actions that support the national ecosystem in a context of international and mainly European relations are necessary, promoting mobility, the return of Italian talents from abroad, and the attractiveness of Italian universities and research centers for foreign talents. Italian research must, therefore, be supported with investments comparable to those of the international landscape, focusing both on the continual evolution of foundational AI research and high-risk, long-term blue-sky research, and on research that emphasizes sustainability in ecological, social, ethical, and legal terms typical of Italy and Europe, as well as on multidisciplinary and applied research directly related to enterprises.

This last area is particularly relevant considering the risk that Italy could lose global competitiveness in its productive excellences if not effectively supported by technologies capable of standing up to stronger economies and more innovative contexts. To this end, the

creation of synergies should be favored both with enterprises using technologies and with those operating in the ICT world enabling new AI solutions, in order to create a strong national ecosystem that is also fertile ground for the development of innovative startups.

Objectives

- **Invest in foundational scientific research on AI**, consolidating existing initiatives such as the Extended Partnership on AI; promote collaboration among different skills, funding interdisciplinary projects; open the field to the exploration of highly ambitious and broad-spectrum (blue-sky) projects; support an extraordinary plan to retain and attract talents to sustain competitiveness in the international context.
- **Enhance applied AI research** through initiatives co-designed by public-private partnerships, including dedicated laboratories involving enterprises, universities, and research centers, focusing on contexts of greatest economic and social value for Italy and the greatest impact on citizen welfare.

Strategic Actions

R.1 | CONSOLIDATION OF THE ITALIAN RESEARCH ECOSYSTEM

Description

The Italian AI research ecosystem is extremely vibrant, dynamic, and of recognized international value, but also widely distributed across many universities and national research centers. Funding from the PNRR has allowed the creation of the FAIR Foundation, which has developed a multi-choral ecosystem starting from a core group of 15 universities, accredited AI research entities (CNR, IIT, FBK), centers of significant scientific importance (INFN), and large local enterprises, extended through the presence of the National Inter-University Consortium for Computer Science (through the AIIS Lab) to more than 50 research centers covering the entire national territory. The ecosystem will also strengthen over the years through cascading funding, with the aim of maximum inclusivity of Italian excellences and enterprises. This represents an investment in an important ecosystem, which needs to be supported and further enhanced, also by carefully analyzing any issues and potentially remodeling or redesigning the current organization. It will therefore be essential for the development of research to further invest in promoting the initiative, also considering the extension of the partnership. It will be particularly essential to involve the productive and entrepreneurial fabric in the partnership, characterizing the initiative as a public-private ecosystem, a place of meeting and natural exchange of skills and knowledge between universities, research centers, ICT companies developing AI systems, and those that in their specific activities can benefit from technological innovations. Additionally, there may be a focus on developing territorial or thematic verticalizations and creating stable synergies with the Public Administration through targeted research activities “on public commission,” activities of benchmarking, and validation of solutions, both from a technological and ethical-legal standpoint.

R.2 | RETAIN AND ATTRACT TALENT

Description

Current funding from the PNRR has allowed for an increase, sometimes significant, in the number of researchers dedicated to Artificial Intelligence, both in academia and in public research entities. Once the impetus of the PNRR is exhausted, the current setup will likely be unsustainable in the dynamics of “normal” funding, leading to the exit from the research ecosystem of those talents who were trained thanks to the PNRR and who today hold fixed-term positions. To maintain a high level of competitiveness in research, an extraordinary plan for hiring in universities, research entities, and enterprises, at various levels, will be necessary. There will be a need for an extraordinary plan for Tenure Track researchers, PA and PO (and equivalent EPR positions) on foundational and applied topics related to AI, which will allow: (i) to absorb the most excellent among the many RTDa/TD (trained thanks to PNRR initiatives and not only); (ii) to respond to new training and research needs that will emerge in the coming years; (iii) to retain and attract foreign talents. In particular, attracting foreign talents can help create a driving effect on the entire community, stimulating the formation of local skills and facilitating the continuous exchange of knowledge in the field of Artificial Intelligence; it will therefore be important to promote specific incentives for the “brain gain” in AI, also in line with European policies (for example, Germany has indicated funding of 500 million euros just in 2024 to cover 150 new professorship positions in AI). In addition to positions specifically dedicated to AI, it will be important to define positions for researchers in multidisciplinary areas, as well as to encourage enterprises to hire researchers trained on AI within the initiatives promoted by the PNRR in the last two years.

R.3 | DESIGN OF ITALIAN LARGE MOLECULE MODELS (LMM)

Description

The development of Foundation Models is increasingly a privilege of large private research centers, with investments often on a scale that is unattainable for the Italian ecosystem. However, Italy cannot fall behind in this important area of technological competition and must become competitive in Europe, where Germany and Great Britain stand out with investments of 500 million euros and 100 million euros respectively (in this case for “safe” foundational models). Thus, competitive programs must be deployed for funding, also in synergy with private entities, collaborative research projects for the creation of Large Language Models (LMM) and Large Multimodal Models (LLM) based on Italian and multilingual systems. Development should focus on specific applications contextualized in significant application domains for our country, for example in Public Administration or in the health sector, that fully comply with European values and regulations in terms of: (i) transparency of training data, to ensure compliance with non-discrimination laws, privacy (GDPR), human rights protection, providing reliable information on the sources from which content is generated; (ii) protection against generated false content (hallucinations); (iii) protection of the rights of authors and creators whose works are used in the training data; (iv) tracking mechanisms for content generated by AI (such as watermarking); (v) environmental sustainability, aiming at innovative techniques to reduce the size of models (also with approaches of incremental and federated learning); (vi) assessment of socio-economic impacts in the medium and long term. The program could be organized in phases, with a monitoring entity identifying projects to admit to subsequent phases based on the results achieved.

Considering the complexity and the very nature of LMM systems, each initiative must be supervised by an Ethics Committee that approves the general guidelines and implementation methodologies. In particular, the Committee will take care to highlight the risks inherent to specific initiatives, guiding project choices towards approaches that ensure the safety and reliability of the solutions.

R.4 | SYNERGIES: INTERDISCIPLINARY PROJECTS FOR SOCIAL WELLBEING

Description

To foster interdisciplinary research related to AI, competitive initiatives should be planned for medium-small synergistic research projects (from 2 to 5 partners), aiming at ambitious foundational scientific advancements in various domains where the role of AI is fundamental or in which AI itself represents the object of research, but for which the coordination of multidisciplinary skills is essential. The evaluation procedure will be based on criteria of “excellence, interdisciplinarity, and originality,” inspired by the Synergy Grants of the European Research Council (ERC). The areas of application aimed at using AI for social wellbeing (outlined in the “Strategy Principles” section) should be primarily considered.

