

2024 Artificial Intelligence Strategy



#SALMANQADIR



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MINISTERIO
PARA LA TRANSFORMACIÓN DIGITAL
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Foreword to the 2024 Artificial Intelligence Strategy

Artificial Intelligence (AI) represents one of the most momentous revolutions of recent times, given that its characteristics endow it with the capacity to address the most complex challenges of today's world. This technological revolution, whose pace of development and expansion has been accelerating considerably over the last few years, seems likely to be the catalyst for major economic and social transformations. From an economic perspective, the new possibilities it generates turn it into the potential driver of a remarkable increase in productivity and growth, with an effect extending across a broad range of economic sectors. In addition to these impacts, AI also has the capacity to influence a wide array of areas that go beyond the purely technological or economic into the realm of human behaviour and relationships. Therefore, along with its obvious benefits, AI inevitably poses challenges and uncertainties about its uses and its implications in all spheres of the economy, society and people's lives, comparable only to what happened in the great industrial revolutions throughout history.

Faced with this dynamic reality with a transformation now underway, this 2024 Artificial Intelligence Strategy aims to accelerate, facilitate, accompany and promote the development and expansion of AI in our country, in response to the speed at which that transformation is taking place. To achieve that goal, it is essential to build on existing strengths, and leverage them through a suite of initiatives backed by a government that is firmly committed to the digital transition. These measures are designed not only to capitalise on the benefits of AI, but also to drive progress towards transparent, ethical, accountable and humanistic AI. This approach takes on particular relevance given the commitment to ensuring that this transition is carried out with respect for human rights, the promotion of technological security, social and economic inclusion, and in compliance with the European regulation on Artificial Intelligence that was agreed during the Spanish Presidency of the Council of the EU in the second semester of 2023.

The process of developing this 2024 Artificial Intelligence Strategy has revolved around the conviction that a country's success in tackling a digital transformation of this scale depends essentially on the continuous interaction between technological progress, the economic dimension, social demands and regulatory changes. This strategy does not only emerge from detailed analyses and reflections on the transformative potential of AI but is also nurtured by multiple interactions with the multiple actors that are participating in this transformation process, from the sphere of scientific research through to practical innovation and effective implementation, involving both regulatory bodies and experts in the different domains in society. It is therefore all about accepting and assimilating the true multidimensional nature of AI, not as an external force that "impacts" on society or needs to be "humanised" by adding ethical components to it, but as an element intimately intertwined with the other aspects, all feeding into each other and evolving in parallel.

One of the main conclusions reached is that the deployment of AI requires a permanent, ongoing public-private partnership as well as a broad, solid social consensus on the design of decision-making processes. The challenge of a world in which decisions will be made not only by people but also by machines must be met by determining the space corresponding to each one and the possibilities for collaboration between the two. The success of the actions included in this Strategy is bound up with its capacity to promote an inclusive and collective social debate with broad participation. For it to be a real transformation of our country, in addition to being digital it also must be inclusive and socially fair.

Within this framework, the initiatives proposed in this 2024 Artificial Intelligence Strategy have been articulated around three key pillars.

Firstly, the Strategy identifies the need to strengthen the necessary levers to respond to and accompany the increase in demand for AI that is already occurring in Spain. These levers essentially mean boosting supercomputing, a field in which we are in an excellent starting position, as well as data processing capabilities, sets of algorithms, data and models, and, unquestionably, human capital. While all these aspects are of utmost importance, one of the key new elements is the Spanish government's firm strategic commitment to a foundation language model in Spanish and the co-official languages: the ALIA model. The ALIA family of models, based on the reach and scope of our languages – spoken by 600 million people in the world today – aims to facilitate the development of advanced services and products in language technologies, offering an infrastructure of models characterised by maximum transparency and openness, under the supervision and certification of the new Spanish Agency for the Supervision of Artificial Intelligence (AESIA), which is the first supervisory agency of its kind to be set up in Europe.

Secondly, the Strategy aims to ensure that citizens will reap the benefits of these technologies. To this end, it incorporates different initiatives to promote the use of AI both in the public sector, which will act as a catalyst, an example and a driver in this process, and in the private sector, with special emphasis on small and medium-sized enterprises, as well as in innovation and entrepreneurship.

Lastly, the launch of the AESIA is a fundamental anchor of this strategy. The supervisory agency was created with the aim of encouraging and supporting the new technological developments to take place in a way that maximises their effectiveness, their positive and shared social impact, the safeguarding of rights and total transparency. The AESIA will be the beacon going forward, with its mandate to observe the evolution of AI and to analyse trends and perspectives in order to prepare for its challenges. It will be responsible for building a dialogue between the scientific community, industry and civil society, establishing a common ground where the concerns and aspirations of each sector can be reconciled. Furthermore, its functions will also include the validation of models and the setting of conditions for their assessment, generating good practices, principles and recommendations to guide their development and evolution in a sustainable and ethical manner.

We are indeed facing a great challenge. We want this 2024 Artificial Intelligence Strategy to contribute to our country's ambitious and bold response in the process of developing and expanding artificial intelligence. We want its uses and applications to maximise social and economic wellbeing, ensuring inclusion, equity and social justice in this digital transformation, while preserving civil rights and democratic values. And we want this transformation to be the outcome of a broad and solid social consensus, as the cornerstone and guarantee of its success.



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Introduction



Introduction

In the space of a few short years, artificial intelligence has become the pivotal force in a technological revolution bringing in to sharp focus how growth and potential for transformation in economic relations and behavioural habits will have an enormous impact on our lives through data mining and analysis of huge amounts of information and a significant degree of autonomy in its processing. The capacity and extensive reach of this technology is turning it into an instrument whose coverage extends across a broad spectrum of sectors, multiplying as a result its penetration and positive impact on the productivity of the global economy.

Because of the capacity it has to accelerate growth, make a cross-sector impact and increase competitiveness, there is increasing empirical evidence today that AI is a lever for technical, economic, and social transformation. AI has become a catalyst for a suite of technological changes that were already present in the economy, but which are now further enhanced and interconnected, thus unlocking their full potential. These changes range from the internet to digital connectivity – especially through 5G – or to data management capabilities. Essentially, AI's strength is underpinned by recent advances in supercomputing and the availability and processing of huge amounts of data, as well as its integration into multiple production processes and services. In recent years, the incipient development of increasingly sophisticated, intelligent technologies based on a type of AI with generative capabilities has been quite remarkable.

Given this opportunity AI brings as a lever for economic transformation, the Spanish government has decided to reinforce and accelerate its National Strategy on Artificial Intelligence (ENIA), first published in 2020 to deliver on the commitment to Milestone 249 in the country's Recovery, Transformation and Resilience Plan (PRTR), and whose roll-out has been funded mainly under the Plan. This reinforcement aims to reap the benefits of the impact of AI on the economy and to capture the positive elements of this ongoing transformation. To achieve that goal, certain aspects of the Strategy have been reorganised and the pace of some of the processes already underway is to be accelerated, although the reference framework approved at the time still stands. All of this will help Spain to deliver on the commitments embedded in the PRTR, continuing the successful track of the measures already deployed over the last few years which are strengthened further with this new Strategy.

This need to reinforce and accelerate the AI Strategy stems from the realisation that AI technologies have evolved at lightning speed over recent years. Since the publication of the first ENIA, there has been a remarkable step-change in compute capacity and the evolution of increasingly powerful intelligent technologies supported by large foundation models is on the immediate horizon. All of that means it is necessary, on the one hand, to react to this rapidly changing environment and, on the other hand, to enhance the initiatives already underway by identifying synergies between the various ongoing projects and so ensure their sustainability and impact over time.

It is becoming increasingly clear that the opportunities provided by advances in AI are changing the way in which new products and services are generated. In this respect, the commitment to large language models, which will constitute powerful infrastructures on which multiple applications can be developed, is crucial. That is why Spain is determined to drive the development of its own Large Language Model (LLM) in Spanish and the country's co-official languages: the ALIA model. This model would then become a fundamental infrastructure for the development of useful applications for the country's productive sector. These actions all form part of the National Language Technology Plan defined in the ENIA.

To continue to make steady progress in harnessing the benefits of this technological revolution, new supercomputing capacities will also be required sooner rather than later and further development of the right professional profiles to meet the growing demand for AI.

In parallel, this technology has already prompted an extensive debate on the challenges and risks of AI, which has crystallised in the need to promote its appropriate and responsible use in order to strike a balance between the economic benefits derived from its deployment and respect for the fundamental rights of citizens. Europe is at the forefront of this debate having recently approved a regulatory framework in the EU on the use of AI that will provide coverage for the progress to be made in this area. Through the Spanish Agency for the Supervision of AI (AESIA), our country aspires to lead the field in the use of responsible, safe and ethical AI, with action principles built on a platform of broad social consensus.

In this context, this Artificial Intelligence Strategy has been structured around the three pillars described below.

The first pillar is the need to equip the country with the necessary capabilities to cope with a growing demand for AI products and services. Given the already visible acceleration in demand, our country must get ready now to be prepared for it by investing in the levers that will ensure

there will be no constraints for the expansion of AI across sectors and so maximise its benefits in terms of productivity, innovation and economic growth. Four areas have been identified in which capacity-building is needed to address this challenge: (i) supercomputing, (ii) cloud infrastructures, (iii) the corpora and models that make up the basic infrastructure for the development of AI, and (iv) talent. With these four levers of technological development as a platform there will be room for the adequate design of public policies that can make it more likely Spain will be able to successfully tackle the challenge of capitalising on the benefits of the expansion of AI.

The second pillar is to drive the adoption of AI, with a particular focus on its application to the public sector and small and medium-sized enterprises (SMEs), as it is the segment of companies most in need of support to internalise this transformation. The public sector must be a driver of AI adoption too, not only because it will improve the delivery of public services to citizens, but also because it will act as a catalyst and an example to be followed for developments in the private sector.

There are two other aspects of particular relevance here. One is the stimulus AI brings to entrepreneurship, given that AI has a significant intrinsic innovation component, which for companies at an early stage of development requires venture-capital financing options where public-private collaboration is essential. This is vital to be able to position our country as a frontrunner in such a disruptive and innovative field as AI. The second aspect is the prerequisite for technological transformation – especially in areas such as this – to go hand and hand with higher standards of cybersecurity, which will generate sufficient trust and certainty for our companies and the public. That will need investment. Cybersecurity is a strategic intrinsic element that must be embedded into any technological advances.mation, especially in areas such as this one, to go hand in hand with enhanced cybersecurity levels, trusted and relied on by companies and citizens, and which will be achieved by making the necessary investments. Cybersecurity is a key strategic component that must be intrinsic to technological advances.





Finally, the third fundamental pillar has to do with the need to achieve a broad consensus on the uses of AI. The use of AI triggers debates that need to be resolved decisively by defining the level of autonomy, transparency and trustworthiness required throughout the process of development, implementation and use of these intelligent technologies. Ultimately what this means is that the limits in decision-making processes and the way people interact with AI developments have to be clearly drawn with the backing of a broad social consensus. Trustworthiness and transparency in the use of AI are essential factors for it to be more widely used and expanded.

If users and citizens are to trust AI its benefits will need to be properly identified as well as recognition of its risks and mitigating factors. This entails the need to draw up a governance framework that ensures maximum transparency and trustworthiness and guarantees compliance with the harmonised standards on artificial intelligence set out in the EU's AI Act. That Regulation aims to protect fundamental rights, the safety and health of citizens and environmental sustainability in AI developments in the European Union, while driving responsible innovation and deployment of AI. The AESIA, Spain's new supervisory agency set up in August 2023, will be a key player in leading the debate on this matter; it will define best practices in the use of AI and guarantee assessment of the models being developed and so build that relationship of trust.

Pillar 1:

Reinforcing the key levers to develop AI



Strengthening the necessary mechanisms to facilitate the expansion of AI across the economy

Lever 1: Boost Investment in Supercomputing

Spain has a long tradition in supercomputing and the considerable investments it has been making in this field for many years now have placed the country in a relatively advantageous position already. One important milestone on this path was the creation in 2004 of the Barcelona Supercomputing Centre – Centro Nacional de Supercomputación (BSC-CNS), with the acquisition and installation of the first MareNostrum. Subsequently, in 2007, the Spanish Supercomputing Network (RES)¹ was set up. This distributed infrastructure provides access to supercomputing resources for the scientific community and centres its operations around the MareNostrum supercomputer, together with 13 other nodes distributed throughout Spain. Its purpose is to offer the supercomputing, data management and AI resources and services that are required for the development of innovative and best-in-class scientific and technological projects, through competitive calls based on the scientific excellence of the projects submitted².

Spain has always played a major role in this highly competitive environment in Europe. It was a founding partner in 2009 of the Partnership for Advanced Computing in Europe, PRACE,

which coordinated all the largest European supercomputers, including MareNostrum. It has also played a key role in the recent EU commitment made to further these technologies; in 2017, it was one of the first seven EU Member States to sign the Rome declaration, in which they pledged to drive development of these infrastructures.

That declaration gave rise to the creation in 2019 of the European High Performance Computing Joint Undertaking (EuroHPC JU)³. Its ambitious initial objective was to draw up a new European map of large supercomputing infrastructures that could compete on the global stage. From the outset, Spain supported the placement of one of these supercomputers in our country and in late 2023 the new MareNostrum 5⁴ was inaugurated. This significant upgrade of the previous version of MareNostrum now ranks as one of the top three supercomputers operating in Europe today, with a much greater capacity than all the others, as shown in Table 2 below. It stands out because of the diversity of its architecture with a good balance between CPU and GPU, as well as its large storage capacity, which is essential for the development of AI.

¹<https://www.res.es/en>

²Both BSC and RES are chaired by the MICIU (Ministry of Science, Innovation and Universities).

³Euro HPC JU. See https://eurohpc-ju.europa.eu/index_en

⁴<https://spanish-presidency.consilium.europa.eu/en/events/inauguration-marenostrum-5-supercomputer/>

Table 1. European supercomputers according to the 62nd TOP 500 report (November 2023).⁵

Name	Country	petaFLOPS	CPU	GPU	Storage capacity	Top 500 World Ranking	Green500 World Ranking
Lumi	Finland	539	64 cores AMD EPYC	AMD Instinct	117	5	7
Leonardo	Italy	314	Intel Ice-lake Sapphire Rapids	13824 GPU Da Vinci	105	6	18
Marenostrum 5	Spain	312	Intel Sapphire Rapids and NVIDIA Greece	NVIDIA Hopper and Intel Rialto Bridge	650 (248+402 tape)	8	6
Meluxina	Luxembourg	18	AMD EPYC	NVIDIA Ampere A100	20	71	27
Karolina	Czequia	13	Over 100.000 CPU cores	NVIDIA A100 Tensor Core	More than 1	113	25
Discoverer	Bulgaria	6	AMD EPYC 7H12	No GPU	2	166	216
Vega	Slovenia	10	AMD EPYC 7H13	NVIDIA A100	24	198	253
Deucalion	Portugal	10	A64FX (BRAZO)AMD EPYC (x86)	NVIDIA Ampere	11.03 (430TB+10,6PB)	Not specified	Not specified

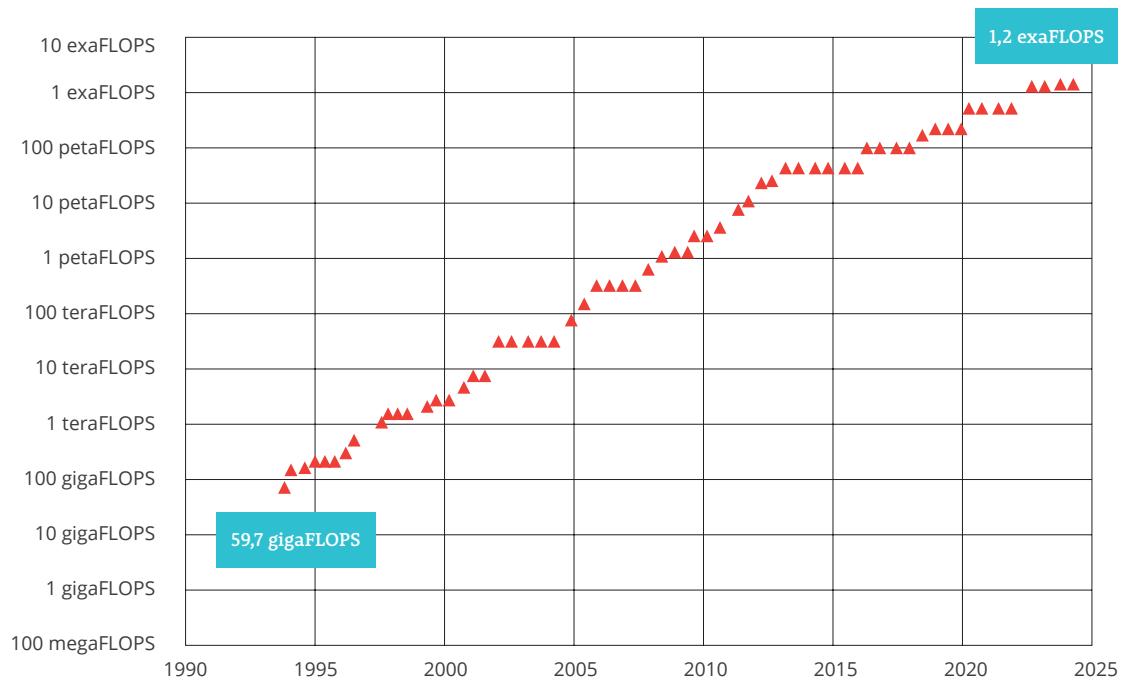


At a global level, the governments of major countries are currently investing huge amounts of public money to ensure that their scientific community and industry have access to world-class computational resources to further innovation in AI. This investment is taking place in an environment of continuous capacity upgrades of these large computers, as shown in Figure 1, which tracks the evolution on a logarithmic axis of the capacity of the world's most powerful supercomputer over the last 30 years, according to the Linpack Benchmark⁶.

