



# Preparing National Research Ecosystems for AI

STRATEGIES & PROGRESS IN 2024

CENTRE FOR  
SCIENCE  
FUTURES



International  
Science Council

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**About the Centre for Science Futures:**

The ISC Centre for Science Futures explores where changes in science and the organization of science are taking us in the future. The Centre for Science Futures works to improve our understanding and provide options and tools for impact and action.

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The International Science Council (ISC) works at the global level to catalyse change by convening scientific expertise, advice and influence on issues of major importance to both science and society.

The ISC is a non-governmental organization with a unique global membership that brings together more than 245 international scientific unions and associations, national and regional scientific organizations including academies and research councils, international federations and societies, and young academies and associations.

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# Preparing National Research Ecosystems for AI

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## STRATEGIES & PROGRESS IN 2024

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# Message from the Head of the Centre for Science Futures



In late 2023, the International Science Council (ISC) released a discussion paper on evaluating rapidly evolving artificial intelligence and related technologies<sup>1</sup>. This new working paper on how countries are preparing their research ecosystems for AI confirms the engagement of the ISC to explore the impact of AI on science and societies. Additional studies and initiatives by the ISC will develop in the coming months and years.

This working paper addresses a gap in ongoing discussions about AI policies, namely the implications of these policies for national science and research ecosystems. This is a critical issue for the future of science globally. Yet, very little has been published on these issues thus far and the information on countries' plans is hard to find. Our ambition with this paper is to increase our knowledge of current initiatives toward the integration of AI in national research ecosystems, of what has been achieved so far, and the possible roadblocks.

To these ends, this paper provides a literature study and twelve country case studies. By the end of 2024, we will release a second, more comprehensive edition of this paper, incorporating additional case studies, and putting forward recommendations for more coordinated and collaborative science policies for AI.

We had a few different but overlapping audiences in mind when developing this work. If you are a STI policymaker involved in integrating new AI technologies in your country's research ecosystem, you will find in this paper first-hand evidence on the issues that are of importance for your work, as well as examples of the initiatives taken by other countries. It is likely that you will find examples of countries from your region, with research ecosystem of a similar size as that of your country. If you work with a granting council or a philanthropy, this paper will give you a sense of the priorities that countries have identified for the uptake of AI in science. If you work with an AI company and you are concerned with the specific technological and infrastructural needs of science and research institutions, this paper will give you a primer on the challenges identified by countries as they roll out their AI strategy for research. If you are a scientist or a science journalist, and your main interest is on the impact of AI on science in general, you will discover in this paper the extent to which countries are currently actively adapting their science system for AI.

This is the beginning of a conversation. We invite science leaders involved in preparing the uptake of AI in their institutions and countries to engage with us in the coming months and beyond. We ask that you share your approaches, experience, and questions. Your inputs will be critical in the further development of this project and help us all better prepare for this critical technological transformation of our science systems.

<sup>1</sup> ISC, 2023. *A framework for evaluating rapidly developing digital and related technologies: AI, large language models and beyond*. International Science Council. DOI: 10.24948/2023.11  
<https://council.science/publications/framework-digital-technologies/>

# Introduction

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The dominant notion communicated today on the influence of artificial intelligence (AI) is its capacity to change everything across all sectors, including science (Khalif et al., 2023; Nature, 2023; Van Noorden and Perkel, 2023; Miller, 2024). Beyond the promises of new advances in different fields of research, a set of critical questions is emerging about the impact of AI on the documentation, funding and reporting of science:

- How is the increasing use of AI going to influence research funding allocation?
- What research data standards will evolve? How will AI change the nature of scientific outputs?
- How will scientific careers evolve with the increasing use of AI in research?
- What investments in infrastructures are required for the successful uptake of AI by the science sector?
- What legal adjustments are needed to enable the use of AI in research while ensuring high standards in the responsible conduct of science?
- How is AI going to affect international research collaborations?

Discussions around these questions are critical for the future of science and research systems. Research institutions and ministries are beginning to tackle them, although with limited resources to guide them. As this study will show, there remains a notable absence of comprehensive literature regarding the impact of AI on the structural aspects of science and research.

Several countries have developed overall AI strategies to set out their plans and aspirations for AI development and implementation across different sectors. Despite the immediate and significant implications of these strategies for science and research, these documents mostly offer broad statements on the involvement of science and research institutions in delivering the national plans without looking further into the concrete implications.

This is not to suggest that countries are inactive. Quite the opposite: much is under way. Partnerships are being formed, training initiatives launched, infrastructures put in place and policies implemented. However, people in governmental ministries, universities and consultancy firms tasked with spearheading the preparation of the research environment for AI are largely working with speculation on the key challenges and have limited insight into the approaches being adopted by countries of similar size and capacity.

Frameworks outlining the key issues for countries to consider when planning the integration of AI into their research ecosystems can come a long way at this critical stage. This working paper offers one such framework derived from an analysis of the existing literature.

To start establishing a knowledge baseline, the paper also presents 12 case studies from countries of different sizes and regions, authored by people directly engaged in these discussions in their respective countries. We intend to expand the number of case studies and achieve a more comprehensive representation of the different global regions in the upcoming and final edition of the paper by the end of 2024.

It is important to consider the circumstances of countries of varying sizes, which are also major contributors to scientific advancements, rather than solely focusing on the AI powerhouses. We deliberately sought to gain insight into how small to medium-sized countries are preparing their research ecosystems for the uptake of AI.

This working paper therefore seeks to:

- gather the basic knowledge and information about the issues, and the current efforts to prepare science and research systems for AI;
- help countries as they develop roadmaps for the uptake of AI in their science systems;
- create regional and global networks of people involved in the reflections on adaptation and implementation of AI for science;
- raise awareness and help shape a critical discussion among the scientific and policy communities of the critical issues that AI raises for the organization of science and research.

The development of the working paper benefitted from a workshop convened in October 2023 in Kuala Lumpur, Malaysia, bringing together participants from 12 countries in Asia and the Pacific. Contributions from some countries who participated in the workshop have been incorporated into version 1 of the paper. The coordination of the workshop was generously supported by the Australian Academy of Science and the Malaysian Academy of Sciences.

The publication of this paper will be followed by similar regional workshops and consultations. A second version of the paper will be released later in the year featuring additional country case studies and a set of conclusions and recommendations.

## References

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- Khalif, Z. N., Mousa, A., Hattab, M. K., Itmazi, J., Hassan, A. A., Sanmugam, M. and Ayyoub, A. 2023. 'The potential and concerns of using AI in scientific research: ChatGPT performance evaluation'. *JMIR Med. Educ.*, Vol. 9, pp. e47049. <https://doi.org/10.2196/47049>.
- Miller, A. 2024. 'The top arguments against artificial intelligence in science'. *ReHack*, 19 January. <https://rehack.com/ai/arguments-against-artificial-intelligence/>.
- Nature. 2023. 'AI will transform science – now researchers must tame it'. *Nature*, No. 621, pp. 658. <https://doi.org/10.1038/d41586-023-02988-6>.
- Van Noorden, R. and Perkel, J.M. 2023. 'AI and science: what 1,600 researchers think'. *Nature*, No. 621, pp. 672–675. <https://doi.org/10.1038/d41586-023-02980-0>.

# Literature Review

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*What are the critical issues for the integration of artificial intelligence in science systems? A bibliometric analysis.*

This working paper seeks to take stock of how countries are approaching and planning the uptake of AI by their science and research ecosystems. A bibliometric study was undertaken to identify publications from different parts of the world exploring the impact of AI on national science and research ecosystems.

The study was done in partnership with Nature Research Intelligence in September 2023. It combines academic journal and book content, conference proceedings, policy documents and 'grey' literature. The search strategy encompassed three steps:

- A high-precision keyword search (with more than 30 search keywords) generated a base document set. Over 1,600 documents were thus identified using the Dimensions database.
- A review of that initial corpus of documents and selection of the most relevant ones (180 in total) created a training document set.
- The refined training document set was used to identify similar documents. Additional web searches were also made. The resulting dataset comprises 317 documents published between 2018 and 2023. They are the documents used in this review.

## Classification of the 317 publications in the literature review<sup>2</sup>

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PUBLICATION TYPE	NUMBER
Journal articles	123
Book chapters	59
Preprints	51
Web pages	30
Conference proceedings	20
Policy documents	18
Books and monographs	16

While 317 publications dealing with national plans to integrate AI in science and research ecosystems may seem relatively low, there was a tenfold steady increase in numbers of publications published annually between 2018 and 2022 (from 9 to 88). This increase suggests a growing attention to the issues relating to the uptake of AI in national science and research ecosystems. We can realistically expect the number of publications to continue growing in the coming years, as more experience is gathered on the progressive integration of AI in national science and research infrastructures.

<sup>2</sup> The full list of publications is accessible on the Centre for Science Futures' website: <https://council.science/publications/ai-science-systems>

## Leading countries by publication volume across project dataset (2018–2023)<sup>2</sup>

COUNTRY	PUBLICATIONS	% TOTAL PUBLICATIONS
United Kingdom	32	11.9%
United States	28	10.4%
Germany	13	4.8%
China	10	3.7%
Canada	9	3.3%
India	8	3.0%
Sweden	7	2.6%
Spain	7	2.6%
Switzerland	6	2.2%
Singapore	5	1.9%

The review of these publications allowed us to identify a core set of 45 issues and topics which experts and observers have posited as critical for the integration and uptake of AI in research and science systems.

We tried capturing these issues using a simplified version of OECD’s framework for technology governance, with three broad themes:

- research and development agenda setting, technology assessment, foresight and science advice;
- public engagement, science communication and public accountability;
- regulation, standards, private sector governance and self-regulation.

Some of the issues listed here are not specific to science and research, such as those related to careers and employment, data quality and AI safety, and those having to do with the development and adoption of AI in general. We tried to limit the number of such issues in this exercise but included those with a particular significance for science (e.g. data quality) or that we expect to be increasingly discussed in relation to the uptake of AI in research (e.g. AI safety and employment).

### Theme

#### › AREAS

##### a. Topics

##### – Issues

## THEME 1: R&D agenda setting, technology assessment, foresight and science advice



### › PRIORITY SECTORS

#### a. Priority-setting

- We must find ways to identify strategic sectors for AI development and for its uptake by the scientific community. Mechanisms may include funding, infrastructure development and capacity building programmes.



### › FUNDING PRACTICES

#### a. Will AI capacity replace scientific merit in science funding decisions?

- AI intensity may become an inappropriate deciding factor in determining the allocation of resources and hence the trajectory of scientific discovery. Its salience could close off areas of research that do not use it.
- Competition within research could become less a matter of merit and more a matter of access to AI. This risks poor decision-making and further concentration of research funding.

#### b. Use of AI in resource allocation

- AI relies on machine learning from existing material. It may produce reviews that are inherently conservative and which reproduce old biases.

#### c. Impact of AI on evaluation panels

- AI-driven science tends to be interdisciplinary because AIs do not know subject boundaries. Today's domain-led expert panels may be unable to review it adequately, despite the many recent calls for science to be more interdisciplinary.



### › CAPACITY BUILDING AND RETENTION

#### a. Growing AI skills in the scientific community

- There is a need for broad but differentiated AI skills development for learners and practitioners at all levels. Important aspects include education in AI, training in domain-specific use, ethics, and interdisciplinary competencies. Teaching will have to recognise that this is a fast-moving topic.

#### b. Diversity in AI research

- There is a need to ensure the gender, ethnic and cultural diversity of the AI workforce, in the interest of equity and to improve the quality of research and other outcomes. Machine learning can reproduce existing inequity.
- We have to develop the right incentives for disciplinary and interdisciplinary AI.

#### c. Talent retention in the public science sector

- Public sector science, including universities and research centres, needs talent acquisition and retention, given the strong demand for AI skills from the private sector. Unusually, this is an area in which the private sector can offer interesting jobs as well as high salaries.



## › INFRASTRUCTURE

### a. Development of cloud computing appropriate for science

- Uncertain funding for cloud computing and research data repositories constrains scientific advances. In the absence of public cloud capacity, wealthier research institutions are likely to contract private companies, limiting the sharing of their research data and leaving less wealthy institutions behind.

### b. The digital divide goes algorithmic

- We must determine how inequity in AI access between individuals, groups, academic disciplines, organisations and locations results in poorer research outcomes.

### c. Development of AI tools for science

- We must determine what kinds of partnerships will encourage the development of AI tools appropriate for specialized research institutions. How do we ensure that new AI technologies are not driven solely by the AI and machine-learning communities, but rather developed jointly with all research communities?



## › INTERNATIONAL COLLABORATION

### a. Variation between legal systems

- We need to assess how jurisdictional variability in governance and data protection between countries impacts international research and research collaboration.

### b. Regional collaboration

- Countries must find out the extent to which they can cooperate to establish regional AI centres and research networks if they don't have the resources to do it on their own.



## › JOBS, CAREERS AND EMPLOYMENT

### a. Impact on jobs in science and research

- There is a need to monitor how advances in AI affect the number and nature of jobs in science.

### b. Continuous AI training

- There is a need to develop ways for scientists and research staff to keep up to date with AI in order to produce better research and minimise job losses. There may need to be specialist AI trainers and teachers, for example to help users understand the ethical issues raised by AI.



## › NETWORK AND REPOSITORY SECURITY

### a. AI effects on scientific cybersecurity

- Science institutions must ensure the best possible network hygiene, ensure the security of partner organisations, and control cybersecurity risks from individual people. How do they secure facilities against intellectual property theft, access to private and sensitive data, and ransom attacks?
- The protection of data quality and integrity requires controls on access to repositories, as well as highly qualified personnel, strong partnerships and an appropriate built environment.

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## THEME 2: Public engagement, science communication and public accountability



### › SCIENTIFIC INTEGRITY IN THE CONDUCT OF RESEARCH

#### a. Principles and values of current science

- AI may generate tensions between some of the core principles and values that define today's science. Such contradictions might include openness vs. rigour; privacy and confidentiality vs. open science; massive data vs. high quality data; or explainability vs. “black box” results.

#### b. Reliability and explainability of results

- Lack of trust in AI, within science and in other activities, may create challenges for its uptake in science. But uncritical trust will lead to a potentially dangerous overreliance on AI technology and the results it generates. AI tends to produce normative results rather than groundbreaking insights, because it is based in existing knowledge and existing opinion.

#### c. Reproducibility

- Today's science already has severe reproducibility issues. How will AI worsen them or perhaps solve them? For AI to improve reproducibility it will need to be more transparent, providing more information about codes, underlying data and experiment design. This applies both to AI research and to research using AI.

#### d. Explainability of results

- The scientific method requires scientific claims to be explainable and understandable. Some popular AI methods operate as a black box, making it impossible to say how they have reached their conclusions or to identify spurious correlations or causalities.

#### e. Ethical data use

- The use of big data and AI complicates present-day notions of consent and of human research participants, as well as the ways in which data is collected and used.
- AI Ethics and Review Boards focus on human subjects. As well as carrying out their present vital role, they should be able to examine possible harms to wider society.

#### f. Accountability

- We will have to determine who is responsible for fabrication, falsification, plagiarism and other bad practice when the faulty conduct can be traced back to an AI. The answer may be simple if the AI has an obvious owner, but in the future many may not.

#### g. Conflict of interest

- We need to see whether new conflicts of interest arise as AI spreads. They may not be covered by current conflict-of-interest policies.



### › ENVIRONMENTAL IMPACT

- AI development has to be made more sustainable (in relation to the use of computer chips and electricity in particular). More fundamentally, AIs may well not be attuned to environmental concerns if they have not learned from appropriate input materials.



## › SCIENTIFIC PUBLISHING

### a. Acknowledgment of contributors and authors

- Researchers have to explain how AI was used in the production of research outputs.

### b. AI for policing science

- Publishers have to determine whether AI should be used to detect non-AI generated fabrication, falsification and plagiarism.

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## THEME 3: Regulation, standards, private sector governance and self-regulation



## › DATA QUALITY

### a. Accuracy

- Larger datasets are better for training AIs, yet they are also more likely to produce responses based too closely on the data available to them (overfitting) or to contain inaccuracies and biases that could result in wrong or misleading results. Incorrectly sourced data, Frankenstein datasets and biased datasets already have dangerous implications for science. This problem needs to be addressed at every level, from considerations of governance and management to operational use.

### b. Bias and exclusion

- While AI, and large language models in particular, use ‘biases’ (statistical similarity) in data to produce results, it is important to curate training data to avoid further marginalization of particular groups and regions. Digital exclusion leads to gaps in data. Furthermore, how do we represent those who are offline?

### c. Subject orientation of data vs. the interdisciplinary nature of AI research

- Most scientific knowledge comes from a specific subject. We need to encode and use it, while enabling communication between domains and allowing for the growing generation of interdisciplinary knowledge.

### d. Data coding and annotation

- AIs, and large language models in particular, require humans to code and annotate the data they use. These individuals must be aware of the risk of embedding cultural differences in the data during the annotation process.



## › DATA MANAGEMENT AND GOVERNANCE

### a. Open data vs. AI safety

- Access to high-quality data is crucial to the development of AI for science. But the public interest, as well as that of individuals, calls for governance structures to protect privacy and to guarantee the ethical use of data.

### b. Access vs. Advantage

- Much of the data required for the development of scientific AI will not fall within the scope of open data initiatives, for example data held by the private sector. The tension between enabling access and maintaining commercial advantage may result in high-quality data being kept confidential.

### c. Data infrastructures

- The development of AI for science will require harmonization of practices and the development of communities of practice. Current norms and practices for the

production and use of data differ between disciplines and institutions.

- As scientific organizations increase their data curation and storage capacity, they will need to increase interoperability between repositories.



## › DATA STANDARDS

### a. Data standards for provenance

- The sources of training data must be appropriately disclosed and evaluated. A specific concern is the ethical aspect of data and data sources, and its implications for bias in AI.

### b. Data standards for quality (see also ‘data quality’ above)

- Technical standards, certification and compliance should be imposed to ensure that data used in science is properly curated and stored.



## › LAW, REGULATION AND POLICY

### a. Legal liability of research done with AI

- We have to reconcile traditional liability systems with AI processes and outputs, with their varying degrees of autonomy and transparency. At what point does an AI, rather than its maker, become responsible for its actions?

### b. Copyright protection or patenting for machine-generated creations?

- Uncertainty about the eligibility and appropriateness of copyright protection for AI-generated creations may lead to the use of patenting or trade secrecy techniques to protect intellectual property. This would reduce public availability of the valuable results, positive and negative, of AI projects.

### c. Protection and use of digital data

- Text and data mining risk infringing copyright through the creation of unauthorized copies, and may violate the terms and conditions of websites and databases. The United Kingdom is creating a copyright exception rule for text and data mining, and other jurisdictions may follow.
- Works mined for data can be protected by copyright, but data themselves are usually protected only if they were part of original datasets. This may lead to the use of trade secret to protect data. The European Union protects data extracted from protected databases for scientific research. But the borderless character of digital data exacerbates tensions between jurisdictions.



## › REGULATIONS

### a. The domestic regulatory environment

- Work towards domestic AI regulation will be a balancing act between different considerations and needs. In these arbitrations, countries must create beneficial conditions for their science and research sectors to thrive and work for the common good.

### b. Impact of regulation in other jurisdictions

- Observation of other countries’ actions can lead to leap-frogging and the alignment of provisions; or, uncertainty about regulation may lead some legal regimes to seek competitive advantage through less rigorous regulation, to the detriment of the country where the creation was generated.