Some specific application domains, by way of example, involve projects for: landscape protection, sea or environmental protection; research on new challenges created by AI on issues such as copyright, deepfakes, online disinformation, and responsibility; research on ethics and AI; studying the socio-economic impacts of AI on issues such as economic inequality, social discrimination, and monopolies; the application of machine learning in other disciplines (with AI4Science projects); national and personal security; optimization of environmental and energy resources; pilot projects of digital/AI and social systems to guide the digital transformation centered on people and society enabled by AI; solutions to support the digitalized intellectual and cultural heritage (digital humanities).

R.5 | AI GRAND CHALLENGE: FOUNDATIONAL AND BLUE-SKY RESEARCH FOR NEXT-GENERATION AI

Description

In order to continue supporting foundational research activities, in line with what is currently being developed under the FAIR project, a research program inspired by the structure of North American research challenges should be launched, focused on foundational research with the potential to create a generational leap at a technological-scientific level and generate disruptive innovation. The program should have a bottom-up nature, foreseeing the selection of project ideas through two phases. In the first phase, researchers will be able to propose themes for the challenges. The ideas will be collected and selected: the proponents of the selected themes will contribute to the management of the subsequent phase, in which proposals consistent with the themes will be gathered and the winning proposals will be selected. The proposals will be formulated by consortia of small size.

R.6 | ENHANCEMENT OF INTERNATIONAL COLLABORATIONS

Description

To encourage high-quality research in Italy, it is essential to promote international collaboration. To this end, research programs will be funded to: (i) define new AI tools and solutions; (ii) define common methods for effective adoption of AI (especially for transnational social challenges, and for markets where companies are international, or even though national, strongly focus on foreign markets); (iii) develop legal-administrative tools for the protection of solutions; (iv) design and realize advanced computer platforms capable of systematically and autonomously detecting and analyzing the evolution of cyber threats and the “anomalies” present in network traffic that may represent an alert for the conduct of an imminent attack, with the ability to promptly activate proactive actions to mitigate or repel recognized threats. The competitive research programs, limited to a duration of 2 years, will aim to promote joint research with at least one other European or Extra-European nation, foreseeing exchanges of incoming and outgoing researchers and the creation of documentation that may become an international reference and in the institutional relations of the involved countries.

STRATEGY FOR PUBLIC ADMINISTRATION

| | |
|--------------------------|--|
| Objectives | Support administrative processes |
| | Facilitate the use of PA services |
| Strategic Actions | PA.1 Guidelines for promoting the adoption of AI |
| | PA.2 Procurement guidelines |
| | PA.3 Guidelines for the development of AI applications |
| | PA.4 Simplification for citizens and businesses |
| | PA.5 Efficiency of Public Administration |
| | PA.6 AI in schools for Public Administration |

Overview

Artificial Intelligence can become a central factor in the digital transformation of Public Administration, due to its potential to enhance both the efficiency of internal operations and the delivery of services more closely aligned with the needs of citizens. In recent years, various sector-specific initiatives have started to integrate AI into Public Administration. What is now required is a structured and systematic approach that supports all elements contributing to effective public administration functioning. In particular, it will be crucial to avoid fragmentation of solutions: on one hand, by developing specific national interest projects that enable new processes of action and interaction for the Public Administration, deserving large-scale development; on the other hand, by defining frameworks within which individual entities and administrations can autonomously make their innovation choices, while still positioning themselves as a collective entity capable of implementing AI solutions and applications that are interoperable and meet precise functional standards.

In developing the strategy for Public Administration, it will therefore be necessary to develop a coherent set of actions, with a multidisciplinary approach, to fully exploit the opportunities offered by new technologies based on Artificial Intelligence with the aim of creating a virtuous cycle among: (i) quality, privacy, security, and proper data management functional to the use of AI techniques; (ii) the development of AI-based technologies and software tools for interoperability, source traceability, credibility, accuracy, and relevance, in order to build trust in decision-making tools that leverage what is available on digital platforms; (iii) the training of specific skills for Public Administration personnel on AI technologies and tools in compliance with laws, regulations, and best practices and experiences; (iv) systematic monitoring and improvement, with statistical quality measures, of service performance in development and operation; (v) support for strategic decision-making processes and regular performance evaluation of AI tools; (vi) commitment against biases and intellectual property violations; (vii) development of tools to support citizens, carefully assessing their enabling capabilities, benefits,

and risks. Artificial Intelligence is increasingly showing us its enormous potential. How to adapt our operations to the opportunities AI offers remains the fundamental question to which, in a historical moment dense with often unpredictable socio-economic changes and events, Public Administration must respond. In this direction, besides more technical actions, it will be essential to implement “supportive” actions—with careful and authoritative direction—that, taking into account skills and knowledge not yet widely spread in Public Administration, can promote a fruitful use of AI and channel procurement actions and development of solutions, enhancing their reuse and sharing of good practices.

Objectives

- **Support administrative processes** through AI technologies, increasing efficiency and optimizing the management of public resources; fund some national-scale pilot projects; support the initiatives of individual administrations, framed as a collective entity capable of realizing AI solutions and applications, defined in accordance with precise interoperability guidelines that ensure adequate functional standards.
- **Facilitate the utilization of Public Administration services** by citizens and businesses through AI solutions and technologies, ensuring usability, privacy, and process transparency; promote the technological neutrality of software and PA platforms to offer alternatives to the exclusive use of proprietary solutions.

Strategic Actions

PA.1 | GUIDELINES FOR PROMOTING THE ADOPTION OF AI IN PUBLIC ADMINISTRATION

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|--------------------|---|
| Description | <p>Public Administration, which manages information and services for citizens and communities, can greatly benefit from the innovations brought by AI. However, for this transformative lever to be truly deployed, it is necessary that not only adequate competencies are widely disseminated, but also a full awareness of the technological potential of Artificial Intelligence, with particular attention to the possible risks arising from its use and the significant opportunities it can provide. A crucial first step will involve systematically guiding the Public Administration in navigating through a complex landscape, via guidelines that highlight the potential and use of AI platforms, also through specific case studies on the use of Artificial Intelligence, while promoting knowledge of “best practices.”</p> <p>In this regard, it will be particularly important to develop specific vertical analyses, such as assessing the impact of AI techniques in the legal field or other areas of specific interest to Public Administration. The guidelines will also define the methodological steps to be deployed to define innovative project activities in Public Administration where AI tools are present, both in relation to technological issues (technologies, skills, risks) and in relation to the definition of ethical and regulatory frameworks. Furthermore, these guidelines will categorize the different applications into homogeneous classes, characterizing their minimum functional standards and interoperability requirements, thus ensuring the possibility of deploying AI solutions and applications that place each Italian citizen in a relationship with their local authority entirely similar to that of other citizens in other cities and regions of the national territory.</p> |
|--------------------|---|