⁵<https://www.top500.org/lists/top500/2023/11/>

⁶www.top500.org/project/linpack

Illustration 1. Development of supercomputing between 1993-2023



Source: top500 list (www.top500.org)

This trend has been reinforced by the latest generations of Graphics Processing Units (GPUs), which have become essential to the progress and efficient development of artificial intelligence. With their parallel architecture, GPUs have the ability to handle the computationally intensive operations required by deep learning algorithms, enabling huge volumes of data to be analysed and processed with unprecedented speed and efficiency. By integrating supercomputers equipped with advanced GPUs, researchers can experiment with more sophisticated AI models, opening up new avenues to the creation of AI applications previously thought impossible.

In parallel to maintaining best-in-class computing power, the second challenge for the country is to promote the presence of technology developed in Spain in these infrastructures. The Secretary of State for Telecommunications and Digital Infrastructures has been driving this ambition through funding for the Zettascale Project⁷ for RISC-V-based prototypes. The goal is to promote the development of designs of advanced chips or microprocessors, which will be incorporated into the new generation of European supercomputers following the open-source hardware paradigm.

To ensure Spain can maintain its leading position in Europe, this Strategy includes a series of initiatives designed to boost Spanish supercomputing and place it at the service of the productive sector. The initiatives are organised under the following four headings.

⁷<https://www.bsc.es/es/research-and-development/projects/laboratorio-zettascale-desarrollo-de-un-laboratorio-de-las> (in Spanish)

Initiative 1.1. Boost supercomputing in AI



Although Spain is already well-positioned in supercomputing – especially after the commissioning of MareNostrum 5 – its capacity is to be further reinforced with another upgrade scheduled in only a few months. The intention is to acquire a new specialised AI cluster, for an expected investment of between €55-90 million. It is due to be operational by 2025 and will incorporate the latest GPU technologies to complement the diversity of architectures with which it has been designed. This upgrade will increase MareNostrum 5's processing capacity by almost 50%, i.e. to more than 450 petaflops per second, with the latest accelerator technology available on the market and with the necessary upgrades in auxiliary infrastructures for a supercomputer of this type, certain to be ranked among the top 10 in the world.

In early 2024, the European Commission announced a new regulation to strengthen the EuroHPC JU⁸, highlighting the crucial role of AI and foundation models in the advancement of technology and society. Prompted by the rapid evolution of AI, this measure seeks to integrate AI with supercomputing to contribute to a more innovative, sustainable and competitive economy. This regulatory impetus endeavours to

leverage on Europe's advanced supercomputing infrastructure and robust research ecosystem and overcome weaknesses such as its reliance on AI systems from non-European companies and the fragmentation of initiatives in the EU. It will focus on increasing the AI-oriented capabilities of existing European supercomputers, while creating AI Factories around the institutions hosting these large supercomputers.

This new instrument will be used to deploy dedicated AI supercomputing infrastructures for the ecosystem created around scientific research and start-ups. This strategic approach aims not only to strengthen European competitiveness and innovation in AI, but also to ensure sovereignty by improving control over data and safety and guaranteeing trustworthy AI models. With an estimated investment in the range of €400-500 million from the Digital Europe Programme, this significant drive towards AI autonomy reflects the urgency for swift action to put Europe at the forefront of AI technology globally. Spain strongly supports the initiative and this Strategy will reinforce the National Supercomputing Centre's bid to be one of Europe's first AI Factories through the upgrade of MareNostrum 5.

⁸<https://digital-strategy.ec.europa.eu/en/policies/high-performance-computing-joint-undertaking>

Table 2. Evolution of the capacities of Spain's most powerful computer: MareNostrum

Name	Year Installation	Processing capacity (in Pflops/s)	Storage capacity (in Pbytes)	Top 500 Ranking	Architecture	Capex (in M€)
MN 1	2004	0.042	0.128	4	CPU	12
MN 2	2006	0.094	0.390	5	CPU	13
MN 3	2012	1.10	2	36	CPU	18
MN 4	2017-19	13.90	14.5	13	CPU	
MN 5	2023-24	312 s	650	19	CPU	



Initiative 1.2. Supercomputing services for industry

The enormous efforts Spain has made in supercomputing have so far been focused on supporting research. That support has made it possible to guarantee the competitiveness of our R&D ecosystem internationally through access to the best High Performance Computing (HPC) technology available at any given time. The next step is to open up these infrastructures to our industry too, to help companies gain in competitiveness thanks to the massive use of these technologies. This new priority requires a change in the service paradigm applied so far, including the implementation of protected data spaces, ad hoc services for companies, etc.

The overarching goal of this second initiative is therefore to significantly increase the use of high-capacity computing resources and AI by Spanish industry on the back of the new EuroHPC JU regulation⁹, which will allow companies to access up to 20% of the capacities of the large European supercomputers (including both the current MareNostrum 5, already in operation,

and its forthcoming upgrade in 2025). The specific actions that will be put in place to make this access possible and efficient, and which will mobilise around €10 million, are described in Lever 6 of this document. They include a platform in a secure pre-commercial environment for companies to develop their use cases, investment in the infrastructures necessary for these developments, support teams for the planned industry hubs, and a network of accelerators throughout Spain for language technologies start-ups.

Expected results include increased take-up of HPC and AI technologies, the development of new AI-based products and services, cross-sector collaboration fostering the transfer of knowledge and innovative ideas, advances in applied research in strategic areas and the creation of skilled jobs.

⁹Euro HPC JU. See https://eurohpc-ju.europa.eu/index_

Initiative 1.3. Build up the Spanish Supercomputing Network (RES)

Currently the Spanish Supercomputing Network (RES), created in 2007, is an alliance of 14 organisations¹⁰ offering advanced services in supercomputing, data management and AI to the national research community. As Spain's National HPC Competence Centre recognised by EuroHPC JU, the RES plays an essential role in facilitating access to critical compute resources for the advancement of research and technological development. Governance of the Spanish Supercomputing Network is articulated through an agreement signed by all its members in which the RES Board, chaired by the Ministry of Science, Innovation and Universities (MICIU) and coordinated by the BSC, is the highest decision-making body.

The RES has a strategic plan ending in 2024. Looking ahead to its renewal, it will be essential to strengthen the network as a national scientific-technological infrastructure for AI-related services under a new strategic plan and including funding for all its nodes and their specialisation. This would take advantage of the network's geographical distribution and share-out of responsibilities between nodes. Furthermore, efforts will be made to expand the network by adding supercomputing nodes in the Autonomous Communities where there are none as yet.



Figure 1. Spanish Supercomputing Network (RES).



To achieve these goals, an ambitious investment plan has already been launched with an overall funding envelope of €67.4 million under the aegis of Spain's Recovery and Resilience Plan. In addition, the intention is to take steps to strengthen governance of the RES and to fund a further €5 million of new investment in the BSC-CNS to diversify and enhance the offering of supercomputing and AI services. The end result would be for RES to be acknowledged as the platform for supercomputing, AI or language technology activities. In addition, a funding proposal will be envisaged to sustainably support business services and the deployment of key capabilities in technologies such as language technologies in line with Lever 6 (especially with the proximity deployment plan initiative, to make support teams available to businesses to provide guidance on the use of AI services).

The expected results of these actions include increased capacity to support advanced research and innovation projects in critical areas, thus facilitating access on the part of industry and academia to world-class compute resources. The outcome will be increased competitiveness for Spain on the global scientific and technological stage, the promotion of cross-sector collaboration and the reinforcement of Spain's position as a frontrunner in the use and development of advanced supercomputing and artificial intelligence technologies.

Lever 2: Generate storage capacities with sustainability

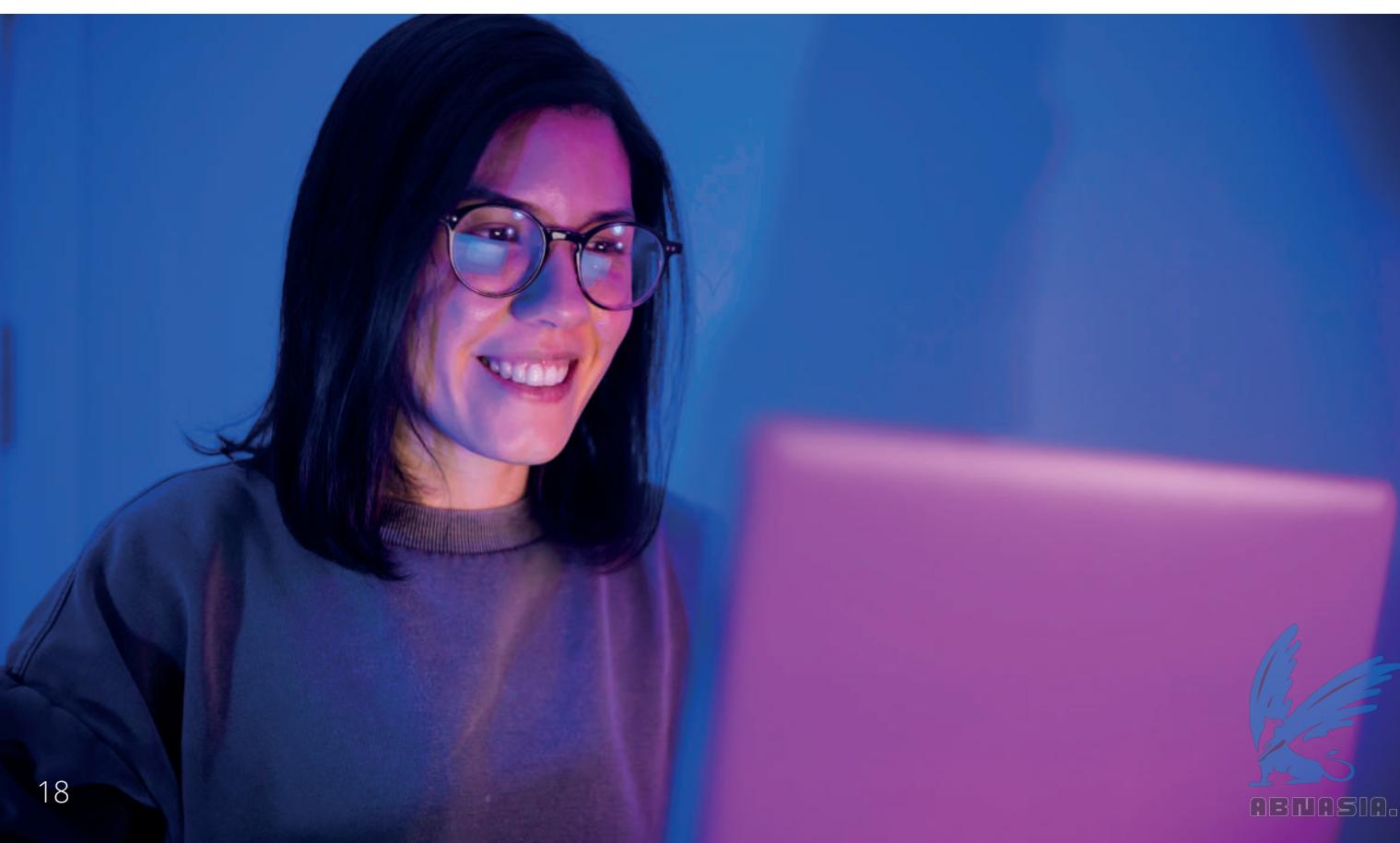
The rise of AI is driving demand for data centres and cloud-based solutions. The training and inference of AI models require large storage and compute processing capacity, resulting in a significant increase in demand for data processing centres (DPCs) and cloud infrastructure. According to estimates from leading companies in the industry, between 7-10% of their computing infrastructure is currently dedicated to AI applications, with usage split between 3-4.5% for training, and 4-4.5% for AI inference.

Against this backdrop, the opportunity has arisen for our country to reap the economic benefits of AI in a sustainable manner and anticipate the challenges it brings with it. Planning and managing the growth in data centres, together with the implementation of energy efficiency measures in the deployment of AI-based solutions, are key to preventing the saturation of data storage resources from becoming an obstacle to technological

development¹¹. In parallel, it is essential to take advantage of the opportunities created by AI to ensure that its development is sustainable and orderly.

Although investments in data centres certainly generate a positive economic impact, they must be made in an orderly and strategic sequence. The design of a package of measures that will encourage energy efficiency in the deployment of AI solutions and the optimisation of available resources for all productive sectors would be a necessary step in this process. It will maximise the positive impact of AI on the economic and social fabric of the country overall, as well as fuel innovation and growth in different areas. Three specific initiatives are proposed so that Spain can become a state-of-the-art country in the efficient use of compute infrastructures and the development of sustainable AI.

¹¹Schwartz, R., Dodge, J.. Smith,N.A., y. Etzioni, O.(2020): ."Green AI". Commun. ACM 63, 12 (December 2020), 54–63. <https://doi.org/10.1145/3381831>



Initiative 2.1. Sustainable data processing centres

Spain is a reference country in the development of data processing centres (DPCs) thanks to its unique advantages: a strategic geographical location, a favourable climate and a leading position in renewable energies.

In this context, a regulatory framework will be developed to foster the sustainable installation of DPCs.

In Europe, some countries – Ireland is a good example¹² - are producing guidelines for the development of sustainable DPCs. The EU Commission has also developed the European Code of Conduct for Data Centres through the Joint Research Centre (JRC).

The Spanish government, through the Secretary of State for Telecommunications and Digital Infrastructure and the Secretary of State for Energy, is working on the transposition of the Energy Efficiency Directive (EU) 2023/1791 and its delegated act. The directive lays down certain requirements for data centres. Data centres of at least 500 kW are required to collect and publish relevant data for their energy performance, renewable energy usage, water footprint and demand. In addition, DPCs exceeding 1 MW are expected to implement waste heat recovery strategies. The total estimated cumulative capacity for the data centre sector up to 2030 is 2500 MW.

Through this new legislation, as well as the register of data centres in Spain, the information required to measure the energy efficiency and usage of data centres throughout the country will become available, making it possible to devise strategies and best practice models going forward.