It has become common sense to predict that AI will transform science and research. The encompassing set of considerations and issues identified through the literature review unpacks the many ways in which AI is influencing how science is made, organized and funded. They relate to conditions for good and responsible practices of science with AI. The list should therefore be of use to countries as they develop and implement roadmaps for the uptake of AI in their science and research systems. It reflects imperfectly, however, the considerations that are currently guiding countries. As will become clear in the case studies current plans for the uptake of AI in science are only partially driven by considerations such as those highlighted in the list. By and large, they are rather guided by a country's overall approach to AI and seek to support the ambitions (in terms of economic growth, better governance, digital infrastructures, etc.) attached to AI more generally. This partial disconnect and the pre-eminence of national strategies is understandable. However, insufficient attention to the specific conditions for a successful uptake of AI in science and research will affect the quality of science in these countries and everywhere. It will be measured in poor research data policies, strengthened epistemic biases, insufficient capacity and ineffective institutional and regulatory environments. It will lead, in other words, to bad science.

# Introduction to the case studies

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The following case studies were developed to help increase our collective knowledge and understanding of countries' approaches towards the integration of AI in research ecosystems. These short essays were developed by people involved in the development and rolling out of their country's AI strategy for science.

The countries were selected somewhat opportunistically, using ISC's networks and connections to identify willing contributors from diverse global regions. The next iteration of this report will include more case studies and a more balanced geographical representation including Canada, France, Jordan, Malawi, Morocco, Nigeria, Norway, United Arab Emirates, United Kingdom, Panama, Romania, Rwanda, South Africa, United States. In our initial interactions with the authors, we introduced the project's goals and ambitions, and provided a set of guidelines. Case studies signed by authors reflect each author's perspective based on their experiences in their positions and what they deem most pertinent and current at the time of writing. In line with the ambition of expanding our knowledge basis and initiating a discussion, authors were encouraged to provide factual information and refer to key documents. An internal review process within the project's core team was conducted upon receipt of the first draft from each author. Comprehensive feedback was provided on the first drafts from the project team, followed by a secondary discussion to address the feedback and refine the draft further.

References to the key documents framing countries' approaches are included in each case study. The bulk of those documents are not findable in the international publication databases and were therefore not included in the literature review discussed previously.

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# AUSTRALIA

## Preparing for human-centric use of artificial intelligence

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### Key takeaways

- Ethical principles and human-centric approaches to AI are informing Australia's emerging framework for AI governance. The number of tertiary education offerings for AI have increased in Australia and are complemented by an initiative to attract and train job ready AI specialists.
- While active programs to enhance diversity in Australia's STEM workforce exist, they are not specifically tailored to address AI. Additionally, there is a recognized need to enhance ethical competence and raise awareness of human rights in AI-related scientific endeavours. However, more customized resources for the science sector are required.
- Other challenges remain to be addressed such as the high-performance and data computing infrastructure needed for AI and AI-enabled science and the implementation of FAIR and CARE data principles.

Australia's government, scientific organizations and universities are exploring the preparedness of the national science system to capture the opportunities and mitigate the risks of AI to accelerate scientific discovery. For example, the national science agency, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), released the report *Artificial Intelligence for Science – Adoption Trends and Future Development Pathways* (Hajkowicz et al., 2022). It examines the impact of AI on science and the imperative for research organizations to invest in mechanisms to harness the benefits and mitigate the risks of these technologies. The report outlines six future development pathways to enable the transition, including hardware and software upgrades, data capability uplift, improved education and training, the development of human-centred AI, improved workforce diversity and ethical capability. Organizations throughout Australia's national science system have begun expanding their capacity for AI uplift in these areas with recent research initiatives, activities, programs and guidelines. However, challenges remain to be addressed.

### Hardware and software

Scientific organizations seeking to uplift their AI capability must make decisions about hardware, software and computational infrastructure upgrades. The Australian Academy of Science recently held a national roundtable to discuss the Australian science sector's future supercomputing needs. The group highlighted the need for a national strategy and an exascale computing facility to secure Australia's sovereign research capability and enable science to meet national and regional priorities into the future (Australian Academy of Sciences, 2023).

## **Data**

Future AI capability uplift also requires investment in high-quality data which is fit for purpose, provenance assured, validated, up to date and ethically obtained. The Australian government is leading by example through its Data and Digital Government Strategy (Government of Australia, 2023). This initiative focuses on adopting best-practice approaches to data collection, management and use to become a data-driven organization.

In conjunction with the increasing use of AI, it is essential for Australia to better implement the FAIR (Findable, Accessible, Interpretable and Reusable) and CARE (Collective benefit, Authority to control, Responsibility and Ethics) data principles. These and other principles and practices from open science, the Indigenous Data Sovereignty movement and participatory data stewardship all provide critical guidance for the creation, use and management of the data that will underpin AI in Australia's science system.

## **Education, training and capability**

There is an imperative for education, training and capability uplift across the science sector and into lifelong education. The number of tertiary AI courses offered in Australia almost doubled between 2020 and 2023, providing greater educational opportunities (37 offerings in 2020, 69 in 2023) (OECD, 2024).

The Australian Human Rights Commission (2023) has recommended that 'professional development and training be provided to teachers' and 'schools should introduce comprehensive digital literacy programs to provide students with the skills needed to engage with generative AI tools in a responsible and ethical way'.

In 2021, AUD 24.7 million was invested in establishing CSIRO's Next Generation AI Graduates Program to attract and train job-ready AI specialists in Australia (CSIRO, 2021). Currently, more than a thousand CSIRO researchers are working on a diverse range of AI and data science projects (CSIRO, a).

## **Human-centric artificial intelligence**

Human-AI collaboration and human-centric AI is designed and implemented to ensure humans can work effectively with AI and benefit from the complementary strengths of humans and AI systems to carry out tasks to higher standards than either can achieve alone. In 2023, Australia signed the Bletchley Declaration affirming that AI should be designed, developed and deployed in a human-centric, responsible and trustworthy manner.

CSIRO's collaborative intelligence (CINTEL) program of work is developing the science and technology to ensure AI systems support humans to solve scientific challenges, such as highly labour-intensive tasks like genome annotation (CSIRO, b). Annotation uses the genome sequence to create biological phenotypes critical for increasing crop yields through selective breeding. The group is developing a scalable approach involving collaboration between a domain expert and AI that will allow for accurate and timely annotation of genomes.

## Gender, ethnic and cultural diversity

The AI workforce lacks gender, ethnic and cultural diversity, which limits the quality of outcomes. Improving this will contribute to an uplift in AI capability within research organizations.

The Government of Australia's (2020) *Advancing Women in STEM Strategy Action Plan 2020* provides a national, coordinated approach to achieving sustained increases in gender equity in science, technology, engineering and mathematics (STEM). Programs such as Deadly Science (Deadly Science) and the Indigenous STEM Education Project (CSIRO, 2021) seek to support and engage Aboriginal and Torres Strait Islander students in science- and STEM-related careers. Between 2014 and 2021, the Indigenous STEM Education Project reached over 23,000 participants in 603 schools, and Deadly Science has delivered 7,500 boxes of science resources to over 800 schools.

*The AI workforce lacks gender, ethnic and cultural diversity, which limits the quality of outcomes. Improving this will contribute to an uplift in AI capability within research.*

## Ethical capability

Evolving standards and regulation of the design and implementation of AI require investment in ethical capability – including technology, skills and cultures. In support of responsible innovation, the Australian government has produced a framework of eight ethics principles to ensure AI is safe, secure and reliable (Dawson et al., 2019; DISR, a). This was followed by the 2023 discussion paper *Safe and Responsible AI in Australia* (DISR, 2023) to support responsible AI practices and increase community trust and confidence through consultative government responses. The Australian government's January 2024 interim response to the consultation identified a range of legal, regulatory and governance measures that are needed to ensure AI is designed, developed and deployed safely and responsibly (DISR, 2024).

CSIRO's Responsible Innovation Future Science Platform is a program of research that systematically and scientifically assesses the risks, benefits and uncertainties of future science and technology. Meanwhile, the Australian Human Rights Commission (2021) recommends that 'professional accreditation bodies for [STEM] should introduce mandatory training on human rights by design as part of continuing professional development'. However, no framework or strategies are in place for such upskilling in the science sector, and very few professional accreditation bodies exist.

## Other challenges

As well as impacting how science is done, AI may impact how science is administered, governed, funded and assessed. Australia's research councils, the Australian Research Council and the National Health and Medical Research Council, have created policies to account for the role of generative AI in their grant processes (ARC, 2023; NHMRC, 2023). The use of generative AI is prohibited in assessing applications to preserve the confidentiality and integrity of the process. For applicants, the policies note the potential benefits and need for caution in using AI but do not list any specific restrictions on the use of AI by applicants.

## References

- ARC. 2023. *Policy on Use of Generative Artificial Intelligence in the ARC's Grants Programs*. Canberra, Australian Research Council. <https://www.teqsa.gov.au/guides-resources/higher-education-good-practice-hub/artificial-intelligence>
- Australian Academy of Science. 2023. 'Is Australia ready for our supercomputing future?' *News and Media Releases*, 29 November. Canberra: Australian Academy of Science. <https://www.science.org.au/news-and-events/news-and-media-releases/is-australia-ready-for-our-supercomputing-future> (2023).
- Australian Human Rights Commission. 2021. *Human Rights and Technology Final Report*. Sydney: Australian Human Rights Commission. <https://humanrights.gov.au/our-work/technology-and-human-rights/publications/final-report-human-rights-and-technology>
- Australian Human Rights Commission. 2023. *Utilising Ethical AI in the Australian Education System: Submission to the Standing Committee on Employment, Education and Training*. Sydney: Australian Human Rights Commission. <https://humanrights.gov.au/our-work/legal/submission/utilising-ethical-ai-education-system>
- CSIRO. a. 'Artificial Intelligence'. CSIRO. Canberra, Commonwealth Scientific and Industrial Research Organisation. <https://www.csiro.au/en/research/technology-space/ai>
- CSIRO. b. *Collaborative Intelligence Future Science Platform*. Canberra, Commonwealth Scientific and Industrial Research Organisation. <https://research.csiro.au/cintel/>.
- CSIRO. 2021 c. 'Indigenous STEM Education Project'. CSIRO. Canberra, Commonwealth Scientific and Industrial Research Organisation. <https://www.csiro.au/en/education/programs/indigenous-stem-education-project>.
- CSIRO. 2021. '2021-22 Federal Budget Statement'. CSIRO, 12 May. Canberra, Commonwealth Scientific and Industrial Research Organisation. <https://www.csiro.au/en/news/All/News/2021/May/2021-22-Federal-Budget-Statement>.
- Dawson, D. et al. 2019. *Artificial Intelligence: Australia's Ethics Framework. A Discussion Paper*. Canberra, Commonwealth Scientific and Industrial Research Organisation. <https://www.csiro.au/en/research/technology-space/ai/AI-Ethics-Framework>.
- Deadly Science. <https://deadlyscience.org.au/about-us/>.
- DISR. a. *Australia's AI Ethics Principles*. Canberra, Department of Industry, Science and Resources. <https://www.industry.gov.au/publications/australias-artificial-intelligence-ethics-framework/australias-ai-ethics-principles>.
- DISR. 2023. *Safe and Responsible AI in Australia: Discussion Paper*. Canberra, Department of Industry, Science and Resources. <https://consult.industry.gov.au/supporting-responsible-ai>.

DISR. 2024. *Safe and Responsible AI in Australia Consultation: Australian Government's Interim Response*. Canberra, Department of Industry, Science and Resources. <https://consult.industry.gov.au/supporting-responsible-ai>.

Government of Australia. 2020. *Advancing Women in STEM 2020 Action Plan*. <https://www.industry.gov.au/publications/advancing-women-stem-strategy>

Government of Australia. 2023. *Data and Digital Government Strategy*. <https://www.dataanddigital.gov.au/> (Accessed 21 February 2024).

Hajkowicz, S. et al. 2022. *Artificial Intelligence for Science – Adoption Trends and Future Development Pathways*. Canberra, Commonwealth Scientific and Industrial Research Organisation. <https://www.csiro.au/-/media/D61/AI4Science-report/AI-for-Science-report-2022.pdf>

NHMRC. 2023. *Policy on Use of Generative Artificial Intelligence in Grant Applications and Peer Review*. Canberra: National Health and Medical Research Council. <https://www.nhmrc.gov.au/about-us/resources/policy-use-generative-artificial-intelligence>.

OECD. 2024. 'AI courses in English by degree type'. *OECD.AI Policy Observatory*. <https://oecd.ai/en/data?selectedArea=ai-education&selectedVisualization=ai-courses-by-degree-type> (Accessed 21 February 2024).

# BENIN

## Anticipating the impacts of artificial intelligence on West Africa's aspiring digital services hub

Ministry of Digital Economy and Communications

### Key Takeaways:

- Digital infrastructures and platforms have been put in place since 2016 as part of the Beninese vision as the hub for digital services of West Africa. Institutes in the country have initiated AI training and education programs for the young generation.
- Challenges around data collection, preparation, access, storage and governance need to be addressed for proper operation of AI systems. Data protection and fundamental rights as well as data governance also raise legal, regulatory and ethical challenges

The Government of Benin, with its vision to ‘transform Benin into the digital services hub of West Africa for accelerating growth and social inclusion’ (MDEC, 2016) has implemented several structural reforms and deployment projects of digital infrastructure and platforms since 2016. This vision has been articulated in the government’s action programs, which focus on flagship projects, priority projects, and projects with rapid impacts for structural, economic, political and social transformation of the country.

The operationalization of its vision has enabled Benin to establish a digital code, a national data centre, a national portal for public services, a public key infrastructure, a national administration network integrating over 187 sites, and a network of over 2,500 kilometres of fibre-optic cables deployed throughout the national territory, among other projects. The use of Benin’s new infrastructure and platforms will generate massive amounts of data that must be managed and valorised through the use of AI tools and technologies so that their value creation potential does not escape the Beninese economy.

### National Artificial Intelligence and Big Data Strategy

It is within this framework that the Government of Benin adopted, in January 2023, a National Artificial Intelligence and Big Data Strategy (SNIAM 2023–2027). This strategy outlines a structured action plan around four programs, including one related to ‘Support for training, research, innovation, the private sector, and cooperation’ (MDEC, 2023). Through this program, Benin aims to support training and research by equipping universities and promoting partnerships in AI. It also aims to develop financing mechanisms by strengthening institutional support to the structures that are responsible for entrepreneurship and innovation as they mobilize and sustain resources allocated to startups. Lastly, it aims to strengthen sub-regional and international cooperation in this area.

The development of SNIAM 2023–2027 was carried out in two phases: a preliminary stage followed by the development of the document itself. It was during the preliminary stage that the government prepared by providing Benin with its digital code, connectivity infrastructure, data storage and platforms conducive to strengthening digital trust. However, many challenges remain to be addressed. There are data challenges concerning the collection, preparation, access, storage and governance of the data necessary for the operation of AI systems. There are also notable legal and regulatory challenges related to AI governance and regulation, and ethical challenges concerning data protection and fundamental rights.

At the same time, the opportunities for Benin are manifold and relate to supporting the development of priority sectors such as education, vocational training, health, the living environment and transportation.

*The use of Benin’s new infrastructure and platforms will generate massive amounts of data that must be managed and valorised through the use of AI tools and technologies so that their value creation potential does not escape the Beninese economy.*



**Financing and institutional arrangements**

With an estimated cost equivalent to USD 7.7 million over a period of five years, the main actions of SNIAM 2023–2027 will be implemented through a public–private partnership, at the national level, targeting specific areas of development. Various sources of financing are proposed to mobilize the resources needed to implement the actions outlined in the strategy. These include calls for national funding from both the government and the private sector; appeals for bilateral and multilateral foreign aid; and appeals for foreign private capital within the framework of the public–private partnership.

The integration of AI in Benin will require the participation of all public bodies, the public sector and the population to achieve the desired effects. The effects in question include improving productivity and the quality of products and services in priority sectors and those presenting real opportunities for AI; a dynamic AI ecosystem driven by Beninese companies; technology and knowledge transfers between research laboratories and the private sector; and recognition of Benin in the field of AI.

**Stakeholders shaping readiness in research**

On one hand, AI readiness in research involves public innovation bodies, and on the other hand, it involves civil society organizations, academics, startups and the private sector in general. Several targeted skill development programs have been identified to help workers prepare for AI transitions. These programs are either directly envisaged by the government or in collaboration with partners. Thus, the Ministry of Digital Economy and Communications, as part of the operationalization of the AI strategy action plan, is collaborating with various digital ecosystem partners in Benin to implement awareness raising, networking, training activities, and more.

Basic AI awareness actions are also planned during the development of digital literacy modules. The Smart Africa Alliance has developed a capacity building reference document that has led to the implementation of several projects and initiatives, including the Smart Africa Digital Academy (SADA) project, which supports existing processes in various countries (SADA, no date). In Benin, a convention for the implementation of SADA was signed in 2022, and in 2023, actions began to support the Lever of Learning for Retraining in the Digital Sector (LeARN), focusing on three modules: training of 25 Data Steward experts, training of 25 Data Developers, and AI training (Government of Benin, 2021).

Furthermore, there are initiatives by some non-governmental actors in the Beninese digital and AI ecosystem that are worth highlighting. The Odon Vallet Foundation has held a Summer School on Artificial Intelligence since 2021, where around a hundred young people receive pragmatic and high-quality training on basic AI concepts such as programming, machine learning and embedded electronics (including robotics and home automation). Since 2020, the Francophone Agency for Artificial Intelligence has been organizing awareness conferences for young Beninese people, including women, on the challenges of AI, as well as online master's-level training in AI and big data in partnership with Francophone universities (AFRIA, 2020).

### **National scientific and research community**

SNIAM 2023–2027 is the result of a synergy of actions stemming from both government sectoral departments and the private sector, as well as associations or academic organizations.

In its development process, the national strategy's aim was to have a consensus document that takes into account vital domains such as research, developments and innovations, applications, market placement and intersectoral dissemination, support, and guidance for deployment.

In terms of local research institutions, Benin has a training and research centre, the Institute of Mathematics and Physical Sciences (IMSP), established in 1988. With its specialized resources in AI, the IMSP constitutes a centre of competence at the national level in mathematics and AI computer science (at the PhD level), and it has a supercomputer with rare power for an institute in West Africa. The challenge for the IMSP today is to maintain computing power and strengthen the means to take advantage of this infrastructure. The Institute of Training and Research in Computer Science, the Abomey-Calavi Polytechnic School and its Doctoral School of Engineering Sciences, and the Laboratory of Biomathematics and Forest Estimations at the University of Abomey-Calavi are also working on several projects implementing AI technology as well as blockchain.

Furthermore, several capacity-building actions have been initiated and are ongoing to prepare human resources for the labour market transformations induced by AI and emerging technologies in general. In addition to teaching computer science (networking and engineering), the IMSP has been offering a data science master's program since 2020, having already trained about twenty graduates, with around forty students currently undergoing training in this field. About ten theses in AI or related fields have already been defended at the IMSP. Additionally, at the Institute of Training and Research in Computer

Science there is a bachelor's program in AI. Efforts are under way to create a master's program here to allow students to continue their studies in AI. The AI training provided in this field will address the various challenges in AI skills. Several universities and schools are also initiating training programs in AI within the private sector. For example, the Sèmè City Development Agency, in partnership with Sorbonne University, launched in 2022 a cohort of professionals who benefited from highly certified continuing education in AI.

### **Operational steps for the strategy**

SNIAM 2023–2027 aims to make AI and big data a lever for Benin's development by 2027, with increased support for strategic sectors such as education, health, agriculture, the living environment and tourism in an opportunistic approach. Ongoing actions are distributed within the programs, and their implementation will be based on prioritization considering three factors. The first factor is business impact: the extent to which the proposed solution will benefit the primary beneficiary or address the original problem. The second factor is given complexity: the extent to which the data are available and exploitable right now. The third is technological complexity: the effort it will take to create, deploy or adapt an AI solution.

