ARTIFICIAL INTELLIGENCE NEEDS ASSESSMENT SURVEY IN AFRICA

Prateek Sibal;Bhanu Neupane;

Davor Orlic;

© 2021, UNESCO

This work is licensed under the Creative Commons Attribution License (https://creativecommons.org/licenses/by/4.0/legalcode), which permits unrestricted use, distribution, and reproduction, provided the original work is properly credited.

Cette œuvre est mise à disposition selon les termes de la licence Creative Commons Attribution (https://creativecommons.org/licenses/by/4.0/legalcode), qui permet l'utilisation, la distribution et la reproduction sans restriction, pourvu que le mérite de la création originale soit adéquatement reconnu.

IDRC Grant/ Subvention du CRDI: 108914-001-Building a network of excellence in artificial intelligence in Sub-Saharan Africa

United Nations
Educational, Scientific and
Cultural Organization

Artificial Intelligence Needs Assessment Survey In Africa

ARTIFICIAL INTELLIGENCE NEEDS ASSESSMENT SURVEY IN AFRICA

United Nations
Educational, Scientific and
Cultural Organization

Published in 2021 by the United Nations Educational, Scientific and Cultural Organization
7 place de Fontenoy, 75352 Paris 07 SP, France
© UNESCO 2021
ISBN: 978-92-3-100418-6

This publication is available in Open Access under the attribution-Share Alike 3.0 IGO (CC-BY-SA 3.0 IGO) license (http://creativecommons.org/licenses/by-sa/3.0/igo). By using the content of this publication, the users accept to be bound by the terms of use of the UNESCO Open Access Repository (https://en.unesco.org/open-access/terms-use-ccbysa-en).

The designations employed and the presentation of material throughout this publication do not imply the expression of any opinion whatsoever on the part of UNESCO concerning the legal status of any country, territory, city or area of its authorities, or concerning the delimitation of its frontiers or boundaries.

The ideas and opinions expressed in this publication are those of the authors; they are not necessarily those of UNESCO and do not commit the Organization.

This publication is authored by: Prateek Sibal and Bhanu Neupane
Graphic design, covers design, and typeset: Cromatik Ltd.
ePub: Cromatik Ltd.

Watch out for two new publications from UNESCO on AI
- *Understanding Ethics of AI: Why is it everybody's concern?*
- *AI and Education: A guidance for policymakers*

Please find more information on UNESCO's work in the field of AI and emerging technologies at https://en.unesco.org/artificial-intelligence

TABLE OF CONTENTS

PREFACE 7
ACKNOWLEDGMENTS 8
EXECUTIVE SUMMARY 9

INTRODUCTION 15

SURVEY RESULTS 21

POLICY INITIATIVES FOR AI GOVERNANCE NEED STRENGTHENING 22
LEGAL AND REGULATORY FRAMEWORKS FOR AI GOVERNANCE NEED TO BE FOSTERED 26
NEED FOR ENHANCING CAPACITIES FOR AI GOVERNANCE IS WIDELY RECOGNIZED 28
AI PRIORITIES FOR COUNTRIES IN AFRICA ARE VARIED BUT OFFER AN OPPORTUNITY FOR COOPERATION 39
MORE EFFORTS ARE NEEDED TO ADVANCE ON AI EDUCATION, RESEARCH AND TRAINING 44

SUPPORT REQUESTED FROM UNESCO 59

CONCLUSION & RECOMMENDATIONS 65

LEVERAGING DIGITAL COOPERATION IS ESSENTIAL FOR AI GOVERNANCE 66
RECOMMENDATIONS 68

ANNEX 1: GLOSSARY 76

ANNEX 2: SURVEY METHODOLOGY 78

DESIGN 78
ADMINISTRATION 79
ANALYSIS 82

BIBLIOGRAPHY 85

LIST OF FIGURES

Figure 1: Legal and Regulatory Frameworks for AI Governance 27

Figure 2: Capacities to address the legal implications of AI 29

Figure 3: Capacities to Develop Standards for AI Products and Services 31

Figure 4: Capacities to address the ethical challenges of AI 33

Figure 5: Capacities of the executives, legislatures and judiciaries in Member States to address the challenges of AI. 35

Figure 6: Capacity Building Needs of the Executive, Legislature and Judiciary 37

Figure 7: AI Priority Areas for Member States 42

Figure 8: To what extent are Member States engaged in supporting AI Education, Research and Training 45

Figure 9:A 'food for thought' map for a more holistic approach to gender equality and AI. Source (UNESCO 2020) 48

Figure 10: Capacities for AI in Education Systems 49

Figure 11: AI Journal Citation Attributed to Region (Source: 2019 AI Index Report) 51

Figure 12: AI research capacities 52

Figure 13: AI Research Networks within the framework of North-South and South-South Cooperation 53

