

Artificial Intelligence in Morocco: Towards Holistic, Responsible and Ethical National AI Strategy for Moroccan Competitiveness and Strategic Intelligence

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Abstract: This paper analyses current achievements and emerging landscape of artificial intelligence in Morocco. It explores also the various challenges and opportunities related to the development of an AI ecosystem that facilitates the emergence of an agile, holistic, responsible, ethical, and forward-looking national artificial intelligence strategy that supports Morocco's global competitiveness and its strategic intelligence. Based on a methodological triangulation approach, we combined a documentary approach focused on a literature reviews and international benchmarks of national AI policies and strategies. In addition, we have proposed a conceptual model that outlines the essential elements and key enablers and drivers of the national AI strategy for Morocco. We have called it "LAFBAH AI Framework" focusing on Leadership & Vision, Adaptive Governance, Forward-thinking, Breakthrough Innovations, Agility in Implementation, and Human centred approach. This model is predictive and prescriptive, and most importantly, aligned with the Moroccan priorities and strategic orientations of Morocco's New Development Model. The study's findings show that Morocco possesses strategic assets that can help it establish itself as an AI hub for Africa and bolster its leadership and digital influence. These assets mainly include the country's international commitment to AI, its participation in AI cooperation programs, a dynamic creation of institutions and university centres dedicated to AI and the start of a virtuous public and political dialogue on the subject involving the private sector, academia and civil society. Our research argues in favour of a holistic and integrated approach to AI in Morocco, which combines AI Governance with technological innovation, ethical and societal considerations to promote sustainable and inclusive development and enhance Moroccan competitiveness. It also demonstrates the urgent need to design and ensure the implementation of an innovative, adapted and integrated national AI strategy for Morocco. This national AI strategy should be designed as an integrative, agile, dynamic framework with a clear and integrated vision, ambitious strategic objectives, relevant priorities and choices and key pillars of AI such as responsible, ethical and innovative governance and strong ecosystem enablers, collaborative research and development, AI talent and skills, sufficient data and infrastructure. We have also designed the fundamental and necessary milestones for a new ecosystem of artificial intelligence in Morocco focused on the imperatives of the knowledge society, the digital, health, food and energy sovereignties of the country, while aspiring to be a hub of artificial intelligence in Africa.

Keywords: Artificial Intelligence, AI National Strategy, Competitive And Strategic Intelligence, Moroccan AI Ecosystem
Responsible AI, Ethical AI

1. Introduction

Artificial intelligence (AI) defined by John McCarthy (2007) as "the science and engineering of making intelligent machines", has become an extremely important driving force for innovation and the socio-economic development of countries, thus influencing many sectors such as healthcare, finance and energy. The exponential expansion of computing power and the greater availability of data have led to a considerable and unprecedented advancement in artificial intelligence (AI) over the past decades. These advances and innovations in AI are profoundly changing economies and societies around the world (Van Roy, V et al, 2021). Thus, AI technologies are evolving at a very accelerated pace, requiring the establishment of national strategies to guide their development and deployment in an ethical and responsible manner. This rapid development of AI requires urgent action from governments and the private sector more than ever (Bolton et al., 2021; Schmitt, 2022).

The OECD Principles for Trustworthy AI, initially adopted in 2019 and updated in May 2024, establish a unifying framework for developing trustworthy AI systems (OECD, 2024). These principles provide safeguards for different AI stakeholders to ensure that AI technologies adhere to values such as inclusive growth, sustainable development and well-being, human rights and democratic values, including fairness and privacy, transparency and explainability, robustness, security and safety, accountability (OECD, 2024). Additionally, the OECD made recommendations for policymakers, including: investing in AI research and development, fostering an inclusive ecosystem enabling AI, shaping governance and a supportive interoperable policy environment to AI, strengthening human capabilities and preparing the transition to the labour market and international cooperation for trustworthy AI (OECD, 2024).

According to the OECD Framework for the Classification of AI Systems, AI systems have the potential to transform various aspects of society, ranging from education and work to social interactions and daily life (OECD, 2022). Stakeholders impacted by AI systems directly or indirectly, and consciously or unconsciously by the AI system may include workers, Workers/employees, Consumers, Business, Government agencies/regulators, Scientists/researchers, Children or other vulnerable or marginalized groups (OECD, 2022).