PA.2 | GUIDELINES FOR PROCUREMENT IN PUBLIC ADMINISTRATION

| | |
|--------------------|--|
| Description | <p>A necessary condition for selecting the most appropriate technical tools and standards for the needs of Public Administration, in addition to a solid domain knowledge, is the understanding of the available IT products and services, along with an awareness of the risks of use and the opportunities offered. Navigating such a varied and dynamic world, however, is not simple. It will therefore be essential to define appropriate guidelines that integrate what is already currently provided for in the ICT field but with a specific focus on Artificial Intelligence. These guidelines must, in particular, guide Public Administrations towards procurement activities of solutions — within the framework of tender procedures or specific framework agreements — that not only respond well to specific functional needs but also ensure adequate safety levels and full compliance with regulatory provisions and general guidelines on the adoption of Artificial Intelligence in Public Administration.</p> |
|--------------------|--|

PA.3 | GUIDELINES FOR THE DEVELOPMENT OF AI APPLICATIONS IN PUBLIC ADMINISTRATION

Description

Consistent with the general objectives of the national strategy, Public Administration must not only acquire skills in procuring solutions already available on the market, but also develop the ability to actively engage in developing its own solutions. This is a highly elaborate process, which must initially be based on the definition of specific guidelines directed towards the use of platforms developed in Italy and aimed at the implementation of projects that promote: (i) full compliance with national and European Union regulations in terms of risk class management and related compliance, with particular reference to the protection of personal data; (ii) awareness of the requirements dictated by national strategies and related to the development of technologies in highly critical sectors such as energy, defense, and intelligence; (iii) the definition of initiatives aimed at training personnel that can elevate the level of user competencies on advanced technological solutions, focused on the development of certifiable, scalable, and nationally shareable processes.

PA.4 | SIMPLIFICATION FOR CITIZENS AND BUSINESSES

Description

Substantial investments will need to be directed into the design and implementation of tools and interaction methodologies that can facilitate citizens' access to services offered by Public Administration. These initiatives can be defined in collaboration with private partners, academia, and research centers, and are characterized by a national scope. Project activities may be oriented towards the use of various technologies, such as ontological mechanisms for integrating information sources, Multimodal Foundation Models, and deep learning systems, defining specific use cases of broad interest, from the automatic filling of forms for essential services to robotic process automation in specific areas. The activities must also include specific assessments of the reliability of the systems, as well as a precise planning of their adoption methods on a large scale.

These can also be articulated in two phases, initially foreseeing the development of pilots limited to specific administrative system contexts which can then be extended on a large scale considering the feedback received. In any case, the functional specifications and needs must be clearly formalized by Public Administration, while the solutions that best manage these specifics should be identified – through specific tenders – either among those already available on the market or among those that can be developed ad hoc, also through the involvement of controlled or participated companies. Among the application areas, those of social interest defined in the “Strategy Principles” section may be primarily considered.

PA.5 | EFFICIENCY ENHANCEMENT OF PUBLIC ADMINISTRATION

Description

Artificial Intelligence technologies can also play a crucial role in streamlining the internal processes of Public Administration. Similar to what is planned for Action PA.4, it will involve defining initiatives for the development and/or adoption of AI systems (through public calls), starting with the mapping of already implemented systems and their offered services. It will be the responsibility of the Public Administration to identify specific areas of intervention, defining the policies to be adopted and assessing the impact and possible risks of the systems.

There are numerous areas of potential interest. On the strictly administrative front, systems could be defined, for example, for verifying the compliance of acts and administrative decisions with current laws, procedures, and regulations, but especially systems capable of providing automated feedback and recommendations, particularly in the drafting of acts by officials and public managers. Similarly, platforms for the digitalization and automatic annotation of documents or support systems for the Responsible Units of Programs (RUP) for the management and monitoring of Public Contracts could significantly streamline the processes of the PA. All systems must, however, have a national scope and define an infrastructure and operational activity that is actively present across the entire territory.

PA.6 | AI IN SCHOOLS FOR PUBLIC ADMINISTRATION

Description

To support the innovation processes of Public Administration, it will be necessary to promote specific upskilling paths that allow for the expansion of skills and knowledge of the currently serving staff. To this end, a specific Department dedicated to Artificial Intelligence must be established within the National School of Administration, including the activation of postgraduate courses of excellence for Public Administration employees, with potential differentiation based on the level and content relative to the roles of the individuals involved. This initiative may also serve as a preparatory step for launching future innovation actions in Public Administration, including through projects in collaboration with universities and centers. Similar initiatives should be planned in all training schools for Public Administration, including those of local entities.

STRATEGY FOR ENTERPRISES

| | |
|--------------------------|--|
| Objectives | Capture the innovation needs of Italian businesses |
| | Support the Italian ICT sector |
| Strategic Actions | I.1 Facilitators for AI in SMEs |
| | I.2 Support for the development and adoption of AI solutions |
| | I.3 Labs for the development of AI applications in industrial contexts |
| | I.4 Development of startups in the AI field |
| | I.5 Services for ICT companies on AI |

Overview

The system of Italian enterprises is characterized by a vision strongly oriented towards process and product excellence. Italy is a major industrial country with a strong manufacturing vocation, historically at the forefront of innovation and automation. Embracing the Artificial Intelligence revolution thus represents a natural development path for our country's productive and entrepreneurial system. In this journey, it will be necessary to articulate a strategic project that operates on a dual level of action. On one hand, the focus should be on enhancing the role of Italian ICT companies as enablers for the development of new AI solutions and applications, increasing their ability to develop project initiatives, promoting their capacity to synergize with universities and research centers, and facilitating the definition of networks of relationships within the national context that can create levels of expertise and critical mass, in specific technological and application areas, to emerge internationally.

Parallel to the actions aimed at the ICT world, the strategy for businesses must also address the world that does not directly operate in the development of technological solutions but, conversely, receives significant stimuli for the innovation of its value chain from this world. Digital transformation has, for some years now, placed entrepreneurs and managers in front of the need to reorient strategies towards a centrality of data and AI for business competitiveness, also in view of future challenges on environmental sustainability. In this framework, it will become increasingly important to assert the need for a new operational business approach and a new centrality – alongside production – concerning the transformation of data into insights, actions, and decisions, and the enabling of new processes through the use of AI systems, including generative ones. In defining strategies consistent with this vision, it will also be necessary to take into account the peculiarities of the Italian productive fabric, designing and affirming an AI-driven innovation ecosystem that can qualify a perspective in which the excellence of Italian enterprises is strengthened by innovative solutions ai-

med at enhancing their distinctive traits.