Figure 14: Capacities for the use of data for AI development 55

Figure 15: Areas in which UNESCO's support is requested by Member States 61

LIST OF TABLES

Table 1: Types of initiatives taken by a country for the governance of AI as reported in the survey. 23

Table 2: Additional priority areas for the use of AI as per countries that responded 43

Table 3: List of initiatives implemented or in planning for supporting AI Education, Research and Training in different countries 47

Table 4: Countries and Institutions that have responded to the survey. Note: In cases where more than one response has been received from a country, the data is taken from the respondent in Italics as these are from ICT related department or the only response from a government entity. The free text data is taken from all respondents. 79

PREFACE

Artificial Intelligence (AI) applications continue to expand opportunities for progress of humankind and the achievement of the Sustainable Development Goals. UNESCO is working to harness these opportunities in its fields of competence and has also been leading reflections around pressing concerns related to the rapid development of AI, from a Human Rights and ethics perspective. These range from AI's role in the future of education to the omnipresent challenges of disinformation and hate speech online.

In this context, UNESCO publishes the results of a survey intended to establish the priorities and capacity building needs of African countries with respect to AI. The potential benefits and risks of the technology are not equally distributed across regions of the world. Further, in 2019, as part of UNESCO's reflections on AI in Africa, the publication *Steering AI and Advanced ICTs for Knowledge Societies* highlighted that there is a significant gap in terms of access to knowledge, data, education, training and human resources required for the development and use of AI on the continent.

The 32 Member States who responded to the survey have underlined the importance of UNESCO's work concerning AI in the fields of education, sciences, culture and communication and information. It is also relevant to note that a large number of Member States have identified gender equality and related biases, discrimination and divides in the development and use of AI as a priority theme. The gender issue in particular has previously been put into a global spotlight through the 2019 publication of UNESCO's pioneering report "I'd blush, if I could". Furthermore online stakeholder consultations have also significantly contributed to the Organization's standard setting efforts leading to a process of a global normative instrument, a Recommendation on the ethics of AI.

This needs assessment publication is in line with UNESCO's operational strategy for the implementation of its Global Priority Africa, in particular the flagship programme number 3 "Harnessing STI and knowledge for the sustainable socio-economic development of Africa". Based on the findings of the survey and focused discussions with Member States, UNESCO has been able to strengthen its support for knowledge exchange, standard setting, policy dialogue, capacity building and network development related to AI in Africa in the priority areas highlighted by Member States and within priorities set in UNESCO's programme and budget. The preparation of Regional Forums on AI in Africa will benefit from the results of this survey. Theses Forums will serve as a follow-up activity that will allow stakeholders in Africa and beyond to exchange ideas in terms of strategies and practices, and agree on concrete actions for the development and use of AI in different African countries.

As UNESCO develops its programmes to support Member States to harness the potential of innovation and the digital transformation, it invites international, regional and national development partners to join hands with UNESCO in addressing the challenges and leveraging the opportunities for the development and use of AI in Africa as highlighted in this report.

ACKNOWLEDGMENTS

We would like to thank UNESCO colleagues from the Field Offices in Africa and the Headquarters for assisting in the design, execution and follow up of the survey and for their invaluable feedback and inputs.

Guy Berger, Neil Butcher, Mohini Baijnath, Hanna Fiskesjö, Abdoulaye Ibrahim, Magalie Lebreton-Traoré, Dorothy Gordon, Davor Orlic, Matthew Smith, Xianhong Hu, Susan Schneegans, Jaco du Toit, Guilherme Canela De Souza Godoi, Benjamin Pinter, Rachel Pollack, Zulmira Rodrigues, Sasha Rubel, Melissa Tay Ru Jein, Tim Unwin and Cedric Wachholz and Ruolin Zhao provided their feedback on the survey and the report.

Our special thanks to Valerie Charneau for designing the survey interface.

We thank our partners International Development Research Centre (IDRC) for funding support, Knowledge for All Foundation (K4A) and Neil Butcher Associates (NBA) for supporting this survey as part of the ongoing collaboration with the AI4D Network in Africa.

EXECUTIVE SUMMARY

There are encouraging signs of AI innovation and development across Africa, from community run AI classes over weekends, AI training bootcamps for students and young researchers to the establishment of private sector and government driven innovation hubs across the continent. Even as there is an enormous potential for AI development, there are also legacy challenges in terms of infrastructure availability as well as human and institutional capacity gaps to develop and govern AI to optimise benefits and minimise harms.

Building upon the recommendations of UNESCO report *Steering AI and Advanced ICTs for Knowledge Societies*, the findings of this survey aim to bridge the information gap concerning the strategic priorities, policy measures, developmental challenges, human and institutional capacity needs, and legal frameworks concerning AI in African countries.