In operationalizing the strategy, initiatives are under way to identify and execute associated action plans. These include feasibility studies and project definition to operationalize SNIAM 2023–2027. They also extend to the development of application platforms for AI use cases. As part of this latter action, the Government of Benin has implemented GPT.BJ, an initiative to promote access to legal information in citizens' lives (Le Matinal, 2023). GPT.BJ is a chatbot developed by the Benin Agency for Information Systems and Digital and is designed to answer questions related to the general tax code, digital code, labour code and penal code of Benin. It was launched in 2023 during the second Digital Entrepreneurship and Artificial Intelligence Fair.

### **References**

- AFRIA. 2020. *Forum francophone de l'intelligence artificielle (FFIA)*. Francophone Agency for Artificial Intelligence. <https://afria.global/portfolio/forum-francophone-de-lintelligence-artificielle-ffia/>. (In French)
- Government of Benin. 2021. *Secteur du numérique au Benin : Le Gouvernement Lance le Programme LEARN*. [Digital Sector in Benin: The Government launches the LEARN Programme]. <https://www.gouv.bj/article/1316/>. (In French)
- Le Matinal. 2023. *Nouvelle plateforme pour répondre aux préoccupations des Beninois: 'Gpt.bj', la grande innovation du Senia 2023*. [New platform to respond to Beninese concerns: 'Gpt.bj', the great innovation of Senia 2023]. <https://lematinal.bj/nouvelleplateforme-pour-repondre-aux-preoccupations-des-beninois-gpt-bj-la-grandeinnovation-du-senia-2023/>. (In French).
- MDEC. 2016. *Declaration de Politique Sectorielle : Orientations Strategiques 2021 dans le Secteur de l'Economie Numerique* [Sector Policy Statement: 2021 Strategic Orientations in the Digital Economy Sector]. Ministry of Digital Economy and Communications. [https://pspdb.dev.gouv.bj/server/storage/app/PolitiqueFichiers/69\\_DPS.pdf](https://pspdb.dev.gouv.bj/server/storage/app/PolitiqueFichiers/69_DPS.pdf) (In French).

MDEC. 2023. *Stratégie nationale d'intelligence artificielle et des mégadonnées*. [National Artificial Intelligence and Big Data Strategy]. Ministry of Digital Economy and Communications. <https://numerique.gouv.bj/publications/actualites/le-benin-se-doted-une-strategie-nationale-d-intelligence-artificielle-et-des-megadonnees>. (In French).

SADA. No date. *Smart Africa Digital Academy*. <https://sada.atingi.org/>. Accessed 21 February 2024.

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# BRAZIL

## Reaping the benefits of artificial intelligence with some cautionary notes

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### Key takeaways:

- The need to facilitate AI research and development has driven the Brazilian government to enact legislative reform and a key achievement is the partnership of the Ministry of Science with national funders and experts for the creation of AI Applied Research centres.
- Challenges in the country include a gap in AI literacy and education as well funding for AI research. There is also worry on the stagnation of the national AI strategy and bills of law that could hinder science and research priorities, foster uncertainty among researchers and limit international collaboration.

Brazil has a significant history in promoting long-term policies for digital development, beginning in the 1970s with improved digital infrastructure for data collection, storage, processing and sharing (for example, within the federal agencies SERPRO and DATAPREV). Since then, specific legislation has supported the creation of networks by bringing companies and universities together – for instance, IBM and the University of São Paulo, which have developed a joint initiative for long-term research projects on AI such as AI for sustainable agribusiness and food networks, climate decision-making with multiple criteria among other projects – and accelerating deployment of Internet usage, including by instituting an encompassing Civil Framework for the Internet (Government of Brazil, 2014).

However, according to a Berkman Klein Center research report (Fjeld et al., 2020) and the MIT Technology Review (Gupta and Heath, 2020), despite those important steps Brazil was not ranked well amongst Latin American countries, up until 2020, in terms of AI regulations and respective national strategies. It made some progress thereafter, with later initiatives positioning it on OECD's Policy Observatory map of AI regulation and national strategies, as well as in reports from private organizations such as the Global AI Index and others (IAPP, 2023).

## Research centres

Brazil reached important milestones between 2018 and 2021, particularly with the enactment of new laws (Government of Brazil, 2018; 2019a) that removed bureaucratic barriers to digital transformation driven by AI research and development. That was the scenario when, in 2019, the Ministry of Science, Technology, Innovation and Communications (MCTIC) partnered with the Foundation for Research in the State of São Paulo (FAPESP) and the Brazilian Internet Steering Committee to launch a call for creation of eight AI Applied Research Centres.

The targeted beneficiary sectors were health, industry, cities, agriculture (formally prioritized in the Science, Technology and Innovation national policy), information security (including the investigation and design of algorithms and mechanisms) and cyber defence systems. Six of these centres were selected in May 2021 (one for AI in smart cities, one for agriculture, two for industry and two for healthcare) and four in 2023 (two for AI in industry 4.0, one for renewable energy and one for cybersecurity). Each centre involves dozens of senior researchers and dozens of students, and each centre receives around USD 200,000 a year for up to ten years from FAPESP.

*The EBIA aimed at designing an AI development plan for the country by providing guidelines for the federal Executive Branch to encourage research, innovation and development of AI solutions as well as on ethical and reliability concerns.*



## National strategy

In April 2021, MCTIC presented the Brazilian National Strategy for Artificial Intelligence (EBIA), which was linked to the AI Applied Research Centres as another MCTIC structuring action to prepare the Brazilian science and innovation system for AI (MCTI, 2021). The EBIA aimed at designing an AI development plan for the country by providing guidelines for the federal Executive Branch to encourage research, innovation and development of AI solutions as well as on ethical and reliability concerns. Although the EBIA is a general and macro-level national strategy, and has not specified particular fields for research on AI, it has indicated strategic actions where references to research are made, especially regarding research aimed at developing ethical AI solutions.

## Bills of law

In parallel to the structuring of an overall administrative strategy, the legislative attempts to legitimize the national plan were followed, from 2019 through 2021, by the introduction of three AI bills of law in Congress (Government of Brazil, 2019b; 2020; 2021), which particularly envisaged the fostering of innovation and the safeguarding of harm minimization. None of those bills of law were approved. In 2023, therefore, the Senate invited a group of 40 jurists to conceive of a fourth bill (Government of Brazil, 2023; Hilliard, 2023). Its contents were inspired by the European Union's AI Act – then considered as international standard of good practice on the matter – and included the aim of sustaining a risk-based approach to AI regulation. Such a long sequence is indicative of concentrated efforts on legislative action

so far. Finally, since the last quarter of 2023, Congress has debated on all bills of law in an attempt to consolidate them.

### **Strategic goals and action**

At the other end, in the administrative sphere, EBIA purports to be driving the Brazilian government to stimulate research, innovation and development of AI solutions in accordance with multiple considerations, including the assurance of reliable and ethical development and usage (Government of Brazil, 2022). Such goals have drawn on Organisation for Economic Co-operation and Development (OECD) concepts and principles as source of reference for key issues to be addressed, and inspired EBIA's structure with regards to areas of concern – for instance, inclusive growth. In practice, EBIA is split into six primary goals, namely: education, training and workforce; research development and innovation; application in productive sectors; application in public administration; and public security. However, although such EBIA axes point to strategic actions, they have been vaguely worded, so there is lack of clarity on concrete ways to set proper public policies. The goals do not get into prescribed instrumental actions (Filgueiras and Junquilha, 2023).

For example, in the education axis the development of digital literacy programs is generically advocated for all areas and levels of education, irrespective of the natural specificities of each such as the particularities for the teaching of AI in the context of fundamental schooling, or of academic advanced studies. Paradoxically, the Latin American AI Index has interpreted these generic terms as a strength, making the assumption that Brazil has effectively incorporated AI elements into its national school curriculum. The Common National Curriculum Base has indeed been recently updated to add computational thinking and computer programming items, but the reality is that AI literacy has not been properly introduced, as there are neither qualified teachers nor a defined strategy.

### **Research guidelines**

Mirroring such a scenario, in November 2023 the Brazilian Academy of Sciences published a set of recommended guidelines for the use and scientific advancement of AI in Brazil (ABC, 2023). The recommendations stress the existing gap in AI literacy and education throughout civil society, especially for minors, and in fundamental action to prepare the national system for AI in the long term. Alongside these and other issues, the group of researchers from the Academy highlights the need for an immediate increase in funding from the government for public research (as public universities lead AI research in Brazil), the creation of mechanisms for the private sector to also increase investments in this technology, and the need for a regulatory environment safe for teachers and researchers (ABC, 2023).

In essence, the development of a national science system for AI necessitates the implementation of public policies designed to coordinate the various enabling factors involved. Consequently, it is expected that the examination of the current legislative and administrative landscape in Brazil, coupled with an analysis of select studies from both scientific and grey literature, will afford insight into Brazil's efforts to establish its national science system for AI and the resultant impact on the national science and research framework.

EBIA and AI bills of law serve as the principal instruments guiding scientific research priorities and fostering a targeted innovation ecosystem in Brazil. Failure to contemporaneously advance these instruments may engender negative impacts by creating an uncertain regulatory environment for researchers and professors. Moreover, such stagnation could restrict international collaboration and funding.

### **Missing implementation**

However, generally speaking, other Latin American countries' national AI strategies (Chiarini and Silveira, 2022) propose circa a decade to be implemented, while Brazil has attempted to do it within a relatively short period from 2020 to 2022. There should be little surprise, then, that no specific goals have been substantially achieved so far, despite the magnitude they may represent in the context of a country with a continental size and population. EBIA's missing cascade of detailed indications of opportunities and challenges to implementation (Chiarini and Silveira, 2022) is therefore a serious and urgent problem for Brazil, and for everyone who would likely benefit from AI research for accelerated solutioning.

Given all of the above, the fact that AI is quoted in the Brazilian Digital Transformation Strategy 2018 nine times, but very generically and disconnected from any effective action or concrete objective, seems like one more sign that Brazil has not properly set EBIA's goals and has struggled for too long to approve a legislative platform. Brazil's insufficient preparation for AI and machine learning makes its national science system inconsistent with international good practices. Its national challenges and possibilities, and regional prominence, demand prompt action and support.

### **References**

- ABC. 2023. *Recomendações para o avanço da inteligência artificial no Brasil* [Recommendations for Advancement of Artificial Intelligence in Brazil]. Rio de Janeiro: GTIA da Academia Brasileira de Ciências. <https://www.abc.org.br/wp-content/uploads/2023/11/recomendacoes-para-o-avanco-da-inteligencia-artificial-no-brasil-abc-novembro-2023-GT-IA.pdf>. (In Portuguese.)
- Chiarini, T. and Silveira, S. M. da. 2022. *Exame comparativo das estratégias nacionais de inteligência artificial de Argentina, Brasil, Chile, Colômbia e Coreia do Sul: Consistência do diagnóstico dos problemas-chave identificados* [Comparative Analysis of Artificial Intelligence National Strategies of Argentina, Brazil, Chile, Colombia and South Korea: Consistency of the Diagnostics of Key Issues Identified]. Discussion Paper 2805. Rio de Janeiro, Instituto de Pesquisa Econômica Aplicada. <http://dx.doi.org/10.38116/td2805>. (In Portuguese.)
- Filgueiras, F. and Junquillo, T.A. 2023. 'The Brazilian (non)perspective on national strategy for artificial intelligence'. *Discov. Artif. Intell.*, Vol. 3, No. 7. <https://link.springer.com/article/10.1007/s44163-023-00052-w>. (In Spanish.)
- Fjeld, J., Achten, N., Hilligoss, H., Nagy, A. and Srikumar, M. 2020. *Principled Artificial Intelligence: Mapping Consensus in Ethical and Rights-Based Approaches to Principles for AI*. Research Publication No. 2020-1. Cambridge, MA, Berkman Klein Center for Internet & Society. <http://dx.doi.org/10.2139/ssrn.3518482>.

- Government of Brazil. 2014. *Lei Nº 12.965* [Law No. 12,965]. [https://www.planalto.gov.br/ccivil\\_03/\\_ato2011-2014/2014/lei/l12965.htm](https://www.planalto.gov.br/ccivil_03/_ato2011-2014/2014/lei/l12965.htm). (In Portuguese.)
- Government of Brazil. 2018. *Lei Nº 13.674* [Law No. 12,965]. [https://www.planalto.gov.br/ccivil\\_03/\\_ato2015-2018/2018/lei/l13674.htm](https://www.planalto.gov.br/ccivil_03/_ato2015-2018/2018/lei/l13674.htm). (In Portuguese.)
- Government of Brazil. 2019a. *Lei Nº 13.969* [Law No. 12,965]. [https://www.planalto.gov.br/ccivil\\_03/\\_ato2019-2022/2019/lei/l13969.htm](https://www.planalto.gov.br/ccivil_03/_ato2019-2022/2019/lei/l13969.htm). (In Portuguese.)
- Government of Brazil. 2019b. *Projecto de lei Nº 5051 de 2019* [Senate Bill of Law No. 5051 of 2019]. <https://www25.senado.leg.br/web/atividade/materias/-/materia/138790> (In Portuguese.)
- Government of Brazil. 2020. *Projecto de lei Nº 21 de 2020*. [Senate Bill of Law No. 21 of 2020]. <https://www.derechosdigitales.org/wp-content/uploads/Brazil-Bill-Law-of-No-21-of-2020-EN.pdf>. (Unofficial English translation.)
- Government of Brazil. 2021. *Projecto de lei Nº 872 de 2021*. [Senate Bill of Law No. 872 of 2021]. <https://www25.senado.leg.br/web/atividade/materias/-/materia/147434>. (In Portuguese.)
- Government of Brazil. 2022. *Brazilian Digital Transformation Strategy (E-Digital). 2022–2026 Cycle*. [https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/transformacaodigital/arquivosestrategiadigital/digitalstrategy\\_2022-2026.pdf](https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/transformacaodigital/arquivosestrategiadigital/digitalstrategy_2022-2026.pdf).
- Government of Brazil. 2023. *Projecto de lei Nº 2338 de 2023* [Senate Bill of Law No. 2338 of 2023]. <https://www25.senado.leg.br/web/atividade/materias/-/materia/157233>. (In Portuguese.)
- Gupta, A. and Heath, V. 2020. ‘AI ethics groups are repeating one of society’s classic mistakes’. *MIT Technology Review*. <https://www.technologyreview.com/2020/09/14/1008323/ai-ethics-representation-artificial-intelligence-opinion/>.
- Hilliard, A. 2023. ‘How is Brazil leading South America’s AI legislation efforts?’. *Holistic AI*. <https://www.holisticai.com/blog/brazil-ai-legislation-proposals>.
- IAPP. 2023. *Global AI Legislation Tracker*. 23 August 2023 update. Portsmouth, NH, International Association of Privacy Professionals. <https://iapp.org/resources/article/global-ai-legislation-tracker/>.
- MCTI. 2021. *Estratégia Brasileira de Inteligência Artificial – EBIA* [Brazilian Strategy of Artificial Intelligence – EBIA]. Brasília, Ministry of Science, Technology and Innovation. [https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/transformacaodigital/arquivosinteligenciaartificial/ebia-documento\\_referencia\\_4-979\\_2021.pdf](https://www.gov.br/mcti/pt-br/acompanhe-o-mcti/transformacaodigital/arquivosinteligenciaartificial/ebia-documento_referencia_4-979_2021.pdf). (In Portuguese.)

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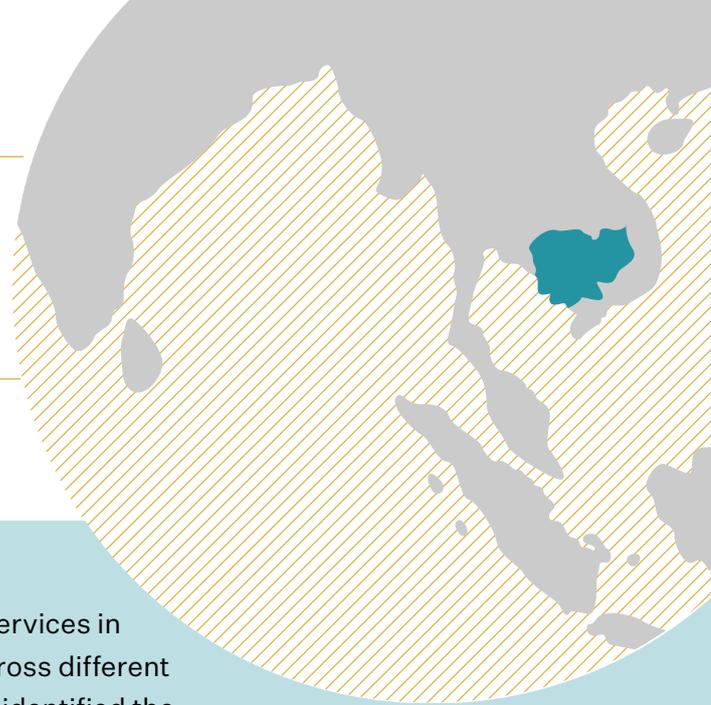
# CAMBODIA

## Seeking artificial intelligence approaches to national research missions

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**Siriwat Chhem**

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### Key takeaways

- The collective efforts in developing cloud-based services in the country has been supported by local actors across different sectors. The National Research Agenda 2025 has identified the national challenges and has put a plan to address these challenges.
- There is limited funding and capacity for research in Cambodia as well as weak alignment between research work and national challenges. Cultural caution around uncertain technologies makes a part of why education is predominantly prioritized for engineering and accounting.
- Among the immediate priorities are strengthening of the infrastructure for data and computing power as well as upskilling and expansion of AI practitioners.

In the rapidly developing landscape of technological advancement, Cambodia stands poised to integrate machine learning and AI into its national science systems. We delve into the strategic approach taken by Cambodia, exploring various facets ranging from the government's perspective on AI's impact to the institutional arrangements and stakeholder involvement essential for fostering innovation and economic growth.

### Human-centred policies

At the heart of Cambodia's strategy lies a keen awareness of the transformative power of AI across diverse sectors. With a vision aligned with global AI trends, the Government of Cambodia is crafting human-centred policies aimed at driving responsible AI research and development (R&D). The Ministry of Industry, Science, Technology and Innovation (MISTI) has published the report *AI Landscape in Cambodia: Current Status and Future Trends* (MISTI, 2023a). This forward-thinking approach underscores Cambodia's commitment to leveraging technological innovations to enhance its socio-economic development, as the Supreme National Economic Council outlined in its *Cambodia Digital Economy and Society Policy Framework 2021–2035* (SNEC, 2021).

### Institutional framework

Institutional arrangements play a crucial role in facilitating Cambodia's AI agenda, with the government spearheading initiatives to initiate and integrate changes. Collaborative frameworks and knowledge-sharing platforms are instrumental in fostering collaboration among multidisciplinary research and innovation sectors, paving the way for holistic development. *Cambodia's Science, Technology & Innovation Roadmap 2030* (MISTI, 2021)

emphasizes that the National STI Policy prioritizes five pillars: governance, human capital, R&D, collaboration and ecosystem building. In addition, MISTI (2023b) developed the *Digital Tech Roadmap*, pinpointing machine learning and AI as key technologies for national digital technology development. According to the MISTI (2023c) *Science, Technology & Innovation Report 2022*, MISTI has the mandate as a government entity to oversee the STI sector, and is responsible for promoting the network of AI, robotics and automation in Cambodia.