In this sense, the design of an AI strategy in Italy must be strongly anchored to the specificities of our socio-technical system and leverage the ongoing initiatives of technology transfer to SMEs and their collaboration with large enterprises, universities, and research bodies. To realize this vision, the national strategy includes actions for coordination, strengthening of the AI ecosystem among SMEs also with specifically dedicated funds, and initiatives to strengthen the ICT system and for the creation of innovative startups.

Objectives

- **Capture the innovation needs of Italian enterprises**, financing and supporting an AI-centered ecosystem that can qualify a perspective where excellence is enhanced by technological solutions aimed at enhancing their distinctive traits.
- **Support the Italian ICT sector**, promoting its enabling role for the definition of new AI applications, also with initiatives that respond to precise demands for innovation in the productive fabric; increase the possibilities to intercept funding for developing new AI project initiatives; support and enhance the AI startup ecosystem, attracting public and private capital.

Strategic Actions

I.1 | AI FACILITATORS FOR SMES

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|--------------------|---|
| Description | <p>To fully leverage the enormous potential of Artificial Intelligence within the productive and entrepreneurial context, a pervasive activity of promoting solutions and developing applications that are concretely usable in specific verticals such as automation, agri-food, furniture, clothing, tourism, chemical and pharmaceutical sectors, and aerospace will be necessary. To this end, an ecosystem of facilitators will be defined, rooted in the territory, under the direct control of the Foundation for Artificial Intelligence which manages the implementation, coordination, and monitoring, and in strong synergy with all the current actors of the innovation ecosystem, and other relevant foundations in the sector, such as FAIR, Chips.IT, and AI4Industry. Each facilitator will be able to collaborate with universities and research centers and will cover one or more productive supply chains, becoming a natural meeting point between ICT companies that offer solutions for innovation and the enterprises that benefit from such technologies.</p> <p>The facilitators will therefore be characterized as: (i) an entity that provides innovation services based on AI, such as the assessment of the technological maturity of companies and the characterization of the needs/opportunities for innovation; (ii) an enabler of usable solutions, also in terms of interoperability, for companies in the supply chain; in particular, Italian ICT companies will be involved to develop AI solutions that bring to common factor the needs shared by at least an entire supply chain, then delegating to individual entities any verticalizations and further customizations; (iii) a vehicle through which to collect and codify the characteristic data of the arts and crafts distinctive of the verticals, using them for the training of Artificial Intelligence solutions and feeding the National Knowledge Heritage (Action A.1); (iv) an entity that raises awareness and promotes the training of human resources; (v) a certifier of digital and AI competences within companies; (vi) a creator of synergies between large enterprises, market-leading companies (tier 1) and SMEs, fostering technology transfer; (vii) an entity that supports the development of start-ups (also through synergies with existing incubators) and facilitates their interconnection with the system of enterprises using AI.</p> |
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I.2 | SUPPORT FOR THE DEVELOPMENT AND ADOPTION OF AI SOLUTIONS

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| Description | <p>An important element in supporting the development of the Artificial Intelligence ecosystem in Italy will be the creation of a dedicated pool of financial resources to support specific project initiatives. This pool will be allocated to finance projects both by companies operating in the ICT sector aimed at developing new AI solutions, and by non-ICT companies wishing to innovate their production processes by adopting AI solutions. The projects can be promoted by networks of companies or individual companies and will be facilitated with a variety of systems: conventional finance to support AI investment projects at the individual company level; corporate venture capital tools with reference, for example, to AI-driven initiatives that involve supply chains; possible support in terms of private equity; or vouchers to be used for AI-based innovation support activities in the facilitators mentioned in action I.1.</p> |
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I.3 | LABORATORIES FOR THE DEVELOPMENT OF AI APPLICATIONS IN INDUSTRIAL CONTEXTS

Description

A crucial element for the growth of the productive fabric in Italy is the ability to develop coordinated projects that facilitate collaboration between enterprises and universities. Various large enterprises (for example, in manufacturing, energy, or pharmaceutical sectors), consulting and service companies, as well as business associations, have long developed vertical research centers in Italy to consolidate their technological know-how and enrich it through projects with universities and research centers. These initiatives are typically individual and almost always funded privately or with regional or European funds. In the specific domain of Artificial Intelligence, the public-private partnership (as evidenced by numerous international experiences) is essential, not only in the definition of project activities but also in the definition of research centers where the industrial and academic contributions are equal.

In the realm of AI, university research must be a source of inspiration for new ideas and experiments. With this in mind, there will be promotion of new initiatives in our country, the “thematic laboratories in applied AI” that involve a company and one or more universities or public research centers, and the “centers/institutes in applied AI,” which aim to group multiple companies from the same sector, always in the logic of collaboration with public research entities. These centers will focus on TRLs more driven towards market applications, and will aim to: (i) develop exploratory applied research, of interest to companies or the supply chain with shared management of intellectual property, also in relation to specific financing; (ii) enable existing solutions in a supply chain context, experimenting with innovative verticalizations that maintain Italian know-how; (iii) act as a bridge between companies, universities, and the world of European and international research and development, leveraging academic links especially in target areas of Italian export; (iv) create synergies between large companies, businesses, SMEs, and startups; (v) provide support for certification and patenting, in collaboration with the national research ecosystem (cf. Action R.1) and with competence centers and EDIHs of a more industrial matrix; (vi) support the training of the next AI experts by funding not only PhD candidates but also researchers and professors in AI, individuals dedicated to technology transfer, and, above all, technicians and professionals ready to immediately enter the job market.

I.4 | DEVELOPMENT OF START-UPS IN THE AI SECTOR

Description

In the realm of development and application of Artificial Intelligence technologies, start-ups are a key element for the overall competitiveness of the productive and entrepreneurial fabric. However, Italy currently lags behind in Europe in terms of the number of AI start-ups (0.68 start-ups per million inhabitants, compared to, for example, 2.05 and 1.99 in France and Germany, respectively). Significant players are already present in Italy with established expertise in incubation and acceleration, and in gathering investments, both in the private sector and within the context of significant academic experiences. The numbers mentioned above, however, highlight the need for further substantial investments in this sector. On one hand, these initiatives need to be consolidated and supported, with the goal of creating synergies among them, not only by focusing on funding programs directly aimed at new high-tech enterprises or on tax relief initiatives, but also by supporting detailed programs that can guide start-ups through all phases of their development. Of particular importance will be the promotion of these initiatives in the academic field, where they are configured as university spin-offs. To this end, the creation of AI-Enterprise labs within universities may be encouraged (based, for example, on the UK model) which offer a dynamic environment where researchers can work alongside business professionals, benefiting from acceleration programs, financial support, and specialized consulting. These labs will help in understanding market dynamics and the needs of the AI industry, thereby helping to transform academic ideas into commercial solutions. In this context, common practices for the granting of intellectual property licenses and for the creation of spin-offs themselves should be promoted, particularly in relation to economic relationships and shareholdings.