Key results of the survey are:

Policy initiatives for AI governance need strengthening

- Development and use of AI is a priority as per the national development plans in 21 out of 32 countries in Africa that responded to the survey. Some of these countries have already initiated measures to guide the development and use of AI through the launch of AI strategies and policies, enactment of legislation, establishment of Centers of Excellence on AI, and through the development of ethical guidelines for AI.

Legal and regulatory frameworks for AI governance need to be fostered

- Even as 22 countries have reported having legal frameworks concerning personal data protection, it may be noted that these legal provisions may need to be updated to the new uses and applications of data engendered by AI to offset biases and discriminations, including on the basis of race and gender, or loss of personal privacy through predictive analysis among others. Beyond data governance and personal data protection, there is also a need for legal protection against algorithmic bias and discrimination, however; only nine countries have developed some measures against the same.

- There is recognition for the power of open government data in strengthening transparency and innovation through the development of data-driven public services. Out of those who responded, 19 countries reported having initiatives for making government data openly available in easy-to-access formats.

Need for enhancing capacities for AI Governance is widely recognized

- In order to support the development and use of AI, both **policy frameworks** to guide and **human and institutional capacities** to develop and implement such frameworks are needed. The need for strengthening capacities to address legal implications of AI was reported by 19 countries. These countries reported a dearth of legal frameworks to address challenges posed by AI and a significant human resource capacity gaps to tackle ensuing legal implications.

- The use of AI technologies has given rise to **ethical challenges** that require urgent attention to inform the governance of these technologies. Twenty-six countries have reported significant human resource capacity gap in addressing the ethical implications of AI. Only six countries reported having the capacities to address the ethical implications of AI.

- The **capacities of the legislature, executive, judiciary** to formulate, implement and enforce policies and laws concerning AI is important for upholding the rule of law and to provide and enabling environment for innovation. Out of 32 countries that responded to the survey, five countries reported having initiatives taken to strengthen knowledge and capacities of personnel within the government. Only one country has done the same for its legislature and two have taken initiatives to strengthen capacities of the judiciaries in their countries. The support requested from UNESCO is outlined below:

    - **Capacity building support for the executive branch of the government:** 68 per cent of the respondents i.e. 22 countries, have requested initiatives for knowledge exchange concerning AI and its governance, 78 per cent of the respondents, i.e. 25 countries, have requested support trainings for government officials and 68 percent of the respondents, i.e. 22 countries, have requested support in the development of policies for AI.

    - **Capacity building support for the legislatures:** 75 per cent of the respondents, i.e. 24 countries, have requested support for facilitating knowledge exchange, 90 per cent of the respondents, i.e. 29 countries, have requested support for training of parliamentarians and officials working in parliaments and 75 per cent of the respondents, i.e. 24 countries, have requested support in the development of policies.

    - **Capacity building support for judiciaries:** 78 per cent of the respondents, i.e. 25 countries, have requested activities for knowledge exchange, 90 per cent, i.e. 29 countries, have requested support for training of officials.

- The development of product and services standards with the involvement of the industry is an important element for ethically aligned AI. Twenty-three countries have reported unavailability of the financial resources or human resources to advance the development of industry standards for AI.

AI priorities for countries in Africa are varied but offer an opportunity for cooperation

More than half of the countries who responded to the survey reported following priority areas to advance AI: protection of personal data and data governance; leveraging AI for economic growth; supporting start-ups and digital innovation; updating education, skills and training systems for imparting AI skills and knowledge; facilitating AI research and development. Further, it is important to underline that a majority of the responding countries have identified addressing gender related bias and discrimination in the development and use of AI as a priority.

- **Personal data protection and data governance** is an urgent and important area of work for 71 per cent of the countries, i.e. 23 countries, while another five consider it to be important but not urgent.
- **Leveraging AI for economic growth, development and digital transformation** is of urgent importance for 22 countries. Similarly encouraging digital innovation and start-ups working on AI is an urgent and important concern for 65 per cent of the responding countries. Whereas the impact of AI on employment and decent work is urgent and important for 31 per cent of the respondents i.e. ten countries, for another 50 percent it is important but not urgent.
- **Updating education, skills and training systems** to strengthen human and institutional capacities for the development and use of AI is important for 84 per cent of the responding countries.
- **Facilitating AI research and development** is important for 84 per cent, i.e. 27 countries out of 32, who responded.
- **Addressing ethical implications of AI systems** is important for 27 countries, of which 12 consider it to be urgent. Similarly, 71 per cent, i.e. 23 countries, consider the **use of AI for the protection of human rights** as important, 14 of which consider it to be urgent.
- **The implications of AI for cultural diversity** is important for 20 countries, of which ten consider the issue to be urgent.
- **Addressing gender biases in the development and use of AI systems** is important for 26 countries, of which 16 consider it to be urgent.