### **National research missions**

The *National Research Agenda 2025* detailed by MISTI (2022) identified eight national research missions: 1) local food; 2) reliable energy supply; 3) quality education; 4) electronic and mechanical spare parts; 5) cloud-based services; 6) electricity and potable water; 7) carbon neutrality; and 8) digitally-enhanced health. The key research areas to support mission 5 on cloud-based services are infrastructure, software, cybersecurity and accessibility. These services would be provided to businesses in Cambodia to develop their digital capacities and store their data locally. MISTI, the Ministry of Education, Youth and Sport and the Ministry of Post and Telecommunications are all leading institutions in implementing policy instruments – ranging from legal and policy frameworks to human resources, infrastructure and collaboration – in accomplishing the cloud-based services research mission, with the National Council of Science, Technology and Innovation as the guiding body. Currently, universities and research institutions such as the CamTech University, Royal University of Phnom Penh, Institute of Technology of Cambodia, Cambodia Academy of Digital Technology and Kirirom Institute of Technology, as well as broadband networks and service companies, software producers and cybersecurity companies, have been producing research to accomplish the cloud-based services research mission.

### **Challenges and pathways to research and innovation in Cambodia**

The National Research Agenda (MISTI, 2022) highlighted five challenges facing the national research and innovation system, all of which are relevant to AI research:

- There is national underinvestment in R&D and limited policy support to promote research.
- There is limited alignment between research activities and national challenges, and insufficient contribution of academic research to private sector innovation activities and policy-making.
- There is limited research capacity in the public and the private sectors.
- Research institutions need strengthening and resources.
- There is need for stronger university–industry linkages and sustainable international collaborations.

In response, the National Research Agenda developed four pathways to achieve the country's national research missions:

1. Invest in research to support the eight research missions.
2. Strengthen the role and capacities of public research institutions.
3. Support research careers.
4. Incentivize research activities and collaboration.

## **Missing pieces**

One urgent area of concern for Cambodia is the significant data and computing power required for effective machine learning algorithms. Infrastructure limitations and a shortage of skilled practitioners in the AI field present immediate barriers for Cambodia. The lack of available talent and financing hampers AI research and experimentation, hindering the country's ability to fully capitalize on AI's potential benefits. Additional support in the form of public-private partnership and international collaboration will be required to address these challenges.

Cultural challenges also loom large as Cambodia delves deeper into AI adoption. A cautious yet experimental mindset is essential to navigate the uncertainties and errors inherent in AI implementation. Furthermore, fostering innovation, critical thinking, and science, technology, engineering, arts and math education is crucial to equip the workforce with the skills necessary for successful AI development and deployment. Cambodia's current education landscape is skewed towards the context of a developing country, with civil engineering and accounting as predominant majors. Without a strong foundation and culture of scientific reasoning, the impact of AI research and applications will be limited.

## **Opportunities ahead**

MISTI collaborated with the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2022) in developing the report *Mapping Research and Innovation in the Kingdom of Cambodia*. UNESCO's Global Observatory of Science, Technology and Innovation Policy Instruments survey conducted in 2021 conveyed that R&D expenditure and human capital in Cambodia were both limited. On the positive side, Cambodia is taking steps to integrate AI effectively into its science systems. 'Networking, matchmaking and/or partner search for R&D/innovation activities' and 'support for infrastructure' were the two highest-ranked types of R&D and innovation-related support or services provided, at 50 percent and 40 percent consensus respectively.

In conclusion, Cambodia offers a compelling narrative of a nation poised to harness the transformative potential of machine learning and AI for sustainable socio-economic development. The median age of Cambodia is 27 years, with a large majority of the population integrating social media, e-commerce and mobile banking applications into their daily lives. With the unique combination of a young, tech-savvy population and a lack of legacy technologies, Cambodia has the unique characteristics to leapfrog conventional technological and industrial revolutions. Although late to the game, the timing is opportune for Cambodia to adopt AI at the national level, in an era where the power of AI is now more accessible than ever. Through strategic planning, stakeholder engagement and a commitment to inclusivity, Cambodia is charting a path towards a future where technological innovation drives progress and prosperity for all.

## References

- MISTI. 2021. *Cambodia's Science, Technology & Innovation Roadmap 2030*. Phnom Penh, Ministry of Industry, Science, Technology and Innovation. <https://misti.gov.kh/public/file/202108261629990117.pdf>.
- MISTI. 2022. *National Research Agenda 2025*. Phnom Penh, Ministry of Industry, Science, Technology and Innovation. <https://misti.gov.kh/public/file/202302191676819231.pdf>.
- MISTI. 2023a. *AI Landscape in Cambodia: Current Status and Future Trends*. Phnom Penh, Ministry of Industry, Science, Technology and Innovation. <https://misti.gov.kh/public/file/202305301685426285.pdf>.
- MISTI. 2023b. *Digital Tech Roadmap*. Phnom Penh, Ministry of Industry, Science, Technology and Innovation. <https://misti.gov.kh/public/file/202307291690603726.pdf>.
- MISTI. 2023c. *Science, Technology & Innovation Report 2022*. Phnom Penh, Ministry of Industry, Science, Technology and Innovation. <https://misti.gov.kh/public/file/202307101688972531.pdf>.
- SNEC. 2021. *Cambodia Digital Economy and Society Policy Framework 2021–2035*. Phnom Penh, Supreme National Economic Council. <https://mef.gov.kh/download-counter?post=7116>.
- UNESCO. 2023. *Mapping Research and Innovation in the Kingdom of Cambodia*. GO-SPIN Country Profiles in Science, Technology and Innovation Policy, Volume 11. Paris, United Nations Educational, Scientific and Cultural Organization. <https://www.unesco.org/en/articles/mapping-research-and-innovation-kingdom-cambodia>.

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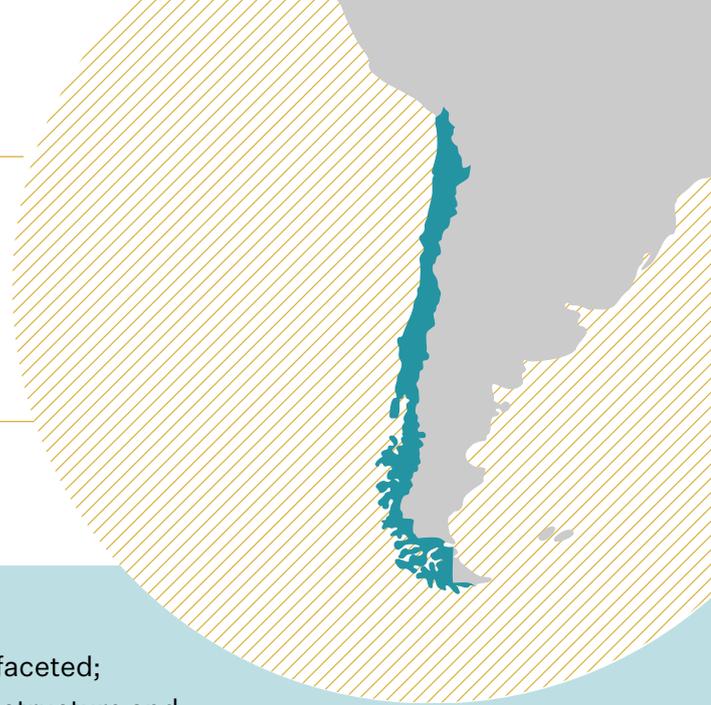
# CHILE

## Finding possibilities to apply artificial intelligence in an existing research financing ecosystem

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**Rodrigo Duran**

CEO, Centre of Artificial Intelligence



### Key takeaways:

- Challenges in Chile around AI for science are multifaceted; primarily there is a lack of funding, resources, infrastructure and capacity and skills for AI.
- Priorities for AI have not been identified at the national scale and universities may be working in silos. Whether a unified vision for AI for science will exist in the near future in Chile is not yet clear.

Chile gained a National Artificial Intelligence Policy in 2021, after a two-year formulation process in which more than 1,300 people participated (MinCiencia, 2021). The policy is formulated in three pillars: enabling factors, R&D, and governance and ethics. The proposed guidelines have a ten-year scope and involve several public and private agencies, which are coordinated by the Ministry of Science for these purposes.

It must be noted, however, that the policy is not a binding instrument; the guidelines are not explicit mandates but proposed courses of action, which implies certain enforcement difficulties. In this sense, the policy also does not define priorities in the area of R&D project financing in any significant way.

### The larger research financing ecosystem

The Chilean research and development (R&D) ecosystem is relatively small compared to the average in the Organisation for Economic Co-operation and Development (OECD, no date). The percentage of Chile's gross domestic product allocated to R&D amounts to 0.36 percent, while in the OECD it is 2.68 percent, meaning the relative investment in Chile is seven times lower. At the same time, the system is highly dependent on public funding, which represents 57 percent of total investment (MinCiencia, no date a). In nominal terms, in 2021 total investment reached USD 1.138 billion, USD 648 million of which was public investment.

These amounts represent the total investment in R&D, including talent training, basic and applied research and technology transfer. Forty-one percent of public investment is managed through the National R&D Agency (ANID), which reports to the Ministry of Science and Technology, while 15.5 percent is resources invested by the universities and comes from the national budget through fiscal contributions or undergraduate university

tuition subsidies (DIPRES, 2023). The remaining 30 percent depends on various agencies with specific mandates, such as the Development Corporation or Public Technological Institutes in specific areas such as fisheries, agriculture or aerospace research. International contributions, for example from observatories, are included in the ANID amount.

### **Public funding to research**

The Chilean public funding system covers the whole researcher career, starting at the formation of advanced human capital, its insertion into industry or academia, the development of long-term individual and associative research projects, as well as infrastructure for centres and universities (MinCiencia, no date b). All of the above is financed through competitive calls, with award rates that vary between 8 percent and 30 percent depending on the instrument (ANID, 2022). The evaluation of the projects is carried out by national academic peers, grouped in 'study groups' that are nominated by collegiate scientific committees representative of the different sectors that participate in the ecosystem (universities, research centres, scientific societies and academia). Currently about 1,500 national researchers participate in 52 study groups, and 120 international peer reviewers evaluate the largest competitions (over USD 1 million) (ANID, no date).

Local research, however, lacks significant targeting and prioritization mechanisms as well as mandates to prioritize. A full 87 percent of public investment in R&D – USD 564 million – is allocated to 'open skies' projects, whether for the formation of advanced human capital or for individual or group research (MinCiencia, no date a). The remaining 13 percent of public R&D investment is mainly housed in the Public Technological Institutes, which have specific mandates from the government. This freedom of research transcends public funding and is also a differentiating element of the university ecosystem, composed of 56 universities, where more than 80 percent of the national knowledge-generating community is concentrated (MinCiencia, no date b).

In summary, the Chilean R&D ecosystem is small compared with the OECD average, with little prioritization in the allocation of resources and high dependence on public funding. Nevertheless, it has solid and transparent mechanisms for the evaluation of highly competitive projects for the entire trajectory of researchers' development, oriented mainly to individual research projects. The impact of Chilean publications measures close to the OECD average, and thus the impact achieved per dollar of investment goes well beyond the average.

### **The arrival of artificial intelligence**

In terms of prioritization of sectors and funding practices, the Chilean R&D ecosystem faces challenges from AI. Being a highly atomized system in terms of project evaluation, many evaluators are not trained to properly assess the impact that the use of AI or machine learning tools can have on research, so more orthodox approaches outside of the science, technology, engineering and mathematics (STEM) disciplines are likely to be prioritized. On the other hand, in the absence of prioritization or targeting mechanisms in specific sectors, the development of these competencies in the academic community depends profoundly on what the host institutions – mainly universities – do. However, the lack of

base funds for universities in this area means they need to prioritize other policies rather than the continuous training of their academic staff. There is no mandate for universities to move in this direction, nor are there any competitive mechanisms to encourage work along these lines.

In this sense, the integration of AI tools in interdisciplinary research depends on the ability and possibility of researchers to articulate around specific projects for particular funding calls – which must be evaluated by peers who do not have the tools to understand their impact – or else focus on particular STEM study groups. This phenomenon means that interdisciplinary projects using AI compete for funds with AI-focused R&D projects, which ultimately may discourage the AI community from collaborating with other disciplines. Addressing AI governance issues has led to more international collaboration which has encouraged academic collaboration.

### **Training and talent**

In terms of training and retention of talent, since 2019 there has been a relative increase of 15 percent in funding for the training of advanced human capital at the local level, with a decrease of 12 percent in funding for master's and doctoral degrees abroad (ANID, no date). This is consistent with the maturation process of the local university system in general. However, in disciplines such as AI it represents a challenge, since the community is less mature and therefore there is less quality supply than in disciplines like astronomy or biochemistry. This means that the speed at which the community has been growing is decreasing, which limits the possibilities for interdisciplinary research. Similarly, the growing interest of the private and public sector in the adoption of AI tools at the international level has generated a significant increase in the demand for advanced human capital, which means that the salaries offered by academic research careers are less competitive than five years previously. Consequently there is a shortage due to better working conditions outside the academy. Although the talent gap that will be faced in the future seems evident, there are no concrete efforts on the part of the private sector to significantly promote talent development on a national scale.

*The growing interest of the private and public sector in the adoption of AI tools at the international level has generated a significant increase in the demand for advanced human capital, which means that the salaries offered by academic research careers are less competitive than five years previously.*

### **Infrastructure and data**

In terms of infrastructure, Chile lacks national laboratories or 'big facilities' with open access to the academic community. The development of AI models requires access to computing infrastructure, either physical or cloud, which is increasingly expensive due to the generalized increase in demand. This lack can be a significant impediment to the adoption of AI tools in an interdisciplinary manner, or a concentration of tools in university institutions with the resources to fund them.



Data access and governance for AI systems is also a structural weakness of the local system. A policy of open access to state-funded research data started in 2022, but the academic community is still reluctant to embrace this openness. There is no culture of standardization of data formats, which means that in many disciplines curatorial work is required prior to their availability. This lack of standards is also reflected in privacy and access policies, which depend on what is established by each university or even faculty within the university. All of the above translates into a substantive challenge for the adoption of AI in an interdisciplinary manner.

## References

ANID. No date. 'ANID-GITHUB'. *GitHub*. <https://github.com/ANID-GITHUB> (Accessed 21 February 2024). (In Spanish.)

ANID. 2022. *Compendio Estadístico 2018–2022* [Statistical Compendium 2018-2022] Santiago, National R&D Agency. <https://anid.cl/anid-publica-actualizacion-de-su-compendio-estadistico/>. (In Spanish).

DIPRES. 2023. *Presupuesto 2023* [Budget 2023]. Santiago, Budget Office. <https://www.dipres.gob.cl/597/w3-multipropertyvalues-15199-35324.html>. (In Spanish.)

MinCiencia. No date a. 'Investigación y desarrollo (I+D)' [Research and Development (R+D)]. *Observa*. Santiago, Ministry of Science, Technology, Knowledge and Innovation. <https://www.observa.minciencia.gob.cl/indicadores/investigacion-y-desarrollo-id> (Accessed 21 February 2024). (In Spanish.)

MinCiencia. No date b. 'Visualización interactiva del sistema' [Interactive system visualisation]. *Observa*. Santiago, Ministry of Science, Technology, Knowledge and Innovation. <https://www.observa.minciencia.gob.cl/sistema> (Accessed 21 February 2024). (In Spanish.)

MinCiencia. 2021. *Política Nacional de Inteligencia Artificial* [National Artificial Intelligence Policy]. Santiago, Ministry of Science, Technology, Knowledge and Innovation. <https://www.minciencia.gob.cl/areas/inteligencia-artificial/politica-nacional-de-inteligencia-artificial/>. (In Spanish.)

OECD. No date. *OECD.Stat*. Paris, Organisation for Economic Co-operation and Development. <https://stats.oecd.org/> (Accessed 21 February 2024).

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# CHINA

## Promoting the Artificial Intelligence for Science approach

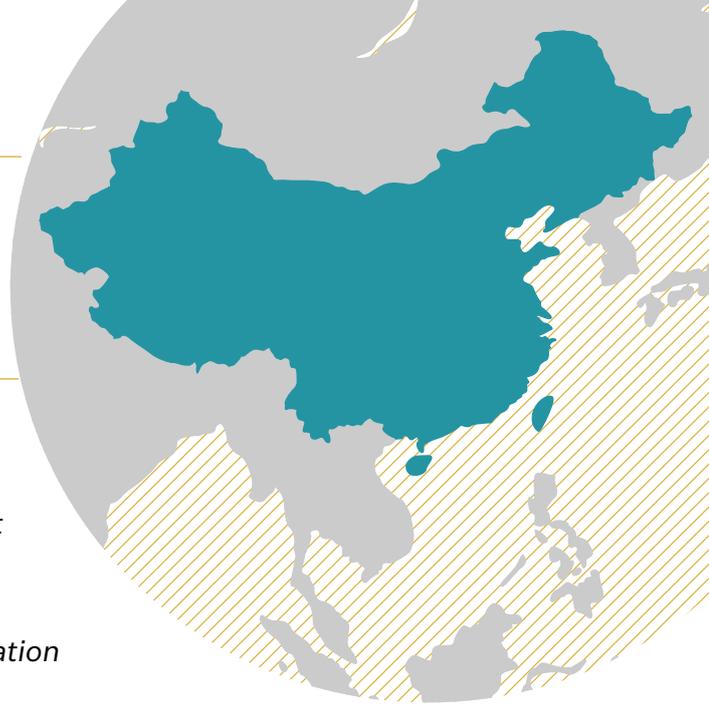
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### Gong Ke

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### Liu Xuan

*Research Fellow of the National Academic of Innovation Strategy, CAST*



### Key takeaways:

- The government in China is supporting the integration of AI across different fields of science through programs and infrastructure.
- China is active on the international front regarding AI technologies and has achieved the development of platforms and software supporting AI.

Artificial Intelligence for Science (AI4S) is an emerging mode that integrates AI and scientific research. It refers to the use of AI technologies and methods to learn about, simulate, predict and optimize various phenomena and laws in nature and human society. This case study focuses on the example of AI4S in China, exploring the impact of machine learning and AI on the scientific system.

The Chinese government attaches great importance to AI4S, promoting innovations in AI algorithms and models oriented towards major scientific problems. They have established open platforms in typical research areas of AI4S, encouraged academic institutions to open their data resources and set norms for ethical conduct with AI4S. At the national and local government levels in China, policy initiatives in the field of AI4S are mainly as follows.

### Special research programs and infrastructure

In March 2023, the Ministry of Science and Technology, in collaboration with the National Natural Science Foundation of China, launched a special initiative called the Implementation Plan for Scientific Research Driven by Artificial Intelligence (2022–2025) to support the adoption of AI tools in basic sciences such as mathematics, physics, chemistry and astronomy. The intention is to address major challenges such as climate change, the energy transition, drug development, genetic research, biological breeding and new materials. The projects include cross integration of AI and materials science, cross integration of AI and basic mathematics, cross integration of AI and information technology, cross integration of AI and life sciences, and cross integration of AI and ethical and social issues (Ministry of Science and Technology, 2023a).

Meanwhile, the Ministry of Science and Technology is leveraging the national project Science and Technology Innovation 2030 – Next Generation of Artificial Intelligence (Ministry of Science and Technology, 2021) as a driver to build open intelligent computing power infrastructure, facilitate the active opening of data resources from various sectors, and generate policy synergy to advance AI4S. In April 2023, the Shanghai government supported Shanghai Jiao Tong University in launching the Open Platform of AI4S with Open-Sourced Models and Scientific Data (Jiefang Daily, 2023).