On the other hand, the effort will be aimed at fostering the interconnection between start-ups and the system of enterprises using AI applications, a factor often crucial due to the difficulties of interaction between the world of innovative enterprises and the incumbents. It will be important to maintain an integrated and coordinated approach, networking institutional, private, and academic actors; it will be necessary to build critical mass by identifying a series of projects capable of acting as a true national catalyst and reference for attracting investors; public-private partnerships should be promoted, facilitating capitalization actions; involvement of academically trained talents should be encouraged, fostering joint projects; AI solutions defined by start-ups should be valued internationally; finally, targeted projects for the implementation of sandboxes should be incentivized.

I.5 | SERVICES FOR ICT COMPANIES ON AI

The competitiveness of the national industry in the field of Artificial Intelligence will be strongly influenced by the ability of Italian companies to develop solutions and services within a highly dynamic European and global regulatory context, where compliance costs constitute a barrier to market entry. At the community and international levels, individual states have felt the need to define “regulatory experimentation spaces” for AI (sandboxes) with the aim of providing a controlled environment that facilitates the development and validation of Artificial Intelligence solutions.

The AI Act mandates CE marking for high-risk AI systems; and additional certification requirements are demanded in specific application contexts. Therefore, it is appropriate to foresee support measures, on one hand, to reduce the burdens of regulatory compliance and certifications for applications, especially those at high risk, and on the other, to encourage small and medium enterprises and startups to access sandboxes. These forms of support could be implemented through funding calls or by providing consulting services. Similarly, companies must be supported in the recognition of AI systems and in obtaining certification in specific sectors (e.g., respecting ENAV, ASA, EASA for aerospace), also in light of the new EU regulations 2023/988 and 2023/1230.

TRAINING STRATEGY

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| Objectives | Promote widespread university education on AI |
| | Implement educational pathways on AI |
| Strategic Actions | F.1 Pathways to Introduce AI at School Level |
| | F.2 Mobility as a Tool for AI Education |
| | F.3 Widespread AI Education in University Degree Programs |
| | F.4 Enhancement of the National PhD Program in AI |
| | F.5 Upskilling and Reskilling Programs for Businesses and Public Administration |
| | F.6 Education on the Use of AI Tools |
| | F.7 ITS Courses Focused on AI |

Overview

Artificial Intelligence (AI) can have a transformative impact on the country's socio-economic system, benefiting from rapid advances and the vast opportunities offered by generative AI. To harness the benefits of AI, however, high professional skills capable of developing and managing algorithms and AI systems are required. Nevertheless, the availability of these skills is far below demand in Italy, a factor that significantly slows the adoption of these solutions. As a preliminary to any strategic action, it is therefore essential to address this structural problem by deploying a major plan to strengthen, integrate, and disseminate AI knowledge and related digital skills throughout the education system: from Higher Technical Institutes (ITS) to universities, with particular attention to research doctorates. Investment in these activities must also be combined with important social issues, such as the need to reduce the gender gap in STEM disciplines and to take into account the intrinsic multidisciplinary nature of the discipline, which requires the definition of pathways that are open to true fields and competencies.

The transformative impact of AI is also leading to changes that require actions that go well beyond the traditional scope of education. Increasingly advanced skills are required in the workplace, and the risk of alienating those inadequately trained and unable to meet the challenges of new technologies becomes more concrete. The development of a national strategy for Artificial Intelligence must be based on the premise that, in this exceptionally dynamic context, no worker can be left behind. Italy, both in the public and private sectors, must deploy a strong incentive program for reskilling and upskilling pathways to update and retrain workers, to effectively reintegrate them into the production cycle, and more generally, to make them conscious users of new technological tools. Artificial Intelligence can be an important resource for creating new em-

ployment and can also have significant impacts in improving the very quality of work, allowing for greater efficiency and productivity, combined with increasingly personalized production environments and contexts.

The implementation of effective reskilling and upskilling programs across the entire territory is clearly an essential prerequisite for this transformation. However, all this will still not be enough. In order for AI-derived applications to have positive effects on the whole society, reducing risks, it will be necessary to further expand the concept of "education" by aiming in Italy to implement an AI literacy process that involves schools, workers, and all citizens, with attention to the most vulnerable categories. The goal is to prevent a strategy of growth and investment in AI from fueling processes of digital knowledge divide that, in the long run, would undermine the social and economic cohesion of the country. Educating for digital citizenship in the era of AI is essential, moreover, to bridge the knowledge gap and address the ethical and social concerns that this technology can produce. Creating AI literacy educational pathways in schools, spreading information through advertising campaigns, and promoting the understanding of the ethical implications of AI represent the fundamental steps that can allow for the correct orientation of the socio-economic fabric as a whole, in understanding the proper use of AI, fully grasping its advantages and critically assessing its limitations and risks.

Objectives

- **Promote widespread university education on AI** in response to the increasingly urgent demands for new skills in society and the workforce, adopting a transversal and interdisciplinary approach; consolidate specialized AI training in pathways aimed at technical profiles and researchers, such as the National PhD Program on Artificial Intelligence.
- **Implement educational pathways on AI** in schools to prepare new generations for careful and conscious use of new technologies; develop targeted dissemination initiatives to raise awareness and engage the Italian society in the AI revolution; fund and support reskilling and upskilling initiatives in all productive contexts.

Strategic Actions

F.1 | PATHWAYS FOR INTRODUCING AI IN SCHOOLS – STUDENTS AND TEACHERS

Description

The AI revolution demands that the introduction to the discipline begins gradually, starting from primary and secondary schools. Therefore, training pathways for AI literacy should primarily target teachers and subsequently students. Regarding students, a useful reference is the law of August 20, 2019, no. 92, "Introduction of civic education in schools," which at Article 5 identifies the core theme of Education for Digital Citizenship. The implementation of this legislative provision should be directed towards pathways that include the study of basic AI principles, as well as practical activities aimed at acquiring skills in using available tools, highlighting their correct use in terms of respecting ethical and social aspects, as well as privacy and cybersecurity.