¹²Baringa, (2022) "Green Data: A vision for sustainable data centres in Ireland," p. 62, <https://www.ibec.ie/-/media/documents/connect-and-learn/industries/technology-and-telecoms/cloud-infrastructure-ireland/baringa-green-data---full-report.pdf>



Initiative 2.2. Planning and management in the installation of DPCs

The aim is to turn Spain into the benchmark for the development of sustainable and efficient data centres by promoting a regulatory framework and encouraging investment to install data processing centres (DPC) in Spain. Led by the Ministry for Digital Transformation and the Civil Service through the Secretary of State for Telecommunications and Digital Infrastructure and the Secretary of State for Energy, this framework has the following primary objectives:

- **Incentivise the installation of sustainable data centres:** A seal or certification will be created to ensure that new data centres are sustainable, energy-efficient, use renewable energies, minimise their water footprint and apply responsible waste management. The latter would entail reducing waste generation by extending its useful life and reuse and, whenever that is no longer possible, by managing it in accordance with waste regulations, especially those applicable to waste electrical and electronic equipment (WEEE).
- **Encourage investment in key infrastructures:** The implementation of investments in connectivity infrastructures, energy and any other areas necessary for new DPC installation projects will be coordinated.
- **Speed up administrative procedures:** DPCs that obtain the seal will benefit from fast-track processing of administrative formalities through a single service point and will have access to a repository of relevant information.

• **Complete the register of DPCs and IXPs:** The development of a register of DPCs and IXPs (Internet exchange points) located in Spain will be completed in line with the provisions of the General Telecommunications Law 11/2022, of 28 June.

This framework will enable the Ministry to:

- **Organise the implementation of future DPCs:** A strategy will be developed to take full advantage of the territory and its resources to guarantee even distribution of the economic impact and leave nobody behind.
- **Foster sustainability and efficiency:** The creation of environmentally-friendly, circular and energy- and water-efficient DPCs will be promoted.
- **Boost economic activity:** Economic activity will be boosted in the area surrounding the DPCs, generating jobs and business opportunities.

The regulatory framework and investment promotion measures driven by the government will attract national and international companies in the sector and so contribute to economic growth and job creation.

Initiative 2.3. Sustainable AI seal and ecosystem

The future European AI Regulation sets out the obligation to document the energy consumption of general-purpose artificial intelligence (GPAI) models in both training and inference phases, in an attempt to reduce the use of resources needed to develop them. In fact, the OECD identifies the definition of measurement standards as one of the primary requirements for the development of sustainability policies in the use of AI.

In the same vein, therefore, the idea would be to supplement the existing sustainability metrics for data centres (such as Power Usage Effectiveness [PUE], Water Usage Effectiveness [WUE], carbon emissions, combined energy models used in the DPC, etc.) with the development of standards that can help to cut training

cycles and reduce the environmental footprint of this type of models.

Spain seeks to establish Europe-wide standards by defining a framework for companies to obtain a voluntary quality certification in different levels of achievement in AI sustainability. Spain is seeking to establish pan-European standards in this area through the definition of a voluntary seal of quality scheme corresponding to different levels of maturity with respect to sustainable AI (in the sense of standard metrics for energy usage in AI model training and inference, by creating self-assessment tools such as those developed by the University of Cambridge (Lannelongue et al., 2021)¹³).



¹³Lannelongue, L., Grealey, J. and Inouye, M. (2021): "Green Algorithms: Quantifying the Carbon Footprint of Computation". Adv. Sci., 8, 2100707. <https://doi.org/10.1002/advs.202100707>

In addition, if Spain is to develop a state-of-the-art AI ecosystem to accelerate the transition to a green economy, it will need to build up a network of excellence in sustainable AI that will bring together leading scientific institutions in the country as well as other actors from civil society and the business sector using the projects already being funded by the ENIA as a platform. This network will help to connect up the research lines of the participating organisations, as well as facilitate public-private collaboration for the development of sustainable AI, and turn Spain into a reference in this field as a result.

Moreover, a “Green AI Challenges” competition will be organised as an opportunity to build up talent and the entrepreneurial ecosystem through sustainable AI. Split into three categories (researchers, start-ups/scale-ups and established businesses), the competition will set challenges in the form of questions to be resolved on how to minimise the use of resources in AI implementation. The competitive format aims to develop talent and produce embryo products and services that can generate market opportunities in the field of sustainable AI.

Figure 2. Sustainable AI

Sustainable AI projects

The ENIA has already financed 18 energy projects for a total funding envelope of approximately €25 million. In addition, some 25 environmental and rural areas projects (including the agri-food sector, protection of terrestrial and marine biodiversity) have been funded to the tune of €69 million.

Examples of projects under the heading of AI applied to the environment and rural areas include water resource optimisation in irrigation and industrial water usage, improving the traceability of the agri-food chain, agricultural production and forestry optimisation, and the conservation of terrestrial and marine biodiversity.

In this way, AI contributes to more informed decision-making, so helping us to conserve the environment, prevent natural disasters and use natural resources responsibly.

ENERGY

Cutting-edge projects are currently being developed to apply AI to the entire lifecycle of the electricity sector. Starting with renewable energy production, AI can help with site optimisation for solar panels and wind turbines and with their preventive maintenance. Transmission grids, on the other hand, are highly distributed, and AI is used in decisions to improve their operation and the integration of new nodes.

Responsible energy usage is crucial. Through predictive algorithms, AI provides more intelligent management of energy resources, giving early warning of peaks in demand. Lastly, AI helps in decision-making for enabling markets.

Other initiatives are also being rolled out to disseminate and recruit talent for professional roles related to AI applied to the energy sector, as well as to carry out technology prospecting activities, including proofs of concept, data catalogue generation and the development of demonstrators.

Lever 3: Generate models and corpora for public infrastructure in language models

Language is one of the most powerful tools created by human intelligence and the most common and versatile way of transmitting and accessing information. We use language to encode, store, transmit and share messages. Supported by massive documentary sources in our languages, Language Technologies (LTs) are arguably the most innovative and expanding field of AI today.

The most advanced language models are typically large and very expensive to train. Their ability to impact economies is remarkable, but their development requires abundant funding, compute capacities and sufficient data. That is the reason why most models are designed around the English language or are multilingual models in which under-resourced languages are generally under-represented.

Spain is fortunate to have an extraordinary asset for the development of this new language economy: the Spanish language, with almost 600 million Spanish speakers worldwide. It also has the added advantage of four other co-official languages: Catalan, Basque, Valencian and Galician. The development and deployment of a foundation language model and of specialised or small language models, and then the process of making them available to the economy and society, represent a major challenge that will require cooperation and collaboration between the different players in the ecosystem.

Spain was already a pioneer in the development of a Plan to Promote Language Technologies back in 2015. This initial work was subsequently reinforced through the ENIA with projects such

as LEIA¹⁴ at Spain's Royal Academy of Language (RAE), which aims to guarantee the correct use of Spanish by AI models; the creation of the Language Valley¹⁵ in La Rioja region; the creation of an observatory to monitor and measure the difference between English and Spanish in the take-up of language technologies; the development of terminologies in the TeresIA project (CSIC)¹⁶; the creation of an Access Point for language resources; or the origin of the Ilenia network¹⁷ through the development of resources for co-official languages. This network is a good launchpad for a more ambitious plan and, led by the BSC-CNS, is articulated around the Alicante Digital Intelligence Centre (CENID), the Basque Language Technology Centre (HiTZ), and the Singular Research Centre in Intelligent Technologies (CiTIUS) at the University of Santiago de Compostela. All these initiatives have also been developed within the framework of the New Language Economy PERTE (Recovery, Transformation and Resilience Plan Strategic Project). However, language technologies are constantly evolving, as shown by the growing impact of generative AI models.

Now that the development of foundation models is picking up pace, Spain has an opportunity to build up the infrastructures it needs to foster AI through a family of language models developed under transparency and trustworthiness criteria, with a larger share of Spanish and the co-official languages, so making them different from the English-centred dominant models. This is one of the primary strategic objectives of this plan. The language model is called ALIA.

¹⁴<https://www.rae.es/leia-lengua-espanola-e-inteligencia-artificial> (source in Spanish only)

¹⁵<https://web.larioja.org/landing/plan-transformacion/lengua.html> (source in Spanish only)

¹⁶<https://pti-esciencia.csic.es/project/teresia-portal-de-acceso-a-terminologias-en-espana-y-servicios-de-inteligencia-artificial/> (source in Spanish only)

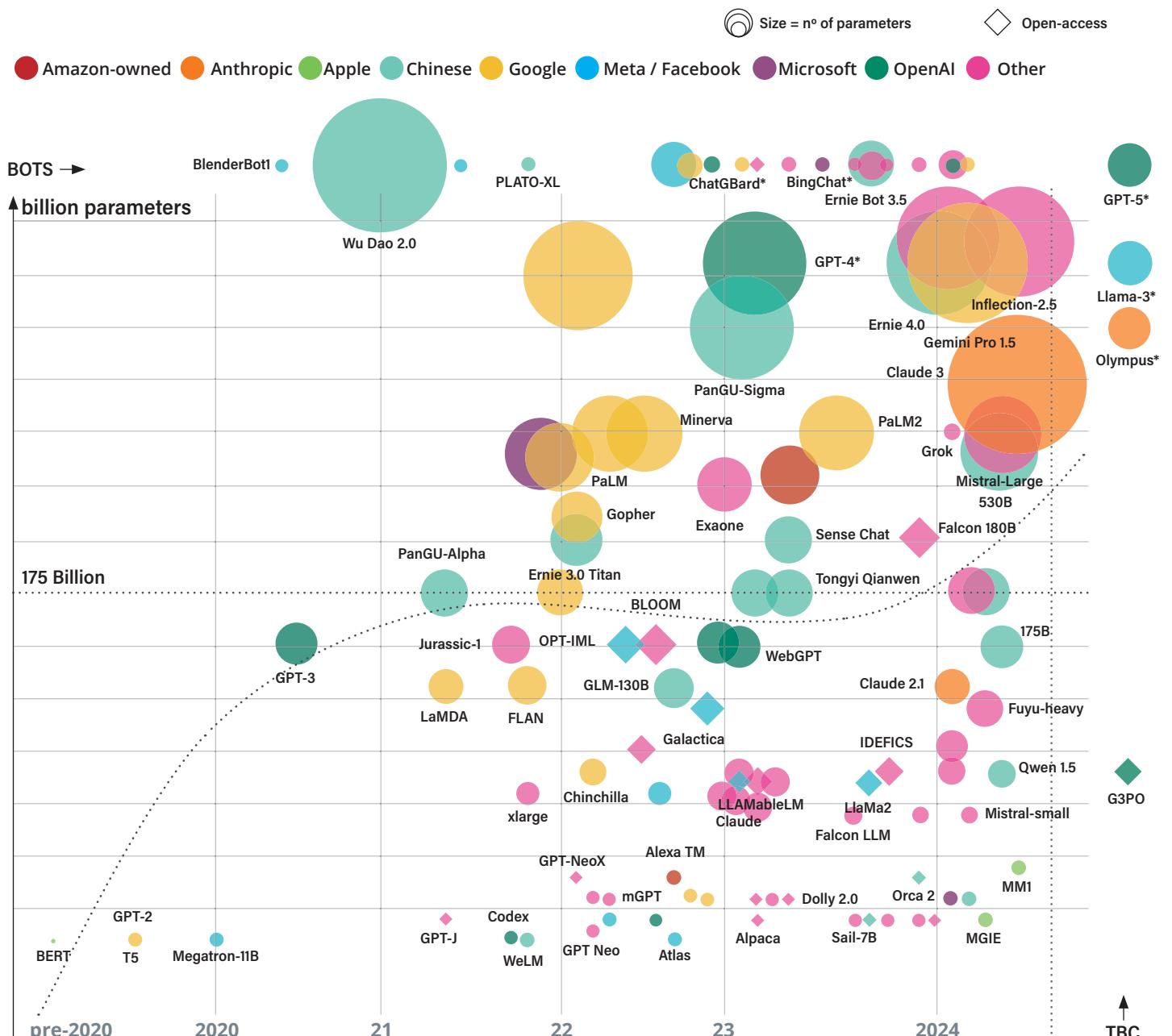
¹⁷<https://proyectoilenia.es/red-ilenia/>

Alia

Figure 3. Evolution of language models.

The rise of artificial intelligence

Illustration 2. Growth of Large Language Models (LLMs)



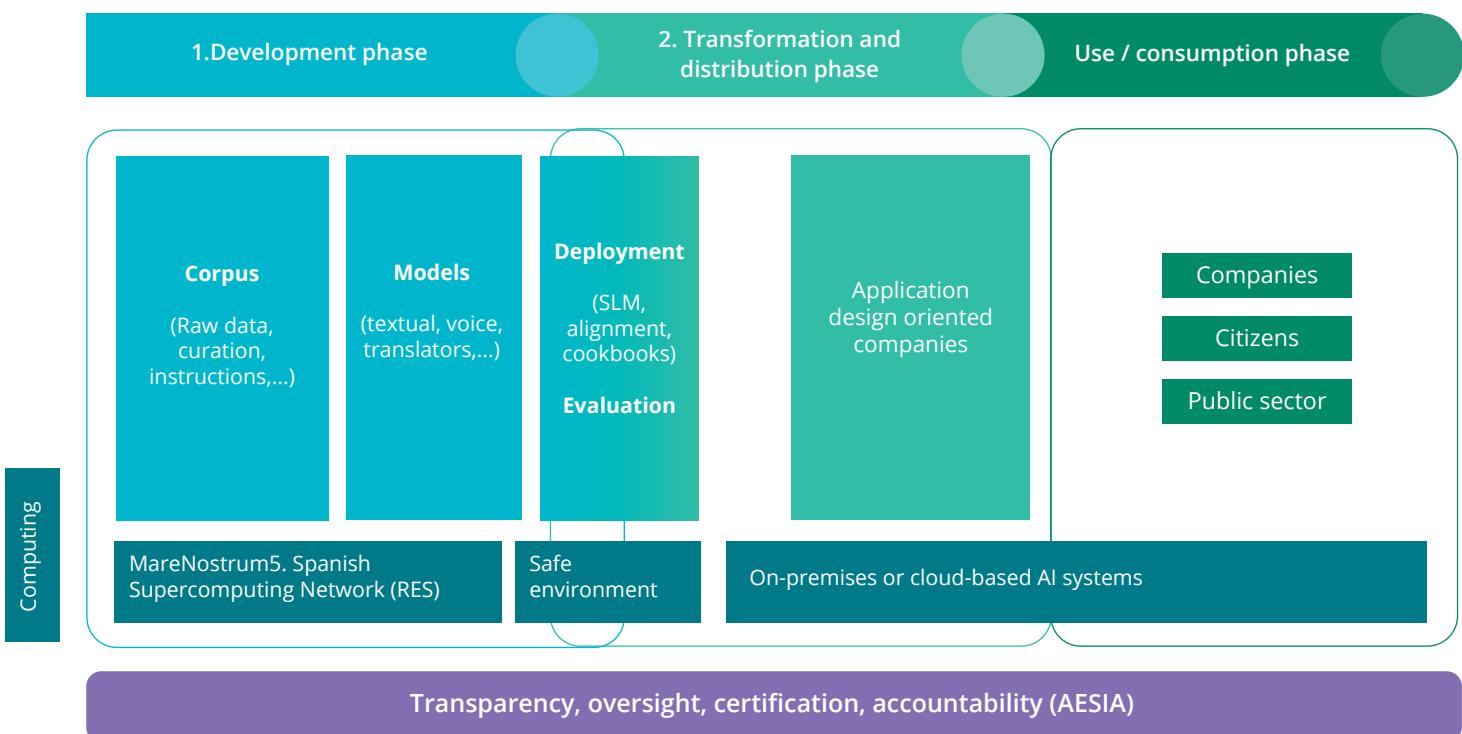
Source: LifeArchitect.ai / Information is Beautiful (updated in March 2024)

Over the last few years, LLMs have evolved significantly, both in terms of new models as well as model size. Until relatively recently, there were only a handful of models, with fewer than 100 billion parameters. Now, however, more and more LLMs are being developed and their size and complexity have increased. The reasons for that growth include better data availability, the development of new algorithms and increased computing power, all of which enable the creation of larger, more efficient, and more effective models. As language models grow in size and scope, so do their capabilities.