### **Ethics governance and regulations**

In 2017, the Chinese national plan for developing AI was released (State Council, 2017), in which it is pointed out that AI has both technical and social features. Two committees were established by the Chinese government to implement the plan: a technical committee and a governance committee. The governance committee is composed of relevant experts from universities, research institutes and enterprises. It has released documents such as *Governance Principles of the Next Generation of AI – Developing Responsible AI* (National Next Generation AI Governance Professional Committee, 2019) and *Next Generation Artificial Intelligence Ethics Standards* (National Next Generation AI Governance Professional Committee, 2021).

In 2021, the Chinese government also established the National Science and Technology Ethics Committee, which has released a list of high-risk AI research and development areas (Ministry of Science and Technology, 2023b). This ethics committee has a subcommittee dedicated to AI, consisting of experts from relevant sectors and providing professional consultations to the State Council for the formulation of China's technology ethics policies. Finally, in 2023, after a month-long online open consultation, the State Cyberspace Administration of China along with multiple departments jointly issued *Interim Measures for the Management of Generative Artificial Intelligence Services*, marking the first regulatory policy for China's AI-generated content industry (The Cyberspace Administration of China, 2023a).

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### **The international perspective**

China has an open and proactive attitude towards international cooperation in AI. It supports the United Nations' irreplaceable role in international AI governance, and actively participates in activities organized by bodies such as the United Nations Educational, Scientific and Cultural Organization (UNESCO), International Telecommunication Union (ITU), World Health Organization (WHO), United Nations Industrial Development Organization (UNIDO) and United Nations Development Programme (UNDP). China has invited United Nations bodies' representatives to join relevant AI conferences and forums in the country.

In November 2023, the Chinese government launched the Global Initiative on AI Governance, outlining eleven proposals that prioritize a people-centric approach and respect for the sovereignty of other countries. It was emphasized that China is willing to engage in communication, exchange and cooperation with all parties on global AI governance, promote the benefits of AI technology to all mankind, and propose constructive solutions to the development and governance issues of AI that are of wide concern to all parties in the new era (The Cyberspace Administration of China, 2023b).

China's promotion of non-governmental exchanges and cooperation is exemplified in the August 2023 International Young Scientist Salon 'AI for Science – Taking Place in the Current Scientific and Technological Revolution', organized by the China Association for Science and Technology in Shanghai. Young scientists from eight countries including the United Kingdom, Greece and Germany participated in the discussion and exchange (CAST, 2023). Shanghai also hosted the January 2024 World Digital Education Conference, jointly organized by the Chinese Ministry of Education, the National Committee of UNESCO and the Shanghai Government. This conference focused on the theme of 'Digital Education: Application, Sharing, and Innovation', with subthemes of enhancing teacher digital literacy and competence; digitizing education and building a learning society; evaluating global trends and indices in digital education development; AI and digital ethics; challenges and opportunities of digital transformation for basic education; and digital governance in education (Ministry of Education, 2024).

### **Overall development trend**

Based on relevant research reports and literature review (AI for Science Institute of Beijing, 2023), the overall trend in the field of AI4S in China can be summarized as follows.

Chinese academic institutions, universities and leading AI enterprises are proactive in the AI4S field, with internationally influential achievements such as MEGA-Protein, Pengcheng Shen Nong, Shanghai AI Lab's FengWu and PanGu Weather (Fang, X., et al., 2022) (K. Bi, et al., 2023). Abundant open scientific research data resources have accumulated for AI4S, with open-source data found in meteorology, astronomy and high-energy physics (Tan, S. et al., 2023).

A considerable number of AI4S algorithms and foundational software have also emerged, including Huawei's MindSpore Science, Baidu's PaddleScience, DP Technology's DeePMD and Zhipuai's GLM, providing rich datasets, foundational models and specialized tools for AI4S research (Huawei, 2017). AI4S applications are being explored in various fields including life science, material science, energy science, electronic engineering and computer science, earth and environmental science, and industrial simulation. In particular, institutions represented by the likes of Baidu and Huawei are actively promoting the development of AI4S industrial practice.

## Foundational Artificial Intelligence for Science software

Baidu's PaddlePaddle began planning technical forms and product routes in the AI4S field as early as 2019. It has since released the biological computing platform PaddleHelix, the quantum computing platform PaddleQuantum, and the scientific computing platform PaddleScience. Baidu has collaborated on exemplary projects with multiple universities and research institutions and launched the PaddlePaddle AI4S CoCreation Program to build an ecological business opportunity. In May 2023, Baidu published a paper in the journal Nature opening up numerous possibilities for the integration of AI into fields such as biology and healthcare (Fang, X., et al., 2022).

Huawei, meanwhile, has launched PanGu large models for drug molecules, meteorology and ocean waves. Among them, the PanGu drug molecule large model can improve the screening speed of small molecule compounds, greatly improve research and development efficiency, and explore more possible combinations of molecular elements at lower costs. In July 2023, the research results of the PanGu meteorological large model of Huawei Cloud were published in the journal Nature, and it is the first AI model to surpass traditional numerical forecasting methods in accuracy (K. Bi, et al., 2023).

## References

- Ministry of Science and Technology. 2023a. 科学技术部,《“人工智能驱动的科学”专项实施方案(2022—2025年)》: [https://www.gov.cn/xinwen/2023-03/27/content\\_5748495.htm?eqid=b37ce62c0003f23100000003645c969b](https://www.gov.cn/xinwen/2023-03/27/content_5748495.htm?eqid=b37ce62c0003f23100000003645c969b). (In Chinese).
- Ministry of Science and Technology. 2021. 科学技术部, 科技创新2030—“新一代人工智能”重大项目: [https://service.most.gov.cn/kjjh\\_tztg\\_all/20210706/4392.html?eqid=83157a1b00020ab2000000066487cd60](https://service.most.gov.cn/kjjh_tztg_all/20210706/4392.html?eqid=83157a1b00020ab2000000066487cd60). (In Chinese).
- Jiefang Daily. 2023. 解放日报, 上海建开源平台推动“第五范式”: <https://www.shanghai.gov.cn/nw4411/20230403/4e6f9b4cd0c84f95a4adb00c690617d8.html>. (In Chinese).
- State Council. 2017. 国务院,《新一代人工智能发展规划》: [https://www.gov.cn/zhengce/content/2017-07/20/content\\_5211996.htm](https://www.gov.cn/zhengce/content/2017-07/20/content_5211996.htm)
- National Next Generation AI Governance Professional Committee. 2019. 国家新一代人工智能治理专业委员会,《新一代人工智能治理原则——发展负责任的人工智能》: [https://www.most.gov.cn/kjbgz/201906/t20190617\\_147107.html](https://www.most.gov.cn/kjbgz/201906/t20190617_147107.html). (In Chinese).
- National Next Generation AI Governance Professional Committee. 2021. 国家新一代人工智能治理专业委员会,《新一代人工智能伦理规范》: [https://www.most.gov.cn/kjbgz/202109/t20210926\\_177063.html](https://www.most.gov.cn/kjbgz/202109/t20210926_177063.html). (In Chinese).
- Ministry of Science and Technology. 2023b. 科学技术部, 关于印发《科技伦理审查办法(试行)》的通知: [https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgnr/fgzc/gfxwj/gfxwj2023/202310/t20231008\\_188309.html](https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgnr/fgzc/gfxwj/gfxwj2023/202310/t20231008_188309.html). (In Chinese).

- The Cyberspace Administration of China. 2023. 国家网信办,《生成式人工智能服务管理暂行办法》: [https://www.gov.cn/zhengce/zhengceku/202307/content\\_6891752.htm](https://www.gov.cn/zhengce/zhengceku/202307/content_6891752.htm). (In Chinese).
- The Cyberspace Administration of China. 2023b中央网信办,《全球人工智能治理倡议》: [http://www.cac.gov.cn/2023-10/18/c\\_1699291032884978.htm](http://www.cac.gov.cn/2023-10/18/c_1699291032884978.htm). (In Chinese).
- CAST. 2023. 中国科协,中国科协AI for Science发生在当下的科技革命国际青年科学家沙龙活动在沪举办: [https://www.cast.org.cn/xs/XSDT/art/2023/art\\_71bd1e6a52a3406aa9f834571db36c04.html](https://www.cast.org.cn/xs/XSDT/art/2023/art_71bd1e6a52a3406aa9f834571db36c04.html) OR <https://finance.sina.com.cn/jjxw/2023-08-05/doc-imzfcferz5757477.shtml>. (In Chinese).
- Ministry of Education. 2024. 教育部,2024世界数字教育大会在上海开幕: [http://www.moe.gov.cn/jyb\\_xwfb/gzdt\\_gzdt/moe\\_1485/202401/t20240130\\_1113437.html](http://www.moe.gov.cn/jyb_xwfb/gzdt_gzdt/moe_1485/202401/t20240130_1113437.html). (In Chinese).
- AI for Science Institute of Beijing. 2023. 北京科学智能研究院,《科学智能(AI4S)全球发展观察与展望(2023)》:(See PDF attachment). (In Chinese).
- Fang, X., Liu, L., Lei, J. et al. 2022. Geometry-enhanced molecular representation learning for property prediction. *Nature Machine Intelligence*. <https://doi.org/10.1038/s42256-021-00438-4>
- K Bi, K., Xie, L., Zhang, H. et al. 2023. Accurate medium-range global weather forecasting with 3D neural networks. *Nature*. <https://doi.org/10.1038/s41586-023-06185-3>
- Tan, S. et al. 2023. 孙坦,张智雄,周力虹等.人工智能驱动的第五科研范式(AI4S)变革与观察[J/OL]. 农业图书情报学报. DOI: 10.13998/j.cnki.issn1002-1248.23-0850.
- Huawei. 2017. Huawei and Baidu Sign Strategic Agreement to Lead the New Era of Mobile AI. <https://www.huawei.com/en/news/2017/12/huawei-baidu-strategic-agreement-mobileai>

# INDIA

## Gaining insights into transformative technologies and their social integration

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### Key takeaways:

- Development of online platforms and AI supporting software tools in India are part of its vision to become the hub for software in the Global South. Achievements in the country include the establishment of Centres of Excellence and upskilling initiatives to advance capacity for AI.
- Streamlining and coordinating the work of the newly established Centres of Excellence as well as the lack of private-public partnerships are challenges in the country which are currently being addressed.

AI is pivotal to India's strategy of harnessing transformative technologies. Driven by the Ministry of Electronics and Information Technology (MeitY), AI missions are designed to foster inclusivity, steer innovation and ensure AI's wide acceptance across diverse sectors. The aim is to yield significant societal benefits and economic growth.

### First applications

A primary focus is on extending the advantages of AI to every segment of society, aligning with the broader vision of comprehensive and sustainable development (TEC, 2020). With current rapid developments in data and AI infrastructure in the country, India aims to become the hub for the Global South for software tools. A prime example of AI's societal contribution in India on the national level is the Bhasini platform, empowered by AI and other advanced technologies and dedicated to local language translation (Bhasini, no date). The National Data and Analytics Platform is another government initiative that streamlines access to governmental data in India: it offers a user-friendly environment for individuals to search, amalgamate, visualize and retrieve datasets easily (NDAP, no date). Moreover, AIRAWAT (AI Research, Analytics and Knowledge Assimilation), a specialized AI-centric cloud computing infrastructure for India, is set to debut soon (AIRAWAT, 2023).

*With current rapid developments in data and AI infrastructure in the country, India aims to become the hub for the Global South for software tools.*



## **Establishing Centres of Excellence**

MeitY is leading the AI initiatives in India. It has formed seven expert groups to focus on various aspects of AI integration, from establishing national missions to skilling the workforce and addressing cybersecurity. These committees are shaping India's AI strategy. The expert groups' recent report (Expert Group to MeitY, 2023) brought out the operational aspects of establishing the Centres of Research Excellence, which now as they are being implemented are referred to as Centres of Excellence (CoEs). The functions of CoEs may include but are not limited to foundational research, technology development, promoting innovation and entrepreneurship, and AI skill development. Institutional structures of CoEs vary from partnerships between national or local government with companies, such as the CoE for Internet of Things and AI, a partnership between MeitY and the trade association Nasscom, as well as the CoE for Data Science and AI, a partnership between the Government of Karnataka and Nasscom. Some CoEs are within universities.

## **Skill development initiatives**

The Ministry of Skill Development and Entrepreneurship has launched a free online training programme on AI available in various Indian languages. This course is jointly developed by Skill India and GUVI (Grab Ur Vernacular Imprint), an ed-tech company incubated at the Indian Institute of Technology, Madras, and Indian Institute of Management, Ahmedabad. The private sector is also stepping up in AI skill development. For example, Infosys has launched a free AI certification training program that is available on the Infosys Springboard virtual learning platform. Intel, in partnership with the Central Board of Secondary Education under the Ministry of Education, has announced the 'AI For All' initiative to foster a fundamental understanding of AI for everyone in India. Many Indian educational institutions have meanwhile developed their own programs and certification courses in AI and machine learning. One such example is the postgraduate-level advanced certification program in Deep Learning (TalentSprint, 2024) offered by the Indian Institute of Science, Bangalore.

## **Strategic direction**

The National Institution for Transforming India (NITI) Aayog serves as the apex public policy think tank of the Government of India. NITI Aayog published a discussion paper in 2018 titled *National Strategy for Artificial Intelligence #AIForAll* (NITI Aayog, 2018). This is a guiding document for understanding India's vision to integrate AI across all sections of society, ensuring its benefits reach everyone. The document highlights NITI Aayog's recommendations for five sectors that are envisioned to benefit the most from AI in solving societal needs: healthcare; agriculture; education; smart cities and infrastructure; and smart mobility and transportation. MeitY drives India's AI missions within these sectors.

Acknowledging that AI research in India is at a relatively early stage, NITI Aayog has put a strong emphasis on enhancing research capacity and infrastructure. The strategy involves setting up CoEs for in-depth AI research and International Centres of Transformational AI for developing practical AI applications. This dual approach aspires to bring together more collaboration among academia, industry and government. Integrating AI into society also requires addressing ethical, legal and socio-economic issues. Recognizing the need for

appropriate handling of data to ensure privacy and security, NITI Aayog recommends setting up Ethics Councils within CoEs. There is also a recommendation for creating a National AI Marketplace to democratize data access, which is essential for AI innovations.

### **Roles for Centres of Excellence**

In acknowledgment of AI's transformative potential, the finance minister, in her 2023–2024 budget speech, emphasized the need to expand India's comprehensive AI capabilities, which led to the inception of three CoEs in premier educational institutions, adopting a hub-and-spoke model.

These CoEs are integral to the 'INDIAai' initiative, positioning the country at the forefront of global AI advancements. The critical areas identified for the CoEs to promote research and development include governance, healthcare, agriculture, manufacturing and financial technology, as a reflection of their significance in promoting inclusive socio-economic growth. The CoE initiative aims to foster an AI ecosystem, driving innovation through collaboration with industry, academic entities and startups domestically and globally. The CoEs are to lead foundational and practical AI research, targeting sector-specific challenges and aiding the commercialization of existing AI solutions. They are mandated to outline sector-specific AI strategies, identify primary challenges and recognize opportunities.

### **India's global position**

The *AI Index Report 2023* by the Stanford Institute for Human-Centred Artificial Intelligence highlighted India's growing contribution to AI research and development, with steady growth in AI-related publications (Stanly, 2023). India is also making contributions in the global AI ecosystem and Indian tech giants are promoting open-source AI contributions to democratize the technology. India served as the chair of the Global Partnership on Artificial Intelligence, an international initiative aiming to promote the responsible development and use of AI, for 2022–2023. The Indian government has meanwhile taken various steps in developing its own roadmap for AI governance. Towards this, INDIAai organized a roundtable in February 2023 to discuss the generative AI developmental trajectory, ethics and intellectual property rights, involving experts from institutions like the Indian Institute of Science, Bangalore, the Global AI Ethics Institute and IBM Research India (INDIAai, 2023).

## References

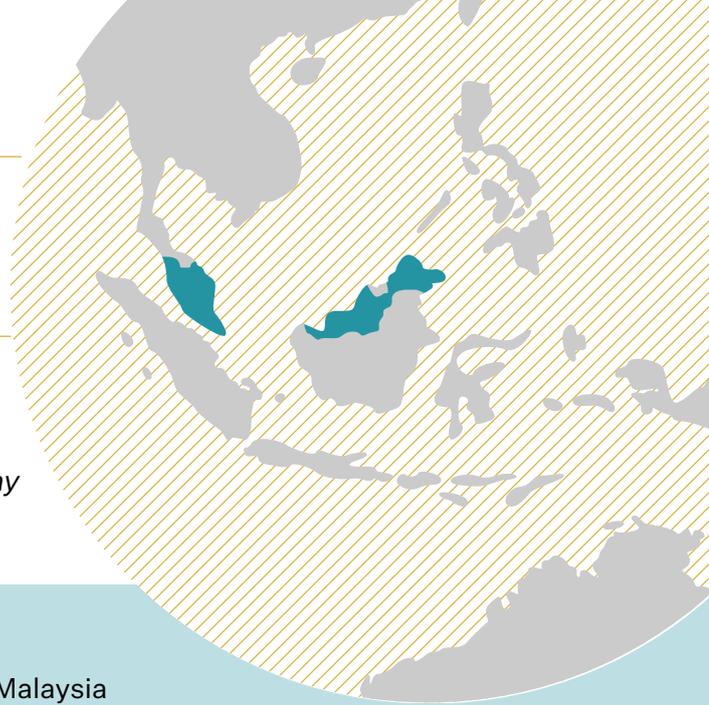
- Bhashini. No date. *National Language Translation Mission*. <https://www.bhashini.gov.in/en>.
- Expert Group to MeitY. 2023. *India AI 2023*. First edition. New Delhi, Ministry of Electronics and Information Technology. <https://indiaai.s3.ap-south-1.amazonaws.com/docs/IndiaAI+Expert+Group+Report-First+Edition.pdf>.
- INDIAai. 2023. *INDIAai*. <https://indiaai.gov.in/news/indiaai-launched-the-generative-ai-report>
- AIRAWAT. 2023. *AI Research Analytics and Knowledge Dissemination Platform (AIRAWAT)*. <https://airawat-psai.cdac.in/airawat/home>. (Accessed 21 February 2024).
- NDAP. No date. *National Data and Analytics Platform*. <https://ndap.niti.gov.in>.
- NITI Aayog. 2018. *National Strategy for Artificial Intelligence #AIForAll*. New Delhi, NITI Aayog. <https://www.niti.gov.in/sites/default/files/2023-03/National-Strategy-for-Artificial-Intelligence.pdf>.
- Stanly, M. 2023. 'Global collaborations: an analysis of India's role in the international AI ecosystem'. *INDIAai*. 27 October. <https://indiaai.gov.in/article/global-collaborations-an-analysis-of-india-s-role-in-the-international-ai-ecosystem>.
- TalentSprint 2023. <https://talentsprint.com/programs.dpl#program=.AlandDataScience>. (Accessed 21 February 2024).
- TEC. 2020. *Study Paper on Artificial Intelligence (AI) Policies in India – A Status Paper*. New Delhi, Future Networks Division, Telecommunication Engineering Center. <https://www.tec.gov.in/pdf/Studypaper/AI%20Policies%20in%20India%20A%20status%20Paper%20final.pdf>.

# MALAYSIA

## Enabling the Fourth Industrial Revolution

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### Key takeaways:

- The cross-cutting guidelines and policies on AI in Malaysia have involved actors from different sectors. The Ministry of Higher Education (MoHE) and Malaysia Qualification Agency provide guidance for responsible AI use in academia.
- The approach to AI for science is focused on innovation through technology. AI upskilling is being led by both the academic and industry sectors.