UNESCO's support to Member States in addressing these priority areas cuts across human rights based advocacy for personal data protection and privacy, programmes to support digital skills, education and training through development of curricula, teacher competency frameworks, media and information literacy trainings and coding education to name a few.

More efforts are needed to advance on AI education, research and training

- Updating education systems to adapt to the challenges posed by AI and new technologies in terms of the skills and competencies required in the twenty first century, strengthening research capacities and networks and provision of AI related trainings for existing workers are some areas that concern most Member States. They have launched several initiatives for AI education, research and training:
  - In seven countries, universities and educational institutions have developed **specialized courses for AI**, and initiatives have been launched to strengthen media and information literacy among students and citizens through schools.
  - In eight countries, universities are in the process of developing courses for AI and there is interest in incorporating AI education at the secondary school level. In 12 countries, no specific measures for AI skills and education have been implemented at university or school level but there is an interest to do so. In four, the level of incorporation of AI in research and education varies widely across universities and educational institutions.
- Capacity building for development of educational resources for AI, fundamental and applied AI research and access to resources for research remains a major challenge.
  - **AI educational resources:** Nineteen countries highlighted gaps in the availability of educational resources for teaching and learning AI and in the availability of trained individuals to provide AI-related instruction. In another 10 countries, educational resources related to AI are available but there are significant human resource capacity gaps.
  - **Research Capacities for AI:** The digital and knowledge divides regarding the quality and the quantity of AI research are growing between and within countries. Twenty-two countries have reported having limited research facilities and significant human resource capacity gaps for AI research.
  - **AI Research Networks:** Sixteen countries have indicated limited engagement between national and global AI research networks and 15 indicated that no links exist between the national and international AI expert networks.
  - **Access to training data for AI is a major priority for all countries** Nine countries have underlined the availability of datasets to train AI systems but a lack of human resources for developing datasets. Another 16 do not have datasets to train AI systems nor the capacities to develop new datasets.

Support Requested from UNESCO

Member States have requested UNESCO's support for standard setting, policy advise, capacity building, network development and for addressing gender equality related concerns in the development and use of AI.

- 32 countries have requested UNESCO's support for building human and institutional capacities in AI-related domains in its fields of competence.
- 26 countries have requested policy advice for the development of aspects of AI policy concerning education, sciences, culture and communication and information.
- 21 countries have requested support from UNESCO in terms of setting standards.
- 27 countries have requested support in building partnerships for the development and use of AI to help them achieve their developmental priorities.
- 17 countries have requested support for addressing gender equality related concerns in the development and use of AI.

These findings would inform UNESCO's programmatic activities both at the international and country support levels. Some of the ongoing activities at UNESCO that can support Member States include the development of the recommendation on the ethics of AI, development of frameworks for AI policies and strategies for upstream policy advise, development of training modules on AI and the rule of law for judicial actors and the launch of a project on development of training datatsets for low resource African languages, organisation of Regional Forums on AI in Africa, among others. The findings of the survey will be useful to initiate focussed discussions with UNESCO Member States at an individual level for in-depth country specific support to further advance on some of the recommendations of this report.

Detailed recommendations based on these findings are available at the end of the report.

INTRODUCTION

Africa is one of the two global priorities of UNESCO, with a specific focus on peace-building and institutional capacity building in pursuit of the Sustainable Development Goals (SDGs).[1] UNESCO has a mandate from its Member States to "enhance future-oriented reflection and foresight initiatives in respect of Africa's development challenges and opportunities through analysis and identification of these challenges and opportunities" (UNESCO 2019a). Technologies like Artificial Intelligence (AI), with their risks mitigated, have potential for accelerating sustainable development and empowerment of young Africans, are an important pillar of UNESCO's work in Africa (UNESCO 2019a).

Underlining the potential of digital technologies for innovative, inclusive and sustainable growth, the African Union's Digital Transformation Strategy for Africa (2020-2030) notes that the advances in these technologies offer Africa a "leapfrogging opportunity"[2] by adopting digitized solutions faster and without being encumbered by "legacy challenges" of phasing out or transitioning from older technologies to new ones. The experience of several African countries in the early 2000s, with respect to the transition from low penetration of landline infrastructure directly to mobile telecommunication is illustrative of the leapfrogging potential of Information and Communication Technologies (ICTs) (UNCTAD 2018).