To be concretely effective, the pathways aimed at students must be conducted by teachers who, in turn, must have been previously trained on the theoretical and practical bases necessary to integrate these concepts into the curriculum. To this end, a broad campaign should be launched to create ad-hoc training pathways, also involving universities, research centers, associations (e.g., third sector), and companies that have developed specific expertise in training initiatives, especially on digital themes. The training courses, delivered on a national basis both in-person and online or in a hybrid format, must ensure that the educational material used is widely shared and made available.

This could be achieved through specially structured online repositories or other digital tools that allow easy and open access to quality educational resources. The sharing of materials will not only promote transparency and collaboration among educational institutions but should also contribute to the creation of a common base of knowledge in the teaching of Artificial Intelligence.

To define clear guidelines and ensure the consistency of educational programs, it will be crucial to establish coordination with AI technical experts and specialists in pedagogy and sociology. The coordination structure will help to define learning objectives, identify key concepts and topics to be addressed, and develop effective and personalized teaching methodologies based on the types of learners. Collaboration between technicians and experts in the field of education will ensure that the educational pathways are technically sound and tailored to the learning needs of students.

F.2 | MOBILITY AS A TOOL FOR AI TRAINING

Description

In the dynamic context of Artificial Intelligence, it becomes crucial to define mechanisms that allow for the exchange of skills and experiences among various institutional actors. Specific “mobility” programs should be deployed along four main axes:

(1) Internships: Experiences in companies are often crucial for the training of young university students. To promote this tool, scholarships for interns should be funded for periods of 3-6 months, to be awarded according to the principles of the right to education.

(2) Internship: The exchange of skills between universities and companies is a good international practice that is difficult to adopt in Italy. To promote its adoption, companies/universities can benefit from appropriate incentives, while for Public Administrations, internship paths can be assimilated into mandatory training.

(3) Mobility for Research: In this case, through research grants, periods of mobility and visiting among different Italian universities and/or public centers and/or Public Administration will be funded, with the goal of maximizing the transfer of knowledge and acting as a lever to promote granular and widespread development.

(4) High Apprenticeship: A best practice that should be promoted is the model of Dual High Education and Research Apprenticeship, used by various regions with ESF funds, which allows companies to hire young people under 30 years old (students of ITS, universities, masters, doctorates) benefiting from the tax relief of traditional apprenticeships, allowing the new hires a period of training. In this case, specific funding for training can promote these interesting paths.

F.3 | WIDESPREAD AI EDUCATION IN UNIVERSITY DEGREE PROGRAMS

Description

Given the increasing needs of the workforce for personnel with advanced digital competencies and the current gap in the qualifications of graduates, efforts must be made to further strengthen the landscape of university degree programs in Artificial Intelligence, also promoting significant orientation initiatives. On the other hand, one of the risks associated with the rapid development of techniques and knowledge in the AI field is the limited pool of users who have access to continuous and updated educational pathways that allow for building the necessary skills and abilities to understand the costs and benefits, critically evaluate the processes, and creatively use the tools. To mitigate this risk, it will be essential that teachings on the foundations of Artificial Intelligence be integrated into all university programs, including non-STEM ones, with content tailored to the objectives of specific disciplines. Consequently, universities should be incentivized, for example in the context of the performance-based operating allocation, based on the percentage of study programs in which such pathways are activated.

F.4 | ENHANCEMENT OF THE NATIONAL PHD PROGRAM IN AI

Description

The Doctorate of National Interest in AI (www.PhD-AI.it), initiated in its 37th cycle, serves as the cornerstone of doctoral training in AI, with approximately 150 enrollments for each of the three cycles activated so far. This initiative has created an ecosystem that has overcome the existing fragmentation in doctoral AI training, consolidating the efforts of over 60 universities and research entities. The first two cycles were funded with specific grants from the Ministry of University and Research (MUR), and primarily by the National Recovery and Resilience Plan (PNRR) for the third cycle.

To ensure the continuation of this strategic doctoral training opportunity, it will be necessary to consistently support the 5 doctorate programs beyond the first three cycles, through the (co)-financing of at least 40 scholarships per year for each (also promoting the expansion of the current partnership). This approach aims to fulfill the requirements of DM 226/21 on Doctorates of National Interest and to allow multi-year planning, avoiding competition with local university doctorates, in line with Article 11 of DM 226/21: "The Ministry promotes the activation of national interest doctorates and provides for their co-financing modalities."

Regarding the educational activities, the PhD-AI.it program initially benefited from a limited budget for activities promoted by the Coordination Committee only in the first two years, under the initial MUR/CNR funding. Therefore, it will be necessary to sustain the coordinated educational initiatives among the 5 doctorates. This could include, for example, inviting international scientists to conduct joint courses, organizing doctoral schools at both individual and national levels, and hosting events to promote and disseminate results.

F.5 | UPSKILLING AND RESKILLING PROGRAMS FOR BUSINESSES AND PUBLIC ADMINISTRATION

Description

The increasingly pervasive use of Artificial Intelligence in productive contexts will quickly transform the dynamics of the workforce. Far from catastrophic scenarios regarding job prospects, it is now increasingly clear that new technologies represent a significant opportunity.

Digital skills and specific knowledge in the field of Artificial Intelligence already open (and will continue to open) career paths in the labor market. Yet, forecasts (such as those by the World Economic Forum) describe a growing phenomenon of misalignment between the skills required and those possessed by job seekers, resulting in a paradoxical scenario where Artificial Intelligence could reduce the pool of jobs not because of its automation capabilities, but because the training system fails to bridge the gap between these two worlds. Therefore, investing in upskilling and reskilling pathways becomes a defining element of the strategy.

These involve tailoring training and professionalization courses on AI for the requalification and updating of workers to facilitate their (re)integration into new jobs created by AI technologies. Special attention will be needed for workers in sectors where AI technologies have already reached a high degree of maturity and offer prospects for greater impact, taking particular care to support—by emphasizing motivational aspects—those who might find it more challenging (e.g., due to their age) to adapt to new scenarios and technological innovations.

In structuring the training pathways, it will be essential to articulate action plans in relation to the different roles and functions of workers, primarily focusing on technology users, to create environments receptive to change and ready to value existing skills and the support that Artificial Intelligence can offer today. Sharing successful experiences developed in the public and private sectors might be useful. For example, following the model of the “Elements of AI” initiative promoted by the Department of Digital Transition and made available to all economic realities of the country through the digital desk of the entrepreneur, developed by InfoCamere, a video course on AI delivered by top Italian experts in the field could be implemented and made accessible in the same way.