As Malaysia strides boldly into the Fourth Industrial Revolution (4IR), the convergence of science, technology and innovation becomes paramount for sustainable growth. At the heart of this transformation lies the strategic integration of AI, propelling Malaysia towards its vision of becoming a high-tech nation by 2030. Guided by pivotal policy frameworks, Malaysia's journey unfolds as a testament to the nation's commitment to leveraging AI for scientific advancement and economic prosperity.

### Enabling policies

The Malaysian government introduced the National Science, Technology and Innovation Policy (DSTIN) 2021–2030 (MoSTI, 2020) to intensify local technology development. As part of this initiative, the Malaysian Science, Technology, Innovation and Economy (10-10 MySTIE) framework developed by the Academy of Sciences Malaysia (ASM, 2020) was specifically designed to boost economic development and enhance the level of innovation, wealth generation, inclusion and wellbeing of society.

A National 4IR Policy was also developed by the Economic Planning Unit, Prime Minister's Department in 2021 (EPU, 2021a) to serve as a comprehensive national strategy for the 4IR. Aligned with the DSTIN 2021–2030, it provides guiding principles and strategic direction to ministries and agencies, aiming to optimize resource allocation and manage emerging risks. The policy supports national development policies such as the Twelfth Malaysia Plan and Shared Prosperity Vision 2030 and complements the Malaysia Digital Economy Blueprint (EPU, 2021b) in driving the growth of the digital economy and bridging the digital gap.

## National roadmap

The National AI Roadmap 2021–2025 (MoSTI, 2021) is an initiative aimed at developing and implementing AI in Malaysia. The roadmap is structured around several key strategies, including establishing AI governance, acculturating AI and kickstarting an AI ecosystem. It aims to create a thriving AI innovation ecosystem in Malaysia and encourage industry leaders and academicians to develop and implement AI solutions.

### Seven principles of responsible artificial intelligence from Malaysia's National Roadmap

- Fairness
- Reliability
- Safety and control
- Privacy and security
- Pursuit of human benefit and happiness
- Accountability
- Transparency

These principles provide guidelines for the development of trusted and privacy-conscious AI.

The Ministry of Science, Technology and Innovation (MoSTI) established the National Blockchain and Artificial Intelligence Committee to coordinate and monitor the action plan implementation planned in the National AI Roadmap (Ministry of Communications, 2022). Additionally, the Department of Standards Malaysia, which functions as the national standards body and the national accreditation body and an agency under the Ministry of Investment, Trade and Industry, formed an AI Technical Committee with representatives from various sectors (DSM, 2023) to provide national AI standards.

To propel AI adoption, the roadmap identifies national AI use cases in supply chains, healthcare, education, agriculture and finance. The roadmap also recommends embarking on fundamental and applied research and development (R&D) in the relevant entities within the AI innovation ecosystem, and encouraging AI adoption in R&D for all fields. Each state in Malaysia has a digital transformation strategy, with states like Selangor, Sarawak, Terengganu, Penang and Melaka showing robust AI adoption due to factors such as digital labour and growing R&D awareness.

## Research streams

Academic research advancement with AI is led by the Ministry of Higher Education (MoHE) and the Malaysia Qualification Agency, such as through the release of advisory notes and guidelines for scaffolding responsible use of generative AI. A cascading effect for AI transformation within higher educational institutions is conducted at each institution, such as through smart campus and digital education initiatives. MoSTI is also supporting the AI transformation for academic development and research.

One national flagship based on AI is the Digitalisation and Internet of Things (IoT) program, with a pilot project at the Pasoh Reserve Forest spearheaded by ASM. The project introduces robots, IoT systems, AI and machine learning–based systems for species digitalization, profiling and analysis, and an ecology simulator for facilitating AI-infused forest management, besides offering training programs (ASM, 2023a). A precision biodiversity alliance has also been formed as part of the change management and transformation enculturation in sustainable biodiversity and forest management.

Meanwhile, Cancer Research Malaysia (2020) has developed an AI-enabled mobile app called MeMoSA (Mobile Mouth Screening Anywhere) for early detection of oral cancers. MeMoSA collects oral lesion images and uses AI and image processing for oral cancer detection. The app has the potential to reach a large number of people in low-cost settings, making it particularly beneficial for individuals in rural areas with limited access to healthcare facilities.

### **Education and services**

ASM has prepared a white paper titled *A New Horizon for Science, Technology and Innovation* (UPM, 2023) with recommendations to MoHE to manage technological disruptions in teaching and learning and the governance of higher education. The paper is in line with the Malaysia Higher Education Blueprint 2015–2025 (JPT, 2013), which promotes globalized online learning to provide accessible education while tailoring learning experiences to each student’s needs. Recommendations address policies including on resource sharing and establishment of centres for high-end infrastructure; open education technologies policy and national open innovation platforms among many other considerations.

Digital government initiatives to support AI expansion are also ongoing. A data sharing platform called the Malaysian Government Central Data Exchange provides data integration services across agencies to facilitate the provision of end-to-end online services, led by the Digital Department under the Ministry of Digital. The Main Database platform developed by the Ministry of Economy centralizes socio-economic data for targeted subsidies, enhancing data security and consolidating management. The Malaysia Open Science Platform championed by ASM fosters a national research asset adhering to open science guidelines.

### **Spaces for innovation**

The National Technology and Innovation Sandbox provides a ‘safe place’ for innovators to test and validate their tech solutions in a live environment with relaxations on regulations and laws. It is coordinated by the Malaysian Research Accelerator for Technology & Innovation and Malaysia’s Applied Research and Development Centre, two agencies under MoSTI, and Futurise, a company under the Ministry of Finance. The Sandbox is open to all technologies, but priority is given to ten science and technology drivers guided by the 10-10 MySTIE. It offers capacity building programs, market access, funding facilitation, testbed and test environment facilitation, and facilitation/review of regulations and laws.

The Malaysia Development Corporation is entrusted to be the AI technology endorser with the collaboration of ministries such as the Ministry of Agriculture and Food Security,

while the strategic agency to MoSTI, MIMOS – the national Applied R&D Centre, focuses on accelerating industrial use cases. The government sector is also moving towards digital transformation with AI, managed by the Digital Department under the Ministry of Digital. The concept paper *GovTech* presents a single platform for integrated government services and outlines the strategic initiatives and innovative technology solutions offered using sophisticated and inclusive digital services (The Star, 2023).

To foster AI talent preparation and scouting for recruitment, various upskilling and reskilling data and AI literacy programs are offered by academia, industry and their combination, in the form of certifications and courses for all layers of society. For the government workforce, the National Institute of Public Administration, the training arm of the Public Service Department, has taken the lead. TalentCorp and the Malaysia Digital Economy Corporation are also actively promoting AI talent and initiatives in Malaysia. TalentCorp’s Future Skills Talent Council aims to bridge the gap between graduates’ skills and industry needs, and they have launched sector-focused industry–academia collaboration workshops to address talent gaps within the Malaysian workforce.

**Recent events**

AI events such as the Chinese Chambers of Commerce and Industry Tech Conference (ACCCIM, 2023), UK MY AI Conference 2023 (BHCKL, 2023) and ASM’s AI Forum (ASM, 2023b) have highlighted examples of implemented AI initiatives and calls for closer collaboration to democratize the promises of AI for all. Talks, hackathons, intellectual discourses, forums, exhibitions and digital channels have been created to identify opportunities such as upskilling and reskilling programs, challenges such as talent gaps and infra/infrastructure necessities, and best practices for AI implementation including use cases. The government is also investing in AI education and research by funding the first AI faculty in Malaysia at Universiti Teknologi Malaysia, expected to start in 2024 (Fam, 2023).

*To foster AI talent preparation and scouting for recruitment, various upskilling and reskilling data and AI literacy programs are offered by academia, industry and their combination, in the form of certifications and courses for all layers of society.*

The establishment of the Malaysia Centre4IR in MyDIGITAL (under the Ministry of Economy) is a further example of unwavering commitment by the government to foster innovation and facilitate the co-design of policies and regulatory frameworks necessary to maximize the social benefits and minimize the risks associated with these advanced technologies. The ‘AI untuk Rakyat’ (AI for People) program (MyDIGITAL, 2024) is another such initiative, aimed at enhancing public literacy in AI and bridging the digital divide, with a focus on inclusivity and participation in AI-related developments. The program consists of two courses, AI Aware and AI Appreciate, that are available in four local languages, based on original courses by Intel. The courses are free and compulsory for all government servants.



## Harnessing artificial intelligence

In conclusion, Malaysia stands at the forefront of a paradigm shift in scientific inquiry, driven by the strategic deployment of AI across various sectors. Through the concerted efforts outlined in its comprehensive policy frameworks, Malaysia has laid a robust foundation for fostering AI innovation, talent development and responsible governance. As the nation continues to chart its course towards the 4IR, the integration of AI into the fabric of scientific endeavours promises to unlock new frontiers of knowledge, propel economic prosperity and foster a future where innovation knows no bounds. With unwavering commitment and strategic foresight, Malaysia is poised to harness the full potential of AI for the betterment of its people and the advancement of science on a global scale.

## References

- ACCCIM. 2023. 'ACCCIM Tech Conference AI UNPLUGGED 2023: navigating business in the post-ChatGPT world'. ACCCIM. The Associated Chinese Chambers of Commerce and Industry of Malaysia. <https://accim.org.my/en/ai-unplugged-2023/>.
- ASM. 2020. *10-10 Malaysian Science, Technology, Innovation and Economy (MySTIE) Framework*. Kuala Lumpur, Academy of Sciences Malaysia. <https://www.akademisains.gov.my/10-10-mystie/>.
- ASM. 2023a. 'Precision Biodiversity Task Force organises IoT Training Program 2023'. *ASM Focus*, 15 October. Kuala Lumpur, Academy of Sciences Malaysia. <https://www.akademisains.gov.my/asm-focus/precision-biodiversity-task-force-organises-iot-training-program-2023/>.
- ASM. 2023b. 'Unlocking the potential: ASM's AI Forum emphasises human wisdom in harnessing technological advancements'. *ASM Focus*, 8 December. Kuala Lumpur, Academy of Sciences Malaysia. <https://www.akademisains.gov.my/asm-focus/unlocking-the-potential-asms-ai-forum-emphasises-human-wisdom-in-harnessing-technological-advancements/>.
- BHCKL. 2023. *UK Malaysia Artificial Intelligence (AI) Conference 2023*. Kuala Lumpur, British High Commission Kuala Lumpur. <https://ukmyai23.com/>.
- Cancer Research Malaysia. 2020. 'Oral and nasopharyngeal cancer'. *Cancers*. Subang Jaya, Cancer Research Malaysia. <https://www.cancerresearch.my/our-work/oral-cancer/>.
- DSM. 2023. *National Standards Committee on Information Technology, Communication and Multimedia (NSC 07)*. Putrajaya, Department of Standards Malaysia. <https://www.jsm.gov.my/standards/standards-development-committee/sectoral/electrotechnical-ict-and-construction>.
- EPU. 2021a. *National Fourth Industrial Revolution (4IR) Policy*. Putrajaya, Economic Planning Unit, Prime Minister's Department. <https://www.ekonomi.gov.my/sites/default/files/2021-07/National-4IR-Policy.pdf>.

- EPU. 2021b. *Malaysia Digital Economy Blueprint*. Putrajaya, Economic Planning Unit, Prime Minister's Department. <https://www.ekonomi.gov.my/sites/default/files/2021-02/malaysia-digital-economy-blueprint.pdf>.
- Fam, C. 2023. 'Budget 2024: RM20mil allocated to establish country's first AI faculty at University Technology Malaysia'. *The Star*, 13 October. <https://www.thestar.com.my/tech/tech-news/2023/10/13/budget-2024-rm20mil-allocated-to-establish-countrys-first-ai-faculty-at-university-technology-malaysia>.
- JPT. 2013. *Malaysia Education Blueprint 2015–2025 (Higher Education)*. Putrajaya, Department Of Higher Education, Ministry Of Higher Education. <https://jpt.mohe.gov.my/portal/index.php/en/corporate/policy-documents/16-malaysia-education-development-plan-2015-2025>.
- Ministry of Communications. 2022. 'Animation experts to enhance use of AI in creative industry'. *News*, 4 December. Putrajaya, Ministry of Communications. <https://www.kkd.gov.my/en/public/news/25108-animation-experts-to-enhance-use-of-ai-in-creative-industry>.
- MoSTI. 2020. *National Science, Technology and Innovation Policy 2021–2030*. Putrajaya, Ministry of Science, Technology and Innovation. <https://www.mosti.gov.my/wp-content/uploads/2022/03/National-Science-Technology-and-Innovation-Policy-2021-2030.pdf>.
- MoSTI. 2021. *Malaysia National Artificial Intelligence Roadmap 2023-2025*. Ministry of Science, Technology and Innovation. <https://airmap.my/wp-content/uploads/2022/08/AIR-Map-Playbook-final-s.pdf>
- MyDIGITAL. 2024. *AI untuk Rakyat [AI for People]*. Putrajaya, MyDIGITAL. <https://www.mydigital.gov.my/ai-untuk-rakyat/>.
- The Star. 2023. 'GovTech paper to be presented at National Economic Action Council'. *The Star*, 17 November. <https://www.thestar.com.my/news/nation/2023/11/17/govtech-paper-to-be-presented-at-national-economic-action-council-says-rafizi>.
- UPM. 2023. *A New Horizon for Science, Technology and Innovation: A Strategy to Enhance Higher Education in Malaysia*. Serdang, Universiti Putra Malaysia. [https://thesun.my/local\\_news/khaled-nordin-adopting-technology-in-higher-education-imperative-to-maintain-global-competitiveness-DA11776261](https://thesun.my/local_news/khaled-nordin-adopting-technology-in-higher-education-imperative-to-maintain-global-competitiveness-DA11776261)

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# MEXICO

## Creating a national lead agency for artificial intelligence

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### Key Takeaways:

- The setting up of a national AI strategy in Mexico has been mandated through the creation of a Mexican Agency for the Development of Artificial Intelligence in 2023. Concurrently, previous multisectoral initiatives in the country are convening discussions on and development of AI technologies with an important role of universities.
- Challenges in Mexico lay in spearheading the next steps of the newly founded agency and focusing on local AI technology development rather than relying on foreign technology.

In October 2023, an initiative to issue a *Law for the Mexican Agency for the Development of Artificial Intelligence* was presented in the Parliamentary Gazette of the Chamber of Deputies (Government of Mexico, 2023a). The AI agency proposed in this legislative initiative would be the creation of a decentralized public body with technical and managerial autonomy. Its main objectives would include formulating a national strategy on AI, implementing a national AI policy, promoting the development of AI in various areas (education, industry, science, technology), fostering international cooperation in AI, and overseeing the responsible use of this technology. The assets of the AI agency would consist of resources, amounts allocated in the Budget of Expenditures, income from services and donations.

The AI agency would have a Governing Board composed of 14 members, including the Head of the Executive as president and representatives from various ministries and organizations. The Board would have responsibilities such as formulating the AI development policy, approving programs and projects of the agency and issuing recommendations. Additionally, experts, stakeholders and the general public would be involved in discussions and decision-making to ensure that any regulation is fair, effective and adaptable to the changing circumstances in the field of AI (Government of Mexico, 2023b). The Governing Board would organize and convene permanent forums and work tables within its first six months.

### **Next steps for a new agency**

This proposed Mexican Agency for the Development of Artificial Intelligence represents a significant step towards the regulation and responsible promotion of AI in Mexico, but it is essential to remember that there are still more stages in the legislative process to go through.

The implications of these changes on science and research involve a series of fundamental actions. These include formulating and proposing a national strategy on AI; implementing a national AI policy in Mexico; and promoting the effective development of AI activities to expand the country's capabilities in educational, industrial, scientific and technological areas. If established, the AI agency will achieve these aims by developing the country's scientific and technological capacity, fostering international cooperation and serving as an instrument of state leadership to strengthen sovereignty and national security. Additionally, the AI agency will seek to facilitate the incorporation of related sectors, especially the productive sector, to enhance competitiveness in markets. It will also promote ongoing dialogue on studies and implications of AI, ensuring public interest and population protection. Finally, public, private and social entities will be encouraged to submit proposals and observations in the field of AI for study and consideration, aiming to advance development, security and peace in Mexico.

### **IA2030Mx**

Since 2018, another ongoing initiative called IA2030Mx has emerged as a multisectoral coalition composed of practitioners, academic institutions, companies, startups, public agencies, organizations, media and other key players in Mexico's digital and AI ecosystem (IA2030Mx, no date). Among its objectives are to facilitate a deeper debate on present and future opportunities and challenges related to AI, translate this debate into actions, make AI knowledge accessible to everyone, advance the use and application of AI for the benefit of Mexicans, and localize the Organisation for Economic Co-operation and Development AI Principles in the Mexican context.

The IA2023Mx initiative has marked significant achievements in catalysing research, fostering innovation and advancing Mexico's presence in the global AI landscape. Through the initiative, universities have spearheaded groundbreaking research endeavours, contributing to the development of cutting-edge AI technologies across various academic disciplines. Moreover, IA2023Mx has facilitated international collaboration, enabling knowledge exchange and positioning Mexico as a key player in the AI domain. Additionally, the initiative has played a crucial role in nurturing AI talent by providing educational programs, scholarships and training opportunities, thereby bolstering the country's pool of skilled professionals.

### **The role of universities**

Despite its successes, IA2023Mx also faces several challenges that universities must address to sustain momentum and maximize impact. These challenges include securing adequate infrastructure and resources to support AI research and education effectively; addressing the skills gap through comprehensive training initiatives; and ensuring that

AI developments adhere to ethical standards and societal values. Furthermore, promoting interdisciplinary collaboration and securing sustainable funding sources remain persistent challenges for academic institutions involved in the initiative.

Universities play a pivotal role in driving the IA2023Mx initiative forward by leveraging their research excellence, educational expertise and innovation capabilities. As hubs of knowledge creation and dissemination, universities lead AI research endeavours, educate the next generation of AI professionals and serve as platforms for collaboration between academia, industry and government. Additionally, universities contribute to shaping AI policies, advocating for responsible AI deployment and engaging with communities to address societal concerns and promote digital literacy. Through their multifaceted role, universities are instrumental in realizing the vision of IA2023Mx and positioning Mexico as a global leader in AI innovation and development.

*As hubs of knowledge creation and dissemination, universities lead AI research endeavours, educate the next generation of AI professionals and serve as platforms for collaboration between academia, industry and government.*



### **National research entities**

A National Laboratory of Artificial Intelligence was founded in Mexico as early as 1990, but it later changed its name to the National Laboratory of Advanced Informatics (LANIA), since an understanding had not yet emerged about what AI would actually be. As a national laboratory, LANIA typically receives funding from various government agencies and entities to support its research activities, infrastructure and operations, including the Mexican government. This funding is often allocated through grants, contracts and other mechanisms to support LANIA's mission of advancing informatics research, innovation, and education in Mexico (LANIA, no date).

Another of the main initiatives in this field is the Artificial Intelligence Centre of the Technological Institute of Monterrey (ITESM), which focuses on the development of AI-based technologies to improve processes in areas such as medicine, transportation, agriculture and security. ITESM currently has a research project called Advanced Artificial Intelligence, which is composed of a group of researchers developing different research lines such as machine learning, computational intelligence and hyper-heuristics, data science and applied mathematics, and biomedical engineering Tecnológico de Monterrey, no date).

Finally, one of the challenges in Mexico for implementing various initiatives related to AI is the country's austerity policy. The constraints of this policy keep Mexico locked in as a user of foreign technology. The goal should rather be for Mexico to become a producer of its own technology and, in the medium term, to export AI solutions.