Galindo, L., K. Perset and F. Sheeka (2021) state that “the development of national policies and strategies focusing specifically on AI is a relatively new phenomenon”. The World Bank (2021) emphasizes the importance of a multi-stakeholder approach in shaping national AI strategies, where governments, private sectors, civil society, academia, and international organizations all contribute to policymaking and strategy implementation. National AI strategies, as outlined by The World Bank (2021), target a variety of sub-goals, which can be categorized into eight distinct policy domains to accelerate AI development and adoption. These domains, influenced by various tools and instruments, are as follows: (1) scientific research, (2) AI talent development, (3) entrepreneurial ecosystem, (4) standards for ethical AI, (5) data access, (6) AI adoption in the public sector, (7) strategic sectoral targeting of AI, and (8) building capabilities for AI governance. The World Bank (2021) outlines six essential tools and instruments for implementing national AI strategies, encompassing legal and regulatory reforms, expansion of public services and programs, soft law and industry self-regulation, multi-stakeholder partnerships, new centres and collaborations, and strategic investments and funding.

In this context, several governments are working to regulate and foster AI innovation and striving to integrate this technology into public services (Oxford Insights, 2023) and in national research ecosystems (International Science Council, 2024). Among the countries seeking to find a place in the world of AI is Morocco which occupies 88th place in the world rankings in the Government AI Readiness Index 2023 (Oxford Insights, 2023) and It is among the countries with AI Strategies in Development (Nestor Maslej, et al., 2024). Like many countries, Morocco recognizes the strategic importance of AI for its economic and social development. The country has taken many initiatives to promote AI, such as specialized training programs in universities, support for research and development, and the establishment of international partnerships to enhance its capabilities in this area.

The Moroccan Special Commission on the Development Model (SCDM) considers that “Digital technology is a real lever for change and development. It should be given special attention at the highest level of the State as a driving force for structural and high-impact transformations” (SCDM, 2021).

The SCDM has called for making “digital technology and technological capabilities a key factor in competitiveness, business modernization and the development of new professions and sectors in step with global transformations” (SCDM, 2021). It emphasized in this context that robotics, automation, and artificial intelligence (AI) technologies will play a pivotal role in reducing human intervention in many economic sectors. This shows the crucial importance of the development of human capital and innovation and their central place in Morocco's New Development Model which places them at the heart of its development priorities, thus accelerating its transition to a technology-driven economy. . As the SCDM specifies “The overall competitiveness of the country will essentially depend on the quality of its human capital” (SCDM, 2021).

Taking into account all these AI global tendencies and Moroccan particularities, this paper aims to answer the following central question: To what extent can Morocco implement a national AI strategy that is integrated, holistic, responsible, and ethical, thereby enhancing its competitiveness, strengthening its strategic intelligence, and positioning itself as an African AI hub?

To achieve this, we noted Morocco's main achievements in the field of AI by highlighting its strengths and its various potentials, then we identified the major challenges and opportunities. The results of our research argue in favour of the establishment of a national AI strategy, that we have designed via our own Framework which we have called “LAFBAH AI Framework” that summarizes the main objectives, the approach to follow, the key factors of success and above all the priority levers for the development of a Moroccan ecosystem of augmented artificial intelligence, contextualized and adapted to the specificities of the country. It is an agile Framework, driven by the creation of meaning, centred on humans, values, ethics with a prospective perspective, an African focus open to global trends, and above all constantly monitoring to strengthen Morocco's competitiveness and its strategic intelligence in line with the strategic foundations of its New Development Model.

2. Theoretical Framework and Research Methodology

2.1 Theoretical Framework

We have mobilized the theoretical framework of technological governance and national strategy by focusing on the work of Castells (1996) and Bell (1973) on the dynamics of the information society and the governance of technologies, while concentrating in particular on aspects related to public policies for digital transformation and artificial intelligence (AI). We also relied on the stakeholder theory of Freeman (1984) by dissecting the main actors of the AI ecosystem in Morocco and their main achievements in this area. Also, we mobilized the concepts of competitiveness and national strategy developed by Porter (1990).

