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BridgeAI: Boosting Regulatory Implementation with Data-driven insights, Global expertise, and Ethics for AI

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Executive Summary

Problem

Regulation (EU) 2024/1689 (hereinafter the “AI Act”, “AIA” or the “Act”) entered into force in August 2024 with a phased implementation timeline, designed to give stakeholders time to adapt. The Portuguese government, industry players, civil society, and citizens need to understand this Regulation and how it will impact them nationally and internationally, as its full implementation approaches in 2027. Several challenges have arisen in preparing for and implementing the AI Act:

- Europe is taking a leading role in AI regulation while striving to foster innovation.
- For the first time in human History, machines are generating content, which may cause harm. These developments require new ethical and moral frameworks and are reshaping labor processes across sectors, such as health and education, which remain underexplored.
- Decision-making services made by AI have benefits, but also pose risks to people, emphasizing the importance of AI literacy among key players, including public administration, industry, and civil society.
- Portugal can lead internationally in innovation by creating responsible products.

Main research findings

Responsible AI (Dignum, 2019) offers potential solutions to these challenges and can help anticipate the requirements of the AI Act:

- Responsible AI supports upskilling and employee development in emerging fields (Dignum, 2019; UN Governing AI for Humanity, 2024);
- Ethical frameworks, and dynamic, adaptable, scalable, and participative governance models (AI4People, Floridi et al., 2018) enable the alignment of products with not just ethical principles but also legal standards, fostering innovation;
- Case studies across industries demonstrate how Responsible AI enables innovation, with methodologies like the OECD risk catalog informing risk assessment in specific use cases;
- Portugal can leverage current risk assessment tools (e.g., GuIA, developed by AMA/ARTE) that can be enhanced to support transversal AI risk management;
- Literacy and upskilling will be key elements, and they imply a sound assessment as a first step (DESI and Digital Decade);
- Portugal as an innovation hub can be strongly aligned with the European and international ecosystems.

Key policy alternatives/recommendations

Preparing for the AI Act requires involving key stakeholders, including public administration, industry, academia and civil society. This process should focus on ethics, law, and literacy while promoting innovation.
The recommendations were carried out by multidisciplinary teams, organized in Working Groups (WGs), are the following:

WG1 - AI risk assessment tools

Recommendation #1: Identify and prioritize most urgent AI use-cases for risk assessment
Recommendation #2: Update GuIA to become a relevant, actionable, flexible and open tool to map and measure AI risks, making it mandatory in the public procurement process (GuIA 2.0)
Recommendation #3: Centralize the AI risk assessment under one single public authority
Recommendation #4: Establish partnerships with third-party organizations

WG2 - Ethics in regulatory processes

Recommendation #1: Dynamic governance model based on AI4People
Recommendation #2: Regulatory Sandboxes aligned with ethical oversight

WG3 - AI Act interface and implementation

Recommendation #1: Upgrade Public-Sector Training Policies and Programs
Recommendation #2: Establish a Support Network of Experts
Recommendation #3: Strengthen Cybersecurity Defense, Monitoring, and Planning
Recommendation #4: Upgrade and Harmonise National Policy Documentation

WG4 - AI literacy & advanced training

Recommendation #1: Launch a National AI Literacy Campaign, adapted to different societal groups
Recommendation #2: Drive Public-Private Partnerships and Governmental Support
Recommendation #3: Evaluate Portugal's level of AI literacy through a national survey

WG5 - Regulatory efforts outside the EU

Recommendation #1: Establish Portugal as a Regional Sandbox Coordination Hub
Recommendation #2: Leverage Cross-Border Mandate Strategically
Recommendation #3: Devise dedicated platforms that facilitate the licensing of protected works for AI training

Recipients

Minister in the Cabinet of the Prime Minister and State Reform, Agência para a Reforma Tecnológica do Estado, IP (ARTE, formerly AMA), Minister of Youth and Modernization, Minister of Education, Minister of Economy, Cybersecurity National Center, National Authority for Communications (ANACOM).

WG1 – AI risk assessment tools

Regulation (EU) 2024/1689 introduces a risk-based framework that defines different levels of risk according to the specific uses of AI systems (EC), prohibiting unacceptable risk applications of AI, and introducing strict obligations for high-risk AI systems. Despite being a flexible approach, allowing regulation to adapt to technological evolution, the AI Act is not easily applicable, as it leaves many concepts open for interpretation, and many more to be complemented and operationalized by harmonized standards (that are still being drafted).