## References

Government of Mexico. 2023a. *Ley de la Agencia Mexicana para el Desarrollo de la Inteligencia Artificial* [Law of the Mexican Agency for the Development of Artificial Intelligence]. <https://forojuridico.mx/iniciativa-agencia-de-desarrollo-de-inteligencia-artificial/> (In Spanish.)

Government of Mexico. 2023b. *Ley Federal para las Entidades Paraestatales* [Federal Law for Parastatals]. <https://www.diputados.gob.mx/LeyesBiblio/ref/lfep.htm> (In Spanish.)

IA2030Mx. No date. *IA2030Mx*. <https://www.ia2030.mx/>. (In Spanish.)

IBM. No date. 'Generative AI'. *IBM Institute for Business Value*. <https://www.ibm.com/thought-leadership/institute-business-value/en-us/technology/generative-ai>.

LANIA. No date. *Laboratorio Nacional de Informática Avanzada, A.C.* <https://www.lania.mx/>. (In Spanish.)

Tecnológico de Monterrey. No date. 'Advanced Artificial Intelligence'. Monterrey, Tecnológico de Monterrey. <https://tec.mx/en/research/advanced-artificial-intelligence>.

# OMAN

## Fostering innovation through an Executive Program

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### Key Takeaways:

- The Ministry of Transport Communications and Information Technology is leading the national AI strategy and its implementation in Oman. Economic objectives through Oman Vision 2040 are the predominant drivers for AI technology developments.
- Partnerships between the ministry and universities and other sectors have been created for AI training programs and initiatives.

Oman is proactively engaging with the impact of AI on its science system, seeking inspiration and collaboration beyond its borders. The country's multifaceted approach to AI involves substantial investment, policy development and international cooperation. In line with Oman Vision 2040, the Sultanate has endorsed the National Program for the Digital Economy (MTCIT, 2021), a cornerstone in Oman's strategy to foster a robust digital economy and significantly increase the digital economy's contribution to the gross domestic product from 2 percent in 2021 to an anticipated 10 percent by 2040. This program, a progression of Oman's digitization efforts, aims to elevate Oman's global standing across various digital economy indices.

### The Executive Program

In alignment with these strategic directives, the Ministry of Transport, Communications and Information Technology (MTCIT) has launched the Executive Program for Artificial Intelligence and Advanced Technologies (MTCIT, 2022). This program is a strategic endeavour aimed at spearheading the adoption and localization of AI and advanced technologies within the Sultanate and it draws insights from international reports and benchmarks. It also involves extensive collaboration with stakeholders from the public and private sectors, academia, and entrepreneurs specializing in these cutting-edge domains. Through the program, MTCIT is supervising the preparation and implementation of an integrated national action plan for AI and advanced technologies.

The Executive Program specifically targets sectors earmarked for economic diversification as per the Tenth Five-Year Development Plan and Oman Vision 2040. MTCIT is committed to identifying and investing in priority technologies and vital information and communications technology infrastructures that align with national capabilities and sectoral needs. This

approach not only aims to establish a competitive edge for Oman in these technological arenas, it also ensures the transfer and localization of knowledge and technology in concert with public and private sector partners, educational institutions and local startups.

### **Other initiatives and ventures**

In addition to the Executive Program, the Ministry of Economy launched the National Initiative to Empower the National Economy Enhanced with AI (ONA, 2023) to integrate AI into economic diversification projects and programs. In recognizing data as the cornerstone of AI, the Sultanate initiated an open data policy, encouraging government units to make their data accessible and establishing a legal framework for open data sharing. A National Data Strategy (NCSI, 2022) through the National Center for Statistics and Information, an independent entity, was also adopted, establishing a comprehensive framework to coordinate national data management, promote data exchange and develop mechanisms to enhance the productivity of government entities. This procedure is currently taking place for each ministry. Upon its completion across all ministries, a similar process will be extended across the public sector (including universities and other academic institutions), followed by the private sector.

A multitude of AI-related projects have been successfully executed across diverse sectors in Oman, reflecting a strategic commitment to integrating AI into various facets of the national economy. In the logistics domain, the Muscat Delivery Project (ONA, 2022) exemplifies this integration by employing drones for parcel delivery between Al Bustan and Muscat Bay. The health sector witnessed a notable application of AI in breast cancer detection (MOH, 2019), achieving a remarkable 96 percent success rate. Additionally, the agricultural sector has adopted drones for pesticide application and palm tree pollination (WIPO, 2021), alongside AI techniques for early detection of pests like the dubas bug and the red palm weevil (Muscat Daily, 2023a). In the oil and gas industry, AI-enhanced drones are being deployed for monitoring pipelines and detecting leaks (CCED, 2021), crucial for preventing security incidents. These drones are also instrumental in inspecting burners at oil refining sites. The transportation sector has seen the digitization of road-related documents (maps, contracts, etc.) using AI, facilitating enhanced decision-making in road maintenance and development.

*In recognizing data as the cornerstone of AI, the Sultanate initiated an open data policy, encouraging government units to make their data accessible and establishing a legal framework for open data sharing.*



## **The agenda of Oman's Executive Program**

The Executive Program recognizes the transformative potential of AI in the science and research sector and aims explicitly at enhancing its uptake in that sector. The approach focuses on the following areas:

1. Collaborations with higher education and research institutions to bolster research and develop academic programs in AI and data science.
2. Awareness and knowledge dissemination, elevating the understanding and appreciation of AI technologies through organizing specialized workshops, events and conferences.
3. Innovation and entrepreneurship support, nurturing innovation in AI through government-private sector collaborations, offering essential support to fund and develop startups in this burgeoning field.

To realize these objectives, the program encompasses several initiatives and projects:

- Development of core AI personnel, focusing on cultivating experts in AI and data science who are capable of spearheading industry advancements.
- Support for skill acquisition, seeking to bolster skills in data science and AI through accelerators, higher education grants and reskilling incentives for employees, and aligning these efforts with industry needs.
- Research and development in core technologies, representing a significant thrust towards accelerating research in key AI technologies such as machine learning, vision, natural language processing, smart sensors and intelligent decision support systems.
- Education centred on problem-solving and critical thinking.
- Localization of AI innovation and entrepreneurship.

## **Training programs**

To achieve the objectives of the Executive Program, the government is working closely with academic institutions and other sectors. In 2023, MTCIT signed a memorandum of understanding with the University of Technology and Applied Science (Muscat Daily, 2023b) with intended impact in the realm of AI and advanced technology. This includes provisions for scientific chairs, research centres and laboratories in these fields. Joint AI programs will further qualify academic staff of the university. The memorandum of understanding also extends to enhancing academic programs via specialized AI courses, collaborating with local and international tech firms for joint research, and enabling faculty to augment their skills through training programs, workshops and conferences. To further AI and tech awareness, the agreement includes holding public lectures, competitions and seminars.

Other AI and advanced technology training programs have been launched under the Makeen Initiative, overseen by the MTCIT. These include partnerships with Sultan Qaboos University and collaborations with local and international companies for virtual training programs in AI. A total of 48 qualification and training programs have trained 1,880 people, working towards a target of 10,000 by 2025.

## **Infrastructural enhancement**

The ambitious integration of AI into various sectors necessitates a robust and adaptable infrastructure. Recognizing this, MTCIT has been actively collaborating with key infrastructure providers, including telecom companies and cloud service providers, to ensure the necessary technological support and enhancements are in place. This collaboration focuses on upgrading the existing cloud computing infrastructure to efficiently process AI applications, a critical step in accommodating the growing demands of AI research and application.

A significant milestone in this endeavour was the introduction of cloud AI services by Oman Data Park (Arabian Daily, 2021). This development came about through a strategic partnership with Nvidia, a global leader in AI and graphics processing. This collaboration is not just a technological advancement but is poised to significantly improve the productivity of various economic sectors and propel the national economy towards a digital transformation.

The telecom sector as well has played a pivotal role in this infrastructural enhancement. A testament to their efforts is the widespread access to mobile broadband networks, which now extend to 97.3 percent of the population. This expanded network access is crucial for facilitating seamless AI research and applications across the nation.

## **Ethics and commitment**

In conjunction with these infrastructural developments, there has been a focused initiative to support research in the field of AI ethics. A notable step in this direction is the establishment of a research chair dedicated to AI ethics, in collaboration with the Islamic World Educational, Scientific and Cultural Organization (Oman Daily Observer, 2024). This initiative underscores the importance of ensuring that AI development and application align with ethical standards and contribute positively to society.

Oman has released a policy on AI systems. Through this policy, the MTCIT seeks to establish ethical principles and controls that in turn promote the optimal use of these regulations and reduce potential risks. MTCIT aims to emphasize the need for all units of the state administrative apparatus to abide by the terms of this policy. Additionally, the Open Government Data Policy is a policy used to define the overall governance for the ICT services continuity within the government administrative units ensuring the continuity of the services during disruptive events.

Oman's commitment to AI is evident in its successful implementation across various sectors, the Ministry of Economy's initiative to integrate AI in the national economy, the comprehensive National Data Strategy, and the focus on AI competency development. Collaborations between governmental institutions and educational entities, infrastructure development through strategic partnerships, and a sustainable and ethically grounded approach to AI research and application further bolster this commitment. Oman's strategic embrace of AI reflects a broader vision of sustainable development, economic diversification and global competitiveness, setting a benchmark for innovation in the region and beyond.

## References

- Arabian Daily. 2021. 'Oman Data Park launches first of its kind Nebula AI Cloud Service'. *Arabian Daily*, 7 October. <https://arabiandaily.com/oman-data-park-launches-first-of-its-kind-nebula-ai-cloud-service/>.
- CCED. 2021. 'ESBAAR harnesses drone and AI technology in partnership with CCED'. *CCED*, October. Muscat, CC Energy Development. <https://www.cced.com.om/esbaar-harnesses-drone-and-ai-technology-in-partnership-with-cc-energy-development/>.
- MOH. 2019. 'MOH-MOTC launch artificial intelligence in breast cancer detection'. *Ministry of Health*, 21 November. Muscat, Ministry of Health. <https://www.moh.gov.om/en/--1149>.
- MTCIT. 2021. *National Digital Economy Program Summary (2021)*. Muscat, Ministry of Transport, Communications and Information Technology. <https://www.mtcit.gov.om/ITAPortal/Data/English/DocLibrary/202112284942713/National%20Digital%20Economy%20Program.pdf>.
- MTCIT. 2022. *Executive Program for Artificial Intelligence and Advanced Technologies*. Muscat, Ministry of Transport, Communications and Information Technology. <https://mtcit.gov.om/ITAPortal/Data/SitelmgGallery/2022101711125582/Executive%20Program%20for%20AI%20and%20AT%20En2.pdf>.
- Muscat Daily. 2023a. 'MAFWR uses drones to tackle palm pests'. *Muscat Daily*, 2 January. <https://www.muscatdaily.com/2023/01/02/omans-mafwr-uses-drones-to-tackle-palm-pests/>.
- Muscat Daily. 2023b. 'MTCIT inks MoUs to enhance AI, cybersecurity excellence in Oman'. *Muscat Daily*, 23 July. <https://www.muscatdaily.com/2023/07/23/mtcit-inks-mous-to-enhance-ai-cybersecurity-excellence-in-oman/>.
- NCSI. 2022. الإحصاء والمعلومات يصدر استراتيجية البيانات الوطنية [NCSI issues national data strategy]. *NCSI*, 4 September. Muscat, National Center for Statistics and Information. [https://www.ncsi.gov.om/News/Pages/NewsCT\\_20220904111825236.aspx](https://www.ncsi.gov.om/News/Pages/NewsCT_20220904111825236.aspx). (In Arabic.)
- ONA. 2022. 'Agreement signed for trial operation of drone delivery service in Muscat'. *Oman News Agency*, 16 February. <https://omannews.gov.om/topics/en/127/show/107498>.
- ONA. 2023. 'National initiative to empower AI-enhanced economy launched'. *Oman News Agency*, 4 June. <https://omannews.gov.om/topics/en/80/show/113037>.
- Oman Daily Observer. 2024. 'UTAS opts for ISCSCO research chair in AI ethics'. *Oman Daily Observer*, 17 January. <https://www.omanobserver.om/article/1148403/oman/utas-opts-for-isesco-research-chair-in-ai-ethics>.
- WIPO. 2021. 'Oman: pollinating date palms with AI and drones'. *WIPO Magazine*. [https://www.wipo.int/wipo\\_magazine/en/ip-at-work/2021/oman\\_wakan.html](https://www.wipo.int/wipo_magazine/en/ip-at-work/2021/oman_wakan.html)

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# URUGUAY

## Following a roadmap to prepare national science systems for artificial intelligence

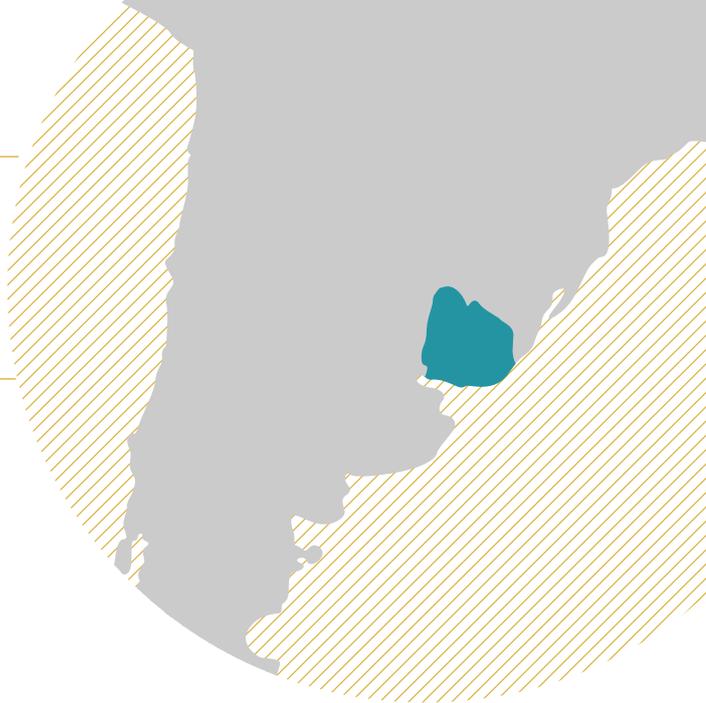
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### **Key takeaways:**

- The Roadmap for Data Science and Machine Learning developed in Uruguay in 2019 highlights the role of universities, public-private partnerships and civil society. National and international investment have supported AI projects in the country since 2017.
- Uruguay is leading regional events and initiatives on AI placing it as a leader in the region.
- Among the immediate next steps in the country are capacity building and upskilling and AI education.

Nearly a decade ago, Uruguay initiated a strategic effort to integrate data science and AI into various aspects of its societal fabric. The resultant Data Science and Machine Learning Roadmap, published in 2019, is a testament to Uruguay's commitment (TransformaUruguay, 2019). Aligned with the National Development Strategy 2050 (Isabella, 2019), the roadmap envisioned Uruguay as a leader in AI solutions application by 2030. It delineated two main dimensions: creating an enabling environment and exploring opportunities in national strategic sectors. The roadmap underscored critical elements essential for fostering AI development in Uruguay, including enhancing education and training in data science and machine learning, attracting talent, improving research and innovation capabilities, updating regulations and fostering international collaboration. The document also identified capacities and opportunities for applying AI in crucial national sectors.

As part of the roadmap, Uruguay conducted a review to identify international experiences conducive to local AI development. The compiled report showcased successful global and regional initiatives, highlighting common characteristics that attract talent and cultivate thriving research and development ecosystems (Etcheverry and Fariello, 2020). After this review, the change in government in 2020 and the onset of the COVID-19 pandemic prompted the suspension or postponement of some roadmap actions. Yet despite these challenges, Uruguay has demonstrated resilience by resuming and continuing key actions and lines of work (AGESIC, 2023).

## **A regional snapshot**

The Latin American AI Index (CENIA, 2023) offers an insightful analysis of AI landscapes across twelve Latin American countries, including Uruguay. This index, structured into three axes – enabling factors; research, development and adoption; and governance – provides a comprehensive perspective on the maturity of the region’s research, development and adoption ecosystems. Uruguay stands out for having high scores in several dimensions assessed in the index, ranking third in the region (55 percent) after Chile (73 percent) and Brazil (65 percent).

There are still opportunities for improvement in many areas to further strengthen the ecosystem’s development across Latin America. As Uruguay already leads regional initiatives and partnerships on AI, thus understanding the needs and differences across the region, it is well placed to lead effective and cohesive interactions towards common AI goals.

## **Artificial intelligence infrastructure**

Uruguay boasts a robust connectivity infrastructure, surpassing the Latin American average in Internet usage and download speed (CENIA, 2023). The country excels in device accessibility, with high indicators – particularly in households owning computers and mobile device subscriptions – exceeding regional averages.

More local computing infrastructure is needed, however. A computing platform called the National Supercomputing Centre (ClusterUY) was created for use by scientists and researchers in the country by the National Agency for Research and Innovation and the Sectoral Commission for Scientific Research. Accessibility and use of ClusterUY is however limited to experienced coders. Universidad de la República (UdelaR) is working on facilitating access to the platform but this remains an ongoing challenge. A large part of cloud computing services comes from the private sector. Google, for example, is set to establish a Google Data Centre in Uruguay with the aim of serving the whole region.

## **Academic initiatives**

Within the academic sphere, UdelaR, the country’s leading research institution, plays a pivotal role. Several initiatives, notably Centro Interdisciplinario en Ciencia de Datos y Aprendizaje Automático (CICADA), aim to develop research, innovation capabilities and multidisciplinary education in AI-related fields (CICADA, no date). Several research lines at UdelaR explore diverse domains, such as genomics, bioinformatics, medical image processing, epidemiology, ecology, neurosciences and education, using AI methods and tools.

The Data Science and Machine Learning Roadmap highlights the role of universities in AI teaching and training as well as for development and research, even though the role of universities is not necessarily distinguished. The research and science ecosystem in Uruguay is limited, with only three main universities creating a tight community. Partnerships between the private sector and public sector are happening naturally or de facto depending on cases and needs.

The roadmap also outlines institutional arrangements involving collaboration between the government, national academic institutions like UdelaR, and the private sector. The national science and research community actively contributes to developing and implementing the response. In collaboration with other local organizations, CICADA actively engages with civil society, fostering discussions on ethical considerations in data science and AI (ANEP, 2023). This initiative is a platform for building knowledge and exchange between researchers, students, professionals and the broader community.

### **Talent and research challenges**

The Latin American AI Index (CENIA, 2023) recognizes Uruguay's data capabilities and governance excellence. However, challenges persist in talent development, with a noted gap in professional AI training and a scarcity of relevant programs in regional QS-ranked universities. Improving data literacy and upskilling students and educators are integral to Uruguay's plans (Ceibal, no date). Building on the country's prominent position in AI research and innovation, the next steps will involve addressing

*Building on the country's prominent position in AI research and innovation, the next steps will involve addressing challenges, particularly in formal AI education, to ensure a sustainable and comprehensive approach to AI adoption in the scientific sector.*



challenges, particularly in formal AI education, to ensure a sustainable and comprehensive approach to AI adoption in the scientific sector.

Uruguay emerges as a regional leader in research and development, showcasing high productivity and quality in open-source development. While patent registration remains low, the Latin American AI Index suggests aligning Uruguay's innovation landscape with its impressive open-source achievements (CENIA, 2023).

### **Investment and innovation**

Uruguay boasts the highest normalized averages of inward investment and total estimated investment value in Latin America (CENIA, 2023). Although research on AI topics receives support from institutions like the National Agency for Research and Innovation and UdelaR, there's a noticeable absence of specific AI-oriented funding initiatives. Some exceptions are the Sectoral Fund for Open Data Research (ANII, 2018), which was discontinued, and the Call for R&D Projects in Artificial Intelligence (ANII, 2022), carried out jointly with the International Development Research Centre (IDRC). The two calls for the Sectoral Fund in 2017 and 2018 totalled USD 1 million, which was distributed among 38 projects (approximately USD 26,000 per project). With the specific calls for AI projects funded by IDRC, seven projects were supported with approximately USD 30,000 per project.