2.2 Research Methodology

To conduct our research, we used a triangular methodological approach combining a systematic review of the literature with a targeted analysis and a special focus on national artificial intelligence (AI) strategies and policies of pioneering countries in the field of AI. To achieve this, we reviewed relevant academic work, think tank reports, and government documents, while conducting in-depth interviews with experts and professionals in the field since May 31, 2023, the date of the first edition of Gitex Africa Morocco 2023 held in Marrakech in which we participated. We also carried out benchmarking of national AI strategies, highlighting good practices and lessons learned in other countries. This multidimensional approach allows us to understand the different approaches nations take to AI governance and identify the most effective strategies for strengthening national competitiveness in this rapidly evolving area. Finally, this approach allowed us to develop our own conceptual model that is both descriptive and prescriptive to guide the formulation of national AI policies and strategies.

3. Main Achievements and Assets of AI in Morocco

Mapping the key actors of AI ecosystem in Morocco allowed us to identify the major players and characterize the nature and multiplicity of actions and initiatives related to AI. Thus, several achievements and efforts made by ministries, constitutional governance bodies, universities, schools and research centres, the private sector, think tanks and the civil society. Our diagnosis shows that Morocco has a conducive and favourable environment for the emergence of an ambitious and global vision for the implementation of an AI ecosystem. The country has several assets of various natures capable of positioning it as an African AI hub and strengthening its leadership and digital influence. These points of strength also predispose it to play a growing role in the global dynamics relating to the AI industry, including a political will emanating from the highest authority of the State to develop the digitalization and digital transformation of the Moroccan economy and society as a whole and Morocco's commitment to good global governance of AI.

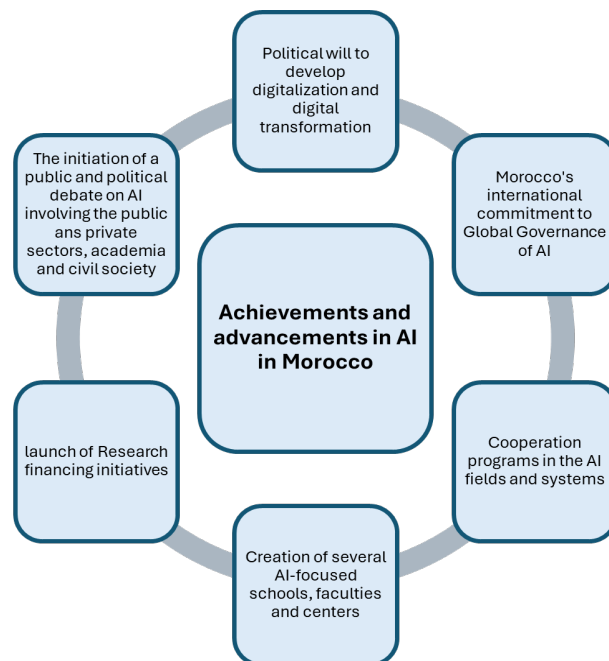


Figure 1: Accomplishments and advancements in AI in Morocco

This international commitment appears obviously in two major initiatives that are revealing and structuring the global AI ecosystem. The first concerns the UN resolution, initially co-sponsored by the United States and Morocco and ultimately supported by 120 countries, on Artificial Intelligence adopted on March 21, 2024, by the General Assembly of the United Nations calling to regulate Artificial Intelligence.

In addition to promoting "safe, secure, and trustworthy" artificial intelligence (AI) systems that will also benefit sustainable development for all, this historic agreement on AI seeks to provide safeguards by establishing international rules intended to govern the uses of AI (United Nations, 2024). The second is the Morocco's official adherence to the UNESCO Recommendation on the ethics of AI and its choice to implement this Recommendation, which includes Morocco in international debates on AI ethics.

Other structuring assets that can facilitate the implementation of a national AI strategy with an international connection and African influence such as close collaboration with international organizations namely the UN, UNESCO, World Bank, ADB on themes related to digital transformation, AI and emerging technologies. In addition, several international cooperation programs with donors, multinationals and large technology groups have been launched focusing on the development of AI, skills training and the development of research and development in AI and disruptive technologies.