Reskilling and upskilling pathways should also be aimed at managerial staff. New technologies profoundly impact organizational aspects and the management of internal processes; innovating means not only adopting new technologies to meet specific efficiency needs but also – thanks to the vast potential offered by AI – comprehensively revising the internal organization to create more stimulating environments tailored to the needs of workers.

Finally, reskilling and upskilling pathways must be dedicated to technicians, both in businesses and public administration, to update their skill sets with new AI technologies. In this context, beyond activating dedicated masters and professional pathways, a best practice to be deployed is that of the industry-specific Academies, implemented by some regions with FSC funds. The initiative will be structured with the creation of specific consortia, including training bodies, trade associations, and medium-large companies that, together, are capable of delivering reskilling and upskilling courses, both for their own workers and for those of all SMEs involved in their supply chain. The consortia would thus take responsibility for the design and delivery of training pathways, involving their own facilities and respective human resources to be employed in training the learners, for educational workshops, and for publicizing specific training pathways to attract young talents.

F.6 | EDUCATION ON THE USE OF AI TOOLS

Description

The pervasiveness of AI necessitates the implementation of awareness-raising activities aimed at citizens regarding the correct use of new technologies, promoting conscious utilization of tools and specific digital applications currently available. In this regard, the involvement of a variety of national “actors” (public administrations, governmental institutions, associations, foundations, media, etc.) will be essential to enable the widespread dissemination of a digital culture aimed at conscious use of information technologies, not necessarily confined to AI alone. Particularly critical will be the collaboration with entities (especially from the third sector) that possess specific expertise in these types of initiatives.

Initiatives should be implemented on multiple levels: (i) Dedicated content within existing TV or radio programs; (ii) Informative and ongoing columns in magazines and general newspapers; (iii) Public service advertisements, with a campaign dedicated to the risks and opportunities of AI; (iv) Billboard campaigns with emotional messages, dedicated websites and social media, video clips on social networks; (v) Events to be organized locally, in collaboration with personal or professional associations; (vi) Public debates and informed social discussion involving various stakeholders, also supported by platforms. All initiatives will be centrally coordinated by a technical-scientific committee, which will define the scopes, channels, and content.

F.7 | ITS COURSES FOCUSED ON AI

Description

The Higher Technical Institutes (ITS) are an exceptional tool of Italian “excellence” in terms of quality education and tertiary professional training, established within a system that has been consolidated over the years in other European countries as well. ITS offer two-year or three-year programs for high school graduates, amounting to about 900 hours per year, including laboratory work and internships with companies, with class sizes of about 30 students. The objective is to train individuals with high technological and professional technical skills, in order to systematically contribute to the support of measures for economic development and the competitiveness of the production system, related to technological areas considered strategic within the policies of industrial and technological development and ecological transition.

These training structures must also organize to deliver courses on AI and to introduce the topic into existing courses, paying particular attention to the involvement of universities and ICT sector companies specialized in the development of AI-based solutions.

MONITORING THE STRATEGY

System Monitoring Architecture

The preparation of any strategic initiative cannot be separated from the definition of an appropriate monitoring system, which represents an essential ingredient to ensure its success. Monitoring, understanding the actual state of implementation and the critical issues, is indeed the basis for deploying corrective actions or even for partially revising the strategic goals themselves, should rapid and significant evolutions of the context be detected. The main distinction that can be made between different measurement systems concerns the use of quantitative tools or the use of qualitative approaches. However, it is not possible to a priori determine the superiority of one approach over the other: their effectiveness depends greatly on the context, the nature of the plan, and of course, the availability of data.

Each of the individual strategic actions defined in the areas of Training, Research, Public Administration, and Business has already been characterized in the document by a specific target value associated with a quantitative metric, defined through a key performance indicator (or KPI¹⁹) linked to the main variables of interest. Specifically, KPIs have been chosen to monitor the progress of strategic actions towards their goals (effectiveness).

At a more ambitious level, it would have been possible to also consider the costs (cost/effectiveness). At an even more challenging level, one could have considered the cost in relation to the opportunities of the resources employed, thus establishing the differential benefit of the project compared to the possible alternative uses of the same resources (costs/benefits). However, the strategy has referred exclusively to evaluations of effectiveness, avoiding considerations of cost and opportunity that would require value judgments not strictly related to the strategy; nevertheless, the introduction of effectiveness criteria represents a step forward in the dissemination of the culture of self-evaluation.

The assessment of the overall effectiveness of the strategy cannot, however, be resolved by analyzing the achievement of targets (on KPIs) related to individual actions but must instead consider the overall impact that these actions have generated. A more articulated evaluation will therefore be entrusted to the Foundation for Artificial Intelligence, which will have the functions of overall monitoring (and of individual strategic actions), control, and early warning.

The Foundation will also have the responsibility to

draft an annual report, which will keep the context analysis up-to-date and provide an overall evaluation of the strategy's implementation. Particularly, the monitoring will offer an evaluation of each strategic area, through the drafting of a report that - in addition to the assessment of target achievements for specific strategic actions - will outline the following approaches:

- Analysis of KPIs related to the entire strategic area;
- Analysis of Flagship projects, identifying a very limited number of specific projects whose progress can be considered as a proxy for the entire sector. For example, for many years in the USA, the results of space projects have been taken as a significant indicator of the entire country's scientific and technological progress. Obviously, the flagship projects must be carefully chosen: they need to be concrete, credible, highly visible, touch on topics of interest to all citizens, and contribute to building a collective image of the future.

In particular, for the drafting of the report, the Foundation will also utilize a panel of experts who will analyze the state of the KPIs and/or the flagship projects, to produce a well-argued evaluation report, adopting the Delphi method^{20,21}. Developed by the Rand Corporation during the Cold War (and repeatedly updated over the years), the method involves anonymous experts responding to a questionnaire over several rounds, under the guidance of a specialized facilitator. After each cycle, the facilitator provides an anonymous summary of the evaluations made, as well as the reasons the experts have provided for their judgments. In light of this information, the experts themselves are then encouraged to revise their previous answers, gradually converging to a synthesis.

Monitoring of Strategic Areas

Regarding the strategic area of **EDUCATION**, the panel of experts will take care to analyze some specific KPIs:

- The number of "interdisciplinary" degree courses (not limited to computer science or computer engineering) that include AI teachings;
- The number of students enrolled in doctoral programs related to AI;
- AI competence/awareness in citizenship, to be collected via CATI/CAWI surveys involving a stratified sample of the population²².

¹⁹ Parmenter D. (2019) *Key Performance Indicators: Developing, Implementing, and Using Winning KPIs*, John Wiley & Sons Inc.