Based on the analysis of concrete case studies from several industry partners (Priberam, Sword Health, Unbabel, and Youverse) with differentiated areas and different levels of risk assessment, ranging from health applications to biometrics, the WG1 team has established a methodology to assess risks aligned with innovation.

Moreover, strongly aligned with the Administrative Modernization Agency (AMA), now called ARTE, the team tested the viability of using GuIA, a tool to assess ethical risks, for a transversal usage of the tool for public and private services.

Based on the multidisciplinary assessment conducted (involving all the WGs), it was also determined that, to properly assess risks and balance those with innovation, an ecosystem of excelling experts is needed, which is already available in Portugal.

From case studies analyses, it was made clear that a one-size-fits-all approach to AI risk assessment is inadequate, as different applications require different levels of scrutiny, evaluation and mitigation mechanisms.

To navigate the complexities of AI risk assessment and governance, Portugal must prioritize practical, scalable, and forward-thinking strategies. Identifying the most urgent AI use cases, updating GuIA into a dynamic and actionable risk assessment tool, centralizing AI risk governance, and fostering public-private collaborations are essential steps. These measures will not only enhance the responsible adoption of AI in public administration but also position Portugal as a leader in AI innovation and regulatory implementation.

By embracing a structured and collaborative approach, Portugal can ensure that AI serves the public interest, strengthens institutional capacity, and contributes to economic growth – ultimately transforming regulatory challenges into opportunities for responsible innovation.

WG2 – Ethics in Regulatory Processes

The slow development of ethical norms and their eventual formalization into binding frameworks is at odds with rapidly evolving technologies. This is especially the case concerning AI, which is characterized by exponential growth and adoption by the general public, public offices, or industry. Due to this rapid evolution and the ability of AI systems to develop emerging capabilities (Bommasani et al., 2021), i.e., capabilities that are not expected based on their initial training, the risks or challenges they may pose are often unpredictable. By contrast, classical ethical frameworks and guidelines propose a static, top-down governance model that promotes the application of a fixed set of rules to a large spectrum of phenomena. Top-down models rely on the enforcement of a pre-established set of norms - often as a "one-fits-all" solution - by a centralized authority. Such "one-fits-all" solutions however have long been argued to be inefficient in dealing with complex phenomena or with local requirements and conditions (Homsy et al., 2019). Bottom-up approaches have commonly been proposed as alternatives to top-down models, whereby decentralized actors - individuals, associations, or commercial institutions - can choose to self-regulate by developing their own set of ethical guidelines. Nevertheless, bottom-up approaches are exposed to difficulties such as incompatibility with national or international regulations, or lack of recognition or adoption. Static top-down governance models cannot keep up with the rapid development of AI nor with any emergent risks it may pose, while bottom-up approaches risk having no institutional support or long-term impact (Floridi, 2019).

WG2 proposes a governance model that is adaptable to emerging issues, encourages bottom-up participation for easier identification of emergent issues, and is scalable to address the broad implementation of AI systems. Following existing work in the field - mainly by the AI4People group (Floridi et al., 2018; Pagallo et al., 2019) - we propose a multilevel governance system that: a) addresses in a first step immediate challenges and risks concerning high-priority essential rights and values, (e.g., human dignity, integrity, and privacy), which are to be upheld in any case of AI development; b) encourages bottom-up contributions from civil, commercial, and scientific bodies based on post-market data, algorithmic, and impact assessments; c) implements coordination mechanisms that allow the mutually informing dialogue between governing and civil, commercial, or scientific bodies through which existing legislation can be updated to meet the emerging requirements of AI development and implementation. The outlined governance model has been informed by existing and possibly emerging challenges that AI systems may pose, identified in a careful analysis of case studies from the industry partners undergone by WG2.

The AI Act's support for regulatory sandboxes is pivotal for balancing innovation with ethical oversight. Sandboxes enable iterative improvement, legal compliance, and societal safeguards, fostering innovation while minimizing unintended harm. We recommend that sandboxes are implemented with embedded ethical and legal consulting services that aid developers cover loose ends they might have overseen. Such services could potentially incentivize developers, especially those underprivileged, to opt for ethically aware designs and consequentially foster fair and responsible innovation.

A holistic, adaptive approach integrating ethical foresight, contextual sensitivity, and stakeholder engagement is essential for realizing AI's potential while mitigating its risks.