Furthermore, it should be emphasized that Morocco has strengths relating in particular to connectivity, access to data, cybersecurity, and the protection of personal data, which we consider to be fundamental and structuring foundations of any AI ecosystem efficient. Also, the notable achievements are the launch of Research financing initiatives, such as the AI Khawarizmi program, with a budget of 50 million dirhams (5 million US Dollars) for the financing of research projects in AI.

In addition, Morocco has created several artificial intelligence research centres in universities and technological institutions such as the International Centre for Artificial Intelligence of Morocco at the Mohammed VI Polytechnic University. This ambitious initiative enriches Morocco's repertoire of ambitious actions contributing to the strengthening of Morocco's position as a regional hub for the development of AI and the emergence of an African innovation ecosystem. Morocco has also created public institutions exclusively dedicated to AI. The country has also set up AI training programs, with a particular focus on developing digital skills.

We also highlight the commitment of the 12 Moroccan public universities, in the development of skills and research in AI and the launch of innovative initiatives in this field such as the Mohammed V University of Rabat which comes first in the ranking of Moroccan Universities publishing the most on AI. Added to this is also the commitment of other higher education establishments not belonging to universities such as the School of Information Sciences (ESI), the only public engineering school dedicated to information sciences in Morocco and Africa (Bahji, 2022). Furthermore, several initiatives and programs have been launched to facilitate access to incubators and accelerators specializing in information technologies and artificial intelligence.

Additionally, AI was the subject of a public debate involving several public, private, academic and societal actors to discuss the opportunities, challenges and pillars of the development of an AI ecosystem capable of providing new dynamic to the digital transformation of the country with a view to the emergence of a competitive and economically intelligent start-up nation. We have noted also the emergence of innovative start-ups in the field of AI. In this context, several scientific and institutional events have been launched to present the advantages of AI, its particularities, its opportunities and the main recommendations for implementing an integrated AI policy at the national level. In addition, Morocco has organized several events and meetings to explore the contributions, challenges, impacts and opportunities of using AI in different areas of activity. These initiatives, such as forums and conferences dedicated to AI, are helping to breathe new life into AI research and encourage exchanges between the key players in this field. It should also be noted the launch by certain constitutional institutions of public consultations on the opportunities and issues linked to the use of AI in different fields in Morocco. Thus, we can conclude that Morocco has indeed made notable progress in the field of artificial intelligence, positioning it as an emerging player in the field of AI in Africa.

4. Major AI Challenges in Morocco

The results of our research have identified the main challenges of artificial intelligence (AI) in Morocco. These issues should be addressed to ensure the harmonious and beneficial development of this transformative and emerging technology. As shown in the following figure, the main challenges can be described as follows:

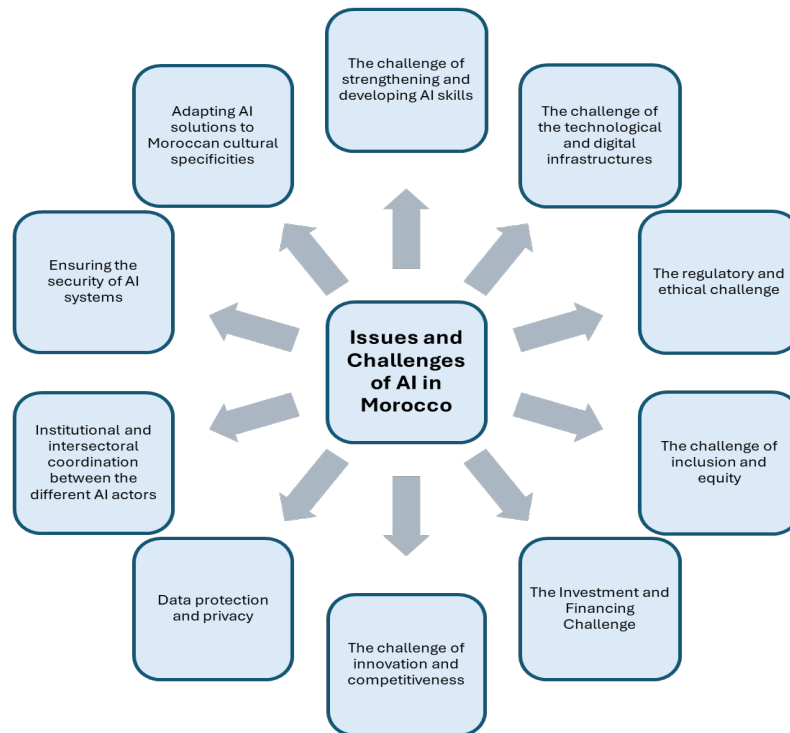


Figure 2: Main issues and challenges of Morocco AI

A major challenge in Morocco is strengthening and developing AI skills. We consider training in its initial and ongoing dimension as a fundamental condition for an effective and efficient AI ecosystem in Morocco.

In addition, we identified additional challenges, including insufficient technological and digital infrastructure essential to promote and support AI systems and projects. There is also the data challenge, marked in particular by restricted access to diversified and qualified data necessary for the proper development and relevance of the training of AI models. In addition, we have identified the regulatory and ethical challenge linked to the absence of standards and guidelines specific to AI in the Moroccan context allowing AI to be used wisely in an ethical and responsible manner, in accordance with the principles of the UNESCO Recommendation on the Ethics of AI. We have also identified the challenge of the inclusive and equitable use of AI guaranteeing everyone in society the right to benefit from AI and to combat potential algorithmic bias and discrimination. Also, AI requires massive investment and therefore there is a great need to increase public and private investment to support the research, development and implementation of AI solutions.

We have identified also the challenge of innovation and competitiveness which deserves great attention to the extent that Morocco must continue to encourage innovation in AI and support the development of cutting-edge technologies to remain competitive on the international scene, which obviously requires substantial investments. Furthermore, the other major challenge of AI in the Moroccan context is that of data protection and privacy, highlighting the imperative need to have robust regulatory frameworks to better guarantee the confidentiality and security of information. personal, while ensuring the balance between innovation and respect for individual rights. Other challenges should also be highlighted. This concerns the lack of convergence and institutional and intersectoral coordination between the different stakeholders of the Moroccan AI ecosystem marked by fragmentation. Another equally crucial issue is the need to ensure the security of AI systems to prevent cyberattacks and the growing vulnerabilities in this area. This requires the development of rigorous security standards and the implementation of advanced cybersecurity protocols to protect critical systems and maintain the trust necessary for the emergence of a high-performing AI ecosystem in Morocco.

Another challenge is the adaptation of AI solutions considering the specific cultural nuances of Morocco. Indeed, a well-contextualized adaptation of AI improves its acceptance and effectiveness. This involves the development of technologies integrating national values, languages and socio-cultural contexts, thus ensuring their relevance and recognition of Moroccan cultural diversity.

5. Toward a National AI Strategy in Morocco: “LAFBAH AI Framework” Implementation and Recommendations

The proposed model for a national AI strategy, encapsulated by the acronym “LAFBAH”, provides a thorough and forward-thinking strategy that is specifically adapted to Morocco's particular context. Morocco can create a strong and inclusive AI strategy by concentrating on Leadership & Vision, Adaptive Governance, Forward-thinking, Breakthrough Innovations, Agility in Implementation, and Human centred approach. This approach seeks to use AI to advance human-centred ideals, economic expansion, and environmental development while upholding moral and ethical principles. A comprehensive, cohesive, and ambitious national AI strategy is required, fully aligned with the Sustainable Development Goals.

5.1 Critical Success Factors of National AI Strategy According to the “LAFBAH AI Framework”

We consider that the implementation of an effective and relevant national strategy, following an inclusive, integrated, comprehensive, and holistic approach, both ethical and forward-thinking, should adhere, as shown in the following figure, to a set of critical success factors of the Moroccan AI strategy according to an approach we've named “P3A: Prioritize, Adapt, Agilize, and Assess”.



Figure 3: Critical success factors of the Moroccan National AI strategy

5.2 The Levers of a National AI Strategy in Line With the “LAFBAH AI Framework”

Our Framework sets out the milestones of a new national AI strategy which draws its substance from the strategic orientations of the State and the priority choices of the New Development Model as aspired by the public authorities and draws on its guiding doctrine and its founding principles. It aims to translate the priorities of the government program in terms of IT and digital transformation into concrete actions. It is a model of co-construction which is driven by the objective of propelling Morocco to the rank of pioneering nations with strong capacity for innovation and high added value on the academic and scientific levels and as an African hub of AI.