At national level, with a view to driving the development of the complex language model infrastructure that will be needed for the inclusion of Spanish and co-official languages in future AI applications, a number of different technical and organisational measures will be put in place in the phased sequence shown in the illustration below. The diagram describes the system and process for the generation of a foundation model in Spanish and co-official languages (i.e. entities, roles and relationships). This approach guarantees that the primary work on the data and models follows a structured pathway right through to the adoption of the models by the public-private sector and citizens.

Illustration 3. Phases in the development and launch of language models.



The primary phase includes the collection and generation of quality data and the development of a family of pre-trained models using supercomputing resources. During this phase, fine-tuning data, instruction data and model evaluation data are also prepared. This process must be followed for each of the co-official languages to ensure the best performance of the models in each one. The intellectual property rights of the protected works and services used to obtain the training data must be respected throughout.

The next step is to tailor the general-purpose language modelling infrastructure to the needs of each particular use case and environment. In this “secure environment”, halfway between R&D&I and technology transfer, model inference, fine-tuning, model evaluation, etc. can be performed for innovation-related activities. More details can be found in the section on Lever 6. Lastly, in the case of public administrations, the services and products that have been developed in the previous phase can be used and integrated directly into their environments. In this phase, “sector nodes” will facilitate cross-organisation collaboration, bringing together diverse partners from industry, the public sector and academia, to optimise their use and data-sharing in a given domain.

This initiative is, furthermore, proof of Spain's commitment to collaborative technological development, both nationally and internationally. In Spain, the aim is to follow the same approach taken in the ILENIA initiative and to coordinate this Strategy with the projects promoted by the Autonomous Communities with a co-official language. These projects are essential to strengthen the country's linguistic diversity and develop multilingual applications that benefit all the languages of Spain. In Europe, Spain's participation in the European language technology infrastructure programme ALT-EDIC¹⁸ is a strategic commitment to the pan-European advancement of language technologies. This alliance, focusing on the development of LLMs, seeks to improve European competitiveness and uphold its cultural and linguistic diversity, as do other essential infrastructures for language models like EuroHPC¹⁹ or Clarín²⁰.

This series of alliances and the synergies between them are crucial for Spain's own National AI Strategy not only to advance technological development, but also to achieve a significant and sustainable impact.

A governance model has been drawn up for the implementation of the actions included in this lever, which make up the National Language Technologies Plan, and as included in CID 251 of Component 16 Reform 1, the National Artificial Intelligence Strategy, in which a number of institutions will be participating. This governance framework is regulated through an agreement signed by the following fifteen members:

- The Secretary of State for Digitalisation and Artificial Intelligence (SEDIA), which leads on the content and coordination of this plan, given its remit on the promotion and regulation of digital services and the digital economy and society; dialogue with business, industry and academia; greater digitalisation of the public sector; and interministerial coordination and cooperation in this area.
- The BSC-CNS, with the benefit of its advanced compute capacity, will be the technical coordination hub for the plan. It will also be responsible for developing a family of foundation language models for Spanish and the co-official languages, as well as for coordinating the creation of relevant corpora and the evaluation of those models.
- The AESIA, which will be responsible for generating best practices in those models and for ensuring their transparency, trustworthiness and openness by validating and monitoring them.
- The Cervantes Institute, as the institution with a mandate to promote Spanish culture internationally and as a primary certification body for Spanish language proficiency worldwide.
- The Spanish Royal Academy, which will ensure the linguistic correctness of the models as well as coordinate and centralise pan-Hispanic projects working closely with the other academies.
- The Academies of the Basque, Galician and Valencian languages, as well as the Institut d'Estudis Catalans, as collaborating partners in the training of models in co-official languages and guarantors of the linguistic correctness of those models.
- The Ministry of Culture, whose remit includes intellectual property, archives and libraries, and also covers the National Library of Spain, which holds the largest corpus of documents in both Spanish and co-official languages.
- The La Rioja Regional Government's National Centre of Spanish, which will be one of the partners participating in the development of language models, boosting knowledge transfer and collaboration between academic and cultural institutions and research centres.
- The centres participating in the ILENIA project, namely the HiTZ research centre - Basque Language Technology Centre, the Instituto da Lingua Galega (ILG) in collaboration with the Centro Singular de Investigación en Tecnologías Intelixentes (CITIUS) and the Digital Intelligence Centre (CENID), together with the Centre for Advanced Studies in ICTs (CEATIC), represented by their universities. These centres will collaborate in the construction of databank models, the design of methodologies and tools, and in the dissemination of the models.

¹⁸<https://digital-strategy.ec.europa.eu/es/policies/edic>

¹⁹<https://eurohpc-ju.europa.eu>

²⁰<https://www.clarin.eu>

Initiative 3.1. Development of high-quality corpora

The crucial factor to move ahead on the training of language models in this proposal is the quantity and quality of the available data. Thanks in part to the work done in the framework of the previous National Language Technologies Plan, a massive multilingual corpus (36 European languages) with a total of 10 trillion tokens is now available. In addition, material is available with more than 40 annotated corpora for model fine-tuning and evaluation. Datasets and instructions have also been created in several languages for model alignment.

All of this together adds up to the largest existing world database of linguistic data in Spanish and the co-official languages, thus guaranteeing the much higher standards of the models in our languages, as stated in the report published on the status of corpora by the Cervantes Institute in 2023²¹.

To improve the automatic collection and processing of data from new sources (general

and sector-specific), sources of interest will be identified on the basis of two criteria: the size of the data (minimum four trillion words) and their usability (licences for their use). The data collection and processing tasks also include compliance with the transparency and traceability requirements imposed by the European AI Regulation on general-purpose models. Approximately €3.5 million will be earmarked for this initiative²².

Once the data have been obtained, tasks such as the generation of instructions will be performed in order to make smooth use of generative model demands, data annotation for adaptation of discriminative models and for generative model evaluation tasks. Evaluation datasets in Spanish and co-official languages will also need to be developed, especially for generative models (including instruct and aligned models) capable of evaluating the performance of models and comparing them against each other.

²¹Instituto Cervantes. (2023): Informe del estado actual de los corpus en español, lenguas cooficiales y variantes del español. Instituto Cervantes. <https://cervantes.org/es/sobre-nosotros/publicaciones/informe-estado-actual-corpus-espanol-lenguas-cooficiales-variantes>

²²This figure does not include the licensing fee for the use of copyrighted works.



Initiative 3.2. Development of foundation models in Spanish and co-official languages

In Spain there is already an array of published open-source small language models with permissive licences. However, as the aim is to develop foundation models (also known as large language models or LLMs) that might create traction for the further development of language models in Spain, the idea would be to create larger models, of up to at least 70 billion parameters, a size that is deemed to have the capacity to obtain efficient results.

The intention is to generate 7 billion, 22 billion, 40 billion and 70 billion parameter models and even 175 billion with the upgraded version of MareNostrum 5. The share or proportion of Spanish and the co-official languages will be substantially increased in these models thanks to the data generated in the previous initiative, thus avoiding bias and improving the quality of their applications compared to the current models on the market. Whereas the percentage of Spanish in large models is usually under 5%, in this case it is expected to exceed 20%.

The results of the models currently available – trained mainly in English – show considerable room for improvement and do not reflect the culture and traditions of our language, nor do they reflect the nuances of its different variants. These biases limit their use in many applied fields. Hence the need to develop the ALIA project, which will generate a family of language models. The first version of the first model will be available in the summer of 2024.

The family of language models whose development is to be supported would cover a wide range of models, from (i) generative AI models (such as MarIA²³, Aguila²⁴, Flor²⁵ or Latxa²⁶, some of which would be trained from scratch and others through continual pre-training mechanisms based on open-source models such as BLOOM²⁷, Falcon²⁸ or Llama²⁹), (ii) task-oriented discriminative AI models (usually in one or two languages, based

on systems such as RoBERTa³⁰), (iii) speech synthesis and speech recognition models, and (iv) machine translation models between Spanish, co-official languages and other relevant languages on the basis of the number of speakers they have or their commercial and cultural links.

As part of the process of developing the foundation models, innovations for models will be incorporated through the use of non-transformer-based architectures or through the generation and use of synthetic data. Moreover, work will be done to continuously improve the models by incorporating new data, and to carry out continuous evaluations of their performance and bias or toxicity criteria, supported by existing model assessment frameworks.

In concrete terms, the plan is to develop an initial baseline family of multilingual models in the third quarter of 2024, trained on raw data with very large datasets. These models will be capable of making minimal assumptions about the text structure they are completing at the generative level. Subsequently, in Q4 2024, the same models will be developed as instruct models, i.e. trained with question answering and with the ability to accept answers following a given instruction.

During 2025, “Iberian” model families, i.e. models focusing only on Spanish, Portuguese and Spain’s co-official languages, will be developed in parallel, as well as the second generation of the multilingual models developed in 2024. These new models may have as many as 175 billion parameters once the MareNostrum 5 upgrade is running. So-called discriminative models, i.e. models specialised in a particular domain, will also be developed. Applications to sectors such as the biomedical or legal fields are envisaged for 2024 and will be expanded in 2025.

²³<https://datos.gob.es/en/blog/maria-first-artificial-intelligence-spanish-language>

²⁴<https://huggingface.co/projekte-aina/agUILA-7B>

²⁵<https://huggingface.co/projekte-aina/FLOR-760M>

²⁶<https://github.com/hitz-zentroa/latxa>

²⁷<https://huggingface.co/bigscience/bloom>

²⁸<https://falconllm.tii.ae/>

²⁹<https://llama.meta.com/>

³⁰<https://huggingface.co/FacebookAI/roberta-base>

In all cases, licences will be adapted to the type of data used for training. Thus, whenever possible, the models will be distributed with a permissive licence, allowing companies to use them commercially. At any rate, the aim is to make these resources available in public repositories such as HuggingFace, GitHub or Zenodo, in line with the highest standards of openness and transparency as always.

That means evaluation datasets will need to be developed, especially for generative models (including instruct and aligned models), capable of assessing the performance of models and comparing them against each other. One of the most salient elements of this family of models is that it will comply with high standards of

transparency, as assessed by the AESIA. Current models have limited transparency standards when compared against the requirements of the European AI regulation.

ALIA's objective is to generate ethical and trustworthy AI standards, with open-source and transparent models, guaranteeing the protection of fundamental rights, the protection of intellectual property rights and the protection of personal data, and developing a framework of best practices in this field. In this way, the information that will be made public will contain everything that can be known about the model, from the composition of the corpora to the training carried out, the structure of the models and the resources used for it.

Initiative 3.3. Generate specialised or task-specific language models

Building on the development of the foundation models covered in the previous initiative, the development of specialised models (known as small language models or SLMs) is a lever to generate a robust and diverse national business ecosystem in this field. It would then be able to promote value-added services based on language-supported technological resources and foster a sustained gain in competitiveness for businesses at home and abroad.

These models are an efficient complement to LLMs because of their ability to perform specific tasks in given domains with lower compute resource demands. Their small size makes them better suited to limited infrastructures and mobile devices, thus facilitating broader and more democratic access to AI technology. Specialised models are trained on smaller datasets, resulting in less costly and more technically feasible implementation. Advantages include better explainability, ease of deployment and task-specific efficiency. The adoption of specialised models represents a step in the right direction towards inclusion and equal opportunities in the technology ecosystem, in alignment with the goal of making access to advanced AI models more democratic.

The specialised models to be developed will be available by the end of 2024 and will boost the modernisation of the public administrations, as described in Lever 5, with approximately €3 million allocated for their development. In addition, they will support the private sector through access to quality, cross-cutting resources that facilitate compliance with AI regulations in Europe, making the production of applications and language tools cheaper and enabling new quality and added-value business models, as detailed in Lever 6. Along the same lines, more multimodality will be promoted following the principal international trends, with the progressive incorporation of voice, images, scientific data, etc.

Initiative 3.4. Infrastructure and processes for language model assessment

Model assessment and benchmarking are also critical technological activities here. Spanish and the co-official languages do not currently have sufficient evaluation datasets and lag far behind English.

Evaluation datasets therefore will need to be developed – especially for generative models (including instruct and aligned models) – and they will have to be capable of assessing the performance of models and comparing them against each other. Approximately €1.5 million will be invested in this action line.

Up to now, the assessment of models and datasets has basically been done through manual processes that have gradually become more automated. A model assessment framework and an ethical evaluation dataset to detect bias and toxicity are now available. Nevertheless, when the AI Act comes into force and is applicable, the work on assessment and automation frameworks should be taken further and the frameworks made available to the Spanish Agency for the Supervision of Artificial Intelligence (AESIA) as the national accreditation and oversight body for the responsible deployment of language models.

The technical operational dimension will require the incorporation of robust assessment strategies ranging from model performance – considering model size, accuracy and environmental impact – to benchmarking against sector-specific reference models and those specialising in the assessment of other models. This benchmarking will not only focus on compute capacity, but also on the efficiency and green footprint of AI³¹. Given the changing nature of data, models and the use of language technologies, these assessment processes will have an embedded expiry date; they will require periodic updates to adapt to new developments and emerging standards, thus ensuring the validity and relevance of the AI systems. In technological terms, this infrastructure will share the same capabilities as Lever 6's initiative 3 on specific-purpose and secure commercial model training infrastructure.

³¹OECD (2022), “Measuring the environmental impacts of artificial intelligence compute and applications: The AI footprint”, OECD Digital Economy Papers, No. 341, OECD Publishing, Paris, <https://doi.org/10.1787/7babf571-en>

Lever 4: Foster talent in AI

The development, attraction and retention of talent in AI is an essential part of this Strategy. Given the significant correlation between technological transformation and a country's talent, the action plan must be ramped up in this area. This can be done by creating new measures to develop talent as well as by strengthening the measures that have been put in place in recent years and intensified further with the Recovery, Transformation and Resilience Plan.

The promotion of talent and scientific research has been one of the main areas targeted in this drive so that Spain can become a powerhouse in research, talent attraction and retention, with an emphasis on transferring the outputs of research to business and industry. These promotion initiatives fall within the remit of the Ministry of Science, Innovation and Universities, as the ministry responsible for training in this field.

Initiative 4.1. Institutionalisation and reinforcement of ongoing AI projects

Over the last three years, many major initiatives have been launched with the aim of **positioning Spain as a powerhouse in the field of research, talent attraction and retention**, and boosting the transfer of research results to business and industry. Actions taken include the creation of university-industry Chairs in AI to promote public-private collaboration in diverse applied AI fields and the design of programmes to retain scientific talent through AI research consolidation grants. Excellence networks have also been built up around interdisciplinary AI research projects in strategic areas, and an extensive programme of training grants have been made available to encourage the development of talent in AI and cybersecurity.

The investments made over this period include a series of initiatives amounting to a total envelope of €600 million:

- The Artificial Intelligence Value Chain programmes³² designed to integrate AI into companies' value chains;
- The R&D&I Missions in Artificial Intelligence³³, which aim to develop strategic projects in health, agriculture and energy through AI;

- The Territorial Networks of Technological Specialisation (RETECH)³⁴, a regional investment programme for digitalisation, run with the support of the Autonomous Regions to promote cross-region and specialisation-oriented projects;
- In addition, the Quantum Technologies National Strategy is being finalised and the Green Algorithms National Programme is under development³⁵.

Through initiatives like the ones described above, the aim is to ramp up the transfer of research results to industry, hand in hand with a firm commitment to encourage talent and upgrade supercomputing capacities and so consolidate Spain's position in the international artificial intelligence ecosystem.

To achieve that aim, areas of specialisation in AI will be created and integrated to unlock synergies between projects and make them sustainable over time. The ERDF programme will provide additional funding to take these initiatives further, with €300 million available to extend the initiatives beyond the end date of the PRTR funds.