WG3 – AI Act interface e implementation

The European Union's Artificial Intelligence Act - Regulation (EU) 2024/1689 on Artificial Intelligence - is the global benchmark for responsible AI governance, demanding immediate and profound institutional reform at the national level. As we move into the final quarter of 2025, the Portuguese Public Administration (AP) is already operating under key provisions of this landmark Regulation. The central objective of this report is to map the path toward full national compliance, ensuring that our commitment to fostering innovation is rigorously balanced by the constitutional imperative to safeguard fundamental rights and maintain administrative integrity. The governance of AI is not merely a technical concern; it is a political priority that requires strategic legislative action, dedicated resources, and decisive leadership.

As described in the UN Governing AI for Humanity (2024), legislation on AI is a globally coordinated effort. The EU seems to be playing a solo part on this, but the EU AI Act is a strong and needed statement that has been followed by global efforts. Despite global differences (tackled in WG5), it sets the motto for several global efforts and coordinated strategies. Therefore, our recommendations are aligned with global best practices, allowing public administrations (and industries) to move towards alignment on Responsible AI policies.

Portugal has also been a pioneer in several aspects of AI governance and digital public policy. In 2019, it became one of the first EU Member States to publish an official ethical framework for AI in the public sector — the *GuIA para uma Inteligência Artificial Ética, Transparente e Responsável na Administração Pública*, developed by the Agência para a Modernização Administrativa (AMA). This document anticipated many of the AI Act's core principles like responsibility, transparency, explainability, fairness, and ethics and positioned Portugal among the earliest European countries to translate abstract ethical commitments into administrative practice. In parallel, the *Zonas Livres Tecnológicas* (ZLTs), created under Decree-Law 62/2021, established one of Europe's first legal mechanisms for real-world testing of emerging technologies under supervised, legally secure conditions. At the research and coordination level, Portugal has played a leading role in EU-funded projects such as the *AI4PublicPolicy*, focused on risk management, capacity building, and responsible deployment of AI systems in the public sector. The country also hosts one of the most advanced cybersecurity frameworks in Southern Europe through the *Centro Nacional de Cibersegurança (CNCS)*, which has already integrated AI risk considerations into its monitoring, training, and national resilience programmes. These early initiatives demonstrate that Portugal has not merely followed European trends but helped shape them, providing a solid foundation to move from normative leadership to operational excellence under the EU AI Act.

Across the world, governments are moving from abstract principles to operational governance of artificial intelligence. The United States, through its NIST AI Risk Management Framework and the newly created AI Safety Institute, has begun to institutionalise red teaming and adversarial testing for frontier models, requiring both private developers and public agencies to perform structured robustness assessments before deployment. The United Kingdom followed a similar path: its AI Safety Institute and the cross-departmental "Red Team Network" are now running continuous evaluations of large-scale models for bias, security, and misuse, with results feeding directly into procurement and certification schemes. France, Germany, and the Netherlands are developing comparable structures inside their national digital agencies, integrating AI testing cells into existing cybersecurity frameworks. Singapore and Canada have gone further by embedding AI assurance toolkits into public procurement contracts, making suppliers legally responsible for demonstrating compliance through traceability, robustness, and ethical-impact documentation.

These experiences show a convergence toward three complementary mechanisms that can be developed in Portugal in view of a full and effective implementation of the European Union's Artificial Intelligence Act.

First, continuous adversarial testing, or red teaming, is becoming a standard international safeguard. It combines ethical hacking and stress-testing of algorithms to identify hidden vulnerabilities, biases, and risks of manipulation. In the U.S. and U.K., such exercises are conducted jointly by AI and cybersecurity teams, under coordinated oversight by national agencies. Portugal can replicate this model by establishing a joint programme between ANACOM and the Centro Nacional de Cibersegurança (CNCS), integrating red teaming into the governance of high-risk and general-purpose AI systems used in the Public Administration. The outcomes of these exercises should feed directly into the risk-management and post-market monitoring obligations foreseen in the AI Act and the NIS2 Directive, turning compliance into proactive resilience.

Second, most leading jurisdictions are creating permanent expert networks to sustain capacity. France's "Comité de l'Intelligence Artificielle de Confiance", Canada's "AI Advisory Council", and Singapore's "Model AI Governance Framework Working Group" all gather specialists from administration, academia, and the private sector to provide technical guidance to regulators and deployers. Portugal can adopt a similar model by forming a transversal network of national experts under the coordination of ANACOM and CNCS, providing agile support to competent authorities and public entities. This network should issue practical guidance, organise technical workshops, and maintain a living repository of best practices accessible to all levels of government.