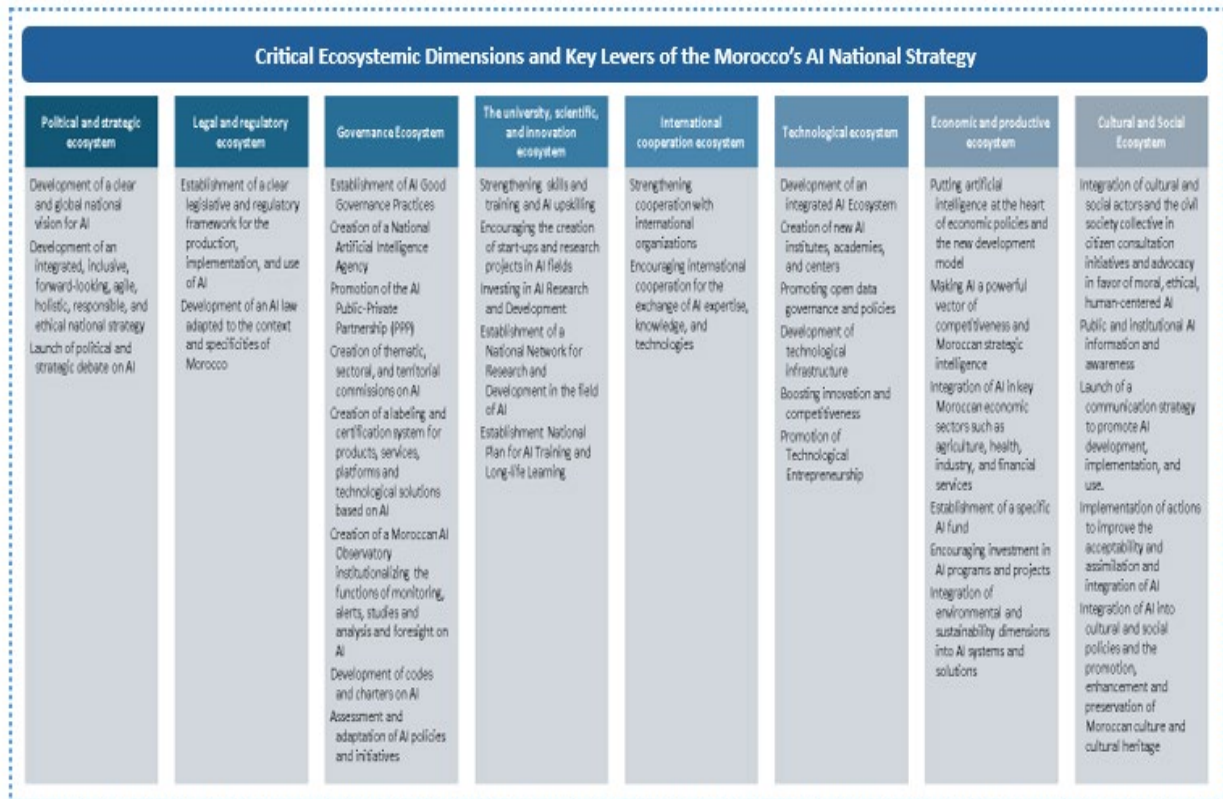


Figure 4: Critical Ecosystemic Dimensions and Key Levers of the Morocco's AI National Strategy according to the "LAFBAH AI Framework"

We consider that the first lever of the AI National Strategy of Morocco is the development of a clear and committed strategic and forward-looking national vision for AI aligned with Morocco's economic and social development objectives. Indeed, to implement an effective, holistic, responsible and ethical national strategy in AI, we consider, on the basis of our research and our benchmark of good practices in this area, that the first thing to have is a clear, global, integrated and strategic vision.