³²<https://espanadigital.gob.es/en/measure/integration-ai-value-chains>

³³<https://espanadigital.gob.es/en/lines-action/ai-rd-missions-program>

³⁴<https://espanadigital.gob.es/en/measure/retech-territorial-networks-technological-specialization>

³⁵<https://espanadigital.gob.es/lineas-de-actuacion/programa-nacional-de-algoritmos-verdes> (in Spanish)

Table 3. Breakdown of budget implementation on AI (April 2024)

Programmes implemented to date	Investment	Project description
AI R&D&I missions	50 M€	Resolve major national challenges through 5 projects in cooperation between 78 entities in health, agriculture and energy and other fields.
Interdisciplinary AI networks ³⁶	32 M€	Cooperative research projects through interdisciplinary groups applying AI in strategic and cutting-edge areas.
Chairs in AI ³⁷ and Cybersecurity	25.8 M€	Funding of 23 university Chairs led by research centres and universities to do research and training on the application of artificial intelligence to specific subjects in sectors such as health, energy, regulation, data and the environment.
Spain Talent Hub	18 M€	Training and consolidation of AI researchers with a targeted investment of €10 million for a facility to attract and retain AI research talent through the development of research projects.
Quantum Spain ³⁸	22 M€	Development of a solid quantum computing infrastructure in Spain, with the first quantum computer in southern Europe.
Language technology	23.85 M€	7 development projects included in the National Plan on Language Technologies to drive development in the co-official languages, the creation of an observatory to measure the use of Spanish in language technologies, the Spanish Language in AI (LEIA) project, the Language Valley (La Rioja), the development of terminologies (TeresIA), and the development of language models. All of these activities fall under the aegis of the New Language Economy PERTE.
Value chains	105 M€	Projects on AI application in daily business activities, €10 million investment in 217 projects, 69% of funding received by SMEs.
Green algorithms ³⁹	3.24 M€	A project that promotes Green by Design artificial intelligence through four strategic pillars: boosting energy efficiency in the development of AI models, use of efficient infrastructures and services, integration of green AI and blockchain in business and industry, and revitalisation of the Spanish market through green AI.
Ethics and Regulations ⁴⁰	3.3 M€	On ethical and responsible artificial intelligence, work is underway to achieve a broader understanding of the European AI Regulation through guidelines to facilitate ethical AI, aligned with the European framework, the definition of an AI supervisory agency and the implementation of the European Declaration on Digital Rights and Principles.
RETECH and Public Procurement of Innovation	317 M€	Territorial Networks of Technological Specialisation (RETECH) aimed at digital transformation and specialisation, ensuring coordination, collaboration and complementarity in AI. INCIBE's Public Procurement of Innovation is included here.
TOTAL	600M€	

Table 4. Breakdown of budget implementation on AI by sector (April 2024)

Programmes implemented to date	Investment	Project description
Supercomputing capabilities	7.9 M€	10 projects in the Value Chains Initiative for business management and operations in the cloud, as well as the development of software adapted to specific business activities, massive material and data processing cloud-based solutions for companies, or the development of new functionalities in algorithms already in operation. Projects included in the Spain Talent Hub initiative are added.
Cybersecurity	78.6 M€	20 cybersecurity-related projects specialising in biometrics and digital identity, Machine Learning, Deep Learning, Blockchain and neural networks, with diverse applications such as digital identity solutions, human identification, forensic identification or advanced detection of money laundering for agencies and national authorities.
Cloud, Big Data and SW	84 M€	90 projects for the development of mass data storage environments (cloud technology), cloud computing technologies, for the generation of cloud computing services.
Quantum	24.5 M€	18 quantum technologies projects in universities and research centres, as well as the Barcelona Supercomputing Centre - National Supercomputing Centre Consortium (BSC-CNS), and the Supercomputing Centres in Galicia and Castilla y León regions, for the generation of the first quantum computing ecosystem and the creation of the first quantum computing infrastructure in Spain, exploring the applications of this new computational paradigm.
Energy	26 M€	18 projects designed to improve the energy efficiency of AI itself in the supercomputing machines it requires (Green Tech), e.g. developments to improve energy efficiency in wind and solar energy production, urban mobility, industrial plant consumption, etc.
Industry and cities	125.4 M€	80 projects in the RETECH Value Chains Programme and RETECH Collaborates programme, both of which are run in the Autonomous Communities, together with university research projects applied to communications, the aeronautical industry, architecture, engineering and construction, self-drive vehicles, logistics, transport and security, and other fields.
Intelligence, culture and regulation	72.7 M€	38 projects applied to multiple fields such as the music and video game industries, but also to legal settings, to generate automated decision-making systems for the justice administration, management of historical heritage, entrepreneurship in the rural environment, the data economy, demographics and ethics.
Environment and rural environment	69 M€	25 projects dedicated to protecting the economic activities that sustain our rural environment, such as the agri-food, livestock and forestry sectors, as well as protecting biodiversity and the terrestrial and marine environments.
Health	63.7 M€	106 projects for the development of AI health-related applications, both in terms of the management of health infrastructures and medical consultation and care services, as well as for medical and scientific research, clinical diagnosis, medical treatment, and forecasting of medical and health contingencies, among others.
Public Sector	13.4 M€	24 AI initiatives applied to public administrations as part of the Digital Competences for Citizenship, AI Strategy in Public Administrations, AI and Democracy Chair, RETECH Missions projects, in Castilla y Leon, Galicia and Aragon Autonomous Communities, as well as the Knowledge Heritage Network.
Language technology	34.8 M€	36 initiatives integrated in major projects such as the ILENIA network and the PNTL (National Language Technologies Plan) for the generation of corpora and the development of natural language processing and machine translation in Spanish and co-official languages. The initiatives also encompass the development of LTs for the generation of multiple applications.
TOTAL	600M€	

Initiative 4.2. Promoting AI skills

In addition, training in AI skills is being promoted through various initiatives. Training grants for training in AI and digital enabling technologies will be available as part of a €120 million package launched in April 2024, on top of the €30 million in specific AI projects to be implemented shortly.

Continued, guaranteed investment in AI development and specialised training is essential to avoid it becoming a constraining factor. This training should encompass several aspects. On the one hand, scientific and academic aspects, through the promotion of PhD programmes and research grants. This would include not only infrastructure subjects (data, computing, etc.) and language areas, but also everything related to the adoption of AI (e.g. business schools, engineering schools, philosophy and ethics in the use of technology, etc.) and the adequate transfer of AI research outcomes to market products.

Table 5. Breakdown of budget investment on AI capacity-building activities (April 2024)

Talent & Capacity-building in AI programmes	Investment (in M€)	Project description
Research grants programme for AI and digital enabling technologies	120	Programmes to attract and retain research talent under Investment 4 of Component 19 devoted to funding digitalisation projects with technologies such as AI, mass processing, high-performance cloud computing, cybersecurity, biotech, robotics, quantum technologies, biometrics and digital identity, etc.
Specific training in AI	30	Training in artificial intelligence under Investment 4 of Component 19 devoted to improving skills for digital professionals.
Excellent AI Call for projects	10	Development of a programme to implement high TRL (6-8) R&D&I projects to foster the transfer of results of applied research in AI to commercial products by public research centres of recognised excellence.
TOTAL (€M)	160	

On the other hand, skills training needs to be applicable to the world of business too, to start-ups and big companies, SMEs and industry associations, to know what the technology capacities and constraints are, as well as the business use strategies and integration of AI into value creation (tasks, jobs, production systems, etc.) These measures complement steps already taken in Spain to reform education and vocational training and will create further momentum for the development of training in technologies in Spain.

In recent years, several universities in Spain have created new courses (graduate and master's degrees) specialising in AI. Figures for the 2022-23 academic year show that 15 public universities in Spain now run graduate degree courses in both Artificial Intelligence and Data Science and Engineering. There is a wider range of Master's courses available given that the subjects offered at this level can be more specialised. For the 2022-23 academic year, 20 Master's degrees were on offer (in generic AI subjects or specialising in Business Intelligence, Visualisation, Computational Intelligence). In addition to these courses in public universities, another 5 graduate or Bachelor degrees and 5 Master's degrees are offered in the same subjects in private universities.

There have also been new developments in vocational training in Spain. In 2021, several specialisation courses were created within the category of vocational training in Computer Science and Communications so students can now study subjects such as Artificial Intelligence, Data Management or Cybersecurity. Specifically, the current list of vocational training courses on offer in Spain includes modules specialising in Artificial Intelligence and Big Data, Cybersecurity in IT environments and Development of Video Games and Virtual Reality.

These data show us how the use of artificial intelligence is becoming especially relevant in the field of education today, with a commitment to embed AI in the syllabus through the curricular development of computational thinking and the digital skills for students, as well as through the continued professional development of teachers with training and support programmes on

developing digital teaching skills. Programmes such as Código Escuela 4.0 (2023-2026), designed to improve teacher and student skills in computational thinking, programming, robotics and AI and developed by the Ministry of Education, Vocational Training and Sport and the Autonomous Communities, is just one example. The ethical aspects of the use and development of AI are of course also taught in these education programmes.

Lastly, the public administration is at a crucial juncture when it must get ready to respond effectively to the changing demands of society. The provision of quality public services is essential to meet the needs of citizens and guarantee their wellbeing. However, to achieve that goal, the public administration must have a highly qualified and committed workforce, capable of anticipating emerging demands and adapting to a constantly changing environment. The generational shift in staffing that public administrations in Spain will have to deal with in the coming years is an ideal opportunity to update their technical and professional skills. Those skills will be required for a smooth handover as younger generations join the civil service equipped with the knowledge and skills to service the needs of the administration and the public in the 21st century.

Fortunately, Spain already has a legislative platform on which to lay the foundations for the transformation of its civil service: RDL 6/2023³⁶. The new model will be built on the provisions of this recent Royal Decree Law whose provisions include predictive personnel management and greater management autonomy, the attraction and retention of junior and senior talent, competency-based human resources and more attractive professional careers.

The implementation of this model will improve the entry, in-service performance and end-of-career of public employees and work in parallel to meet the commitments of the Framework Agreement for a 21st Century Administration. The overall aim of this framework for action is to modernise the public administration and acknowledge the contribution of public employees to economic growth and social wellbeing.

³⁶<https://www.boe.es/buscar/act.php?id=BOE-A-2023-25758> (in Spanish only)

Pillar 2:

**Facilitating the expansion
of AI in the public and private
sectors, fostering innovation
and cybersecurity**



A future driven by the responsible adoption of AI in the public and private sectors

Lever 5: Boost AI in the public sector

Digitalisation and AI represent an opportunity to bring government closer to citizens and bridge the gaps in access to the public administration by providing quality public services and ensuring people can choose how they communicate with it. In parallel, greater use of AI in the public sector can provide public employees with the ideal tools to support them in the provision of quality public services of the standard expected in a mature welfare state and advanced democracy. The development and promotion of AI in the State General Administration (AGE)

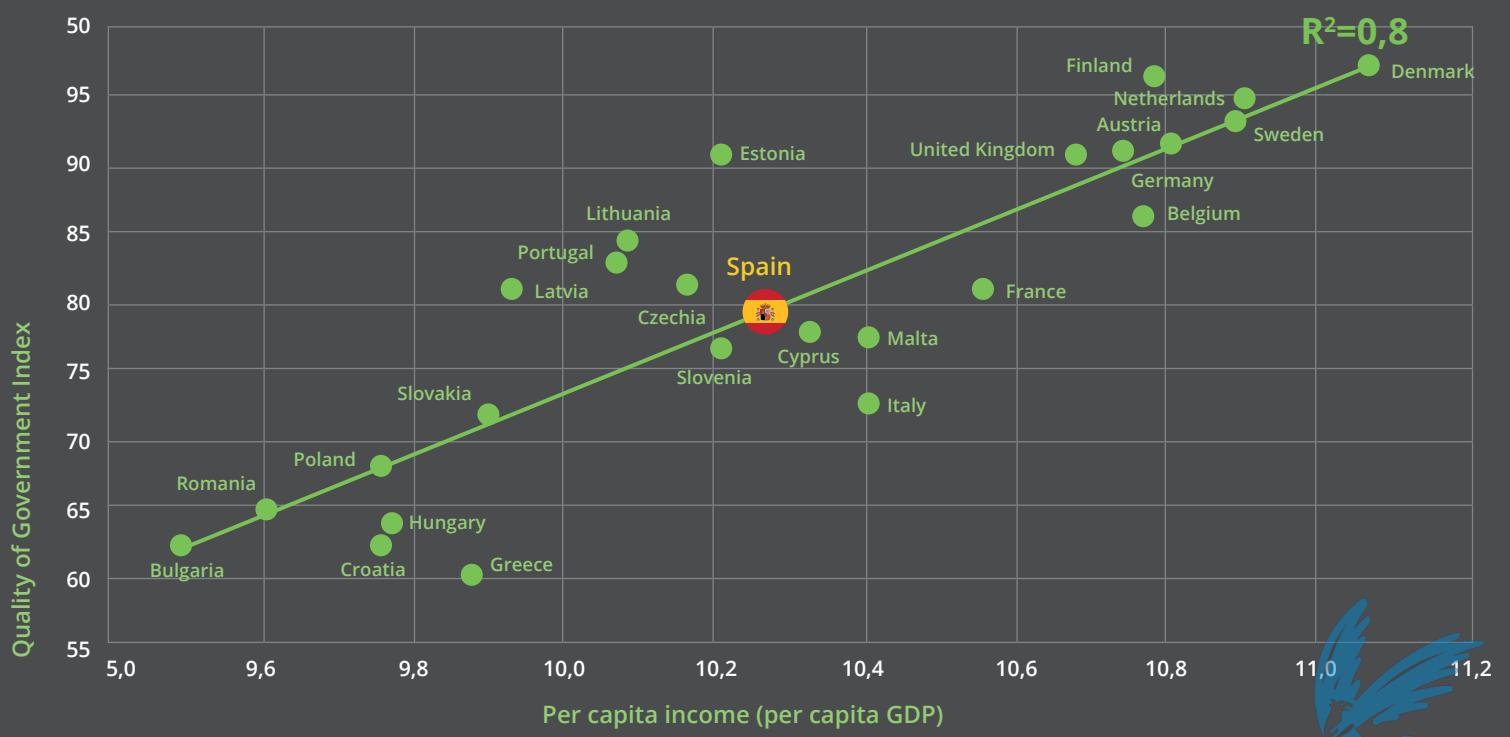
in Spain is one of the essential building blocks in the project to develop an open, modern Administration in which the General Secretariat for Digital Administration (SGAD) must be the driving force behind this transformation. The SGAD's role is to optimise capacities and investment in technological assets to generate inclusive public services and so harness all the benefits of generative AI, while guaranteeing data protection and information security.

Figure 4. Evolution of public services

Quality public services and economic growth.

- There is an empirically proven correlation between the quality standard of public services and economic growth.
- Spain lies in an intermediate position when the correlation is made by countries.
- The incorporation of AI will help to move Spain into the positions held by the top-ranked Nordic countries, with Denmark in first place.

Illustration 4. Correlation between the quality of public services and economic growth



Citizens now demand better response times and more customised public services; they also have greater expectations about the role of the Administration in the digital era. It is therefore essential to take steps to turn the public sector into a technologically mature sector, supported by AI and the analysis of large volumes of data, as it endeavours to meet these challenges.

The Administration can use AI as a tool to improve decision-making in the development of public policies. It can also harness its potential

as a key input to improve the efficiency of daily tasks in numerous administrative processes as well as for other purposes, such as more accurate detection of social problems, better predictions about the effect of public policies, process automation or enhanced delivery of public services thanks to the introduction of personalised services. The use of generative AI can bring significant potential productivity gains for the public sector in this domain and complement existing AI capabilities that are already being developed in it.