Third, international best practice points to the need for harmonised and operational policy documentation. The United Kingdom's "Algorithmic Transparency Recording Standard", Canada's "Directive on Automated Decision-Making", and Singapore's "AI Verify" toolkit translate broad ethical principles into daily administrative procedures, templates, and checklists. Portugal can follow this path by reviewing existing documents, such as the AMA's *GuIA para uma Inteligência Artificial Ética, Transparente e Responsável*, and merging them into a single compliance playbook. This should clarify responsibilities among ANACOM, CNCS, and the various sectoral regulators identified under Article 77 of the AI Act, while providing model clauses for procurement, datasets, and human-oversight procedures.

By integrating these tested international practices, red teaming as a standard safeguard, expert networks as a continuous learning structure, and harmonised policy toolkits as instruments of legal clarity, Portugal can accelerate its implementation of the AI Act and position itself among the leading European jurisdictions in responsible AI governance. This approach transforms compliance into confidence: ensuring that every AI system deployed or supervised by the State is not only lawful, but trustworthy, explainable, and secure.

WG4 – AI literacy & advanced training

The rapid development and adoption of AI technologies pose both opportunities and challenges. On one hand, AI can boost economic growth, drive innovation, and streamline services in various fields. On the other hand, without equitable access to AI competencies, this technological shift may exacerbate existing inequalities and expose societies to a broader range of risks. One way to address these issues is by promoting AI literacy and advanced training.

AI literacy and advanced training carry different meanings for each target audience. For example, for students (basic and secondary, universities, technical and professional schools), it means understanding fundamental principles, technical aspects, and applications. For politicians and decision makers, besides

fundamental principles, it should encompass the applications in various sectors (e.g., public administration, media, health, security, military, etc.), relevant existing regulations, other legal models in place, and risks for individuals, populations, and systems.

Considering that a significant amount of work has already been done, at both international and national levels, as well as by private and public institutions, it would be wise to build on these efforts rather than start from scratch, ensuring that all the initiatives move in the same direction and collectively contribute to the country's AI literacy and advanced training.

Finally, at the moment, there is no qualitative perception of the state of AI literacy in Portugal, which would be fundamental to understand the success (or failure) of these training efforts.

When launching a national AI literacy campaign tailored to different end users, it is essential to address both formal and informal educational avenues, ensuring comprehensive engagement with diverse audiences. Such strategies are:

i) Formal Education: Integrate AI literacy into the national curriculum at all educational levels, leveraging ongoing initiatives such as those by Academia ubbu and DGE. Promote active learning methodologies, including problem-based learning, as successfully implemented, for instance, by IEFP and ANQEP.

ii) Informal Education: Extend AI literacy to the general public through targeted public campaigns using social media, television, and radio to highlight AI's impacts and opportunities; collaborate with museums, libraries, and media outlets to create accessible, engaging educational materials about AI. Empower non-governmental organizations (NGOs) and community organizations to lead initiatives aimed at increasing public familiarity with AI, with a focus on rural and underrepresented areas to ensure equitable access to resources.
To drive the AI literacy initiative, Portugal could develop partnerships between government agencies, private industry, and NGOs, whose efforts would: encourage private sector investment in non-product-specific AI literacy programs, especially from companies with a strong presence in Portugal (e.g., technology, finance, and healthcare sectors); leverage EU funding for digital transformation to support AI literacy projects; target the creation of a centralized platform where individuals and organizations can access AI literacy resources (such as MLU-explAIn), including digital tools, educational programs (as pix), and training sessions in Portuguese (e.g. MILObs, LEME); programs to promote exchange between professionals from various areas in society and AI specialists. In this way, the identification of technological tools for resolving specific professional challenges would be more easily promoted and facilitated (e.g. Pólos de Inovação Digital).

From the 2024/2025 Digital Economy and Society Index (DESI) indicators and the Digital Decade Country Report 2024, there is a clear focus on AI usage in the business context. However, a significant gap exists in terms of AI literacy metrics. Therefore, conducting a national survey to evaluate Portugal's level of AI literacy would be a key step. Such an effort would allow us to obtain AI literacy metrics covering educational, social, and regional sectors.

Although an initial survey would help guide the efforts for the herein proposed recommendations, this should be a continued effort to evaluate the effectiveness of policies' implementation and of the previous recommended AI literacy campaign. Work carried out by INCoDe or AMA (now called Agência para a Reforma Tecnológica do Estado) could serve as a foundation for this effort.