Even as legacy issues of low infrastructure development and persistent human capacity gaps exist in several countries, the United Nations E-Government Survey 2020, which analyses trends in digital government, has reported "positive signs of accelerated advancement" in Africa.[3] In 2020, 15 African countries have moved to a higher E-Government Development Index (EGDI) group as compared to the last survey from 2018. Only 7 of the region's 54 countries remain in the lowest EGDI group (UNDESA 2020).[4]

However, progress on digital transformation in governments alone is not enough, as the development and use of AI brings about social, environmental and eco-

---

1 UNESCO's global priorities are Africa and Gender Equality. More information is available at https://en.unesco.org/priorityafrica. It may be noted that the Africa regional group at UNESCO is narrower than the total of countries on the continent. This research sought responses from all countries in the geographical continent of Africa.

2 The concept of "bypassing intermediate stages of technology through which countries have historically passed during the development process" (UNCTAD 2018).

3 The findings of the United Nations E-Government, though focused on digital government, are relevant to AI as well as the infrastructure needs for the development and use of AI and for digital government overlap to some extent. For more information on AI specific hardware needs see Chapter 3 on Access in 'Steering AI and Advanced ICTs for Knowledge Societies' at https://unesdoc.unesco.org/ark:/48223/pf0000372132

4 Digital government is one area where AI can be used to strengthen good governance. For instance, AI can be used by governments in healthcare, energy management, environment monitoring, mobility, smart cities and delivery of justice among other applications. For more information, see report of the Oxford Commission on AI and Good Governance 'Four Principles for Integrating AI & Good Governance' at https://oxcaigg.oii.ox.ac.uk/wp-content/uploads/sites/124/2020/07/Four-Principles-for-Integrating-AI-and-Good-Governance.pdf

nomic transformations that require creative solutions and improved governance by stakeholders working together. In this context, some African governments have launched AI strategies, policies, programmes for education, research and training, and initiatives to support innovation through start-ups.[5] The economic impetus for governments to respond is strong; AI is expected to add $15.7 trillion to the global GDP, with $6.6 trillion projected to be from increased productivity and $9.1 trillion from consumption effects. Although this figure may be debated,[6] North America and China would primarily account for 70 per cent of this global economic impact of AI revolution (Rao and Verweij 2017).

Box 1: Definition of Artificial Intelligence (AI) in this report

This publication refers to AI as the combination of technologies that enable what UNESCO's World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) calls "machines capable of imitating certain functionalities of human intelligence, including such features as perception, learning, reasoning, problem solving, language interaction, and even producing creative work" (COMEST 2019).

In order to facilitate knowledge exchange and learning from the experience of others, several AI policy repositories and observatories are collecting information about national initiatives for AI governance.[7] However, information about African initiatives is scarce. This report aims to bridge this information gap concerning the strategic priorities, policy measures, developmental challenges, human and institutional capacity needs, legal frameworks concerning AI in African countries and to highlight questions related to gender equality in the development and use of AI.

Further, despite the encouraging signs of digital innovation and development across Africa, more can be done to create an enabling environment for the development and use of AI for human rights and sustainable development and to ensure that Africa actively participates and contributes to the development and use of AI. Exploring this further was the objective of this survey.

---

5 For instance, UNESCO report 'Steering AI and Advanced ICTs for Knowledge Societies' discusses the initiatives to harness the benefits of AI by Kenya, Nigeria, South Africa, Mauritius, Malawi, Ghana, Tunisia, Egypt, Namibia and Morocco (UNESCO 2019b).

6 The impact of AI might not be linear but could build up at an accelerating pace over time. https://www.mckinsey.com/featured-insights/artificial-intelligence/notes-from-the-ai-frontier-modeling-the-impact-of-ai-on-the-world-economy#

7 See OECD AI Observatory at https://oecd.ai, Nesta AI Governance Database at https://www.nesta.org.uk/data-visualisation-and-interactive/ai-governance-database/, 2019 Government AI Readiness Index Report also provides information on AI initiatives at https://ai4d.ai/wp-content/uploads/2019/05/ai-gov-readiness-report_v08.pdf

Box 2: A multistakeholder approach for AI governance

Multistakeholder mechanisms promise inclusive AI governance by enhancing ownership and transparency and helping decision-makers to consider diverse viewpoints and expertise, and avoid AI being 'captured' by particularly vested interests at the expense of complementary or common effects that contribute to, rather than work against, sustainable development. The quality of results and legitimacy thus ascribed make for better governance of the enormous complexities and interdependencies of the Internet and AI (as well as other advanced digital technologies) (UNESCO 2019b).

The successes and failures in the experience from Internet governance shows that multi-stakeholder approaches need to exhibit certain values if they are to be effective in shaping norms, developing consensus, and enabling decision-making concerning governance. Strain is increased when there is unilateral decision-making, or in public-private partnerships that exclude civil society input into governance issues. Private sector stakeholders' lack of participation, or less transparent participation, also weakens the legitimacy and efficiency of multi-stakeholder initiatives. Civil society's inability to participate fully, due to resource constraints, often means that decision-making neglects human rights concerns (UNESCO 2019b).