The second lever is the development of the Digital Ecosystem that strengthen connectivity, access to data, cybersecurity and the protection of personal data to promote the adoption of AI and promote research and development in AI. It is also fundamental to strengthen international cooperation with the various pioneering countries in the field of AI and international organizations participating in global AI governance. It is also necessary to encourage national and international partnerships and strengthen collaborations with research institutions and international companies.

Others levers are identified such as : the promotion of the Public-Private Partnership (PPP) and strengthening collaboration between universities, centres of research, businesses and public institutions; the strengthening skills and training by establishing ambitious AI training programs to develop the necessary skills and promote continuous learning and upskilling; investing in AI Research and Development by allocating financial and human resources to support research in artificial intelligence and finance research projects; creation of new institutes, academies and centres dedicated to AI; increase investments in fundamental research; encouraging the creation of start-ups and research projects; boosting innovation and competitiveness; promoting open data policies to encourage innovation and transparency; development of technological infrastructure involving modernizing telecommunications networks, including the expansion of 5G technology, and strengthening local data centres to provide storage and processing capabilities suitable for AI applications.

In this context, the installation of supercomputers and high-performance computing (HPC) infrastructure is also crucial to support research and development. Morocco should carry out several actions to ensure rapid and stable connectivity, encourage and stimulate innovation, increase the global competitiveness of businesses, and reduce regional and local disparities in access to digital technologies. These actions include specially extending the fibre optic network, facilitating access to technological resources for businesses and institutions through subsidies and public-private partnerships.

Another lever is the assessment and adaptation in the sense that we should establish mechanisms for the continuous evaluation of AI policies and initiatives to adapt them to technological and societal developments. Training and awareness-raising among public and private stakeholders, civil society and particularly users and citizens is highly recommended to ensure accessibility of this emerging technology and to encourage citizens to adhere to the national vision of AI, its benefits and advantages and challenges and issues of inappropriate use or failure to master AI systems at national, regional and local levels.

By combining these different levers mentioned above Morocco can lay the foundations for a truly well-thought-out, global, sustainable national artificial intelligence strategy in alignment with its strategic choices and priorities and specificities. In this context, we propose the following components of an integrated system for the institutionalization and promotion of an inclusive and effective AI ecosystem in Morocco:

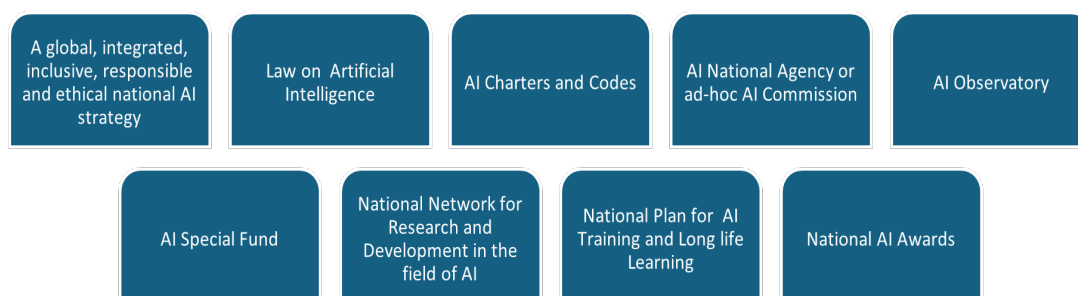


Figure 5: Components of an Integrated Framework for the Development of AI Ecosystem in Morocco

6. Conclusion

Our research revealed that by adopting an integrated, holistic, responsible and ethical AI approach, Morocco can not only strengthen its competitiveness and strategic intelligence, but also become a leader and hub for AI in Africa. To be effective and sustainable, this strategy will require close collaboration between the government, the private sector, academic institutions and civil society which have launched various actions and initiatives for the development of AI in Morocco. Indeed, Morocco has several positive points linked mainly to the political and governmental will to make digitalization its workhorse in addition to an international commitment for the benefit of global governance of AI and many other achievements infrastructure and technology to be capitalized. However, several challenges remain to be overcome, notably the lack of convergence and coordination between the different stakeholders, the insufficient human resources and talents in AI, as well as the absence of a legal and regulatory framework governing AI and its complex characteristics and impacts. All these elements argue in favour of the establishment of a national strategy which is essential for Morocco. This strategy should be thought within the framework of a prospective, holistic, well-integrated strategic vision, adapted to the Moroccan context and which drives a new dynamic of development and innovation of trusted AI adapted to the Moroccan context. Above all, it should be implemented and used in an ethical, inclusive and sustainable way. By following guiding concepts such as innovation, collaboration, transparency and human-centred values, Morocco can effectively harness the potential of AI to drive economic growth, improve social well-being and maintain competitiveness on the global stage. A robust and comprehensive AI framework, tailored to the country's unique context and aligned with international standards, will surely ensure that AI technologies contribute to a prosperous and equitable future for all Moroccans.