WG5 – Regulatory efforts outsides the EU

AI regulation has become a global priority. Although approaches differ significantly between jurisdictions, comparative analysis reveals recurring concerns: the need to reconcile innovation with safety, accountability, and respect for fundamental rights. Regulatory frameworks are indispensable for public trust but can also raise compliance costs and slow experimentation. How each legal system manages this tension depends on its constitutional culture—its tolerance for risk, its institutional design, and its conception of the public interest.

The United Kingdom, United States, and Japan follow decentralised, sector-specific and largely soft-law models, while the European Union applies a horizontal, legally binding approach grounded in conformity assessment and fundamental-rights guarantees. For European policymakers, the challenge is to maintain high standards of protection while creating conditions that encourage technological leadership and responsible innovation.

According to the *2025 AI Index Report* of Stanford University, governments worldwide are dramatically increasing both AI regulation and public investment, yet global coordination remains fragmented. Portugal can position itself as a Southern European reference point for responsible and ethical AI implementation by focusing on transparency, safety, and cross-border collaboration. To achieve this, Portugal should establish clear oversight structures for its national AI sandbox and embed ethical and human-rights safeguards as the foundation of its experimental framework.

The sandbox should not be a space for deregulation but a structured environment where innovation is tested under supervision, with built-in mechanisms for risk mitigation, explainability, and citizen protection. Each participating project should demonstrate compliance with principles of fairness, accountability, and transparency, supported by documented risk-management and red-teaming plans. A dedicated ethics committee, integrating representatives from the public sector, academia, and civil society, could oversee all sandbox activities to ensure that experimentation aligns with constitutional and fundamental-rights obligations.

In parallel, Portugal should strengthen international cooperation. Collaboration with Spain remains an important option, but equivalent or broader partnerships could also be developed with France, Canada, Singapore, or Japan, countries that have established internationally recognised AI sandboxes integrating ethical-by-design principles and transparency requirements. Portugal could therefore position itself not only within a European network of interoperable testing environments coordinated by the European AI Office, but as a Southern European gateway to global experimentation frameworks. By aligning with initiatives such as Singapore's *AI Verify*, Canada's *Directive on Automated Decision-Making* sandbox, or Japan's *Regulatory Sandbox Scheme*, Portugal can ensure that lessons learned circulate beyond Europe and that ethical and human-rights standards are harmonised internationally. This outward-looking model would allow Portugal to pilot joint testing environments in priority sectors such as health, energy, defence, and public administration and to attract global research and investment focused on trustworthy and human-centric AI.

Finally, Portugal should promote responsible AI development by facilitating access to lawful, high-quality training data while protecting intellectual property and moral rights. Dedicated licensing platforms for AI training would help guarantee compliance and transparency, supporting research and development without undermining authors' rights.

In summary, Portugal's leadership should focus on three pillars: (i) ethical and rights-based sandboxes that make responsible innovation the default; (ii) international coordination through trusted European partnerships; and (iii) fair, transparent access to data that respects

creativity and legality. This approach would align the country with global best practice, strengthen public confidence, and position Portugal as a credible, forward-looking hub for trustworthy AI in Europe.

Conclusions

The Bridge AI team considers that there are three core transversal recommendations from all WGs, advisors and public discussions: ***continuity*** *of the work on AI,* ***agility*** *to implement the recommendations and adapt those to current contexts, and attracting and retaining AI* ***talent****.*

BridgeAI tested the hypothesis that by creating appropriate multi-stakeholder learning spaces, supported by technology tools that allow streamlining communication and extracting information, actionable knowledge (Cross et al., 2004; Stern et al., 2021; Jagannathan et al., 2023) can be created from real case studies and fuel the effective implementation of decision-making processes. The team:

i) showed that it is possible to achieve an enlarged consensus across the fundamental elements allowing for the most efficient implementation of regulations;

ii) proposed concrete outcomes grounded in the real case studies from industry;

iii) ran the proof-of-concept for the proposed actionable knowledge methodology that can be applied to other thematic areas relevant for public policies;

iv) contributed to the implementation of the EU AI Act in Portugal.

The sustainable implementation of the EU AI Act requires a continued dialogue between all relevant stakeholders to guarantee that policy-making and its effective implementation is able to keep up with the dynamic evolution in this technological and regulatory field.

As such, and in alignment with the vision of propelling the national economy grounded in a deep reform and digitalisation of state-related structures and workflows - as deemed of high-relevance with the creation of the Ministry for State Reform, led by Minister Matias, we would like to leave a recommendation for the continuation of these types of initiatives, including those with financial support under the scope of science for policy mechanisms, that allow the sustainable flow of actionable knowledge towards public policy making.

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