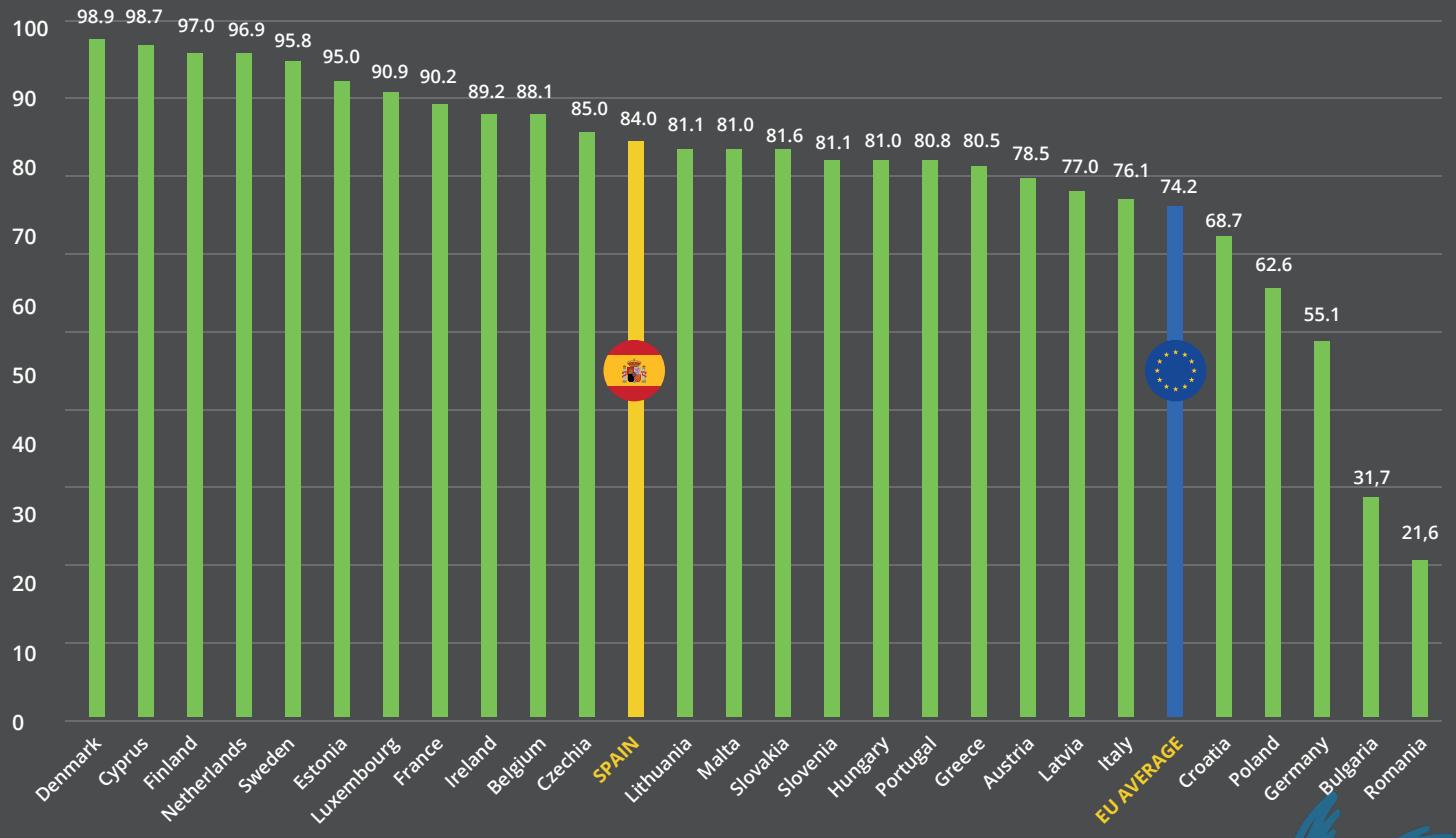
Figure 5. Benchmarking of digital public services

Spain is in a good starting position in e-government and digital public services in the EU.

Spain is already in a reasonable position: statistics show that it is above the EU average (State of the Digital Decade Report 2023) in indicators such as:

- No. of internet users using e-government services, 84% vs. 74%.
- Digital public services for citizens, 86% compared with 77%.
- Access to electronic medical records, 83% vs. 72%.
- 73.8% have used the internet, telephone or tablet to make enquiries with the Administration in the last 12 months (XIV CIS Study on the Quality of Public Services).

Illustration 5: Digital public services for citizens.



Source: European Commission. Digital Decade 2023. Data from 2022.

Figure 6. AI adoption in the public administrations

Examples of AI adoption by public administrations in other European countries for daily tasks

EUROPEAN CASE STUDIES

Poste Italiane	Use of generative AI to produce a significant change in customer experience through a new Knowledge Management Model.
Paris City Hall	Simplification of access to social benefits with generative AI through a chatbot that interacts with the user to check the person satisfies eligibility criteria.
Heidelberg City Hall	Citizen assistance through AI Lumi, which uses publicly available information in to provide a response tailored to each one of the concerns raised by citizens.
Islandic Government	Creation of resources (involving collaboration with OpenAI and the use of GPT-4 technology) for the preservation of native languages.
Lidingö City Hall (Sweden)	Mentor för hemtjänsten-Mentor for at-home care and homes for the elderly, enabling carers to obtain answers to any questions arising at work about the people they are looking after.
Government of Finland	Group of virtual assistants for AI providing a much smoother and unified service for entrepreneurs interested in taking their businesses to Finland.
Education Ministry (Poland)	Implementation of decision-making algorithms that analysed different factors to match children with schools.
Employment Service (Austria)	Jobseeker profile maker algorithm programme to make the advisory service more efficient and more effective.

Sources: Compiled by the authors from the report “Public sector and healthcare organizations in the Nordics are using conversational AI to improve quality of life for citizens” by boots.ai. 2024; the report “Automating Society: Taking Stock of Automated Decision-Making in the EU” by Open Society Foundations. 2019; and the article “Auditing Risk Prediction of Long-Term Unemployment”, Seidelin, C & al. 2022.



Spain stands in a fairly good comparative position when it comes to the take-up of AI in the public administrations. According to recent studies, it ranks sixth among the EU countries with the highest rate of implementation of algorithms in the public sector. Some examples of projects driven by the AGE – all centralising the introduction of AI in public administrations – are: (i) the GovTechLab project, focused on bringing innovative business solutions closer to the administration and vice versa; (ii) basic linguistic services in co-official and mainstream languages for use in all public administrations; and (iii) the incorporation of AI to improve efficiency and remove administrative bottlenecks, through the development of use cases with virtual assistants, anti-fraud or cybersecurity measures. The underlying idea with this lever is to promote the implementation of new actions that will turn the public sector into a role model for AI solutions innovation and applicability. They would also harness the public sector's capacity for traction as a driving force to create new services and solutions that will enable the build-up of a private sector ecosystem around AI in Spanish industry.

The roll-out of the initiative to incorporate a foundation model in Spanish and co-official languages into the work done by public administrations will be crucial, insofar as it will increase the capacity, effectiveness and efficiency of public agencies as service providers and reduce the overall administrative burden on staff.

In addition, the creation of specialised small language models, derived from the foundation model and adapted to different administrative divisions in the public sector (health, territorial, justice, environment, taxation...), will more effectively support the provision of public services by better tailoring them to specific domains or tasks. These models will also meet the highest standards of transparency and will be reviewed by the AESIA.

Initiative 5.1. Use case incubator for the AGE

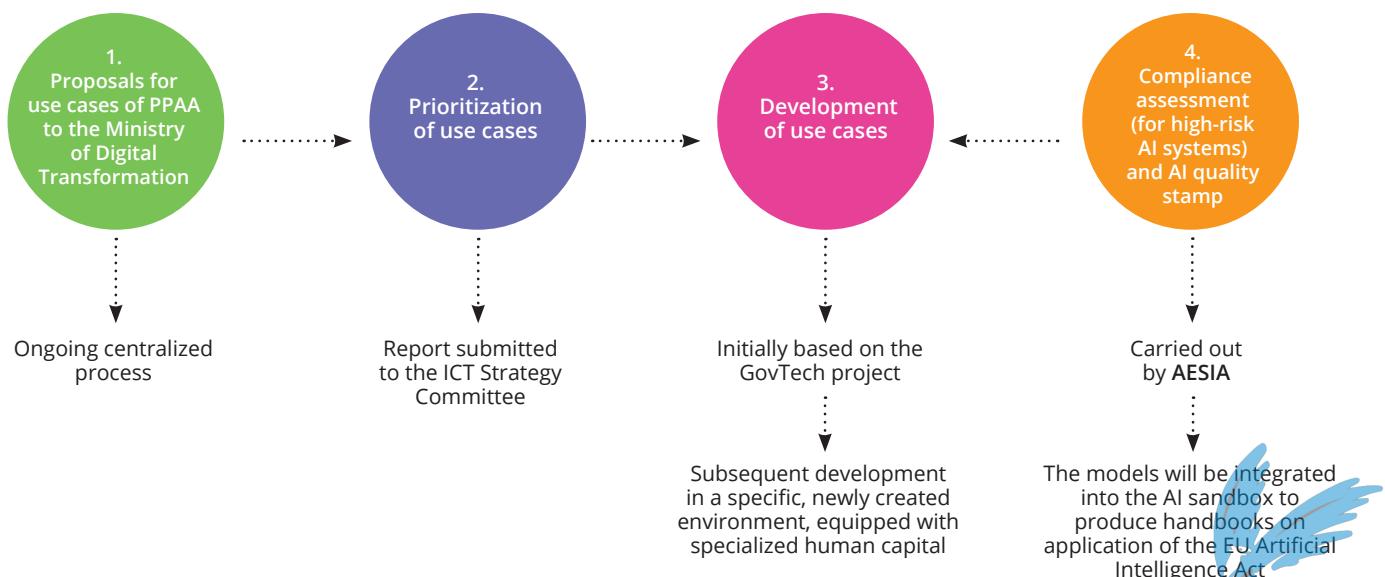
The implementation of use cases in Spain's State General Administration derived from the foundation model developed will be driven by the creation of an innovation lab to centralise AI pilot cases, and the development of innovative solutions for state public sector agencies through the GovTech project run by the General Secretariat for Digital Administration (SGAD), with a budget of €21 million. This approach will make it possible to harness synergies in the development of models and, above all, embed a learning process generating capacities and expertise for their development. This centralised governance scheme for the selection of use cases in the AGE consists of the following elements:

- AGE entities will send their use case proposals to the Ministry for Digital Transformation through the SGAD. AI use cases will be selected and prioritised. Additionally, a guide will be prepared with information on previous examples and centralised services available to develop AI impact plans and services related to AI system experimentation.
- These selected use cases will be shared with the ICT Strategy Committee on a regular basis. The use cases – in a very dynamic environment – will have new demands over time and the results of the use cases and possible synergies between the different cases will be monitored.

• The development of use cases will be carried out by private sector and research organisations. This will contribute to the growth of the AI entrepreneurial ecosystem defined in Lever 6. It will be implemented through the SGAD's GovTech initiative and will aim to create specialised models by fine-tuning the original foundation model. It will evolve into an integrated public sector data space that will serve not only to develop generative AI models, but also to evaluate public policies and move towards open government.

• The AESIA will be responsible for the compliance review of these models by developing an outline of best practices in model development and deployment. Nonetheless, it will take into account the provisions of the European Regulation on Artificial Intelligence and the regulations associated with different specific (or high-risk) sectors and work in coordination with all the other agencies. These models will be the first models to form part of the regulatory sandbox, which will enable the development of implementation guides for models, which will also serve as a reference for the private sector.

Figure 7. Governance of AGE use cases.





Initiative 5.2. Common services based on AI models in the AGE

It is important for all systems produced from the public sector incubator to be made available to the entire public administration on the SGAD's common services platform through SLAs enabling the service provision. In that way, the experience and technology can be reused by other agencies for similar purposes or some of the cases can be scaled up to a common AGE AI system. To facilitate this, the SGAD will create a centralised tech services node for all of the other AGE entities. For the adoption and use of AI models across the board in the public sector, the models must be included in the catalogue of products offered by the SGAD to encourage their reuse.

One example that can be scaled up for the whole administration is the creation of a knowledge base on all the competencies in the administration that can be used by civil servants in their public-facing tasks. This will require the pooling of public sector information, including current legislation, repositories of queries and FAQ, and regular training of AI systems as and when data and citizens' concerns and interests change.

This knowledge base will be a platform on which services could be built, e.g. a common service for the creation of chatbots that can be trained to provide specific web-based and telephone services. One obvious example is the 060 helpline, i.e. an intelligent voice assistant based on generative AI, including age and sentiment recognition. This virtual assistant will be able to generate personalised content such as documents on demand, and translate the information requested by the caller into plain language.

Initiative 5.3. AGE common data governance

To develop specialised language models that will enable the development of applications for deployment in the public sector, a common governance model will be set up for all the data and documentary corpora in the AGE while guaranteeing the safety and security, quality, interoperability and reuse standards of all data.

The current regulatory architecture underpinning the processing and exchange of information in the context of the AGE is articulated through a distributed and complex legal framework, encompassing very heterogenous and wide-ranging European and national regulations. Instead, a more holistic legislative approach must be taken to regulation through the development of a data governance model. This regulatory impetus for effective data governance in the AGE will include the general design of a data-oriented organisational structure, with the new Directorate General for Data under the Secretary of State for Digitalisation and Artificial Intelligence as the cornerstone and enabler.

Data governance will ensure the anonymisation and privacy of information, as well as due compliance with the specific regulations applicable to each case, throughout the entire data lifecycle. It will also ensure that data is used responsibly, linked to use cases, and in compliance with the

ethical and regulatory standards set. The quality, interoperability and reuse standards will be those applicable to each specific sector within the AGE.

All the necessary elements for the effective development of data governance will have to be defined and put in place, including, inter alia, building up the AGE's Data Platform, generating departmental metadata catalogues, mapping data exchanges, enhancing interoperability, quality assurance, the incorporation of ethical principles and the protection of privacy and security. In essence, the effective development of data governance in the AGE will facilitate the roll-out of better quality and more useful AI initiatives, as well as being a central element in other areas such as public policy evaluation.

The AGE data space has datasets that can be used for model training. These datasets need to be sector-specific to provide solutions to the specific use cases of each organisation. Likewise, in a unified environment it is also possible to develop AI-based solutions. The tools provided enable solutions ranging from data preparation, the integration of different data sources, model training and Machine Learning-based operations, through to the visualisation and monitoring of the models developed.

Lever 6: Help with the Expansion of AI in the Private Sector, Particularly in Small and Medium-Sized Enterprises

The expansion of the use of AI requires more encouragement and incentives for its adoption by the business sector, essentially by SMEs and the self-employed, as they are the two segments that usually experience more difficulties to integrate AI. A greater uptake of AI would capitalise on productivity gains in all sectors and generate new business opportunities through value-added services where AI provides that competitive edge. Emerging technologies such as synthetic data generation or the combination of

AI and expert knowledge are increasingly being incorporated into the generation of strategic decision-making, as well as generative AI solutions. It is also necessary to do more to further the development of an entrepreneurial and innovation ecosystem in the business sector. There is a role here too for the public sector, as a facilitator for the integration of this technology in companies and as a stimulus for business innovation within a framework of trustworthy and responsible AI use.

Figure 8. Growth in the use of AI.³⁷

Illustration 6. How the use of AI has evolved.

AI adoption in companies.

- The adoption of artificial intelligence by companies has made remarkable progress in the last two years.
- 11.8% of Spanish companies with ten or more employees use AI technologies.
- Four out of ten large companies use some form of AI (41.2%).
- In medium-sized companies, the percentage is 20%.

- Total
- 10 to 49
- Total micro-enterprises
- 50 to 249
- Over 249



³⁷ONTSI (2023): "Uso de inteligencia artificial y big data en las empresas españolas". (Report in Spanish only)

Initiative 6.1. Incorporate AI into SME processes

The aim of this initiative is to speed up the pace of incorporation of AI solutions and products in SMEs and provide options for them to turn to for advice on how to adopt them. A number of different measures are scheduled with a budget envelope of some €350 million for the second half of 2024. The roll-out of the Kit Consulting initiative with a budget allocation of €300 million and a potential impact on 15,000 companies is also a key part of this package of measures.

The measures include (i) the incorporation of AI products into the Digital Kit for customer management available to companies (focused on CRM digitalisation and optimisation of AI-enabled process optimisation); (ii) data analysis and visualisation (focused on AI-based data mining to improve decision-making or business intelligence) and (iii) process management (so that AI is used to digitalise and automate business

processes related to operational and production aspects in the beneficiary companies).

The Kit Consulting initiative consists of a new service offered to SMEs to obtain external expert advice on the adoption of AI. It will be implemented following the digital kit model, through digital advisers who have signed up to the scheme. This new service will be launched in May 2024 and is envisaged as a pre-adoption phase for companies before they start using AI products.

The Acelera pyme platform with its nationwide network of offices supporting the digital transformation of SMEs, self-employed workers and entrepreneurs can also be used as a channel to make these products and services available to the end users.