²⁰ Blokydyk G. (2023) *Delphi Method. A Complete Guide, The Art of Service*.

²¹ Niederberger M., Renn O. (Eds, 2023) *Delphi Methods in the Social and Health Sciences: Concepts, Applications and Case Studies*, Springer Nature.

²² *Un campione di 1.000 persone sul totale dei cittadini italiani può fornire risultati con un margine di errore del 3%.*

Regarding **RESEARCH**, both KPIs and flagship projects will be evaluated. Specifically:

- Data on scientific production in Artificial Intelligence. In this sector, it is indeed possible to use established bibliometric indicators, considering that “scien-tometrics” has made great progress in terms of analysis, evaluation, and forecasting capabilities²³.
- The progress and quality of initiatives on strategic actions R.1 and R.3. These initiatives aim to promote the strengthening of the research ecosystem and the creation of Italian LMMs and must be analyzed by evaluating the actual results achieved and the real impacts.

As for **PUBLIC ADMINISTRATION**, interesting information, also with respect to comparisons among EU countries, is provided by the DESI report; however, this report, besides having a lag of about a year, offers a general view of the digitalization process and is not particularly focused on AI. On the other hand, a specific measure for all sectors would be difficult and especially costly, so the growth of the Public Administration system will be evaluated by accurately monitoring two important flagship projects:

- **The impact of initiatives on strategic action PA.5.** In this regard, it is considered important to evaluate the improvement in access to and use of citizen services, also measuring their level of digitalization. Monitoring could be performed by allowing citizens who access a service platform to leave their feedback, as is often the case with services offered by the private sector; alternatively, surveys could be employed at predetermined intervals on a sample drawn from those who have made at least one access.
- **The impact of initiatives on strategic action PA.6.** In this area, the involvement of experts well-versed in Public Administration is considered essential to assess the actual streamlining of administrative procedures.

Finally, regarding **BUSINESSES**, the following KPIs and flagship projects will be evaluated:

- Data on AI adoption in SMEs. In this regard, it is observed that some interesting data are provided by the ISTAT survey on information and communication technologies in businesses, containing a specific section on AI. This section provides interesting insights into the state of adoption of these technologies; however, it lacks a view on businesses that develop technology and provide services and/or products with a strong AI content. Thus, an extension of the questionnaire in the specified direction is proposed.
- Impact of initiatives on strategic action I.2, characterizing in particular the SMEs involved in facilitators

and the effectiveness of these in promoting the development and adoption of AI solutions, with the aim of streamlining and transforming business processes.

- The number of startup businesses created with a focus on AI and the number of businesses active in the development of AI technologies. This indicator is indeed relevant to monitor the impact of the strategy on the productive context that acts as an enabler for the adoption of AI solutions in the industrial sector and SMEs.

²³ Si vedano, ad esempio, le riviste *Quantitative Science Studies* (ISSN 2641-3337), *Scientometrics* (ISSN 0138-9130), *Journal of Informetrics* (ISSN 1751-1577).

Contextual Framework

The European regulation on artificial intelligence (AI Act) will establish a uniform legal framework aimed at regulating the development, marketing, and use of artificial intelligence systems in accordance with the values and constitutional rights of the EU. The AI Act seeks to regulate artificial intelligence through a so-called risk-based approach that imposes varying levels of compliance obligations depending on the risk (low, medium, or high) that software and intelligent applications may pose to fundamental rights. The higher the risk, the greater the compliance burdens and responsibilities of the developers of intelligent applications. Moreover, the legislation excludes the use of artificial intelligence for certain purposes identified as contrary to EU values (e.g., social scoring). Following its official publication, the European framework will require approximately two years to be applied, to allow for the complex adaptation by operators.

From the current versions of the regulation, several Authorities will be established to oversee and implement the legislation on AI, distinguishing by competencies and functions: at the European level (art. 56) and the national level (art. 59). The European Authority will primarily aim to coordinate the application of the regulation and the activities of the National Authorities. This role will translate into an important drafting of guidelines and best practices to support developers and users of this technology. A primarily coordinating function, but also clarifying and supportive, to which a supervisory role is added, also through potential coordinated joint investigations.

However, a crucial role will be played by National Authorities, which according to the AI Act, “each Member State shall establish or designate.” Specifically, the regulation outlines two main functions relegated to the national level: the supervisory function and the notification function. Abstracting from the specific details, the former is aimed at ensuring that the AI Act is respected by manufacturers and distributors of AI systems; the notification function, on the other hand, involves verifying the regularity of certification activities issued by third parties to creators of artificial intelligence systems that fall into the high-risk categories. The regulation stipulates that the National Authorities must be entities with strong technical specialization, established through primary national source coordinated with the European system.

Italian Supervisory Agency

Given the outlined framework, the Authority defined within the European regulatory framework can be established in Italy as an Agency, with a role in supervision and notification. In this sense, at least two sets of problems arise, upon which the space and competitiveness of Artificial Intelligence systems developed in Italy will depend. Firstly, the support of those who develop, distribute, or implement AI in understanding and implementing the complex European and national legislation. The Agency, with its legal and technological expertise, must act as a privileged interlocutor so that Italy can support the digital industry or the production system that intends to adopt AI systems, in close synergy with the Foundation for implementation, coordination, and monitoring (referred to in Action A.3). Always to the benefit of the production system, the Agency must provide guidance within the legal framework.

Indeed, the AI Act affects numerous legal areas already regulated and in which other Authorities operate with their different directives due to sector-specificity: data protection and the competence of the privacy watchdog; consumer protection and the regulation of digital services market (also affected by the recent Digital Market Act) under the jurisdiction of AGCM; the countering of harmful digital content – also under the Digital Services Act – under the jurisdiction of AGCOM. Additionally, the banking and financial sector, where in the realm of artificial intelligence the AI Act leaves competence to the ECB and nationally to the Bank of Italy and Consob. In short, a complex framework, an over-regulation complicated by overlapping disciplines and competencies among Authorities, represents a problem that the Agency will need to help simplify to allow an intelligible application, fostering the production system and innovation.

The Agency will also need to establish protocols and maintain close collaboration with the National Cybersecurity Agency (ACN), given the crucial role that AI plays in the sector and the implications for regulatory compliance (consider, for example, the emerging issues of attributing responsibility for cyber-attacks using AI tools). On the other hand, the supervisory agency and the ACN must necessarily be differentiated and independent: firstly, because they implement two different regulatory apparatuses, but primarily they must be independent due to the high specialization and complexity of the distinct functions assigned by the European legislator, defining precise and close ties of collaboration so that AI systems can always guarantee the highest levels of reliability, integrity, availability, and security of the implemented national technology.



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