In this report, drawing inspiration from discussions on Internet governance, AI governance is understood as the development and application by governments, the private sector and civil society, in their respective roles, of shared principles, norms, rules, decision-making procedures, and programmes that shape the evolution and use of AI.

Organization of the report

The report is divided into two sections. Section one presents results of a survey of policy initiatives, legal and regulatory frameworks, and capacities for AI governance in the 32 African countries that responded to the survey. The section further elaborates on the priorities of these countries, with a detailed focus on AI capacities for education, research, training and data.

Section two briefly discusses AI governance in Africa within the larger context of digital cooperation at the global level and presents recommendations for policy development and capacity building in Africa based on the findings of the survey.

©Monkey Business Images, Shutterstock

SURVEY RESULTS

POLICY INITIATIVES FOR AI GOVERNANCE NEED STRENGTHENING

There is a wide variation in the nature and scope of policy instruments used by countries in Africa for the governance of AI.

For instance:

- 18 out of 32 countries have ongoing initiatives to guide the development of AI at the national level.[8]
- Development and use of AI is a priority as per the national development plans in 21 out of 32 countries.[9]
- Out of the 32 respondents, 13 countries have launched AI strategies[10], 13 have developed AI policies[11], 6 have reported enacting legislation to address some of the challenges of AI[12], 12 have established Centers of Excellence on AI[13], and 3 have reported issuing ethical guidelines for AI.[14]

---

8 Benin, Cabo Verde, Cameroon, Congo, Côte d'Ivoire, Egypt, Equatorial Guinea, Eswatini, Gambia, Ghana, Madagascar, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Uganda, Zambia, Zimbabwe

9 Angola, Botswana, Cameroon, Chad, Comoros, Congo, Côte d'Ivoire, Egypt, Equatorial, Guinea, Eswatini, Gambia, Ghana, Guinea, Lesotho, Madagascar, Malawi, Rwanda, Senegal, Sierra Leone, Uganda, Zimbabwe

10 Cameroon, Congo, Egypt, Eswatini, Gambia, Ghana, Madagascar, Sao Tome and Principe, Senegal, Sierra Leone, Uganda, Zambia, Zimbabwe

11 Cameroon, Congo, Egypt, Equatorial Guinea, Eswatini, Ghana, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Uganda, Zambia and Zimbabwe

12 Benin, Cameroon, Congo, Egypt, Equatorial Guinea, Zimbabwe

13 Cabo Verde, Côte d'Ivoire, Egypt, Equatorial Guinea, Eswatini, Gambia, Ghana, Madagascar, Rwanda, Senegal, Sierra Leone, Zimbabwe

14 Congo, Sao Tome and Principe, Zimbabwe

Country Name	Strategies	Policies	Legislation	Ethical Guidelines	Centres of excellence on AI, start-up and incubation centres
Benin			✓		
Cabo Verde					✓
Cameroon	✓	✓	✓		
Congo	✓	✓	✓	✓	
Côte d'Ivoire					✓
Egypt	✓	✓	✓		✓
Equatorial Guinea		✓	✓		✓
Eswatini	✓	✓			✓
Gambia	✓				✓
Ghana	✓	✓			✓
Madagascar	✓				✓
Rwanda		✓			✓
Sao Tome and Principe	✓	✓		✓	
Senegal	✓	✓			✓
Sierra Leone	✓	✓			✓
Uganda	✓	✓			
Zambia	✓	✓			
Zimbabwe	✓	✓	✓	✓	✓

Table 1: Types of initiatives taken by a country for the governance of AI as reported in the survey.

In terms of organization within the government for the governance of AI, out of 32 countries, 28 have taken measures to streamline processes within the government or are considering undertaking such steps. For instance, in 14 countries, a specialized agency in the government is working on specific priority areas, but a coordinated response cutting across different ministries is yet to be developed.[15] In another 14 countries, the government has not launched discussions or concrete actions to address the challenges and opportunities of AI. In two countries, Egypt and Cameroon, the government has organized several conferences and workshops across different ministries to discuss the impact of AI on society.

Box 3: Cabo Verde's strategy to become a regional hub in digital connectivity, capacity and services

Cabo Verde has launched its Digital Strategy with a focus on establishing itself as a regional hub for connectivity, capacity building and service provision. Under the strategy, Broadband connectivity would be strengthened with new fibre optic cables connecting Cabo Verde to other regions and through the establishment of data centres. Knowledge and skills to develop and use ICTs would be enhanced through a train-the-trainer approach as well as trainings for government leaders, civil servants, women entrepreneurs and youth. Cabo Verde endeavours to provide a platform to host national and regional dialogues on policies and strategies for inclusive and sustainable development.