Initiative 6.2. Develop the AI entrepreneurial ecosystem

The aim of this initiative is to facilitate access to financing for Spanish companies – start-ups and scale-ups – developing new AI solutions. The funding will come from the Next Tech Fund which has a total investment potential of €4 billion, of which 10% (€400 million) will be allocated to companies developing AI projects.

The facility has a direct line for direct equity investments in companies developing innovative technologies and also an indirect line of transfer of funds to existing investment vehicles that invest mainly in scale-ups with a strong technological component. The objective is to boost the growth of Spanish companies through the development of high-impact digital projects; to promote digital entrepreneurship and digital enabling technologies; and to consolidate the development of highly innovative technology-based companies (scale-ups). It is also envisaged that the facility will extend its coverage to seed capital projects, as well as prioritise AI-related initiatives.

Initiative 6.3. Specific-purpose model training secure infrastructure

Based on the foundation model in Spanish and co-official languages, smaller specialised models will be developed with applications focused on market needs. ERDF funding amounting to €300 million will be used as in Lever 4. The aim of this initiative is to leverage on the foundation model so that Spain's businesses can develop new products and services by creating specific and specialised models for given sectors or activities. The ultimate goal is to have a positive impact on key sectors such as health, climate change and the connectivity industry, by making Spanish companies more competitive abroad and fostering more public-private collaboration in research and the application of cutting-edge technologies.

The training of these specialised models must be carried out in a controlled environment for companies. Data security needs to be guaranteed with no access to the model training data for competitors, and ease of access to the services and resources needed to train and download the model, with the availability of tools to ensure its quality and trustworthiness. The platform described in "Initiative 3.4. Infrastructure and processes language model assessment" will enable all of this. The following projects and products will be developed on the basis of that infrastructure.



1. A proximity deployment plan: With the creation of a platform in a pre-commercial secure environment for companies to carry out proofs of concept (PoC) testing that require activities such as model inference, fine-tuning, evaluation or alignment of models, etc. This platform will benefit from advisory support teams for companies and start-ups through the ILENIA or RES network points, which will be in charge of managing access to the "secure language model training environment", providing guidance on the use of these services and acting as a regional meeting point for the business ecosystem. This environment will be available to the research community and academia as well as to the innovation and start-ups sector. Moreover, a "Language Data Space" will be created as the main access point to guarantee the availability and access to all the data, models and tools necessary for the development of language models and applications.

2. A catalogue of business services for innovation: Sector nodes will facilitate collaboration between organisations, bringing together diverse partners from industry, the public sector and academia to optimise the use of language models in a given field. On the basis of ambitious projects designed to create traction, collaboration will be encouraged by bringing together a variety of partners from industry, the public sector and academia. Initially, the creation of nodes for (1) GovTech, (2) Health/Biomedicine, (3) Education, (4) Legal/Finance and (5) Communication is envisaged. The development of task- and sector-specific models that can be shared and the creation of new data corpora (both for pre-training and for instruction and evaluation) that can jointly benefit the sector can be promoted. Lastly, the most widely-used providers of large cloud services will be involved to ensure the compatibility and availability of language models in familiar environments for start-ups and other companies.

3. Build up a language model start-ups programme: The aim is to support the development and consolidation of the national ecosystem of language model start-ups by putting in place mechanisms and enhanced instruments for faster access to early-stage funding. On the one hand, a fast-track programme specialising in language models will be set up to facilitate the growth of start-ups with the capacity to attract private investment and scale up at European level and in Latin America and the Caribbean. To this end, collaboration will be sought with one or more private sector entities with experience in managing acceleration programmes in relation to: (i) offering specialised services for start-ups (support for creation, entrepreneurship, specialised business mentoring, legal and financial advice, etc.) and (ii) management and enhanced use of spaces. This initiative is also linked to the use of the Next Tech fund to drive start-ups that use language models, prioritising early-stage public co-investment to help them grow faster. The aim of this whole battery of activities is to generate a robust entrepreneurial ecosystem around language models that guarantees adoption and innovation at national level and the capacity for international expansion.

Lever 7: Develop a Cybersecurity Framework

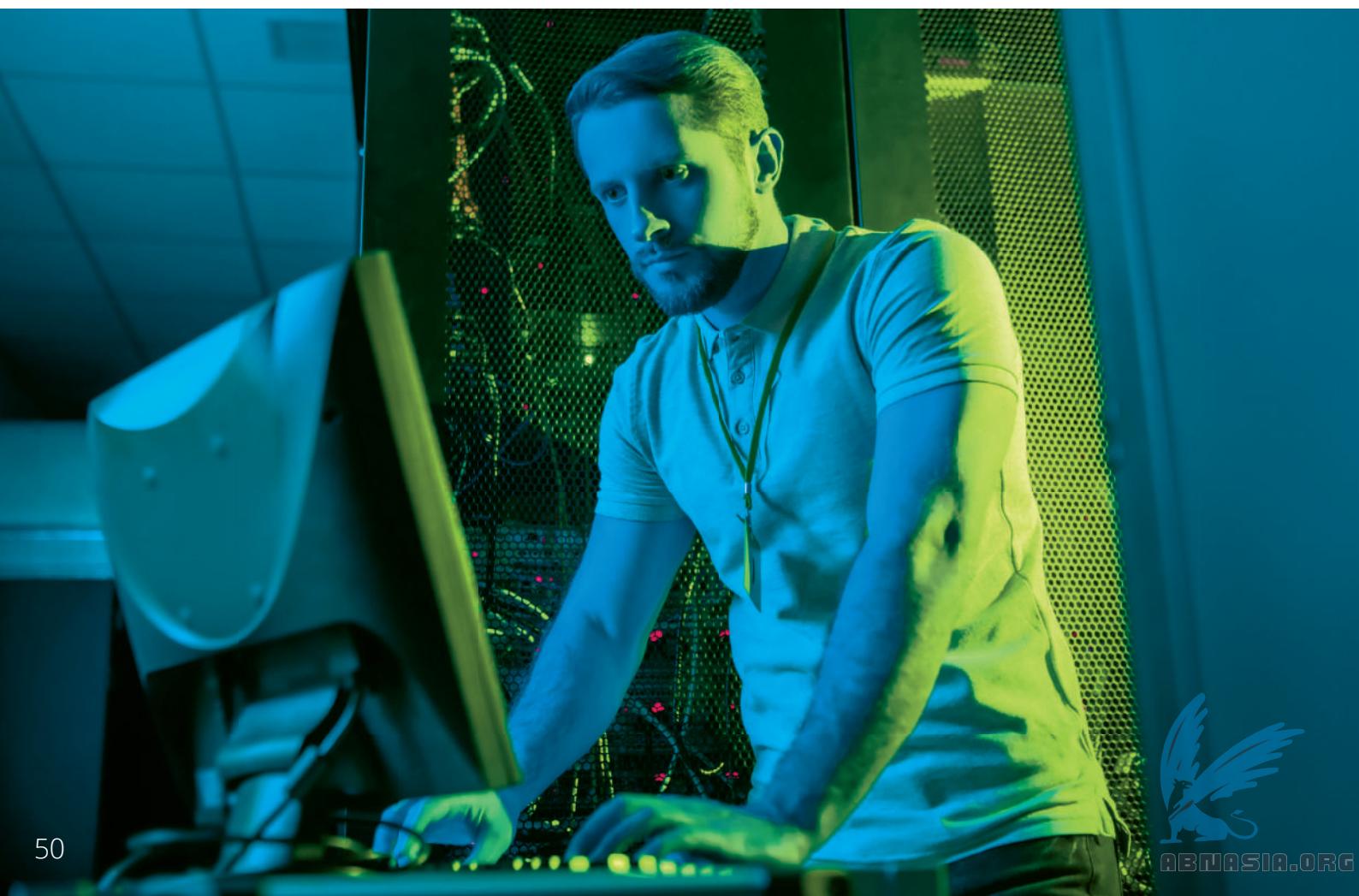
Countries all over the world are increasingly focusing on cybersecurity as an inherent part of digitalisation, especially now, with the explosion in technological transformations such as AI. Cybersecurity is a pivotal aspect of strategic sovereignty and indispensable to build the trust and security that must go hand in hand with the technological transformation of the economy.

Key economic sectors are extremely dependent on highly interconnected networks and information systems, hence the relevance of ensuring maximum levels of security in critical infrastructures and essential services in both the public and private sector. Strengthening cybersecurity is necessary to foster trust, innovation, connectivity and digitalisation while at the same time protecting citizens' rights and privacy. What that means in practice is that cybersecurity is an intrinsic component of digitalisation itself and of the development of new technologies (most notably AI), and

that reinforcing cybersecurity is crucial for the strategic sovereignty of nations and to guarantee the digital transition.

AI has a significant impact on cybersecurity, spanning several areas from the standpoint of prevention through to incident response. On the one hand, it is true that advances in AI challenge cybersecurity, but at the same time AI gives us the tools to enhance threat prevention and advanced detection through predictive models.

Spain is already well-positioned in terms of cybersecurity; it is the third-ranked European country after the United Kingdom and Estonia in the global cybersecurity index (GCI) evaluated by the United Nations. It will build on this current position by strengthening cybersecurity further within the framework of the development of AI, leveraging the opportunities offered by the technology itself through the proposed lines of action described below.



Initiative 7.1. Draft a cybersecurity law

In the context of the European legal framework on security as well as the National Security Framework in Spain, the new cybersecurity law is a government initiative to pass legislation that sets out a clear and comprehensive framework for the development of national cybersecurity leading to enhanced protection of information systems, networks and data in Spain. An overarching piece of legislation encompassing all elements of cybersecurity, from training and investment to strengthen security through to improved incident response capacity is needed to address the growing challenges of the digital world in today's different scenarios.

This initiative proposes a national cybersecurity governance framework establishing the set of policies, processes, organisational structures and oversight mechanisms needed to implement adequate security controls.

Coordination between the different public and private actors within this framework is essential to ensure an effective, unified response to any cybersecurity incidents.

This framework also articulates the different measures needed to improve the national cybersecurity lifecycle. They include specific measures defined for prevention and protection when it comes to security risks and the detection of cyber incidents and how to respond to them. The importance of early detection and effective response to the growing number of cybersecurity incidents is underscored in the proposal. This approach will give rise to the development of the necessary supervisory mechanisms to promote the continuous monitoring and assessment of risks and the effectiveness of the designated security measures.

Initiative 7.2. Build up the corporate cybersecurity ecosystem with AI

Building up the national corporate ecosystem for the development of cybersecurity with AI is an essential step for heightened cybersecurity and protection of the country's digital assets. A suite of actions to be implemented under this initiative is proposed to foster innovation, collaboration and adoption of AI technologies in the field of cybersecurity. For initiatives specifically linked to the combination of artificial intelligence and cybersecurity, INCIBE has made available approximately €12 million in investment. In addition, INCIBE has allocated another €48 million to cybersecurity and AI programmes in its fourth Innovative Public Procurement programme, as described in Lever 4.

Some of the key actions framed by the Recovery, Transformation and Resilience Plan and contributing to digital transformation include the INCIBE's public invitations to collaborate in the promotion of university Chairs in Artificial

Intelligence applied to cybersecurity and strategic cybersecurity projects in Spain. This initiative will be implemented through a collaboration agreement between INCIBE and public and private universities. The purpose of these projects is to take advantage of the opportunities offered by cybersecurity through measures that promote cybersecurity as a driver of innovation and economic, social, inclusive and sustainable growth, as well as strengthening competitiveness through R&D activities related to cybersecurity, including artificial intelligence. Finally, another action dimension in the context of AI promoted through the INCIBE worthy of note is the innovative public procurement strategic initiative, which is all about using AI as an integrated technology in the development of cybersecurity R&D solutions to address different challenges.

Pillar 3: Develop transparent, responsible and humanistic AI



ABMASIA.ORG

Lever 8: Develop the AESIA's functions

A beacon of knowledge and co-creation of governance of AI ensuring the progress of our society and the competitiveness of our economy.

As a transformative force in technology, society and the economy, AI entails a global revolution permeating all of society and poses significant regulatory, ethical and social challenges. But it also presents us with a unique opportunity to improve our lives and build a better future.

This has prompted a global debate in which every country is endeavouring to find ways to leverage the benefits associated with AI and to generate trust in AI on the part of citizens, while trying to mitigate its risks at the same time. Unquestionably, the most important step in this direction has been the international consensus in international meetings and organisations such as the OECD, UNESCO, the G20 and the United Nations, on the need to develop and implement responsible, ethical and safe AI.

Responsible AI implies the development and implementation of intelligent systems that adhere to sound normative principles, safeguarding human rights, equality, privacy and non-discrimination. Security also plays a crucial role, ensuring that AI systems not only function properly but are also protected against potential threats and vulnerabilities. Ethics, on the other hand, establish the moral principles that should guide the design and responsible use of AI, thus ensuring that its applications benefit society as a whole.

In this context, the new Spanish Agency for the Supervision of Artificial Intelligence (AESIA), headquartered in A Coruña, has been mandated with ensuring the deployment in Spain of safe, responsible and ethical artificial intelligence systems. The scope of its remit cuts across both the development of foundation models and the pull effect or traction they can exert through their application to small language models, as well as their implementation and deployment both in the public sector and in industrial applications and in the cybersecurity sector³⁸.

The rapid evolution of algorithms and the relative or absolute impact they can have on people's lives – even when they do not directly affect fundamental rights – can lead to unfair situations, widen socio-economic and other gaps, or even solidify further the increasingly evident digital divide that exists today. An urgent, in-depth and comprehensive debate is therefore needed with the full participation of society to resolve these structural challenges posed by AI in order to draw up clear limits and transparent co-governance that can guide society in the use and enjoyment of this technology. The AESIA will be responsible for spearheading this debate and reaching consensus on the limits of algorithmic decision-making.



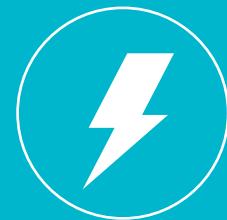
³⁸Taking into account the exclusions referred to in Article 2(3) of the competent Regulation (EU) on the characterisation of national security critical products.

The debate on AI governance needs to be framed in the concrete context of the specific realities of each productive and social sector given that the application of this technology presents us with unique challenges and opportunities that call for a careful, contextualised approach. From agriculture through to education, it is vital we develop flexible but robust frameworks for action, implementation and dissemination that foster innovation while safeguarding fundamental rights and values, ensuring transparency and enabling the development of a society with more equality.

The Spanish government has formed part of this international consensus from the outset, not only with the publication of the Charter of Digital Rights, but also with its leadership during the time Spain held the Presidency of the Council of the EU. It views the issue as one of the cornerstones and cross-cutting pillars underpinning this AI Strategy, with a new orientation to turn Spain into a country with a competitive economy and an efficient and citizen-centric public sector thanks to responsible, ethical and safe AI.

Following on from the work carried out during the Spanish Presidency, the EU is urging its Member States to put in place adequate structures to enable the implementation, surveillance and market oversight of high-risk AI systems. Passing laws and approving regulations is not enough to ensure that our economy and society reap the full benefits of this technology while citizens, businesses, public administrations and other actors are empowered to enforce their digital rights, to use AI, and to understand their ability to mitigate its potential risks.

Illustration 7. AI Regulation. Classification of AI systems according to risk



High-risk AI systems

AI systems that can lead to **risks of harm** to health and safety or **adverse impact** on fundamental rights, in areas such as those used in:

- Recruitment, promotion and evaluation of performance of workers
- Evaluation of creditworthiness and eligibility for public assistance
- Biometric identification (except mere identification of end users and prohibited practices)
- Management and operation of critical infrastructure, as defined in Directive (EU) 2022/2557
- Other products that are already regulated by harmonized EU rules (medical devices, lifts, self-driving vehicles, etc)

E.g.
automatic promotion of employees

AI systems with unacceptable levels of risk

AI systems for the following are **prohibited**:

- Cognitive and behavioural manipulation
- Exploitation of persons' vulnerabilities
- Biometric categorization to infer sensitive data (sexual orientation, beliefs, etc)
- Social scoring or classification
- Non-selective extraction of facial images from the Internet to build or expand facial recognition databases
- Detection of emotional states in the workplace or educational institutions
- Some cases of predictive police surveillance of persons

E.g.
social scoring



Low or minimal risk AI systems

Allowed without restrictions

E.g.
predictive maintenance



AI systems with specific transparency obligations

- Interaction with humans
- **Creation or manipulation of content ('deep fakes')**
- **Migration controls:** reveal that content has been generated by AI

Transparency obligations for GPAI models

- **Provide technical documentation** for the model
- **Supply** documentation to providers of AI systems that form part of the model
- **Respect intellectual property rights and publish a detailed summary** of the data used to train the model

E.g.
chatbots

Although the European AI Regulation addresses certain limits for high-risk AI systems, a broader discussion bringing in the whole of society is vital so as to encompass uses that are not part of this regulatory framework, as well as their transparency and quality. The AESIA therefore needs to focus on defining high standards of transparency and trustworthiness for AI models and systems through evaluation and review processes.