Alongside active investment, Uruguay also emphasizes algorithmic governance (AGESIC, 2023). Transparency in algorithmic systems is a cornerstone of this approach, aligning with global best practices and ensuring ethical considerations in the adoption of AI technology (Rahim, 2023).

## Building bridges

The potential role of Uruguay in bridging academic and enterprise efforts in AI research is exemplified by the KHIPU events (KHIPU, no date). These meetings in Montevideo in 2019 and 2023 brought together top AI researchers from around the world with a strong presence of researchers from UdelaR in the KHIPU committee, and sponsored by international entities. The events culminated in the Montevideo Declaration on Artificial Intelligence and its Impact on Latin America, signed by almost 500 researchers (various authors, 2023).

Uruguay's approach to AI within its scientific system is characterized by a strategic approach under the 2019 roadmap; active collaboration between government, academia and the private sector; and a commitment to ethical and responsible AI practices. Ongoing initiatives and achievements position Uruguay as a regional leader in AI research, development and application, and the country is now focusing on building capacity, fostering transparency and addressing challenges for a sustainable future in AI development.

## References

- AGESIC. 2023. *'Revisión de la Estrategia Nacional de Inteligencia Artificial y elaboración de la Estrategia Nacional de Datos'* [Review of National Artificial Intelligence Strategy and development of National Data Strategy]. AGESIC, 9 November. Montevideo, Agencia de Gobierno Electrónico y Sociedad de la Información y del Conocimiento. <https://www.gub.uy/agencia-gobierno-electronico-sociedad-informacion-conocimiento/comunicacion/publicaciones/revison-estrategia-nacional-inteligencia-artificial-elaboracion>. (In Spanish.)
- ANEP. 2023. *'Ciclo de charlas sobre inteligencia artificial y educación'* [Series of talks on artificial intelligence and education]. ANEP, 24 July. Montevideo, Administración Nacional de Educación Pública. <https://www.anep.edu.uy/15-d/ciclo-charlas-sobre-inteligencia-artificial-y-educaci-n>. (In Spanish.)
- ANII. 2018. *Fondo sectorial de investigación a partir de datos* [Sectoral fund for research based on data]. Montevideo, Agencia Nacional de Investigación e Innovación. <https://www.anii.org.uy/apoyos/investigacion/129/fondo-sectorial-de-investigacion-a-partir-de-datos/> (Accessed 10 December 2023). (In Spanish.)
- ANII. 2022. *Convocatoria a proyectos de Inteligencia Artificial* [Call for Artificial Intelligence Projects]. Montevideo, Agencia Nacional de Investigación e Innovación. <https://www.anii.org.uy/apoyos/investigacion/308/convocatoria-a-proyectos-id-en-inteligencia-artificial-idrc/> (Accessed 10 December 2023). (In Spanish.)
- Ceibal. No date. *Ceibal – Pensamiento Computacional Automático*. [Ceibal - Automatic Computational Thinking]. <https://pensamientocomputacional.ceibal.edu.uy> (Accessed 10 December 2023). (In Spanish.)
- CENIA. 2023. *Latin American Artificial Intelligence Index*. Macul, Centro Nacional de Inteligencia Artificial. <https://indicelatam.cl/home-en/> (Accessed 13 December 2023).

- CICADA. No date. *Centro Interdisciplinario en Ciencia de Datos y Aprendizaje*. [Interdisciplinary Centre for Data Science and Learning.]. <https://cicada.uy> (Accessed 10 December 2023). (In Spanish.)
- Etcheverry, L. and Fariello, M. I. 2020. 'El futuro de las soluciones basadas en Ciencia de Datos y Aprendizaje Automático en Uruguay' [The future of Data Science and Machine Learning based solutions in Uruguay]. *Noticias*, 9 October 2020. Montevideo, Ministerio de Educación y Cultura. <https://www.gub.uy/ministerio-educacion-cultura/comunicacion/noticias/futuro-soluciones-basadas-ciencia-datos-aprendizaje-automatico-uruguay>. (In Spanish.)
- Isabella, F., ed. 2019. *Aportes para una Estrategia de Desarrollo 2050* [Inputs for a Development Strategy 2050]. Montevideo, Oficina de Planeamiento y Presupuesto. [https://siteal.iiop.unesco.org/sites/default/files/sit\\_accion\\_files/11206.pdf](https://siteal.iiop.unesco.org/sites/default/files/sit_accion_files/11206.pdf). (In Spanish.)
- KHIPU. No date. *KHIPU – Latin America Meeting in Artificial Intelligence*. <https://khipu.ai> (Accessed 10 December 2023).
- Rahim, S., ed. 2023. *Government AI Readiness Index 2023*. Oxford, Oxford Insights. <https://oxfordinsights.com/wp-content/uploads/2023/12/2023-Government-AI-Readiness-Index-1.pdf>.
- TransformaUruguay. 2019. *Hoja de Ruta de Ciencia de Datos y Aprendizaje Automático* [Data Science and Machine Learning Roadmap]. Montevideo, TransformaUruguay. <https://www.gub.uy/ministerio-industria-energia-mineria/sites/ministerio-industria-energia-mineria/files/documentos/publicaciones/6112019%2Bhoja%2Bde%2BBruta%2BCD%2BAA.pdf>. (In Spanish.)
- Various authors. 2023. *Declaración de Montevideo sobre Inteligencia Artificial y su impacto en América Latina / Declaração de Montevideu sobre Inteligência Artificial e seu impacto na América Latina / Montevideo Declaration on Artificial Intelligence and its Impact in Latin America*. <https://doi.org/10.5281/zenodo.8208793>.

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# UZBEKISTAN

## Building the right conditions and skills for artificial intelligence

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### Key takeaways:

- Presidential resolution enabling policy frameworks and strategies for AI in Uzbekistan have been put in place since 2020. Among the country's strategic goals is training the young generation, it has therefore set a goal to train one million Uzbeks through an online training platform.
- A new agency for AI development has been founded to monitor and implement AI technologies across all sectors.
- The recruitment of the newly trained generation in coding and the infrastructure to support AI work are next steps for the country.

Uzbekistan's activity in recent years in the structural development of AI and the creation of the necessary conditions for its formation has been identified as one of the country's priority areas. Its reforms are based on the adoption of regulatory documents that structure the system to create the necessary conditions for the accelerated implementation of AI in the economy (Ministry of Digital Technologies, no date).

### Policy foundations

Three documents in particular serve as a solid basis for AI development in Uzbekistan. The first is the 2020 Decree of the President of the Republic of Uzbekistan 'On approval of the strategy "Digital Uzbekistan – 2030" and measures for its effective implementation' (Government of Uzbekistan, 2020). This document defines tasks for the development of teacher technological competences.

This was followed in 2021 by the Presidential Resolution 'On measures to create conditions for the accelerated introduction of artificial intelligence technologies' (Government of Uzbekistan, 2021a). Under this resolution, a program of measures for the study and introduction of AI technologies in 2021–2022 was approved, which provides for the main priority areas of development for the State Program including an AI Development Strategy, a regulatory framework, the widespread use of AI technologies, domestic innovative ecosystem for AI and international cooperation.

Lastly, 2021 also brought the Presidential Resolution ‘On measures to create a special regime for the use of artificial intelligence technologies’ (Government of Uzbekistan, 2021b). Within the framework underneath this resolution, the introduction of a special regime for the use of AI technologies within the framework of experimental and innovative research was approved.

**Strategic tasks**

As described above, the 2020 Decree of the President led to the adoption of the strategy Digital Uzbekistan – 2030. One of the main achievements under this strategy so far has been the organization of training 587,000 people in the basics of computer programming, including by attracting 500,000 young people within the framework of the project One Million Uzbek Coders. This large-scale project is a result of a partnership with the Dubai Future Foundation in the United Arab Emirates and was launched at the end of 2019 (Inha University in Tashkent, 2019). One Million Uzbek Coders is a free distance-learning platform for the general public, especially targeted at young people with students starting from age 13. This training program is currently running, and in 2021 had already reached around 500,000 students (ITPARK, 2021).

Digital Uzbekistan – 2030 has also achieved the implementation of over 280 information systems and software products for automation of management, production and logistics processes in enterprises of the economic sector. The country has meanwhile consolidated relevant higher educational institutions in its regions to improve the digital literacy and skills of khokims (heads of regions) and employees of state bodies and organizations, training 12,000 employees in information technology and information security.

*One Million Uzbek Coders is a free distance-learning platform for the general public, especially targeted at young people with students starting from age 13. This training program is currently running, and in 2021 had already reached around 500,000 students*



**Infrastructure for development**

Particular attention is being paid to the creation of the necessary integrated infrastructure for the development of AI. In the Joint Alliance for the Development of AI, the Ministry for Development of Information Technologies and Communications acts as a working body in partnership with the Ministry of Innovative Development, other government agencies, commercial banks and the private sector. The Alliance, in partnership with the Tashkent University of Information Technologies, will direct a doctoral program as well as organize training and teaching programs for students.

## Comprehensive infrastructure for artificial intelligence development in Uzbekistan

### Comprehensive infrastructure for AI development

- Creation of a Department for the Introduction and Development of AI technologies on the basis of the Ministry for the Development of Information Technologies and Communications.
- Creation of an AI Development Alliance in cooperation with the Ministry for the Development of Information Technologies and Communications, the Ministry of Innovative Development, government agencies, commercial banks and large industrial enterprises.
- Creation of the Research Institute for the Development of Digital Technologies and Artificial Intelligence under the Ministry for the Development of Information Technologies and Communications.
- Creation of a doctoral program in the specialty 'Digital technologies and artificial intelligence' in the systems of higher educational institutions.

The complexity of the infrastructure being created should make it possible to cover all areas of AI development in the country. Thus, state policy in the field of AI will be coordinated by the Department for the Introduction and Development of AI Technologies under the Ministry for Development of Information Technologies and Communication. The Alliance will promote the joint implementation of priority projects for the introduction of AI technologies in the economic and social sectors and the public administration system, the optimization of costs for their development, and dissemination of best practices in this area among government agencies and organizations. The doctoral program will produce highly qualified specialists in the field of AI.

### A new research institute

An important part of this infrastructure is the Research Institute for the Development of Digital Technologies and Artificial Intelligence under the Ministry for the Development of Information Technologies and Communications. Among its main tasks is the organization of scientific research aimed at the widespread implementation of the strategy Digital Uzbekistan – 2030 and the introduction of AI technologies in different sectors of the economy, the social sphere and the public administration system. The Research Institute will also conduct fundamental and applied scientific research in the field of AI, forming a scientific ecosystem for the development of digital technologies. It will further develop innovative products for automation of management and production processes based on AI technologies, as well as their models, algorithms and software. Lastly, it is tasked with

the establishment of cooperation and implementation of joint projects with leading foreign innovative and scientific institutions for the development of AI technologies.

One project, currently in its initiation phase, in the field of scientific activity at the Research Institute is the creation of an electronic platform containing a national citation index of scientific articles and a bibliographic database of scientific publications. This project is notable as one of the first to create AI in research activities in Uzbekistan. In this regard, as part of the ongoing reforms, it is important to step up the implementation of AI in the entire scientific field.

### **Putting a million coders to work**

Thanks to the active efforts of the government over the past few years, the institutional framework of AI in Uzbekistan is being strengthened. In particular, favourable conditions are being created for scientific research in the field of AI. But in parallel with the conditions created, it is important to accelerate the number of scientific projects in the field of AI, which, in our opinion, is not enough today.

In this regard, it is important to take into account the recommendation from the *Innovation for Sustainable Development Review of Uzbekistan* conducted by the United Nations, where it is noted that ‘the creation of a large pool of programmers will require a significant restructuring of the higher education system and closer integration of IT with local and foreign IT companies’ (UNECE, 2022). This recommendation serves as an important signal for the activation of targeted measures to attract foreign investment projects for the development of AI in all spheres of socio-economic life and especially in the scientific sphere.

At the initial stage of the formation of AI in the scientific sphere of Uzbekistan, it is important that the government’s efforts are aimed at creating conditions for attracting foreign scientific and applied projects in the field of AI. These actions will strengthen the practical skills of trained specialists in the field of AI. On the other hand, these measures will help to stop an outflow of specialists in this field to more attractive projects carried out in foreign countries.

The government continues to develop and approve mechanisms to increase the attractiveness of the research field of AI. This is important, since the fastest possible transition of the scientific sphere to AI will accelerate this transition in other industries and spheres of the economy.

### **References**

Government of Uzbekistan. 2020. Decree of the President of the Republic of Uzbekistan ‘On approval of the Strategy “Digital Uzbekistan – 2030” and measures for its effective implementation’ dated October 5, 2020 No. UP-6079.  
<https://old.gov.uz/en/news/view/31479>

Government of Uzbekistan. 2021a. Resolution of the President of the Republic of Uzbekistan ‘On measures to create conditions for the accelerated introduction of Artificial intelligence technologies’ dated February 17, 2021 No. PP-4996.  
<https://data.egov.uz/eng/news/suniy-intellekt-texnologiyalaridan-foydalanishga-b>

Government of Uzbekistan. 2021b. Resolution of the President of the Republic of Uzbekistan ‘On measures to create a special regime for the use of Artificial intelligence technologies’ dated August 26, 2021 No. PP-5234. <https://uzspace.uz/en/documents/index/1> (In Uzbek.)

Inha University in Tashkent. 2019. ‘The large-scale project “One Million Uzbek Coders” has been launched in Uzbekistan’. *News*, 21 November. Tashkent, Inha University in Tashkent. <https://inha.uz/events/the-large-scale-project-one-million-uzbek-coders-has-been-launched-in-uzbekistan/>.

ITPARK. 2021. ‘There are already 500 thousand participants on the “One Million Uzbek Coders” project!’. *ITPARK*, 13 August. <https://it-park.uz/en/itpark/news/there-are-already-500-thousand-participants-on-the-one-million-uzbek-coders-project>.

Ministry of Digital Technologies. No date. *O‘zbekiston Respublikasi Raqamli Texnologiyalar Vazirligi* [Ministry of Digital Technologies of the Republic of Uzbekistan]. <https://gov.uz/digital/>. (In Uzbek.)

UNECE. 2022. *UNECE Innovation for Sustainable Development Review of Uzbekistan*. Geneva, United Nations Economic Commission for Europe. <https://unece.org/economic-cooperation-and-integration/publications/unece-innovation-sustainable-development-review>.

## Next steps

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Following the publication of version one of this working paper, we will organize further regional workshops as well as consultations. These initiatives will serve to validate the concepts outlined in the paper and foster an understanding of the priorities, successes, and challenges encountered by countries as they gear up their research ecosystems for AI integration.

Later this year, we will release the second and final version of this working paper, featuring additional case studies from a diverse range of countries, including: France, Jordan, Malawi, Morocco, Nigeria, Norway, United Arab Emirates, United Kingdom, Panama, Romania, Rwanda, South Africa, United States.

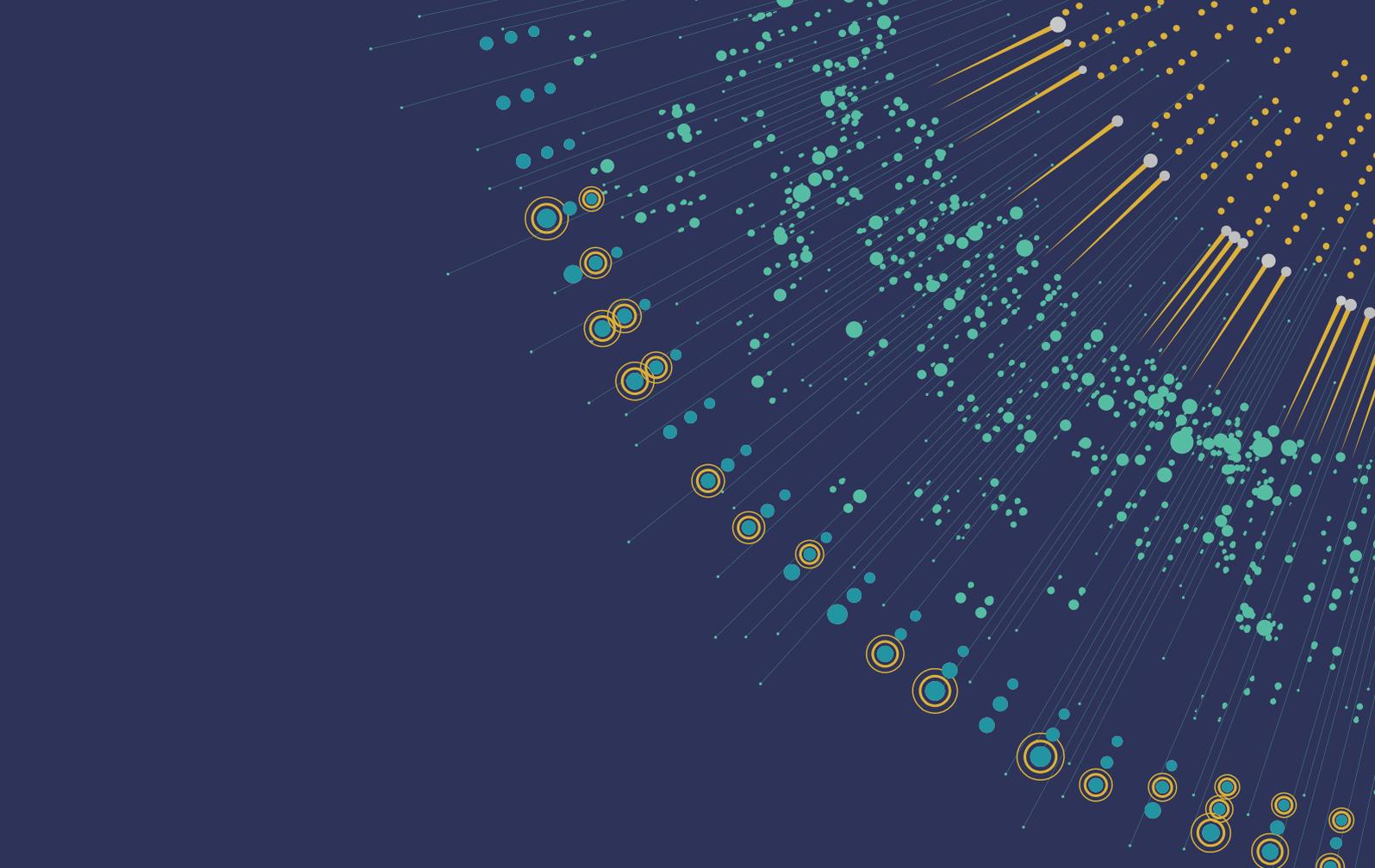
The timeline of the project since its initiation is outlined below:

- Regional workshop in Kuala Lumpur, Malaysia – 5 October 2023
- Publication of version 1 of the paper – 26 March 2024
- Regional workshop in Santiago de Chile, Chile – 9 April 2024
- Africa region engagement - April/May 2024
- Publication of version 2 of the paper - Fall 2024

The working paper is accessible for feedback via an online form on the publication page: [www.futures/publications/ai-science-systems](http://www.futures/publications/ai-science-systems)

We encourage you to reach out to the Centre directly for further inquiries.





**About the Centre for Science Futures:**

The ISC established the Centre for Science Futures in 2023 to improve our understanding of emerging trends in science and research systems and to provide options and tools for impact and action.

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