The “LAFBAH AI Framework” serves as a guiding framework for policymakers, industry leaders and academic institutions to collaboratively drive the national AI agenda, ensuring that Morocco not only keeps pace with global progress, but also leverages AI to address local challenges and opportunities. The development of such a strategic framework will allow Morocco to position itself as a leader in the field of AI, thus strengthening its competitiveness on the international scene and ensuring sustainable and equitable development for all of society.

References

- Bahji, S.E. (2022). “School of Information Sciences (Rabat-Morocco): Evolution or revolution of its identity?”. In: The Swiss Electronic Journal of Information Science (RESSI). N° 22, Mai 2022. e-ISSN 1661-1802. DOI: <https://doi.org/10.55790/journals/ressi.2022.e805>
- Bell, D. (1973). The Coming of Post-Industrial Society: A Venture in Social Forecasting. Basic Books.

- Bolton, Mitzi, Rob Raven, and Michael Mintrom. (2021). "Can AI Transform Public Decision-Making for Sustainable Development? An Exploration of Critical Earth System Governance Questions." *Earth System Governance* 9: 100116.
- Castells, M. (1996). *The Rise of the Network Society*. Blackwell Publishers.
- Freeman, R. E. (1984). *Strategic Management: A Stakeholder Approach*. Pitman.
- Galindo, L., K. Perset and F. Sheeka (2021). "An overview of national AI strategies and policies", OECD Going Digital Toolkit Notes, No. 14, OECD Publishing, Paris, <https://doi.org/10.1787/c05140d9-en>.
- International Science Council (2024). *Preparing National Research Ecosystems for AI: strategies and progress in 2024*.
- McCarthy, J. (2007). "What Is Artificial Intelligence". Stanford University.
- Nestor Maslej, Loredana Fattorini, Raymond Perrault, Vanessa Parli, Anka Reuel, Erik Brynjolfsson, John Etchemendy, Katrina Ligett, Terah Lyons, James Manyika, Juan Carlos Niebles, Yoav Shoham, Russell Wald, and Jack Clark (2024). "The AI Index 2024 Annual Report," AI Index Steering Committee, Institute for Human-Centered AI, Stanford University, Stanford, CA, April 2024.
- OECD (2024). *Recommendation of the Council on Artificial Intelligence*, OECD/LEGAL/0449
- OECD (2022). *The OECD Framework for the Classification of AI Systems* OECD DIGITAL ECONOMY PAPERS February 2022 No. 323.
- Oxford Insights (2023). *The Government AI Readiness Index 2023*.
- Porter, M. E. (1990). *The Competitive Advantage of Nations*. Free Press.
- Schmitt, Lewin. (2022). "Mapping Global AI Governance: A Nascent Regime in a Fragmented Landscape." *AI and Ethics* 2(2): 303–14.
- Special Commission on the Development Model (2021). *The New Development Model: Releasing energies and regaining trust to accelerate the march of progress and prosperity for all*.
- United Nations (2024). *Seizing the opportunities of safe, secure and trustworthy artificial intelligence systems for sustainable development*. A/78/L.49.
- Van Roy, V., Rossetti, F., Perset, K., Galindo-Romero, L. (2021). *AI Watch - National strategies on Artificial Intelligence: A European perspective*, 2021 edition. EUR 30745 EN, Publications Office of the European Union, Luxembourg, ISBN 978-92-76-39081-7, [doi:10.2760/069178](https://doi.org/10.2760/069178), [JRC122684](https://doi.org/10.2760/069178).
- World Bank (2021). *Harnessing artificial intelligence for development in the post-COVID-19 era: A review of national AI strategies and policies*.