Initiative 8.1. Creation of an AI intelligence Think & Do Tank

The AESIA will become the key institution generating intelligence on AI in Spain and will be called upon to prompt a debate on the governance of this technology so that our society can move towards a consensus on the part of all social and economic stakeholders and we can establish the limits of AI's use and deployment. The AESIA has been set up with a clear mandate to inform and educate on AI. This mandate includes knowledge creation, training and dissemination in relation to the nature of ethical, responsible and safe AI. The objective is to highlight its potential and opportunities for socio-economic development, innovation and the transformation of the production model, but also the challenges, risks and uncertainties posed by its adoption and the future direction taken by this technology.

This remit is one of the key building blocks for the work of the AESIA going forward as it strives to become the Think & Do Tank of reference in Spain with a capacity to conduct analyses of the trends, perspectives, innovative and differential elements that may exist in the market. It will also be asked to contribute its vision and experience as inputs in the debates and public policies led by public bodies and other stakeholders in society. In essence, the AESIA will be a beacon guiding the development and deployment of AI in Spain.

To perform the role assigned to it in Spain, the AESIA will follow the example of other think tanks on AI around the world: the Centre for Data Ethics and Innovation in the UK; the Stanford HAI or the AI Now Institute, both in the USA; or the Future of Humanity Institute at the University of Oxford. These role models will also inspire and guide the AESIA's actions and their conclusions can feed into the national debate.

In addition, the AESIA will also help to build up more and better knowledge about frontier AI, i.e. AI's current and future capabilities that may be extremely powerful, ethically troubling or socially harmful. This will require continuous oversight of research developments, as well as the implementation of safety measures, the creation of standards and monitoring systems, and collaboration with the UK and US AI Safety Institutes.

To successfully generate a national debate in Spain – one of the tasks it has been set – the AEISIA will draw up an annual work plan scheduling different sector-specific and specialised discussion fora organised by key AI topics, such as the labour market, AI's impact on the education system or on medicine, or even the updating of current legislation on intellectual property rights or competition law. It will collaborate with the leading bodies in these areas to do so.

Sector-specific and horizontal reports on conclusions or guides will be published following the discussions held to prompt in-depth analyses of trends and challenges, social, economic, ethical and legal impacts, and the opportunities for innovation, economic growth and competitiveness.

The reports and guides will be regularly updated with new developments and will inform future discussions in different government ministries, Autonomous Communities or other bodies, associations or entities by providing an overview of how AI is being developed and applied in various sectors. This will open the door to a more informed dialogue between decision-makers, technology experts and the general public.

The discussions will involve scientists, subject experts, technology specialists, philosophers, policy-makers and society as a whole, so that decisions on the future of AI are made in an informed and open manner, prioritising human wellbeing, responsible progress and global safety.

In addition, the AESIA will take a forward-looking approach so as to identify best practices and the emerging risks in AI development, including those arising from the combination of different technologies with AI, as well as areas where regulation and policies may need to be adapted to address new challenges and opportunities. This foresight will also help companies and organisations keep in step with the latest trends in AI while promoting the application of ethical, responsibility and safety principles in the development of products and services.

In conclusion, the AESIA will be responsible for constructing a wide-ranging debate in a process engaging the whole of society and encompassing all production sectors in Spain. That process will lay the foundations for the definition of a clear framework on AI governance, building on what has been achieved so far with the AI Regulation and drawing clear boundaries between what can be assigned to machines and what has to be reserved for humans. As a result, the AESIA will eventually become the leading think tank on this cutting-edge technology, i.e. the “Intelligence on Artificial Intelligence”.



Initiative 8.2.

Oversight of responsible and innovative deployment of IA

With the creation of the AESIA, Spain has become the first EU country to have an institution of this kind – in anticipation of the entry into force of the European Regulation on Artificial Intelligence – to ensure that the development and application of AI is responsible and beneficial to society as a whole.

The Agency should therefore develop the capacity for oversight of high-risk AI systems to ensure compliance, and more specifically supervision, and wherever appropriate, sanctions, as required by the European regulation.

As part of its supervisory remit, the AESIA will be the market surveillance authority and single point of contact in Spain responsible for the conformity assessment of high-risk AI systems, as well as for coordination, synergies and compliance with EU legislation by all industry-specific market surveillance authorities whose systems and procedures will be impacted and require updating.

AESIA will actively collaborate in the setting of high standards for the assessment of AI systems at both European and national level in the corresponding standardisation bodies, taking into account the demands of SMEs and start-ups. It will also actively contribute to the creation of codes of conduct and best practices to be negotiated at national and European level. This will be useful in furthering compliance with the transparency obligations of both non-high risk AI systems and general-purpose AI models. The Codes will be used to promote transparent, open and trustworthy models. In particular, the AESIA will ensure that the foundation models in Spanish and the co-official languages described in Lever 3 of this plan meet the highest standards of transparency and reliability.

The AESIA will also be responsible for implementing innovation promotion measures such as regulatory sandboxes to support responsible innovation – especially in SMEs and start-ups – or the approval and supervision of real-world testing plans for high-risk AI systems. The scope of this competence will also involve the AESIA supporting the development and use of AI systems of all kinds, collaborating in initiatives led by other public sector entities, as well as fostering public-private collaboration in AI.

In its pursuit of the development and deployment of responsible, safe and ethical AI, the AESIA will propose processes to demonstrate the quality, transparency and safety of those AI systems that are not deemed high-risk systems under the EU Regulation. Those processes may also be extended to providers of general-purpose or foundation AI models. In addition, the AESIA will be responsible for validating the transparency and reliability of all AI systems that are developed on the basis of the LLM referred to in Pillar 1 of this strategy document, as well as specialised small models to be used by public sector bodies.

Lastly, in line with the provisions of Royal Decree 729/2023, the AESIA's mandate will also cover the promotion of responsible, sustainable and trustworthy use of AI, a task that includes setting up an advisory mechanism to analyse and verify the development and safe and trustworthy implementation of AI-based technologies.



Initiative 8.3. The AESIA as an international reference in artificial intelligence

Thanks to the work it will do to build knowledge and consensus and its competences for oversight and implementation of current legislation on AI, the AESIA will become an international reference institution. It will contribute to the different international and European discussions and thinking processes on AI governance or on future collaboration options, public policies and international relations in the field of AI.

The AESIA will also represent Spain on the AI Committee that will lead EU coordination on AI supervision with the support of the European Commission through its AI Office. As the Spanish representative, the AESIA will not only report on its supervisory and innovation promotion functions, but will also contribute to the definition of codes of best practices for general-purpose AI models, the production of standards and implementing acts for the Regulation, such as the definition of the characteristics of regulatory sandboxes, or the exchange of information and alerts on the oversight work done in the different EU Member States.

The AESIA will also participate on behalf of Spain in international meetings to back the consensus on AI governance, e.g. within the United Nations, supporting the work of the UN High-Level Panel on AI. It will advocate the production of guidelines for the implementation of the Ethical AI Principles in the G20 so that Spain can successfully position a responsible standard on AI implementation, supporting the Brazilian Presidency in its annual priorities and also future presidencies and contributing its knowledge and experience in the revision of the Recommendation on the OECD's ethical Principles on AI, as well as their subsequent implementation.

The AESIA will have a special focus on Latin America, to make its knowledge on AI and assets, such as the LLM available to that region within the framework of the European Union-Latin America and the Caribbean (EU-LAC) Digital Alliance and through bilateral relations with the leading countries in AI in that part of the world.

In addition, AESIA will take forward Spain's commitment to achieving regulatory convergence of AI policy and regulation, building on the Madrid Declaration announced at the 4th Assembly of the European Artificial Intelligence Alliance in November 2023.

Monitoring of the strategy and governance model

This Strategy, which incorporates specific milestones and objectives for the next two years as shown in Table 6, will be coordinated by the Secretary of State for Digitalisation and Artificial Intelligence. Given the rapid pace of development of AI and the need to move forward swiftly with the different strategic lines of action, the Strategy will be monitored in different dimensions with the institutions involved in each one.

On the one hand, to monitor the deployment of the public infrastructure of language models, as explained in Lever 3 of Pillar 1, a collaboration agreement will be signed with the entities mentioned in that section under which a monitoring committee will be set up to steer the different stages of deployment of the family of ALIA models.

On the other hand, given the cross-cutting nature of artificial intelligence, and especially of the 2024 Artificial Intelligence Strategy, all government ministries will have to play a part in its implementation and be informed of the progress made.

The Interministerial Commission for the coordination and monitoring of measures to drive connectivity and digitalisation of the economy and society within the scope of the State General Administration has been set up recently for that purpose. Chaired by the Secretary of State for Digitalisation and Artificial Intelligence, this commission will report on and monitor the different phases of the measures making up the Strategy.

Lastly, as indicated in Lever 5, the State General Administration cannot remain on the sidelines of today's AI revolution; it needs to embed AI technology into its day-to-day operations. Therefore, to detect, select and deploy use cases in which there are clear benefits for better public services, and to make the administration more efficient and effective, the ICT Strategy Commission (the highest-level ICT governance body in the State General Administration with representation from all government ministries) will meet every six months.

The format for collaboration with the Autonomous Communities will be the Sectoral Conference for Digital Transformation. An annual status report on the 2024 Artificial Intelligence Strategy will be submitted to the Council of Ministers.





Table 6. 2024 Artificial Intelligence Strategy: Milestones and Timelines

Initiatives	Milestone	Target date	Funds 2024-2025
Lever 1: Boost investment in supercomputing			
1.1 Boost supercomputing in AI	MareNostrum 5 upgrade to + 450 Pflops of capacity	End of 2025	55–90 M€ (C 16 PRTR)
1.2. Supercomputing services for industry	Make 20% of supercomputing capacity available for industrial use	End of 2025	
1.3. Build up the Spanish Supercomputing Network	Strengthen governance and network resources	End of 2024	5 M€ (C 16 PRTR)
Lever 2: Generate storage capacities with sustainability			
2.1. Sustainable data processing centres	Transposition of the Energy Efficiency Directive and a national strategy	End of 2024	
2.2. Planning and management in the installation of DPCs	Development of a framework for the management and planning of data processing centres	End of 2024	
2.3. Sustainable AI seal and ecosystem	Design an industry quality accreditation in sustainable AI	End of 2025	
Leverage 3: Generate models and corpora for public infrastructure in language models.			
3.1. Development of high-quality corpora	Build the largest data repository (4 billion words minimum) for model training in Spanish and co-official languages	End of 2025	3.4 M€ (C 16 PRTR)
3.2. Development of foundation models in Spanish and co-official languages	Availability of a family of foundation models in Spanish and co-official languages	First model in summer 2024	2.2 M€ (C 16 PRTR)
3.3. Generate specialised or task-specific language models	First models in specific sectors	End of 2024	3 M€ (C 16 PRTR)
3.4. Infrastructure and processes for language model evaluation	Design of publicly available public platform for model evaluation	End of 2025	1.5 M€ (C 16 PRTR)
Lever 4: Foster talent in AI			
4.1. Institutionalisation and reinforcement of ongoing AI projects	Create a network of AI initiatives in different sectors	End of 2025	300 M€* (ERDF funds) shared with line 6.3
4.2. Promoting AI skills	Development of a grants programme to foster AI talent	End of 2025	150 M€ (C 19 PRTR)
	Excellent AI Call		10 M€ (C 16 PRTR)

Initiatives	Milestone	Target date	Funds 2024-2025
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Lever 5: Boost AI in the public sector

5.1. Use case incubator for the AGE	Creation of an AI innovation lab to develop solutions	Fin de 2024	21 M€ (C 13 PRTR)
5.2. Common services based on AI models in the AGE	Creation of a hub for centralized AI technology services	Fin de 2025	
5.3. AGE data common governance	Development of a common data governance model	Fin de 2025	

Lever 6: Help the expansion of AI in the private sector, particularly in SMEs

6.1. Incorporate AI into SME processes	Programmes for boosting and adopting AI in SMEs	End of 2024	350 M€ digital kit + 300 M€ consulting kit (C 13 PRTR, maximum)
6.2. Develop the AI entrepreneurial ecosystem	Next Tech investments focused on AI	Mid- 2026	400 M€ (Next Tech fund)
6.3. Specific-purpose model training secure infrastructure	Design of a comprehensive programme of support, services and incentives for start-ups in language models	End of 2025	10 M€ (C 16 PRTR) and 300 M€* (ERDF funds, shared with line 4.1.)

Lever 7: Develop a cybersecurity framework

7.1. Draft a cybersecurity law	Adoption of the law	End of 2024
7.2. Build up the corporate cybersecurity ecosystem with AI	Investments in strengthening corporate cybersecurity	End of 2025

Lever 8: Develop the AESIA's functions

8.1. Creation of an AI intelligence think & do tank	AESIA operational	End of 2024
8.2. Oversight of responsible and innovative deployment of AI		End of 2024
8.3. The AESIA as an international reference in artificial intelligence		End of 2024

List of terms and acronyms

AESIA	Spanish Agency for the Supervision of Artificial Intelligence (Agencia Española de Supervisión de la Inteligencia Artificial)
AGE	State General Administration (Administración General del Estado)
AI	Artificial intelligence
AI Act	European Regulation on Artificial Intelligence
AI Office	EU Artificial Intelligence Office
ALT-EDIC	Alliance for Language Technologies-European Digital Infrastructure Consortia
ANECA	National Quality Evaluation and Accreditation Agency (Agencia Nacional de Evaluación de la Calidad y Acreditación)
BI	Business intelligence
BSC-CNS	Barcelona Supercomputing Centre – Centro Nacional de Supercomputación
CPU	Central processing unit
CSIC	Higher Council for Scientific Research (Consejo Superior de Investigaciones Científicas)
DPC	Data Processing Centre
ENIA	National Strategy on Artificial Intelligence (Estrategia Nacional de Inteligencia Artificial)
ES	Spain
EU	European Union
EU-LAC	European Union-Latin America and Caribbean
EuroHPC JU	European High-Performance Computing Joint Undertaking
GPAI	General-purpose artificial intelligence
GPU	Graphics processing unit
HPC	High-performance computing
ICT	Information and communication technologies
INCIBE	National Cybersecurity Institute (Instituto Nacional de Ciberseguridad)
IEA	International Energy Agency
JRC	Joint Research Centre
LLM	Large language model
LT	Language technology
OECD	Organisation for Economic Cooperation and Development
PA	Public Administration
PERTE	Strategic Project for Economic Recovery and Transformation (Proyecto Estratégico para la Recuperación y Transformación Económica)
PNTL	Language Technologies National Plan (Plan Nacional de Tecnologías del Lenguaje)
PRACE	Partnership for Advanced Computing in Europe
PRTR	Recovery, Transformation and Resilience Plan (Plan de Recuperación, Transformación y Resiliencia)
PUE	Power Usage Effectiveness
R&D&I	Research, development and innovation
RAE	Spanish Royal Academy (Real Academia Española)
RDL	Royal Decree-Law (Real Decreto-Ley)
RES	Spanish Supercomputing Network (Red Española de Supercomputación)
RETECH	Territorial Networks of Technological Specialisation (Redes Territoriales de Especialización Tecnológica)
SLM	Small language model
SMEs	Small and Medium-sized enterprises
UNESCO	United Nations Educational, Scientific and Cultural Organization
WUE	Water Usage Effectiveness

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