Finally, the strategy envisages a digital services hub in Cabo Verde in the domains of e-government, e-commerce, local content creation, cloud based on-demand services and a support and certification services. As part of the implementation plan, Cabo Verde will work towards legislation in the areas of data protection, digital services, cybersecurity and cloud computing among others.

More information at: https://estrategiadigital.gov.cv/index.php/en/paad

15 Cabo Verde, Equatorial Guinea, Eswatini, Gambia, Ghana, Madagascar, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Sierra Leone, Uganda, Zambia, Zimbabwe

Recommendations concerning policy initiatives for AI governance to inter-governmental organizations, development organizations and UNESCO Member States include:

- Develop an AI Policy toolkit with science, technology, innovation, education, culture, and communication policy instruments for sustainable development that can inform national AI policies.
- Develop implementation guides and model use cases to translate AI Ethics principles into practice.[16]
- Launch pilot projects that provide evidence on how AI and training data can be leveraged to harness the opportunities in priority areas identified by UNESCO Member States.
- Develop policy guidelines to address gender bias and discrimination in AI algorithms in cooperation with governments, private sector, academia and the civil society.

16 Notably, once UNESCO finalizes its recommendation on the Ethics of AI

LEGAL AND REGULATORY FRAMEWORKS FOR AI GOVERNANCE NEED TO BE FOSTERED

As the development and use of AI expands across different domains, there is a need to have regulatory guidance to ensure that AI is used in a manner that aligns with human rights and encourages innovation and growth driven by a private sector that can develop products and services within the contours of appropriate regulations that mitigate risks.[17]

Out of 32 countries, which responded to the questionnaire:

- 22 reported having legal frameworks concerning personal data protection.[18] However, it may be noted that data protection laws may need to be relevant to the new uses and applications of data engendered by AI that can lead to bias, discrimination or loss of personal privacy among others. This survey did not probe this issue in more detail.
- 9 reported having legal protection against algorithmic bias and discrimination.[19]

17 Several technology companies have come forward and requested governments to regulate AI. For example, see https://www.ft.com/content/3467659a-386d-11ea-ac3c-f68c10993b04 and https://www.wsj.com/articles/tech-giants-new-appeal-to-governments-please-regulate-us-11580126502

18 Countries that have reported having legal frameworks for data protection include: Angola, Benin, Cabo Verde, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Equatorial Guinea, Gambia, Ghana, Lesotho, Malawi, Namibia, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Uganda, Zambia

19 Countries that have reported having legal protection against algorithmic bias and discrimination include Angola, Cabo Verde, Cameroon, Congo, Côte d'Ivoire, Equatorial Guinea, Malawi, Rwanda, Senegal

- 19 reported having initiatives for making government data openly available in easy-to-access formats.[20]

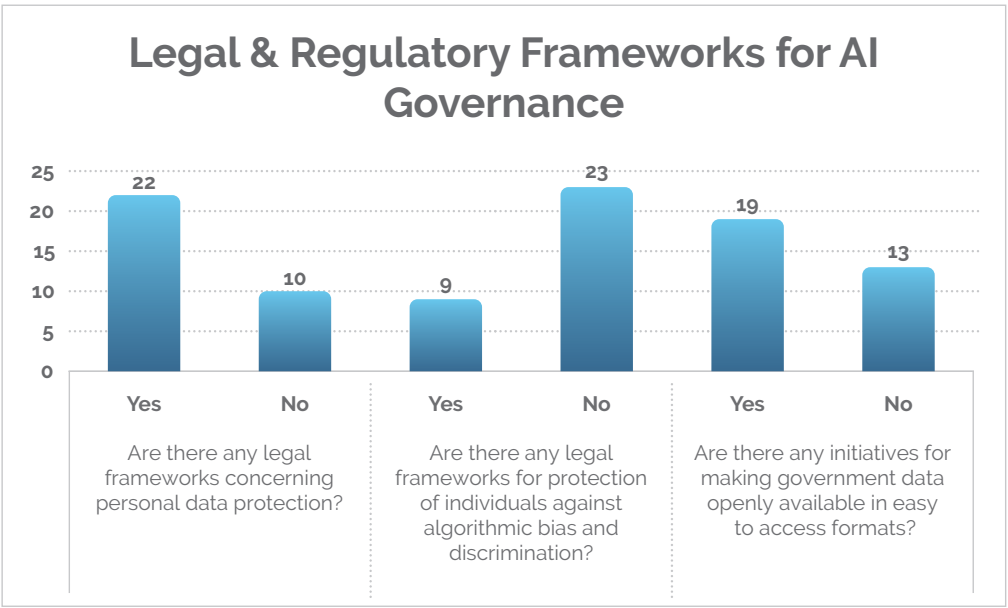


Figure 1: Legal and Regulatory Frameworks for AI Governance

Recommendations concerning legal and regulatory frameworks for AI governance to intergovernmental organizations, development organizations and UNESCO Member States include:

- Adapt and test frameworks for human rights risk assessments and due diligence on AI applications in order to ensure that they do not interfere with the full enjoyment of fundamental human rights and freedoms. Moreover, UNESCO is developing a larger framework on ethics of AI, which includes an Ethical Impact Assessment, that will include the whole range of human rights, fundamental freedoms, human dignity, which will provide with a more robust framework to properly assess and address the challenges and opportunities of AI for all individuals and communities. Such frameworks at:
  - Ex ante level: Ensure there is no discrimination in the selection of datasets and programmers' design choices and make explicit the values informing these choices, including related to implicit and explicit gender biases.
  - Ex post level: Provide for close monitoring of outcomes that could infringe on the rights to expression, privacy and equality, as well as other rights.
- Develop legal and regulatory frameworks updated for Personal Data Protection and Data Governance, including through development of model laws.

20 Countries that have reported having initiatives for making government data openly available include: Angola, Benin, Cabo Verde, Cameroon, Côte d'Ivoire, Equatorial Guinea, Gambia, Ghana, Guinea, Malawi, Nigeria, Seychelles, Sierra Leone, Somalia, Sudan, Togo, Uganda, Zambia, Zimbabwe

NEED FOR ENHANCING CAPACITIES FOR AI GOVERNANCE IS WIDELY RECOGNIZED

Capacities to address legal implications of AI

AI brings up panoply of issues that are not adequately addressed by existing legislation or policy frameworks and are often without judicial precedent.

Some of the legal concerns around AI centre on, *inter alia*:

- Legal personhood;
- Attribution of responsibility and liability in decisions taken by AI systems;
- Data governance;
- Algorithmic discrimination;
- Use of AI for content personalisation online and its implications for access to information, freedom of expression and privacy;
- Intellectual property rights issues, including the ownership of content generated by AI systems;
- Use of AI for moderation and curation of digital content, including content deemed to be illegal or potentially harmful.

These challenges remain significant and require governments to close regulatory gaps and provide legal guidance.

Box 4: Egypt's 'whole of government' approach to AI

Egypt has established a National Artificial Intelligence Council led by the ICT Minister that has a whole government approach. with representation from Ministries of Defence, Foreign Affairs, Planning and Economic Development, Interior, Higher Education, and Scientific Research. The Council is mandated to coordinate and come out with a unified strategy that reflects the government's priorities and those of involved parties, using AI applications. In addition, the Council has the role of supervision in implementation and updating the national AI strategy in line with global developments.

Responding to the survey, 19 of 32 countries reported a dearth of legal frameworks to address challenges posed by AI as well as significant human resource capacity gaps to tackle the legal implications of AI.[21] It may be noted that regulatory frameworks that seek to evaluate existing regulation for the ethical development and use of AI are being tested in several jurisdictions and remain an area of evolving concern across the world.[22]

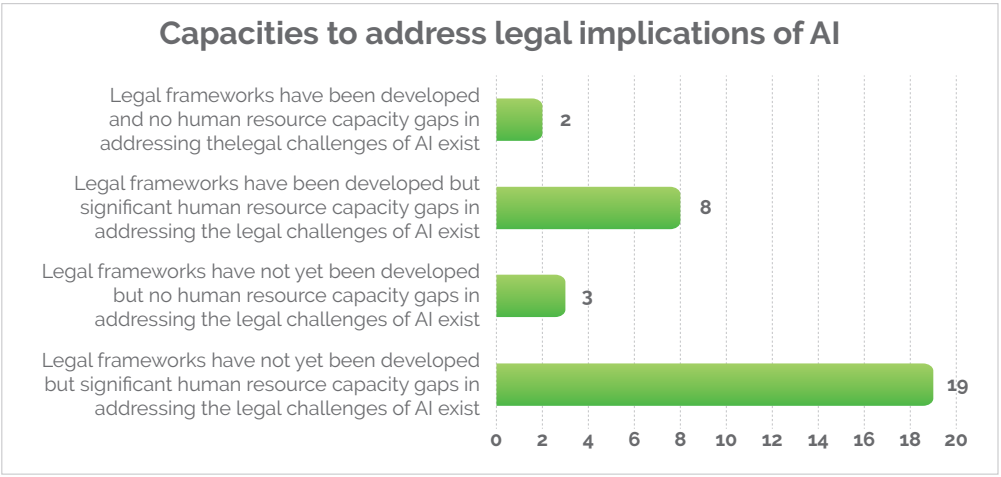


Figure 2: Capacities to address the legal implications of AI

21 Countries include Botswana, Cabo Verde, Cameroon, Chad, Comoros, Democratic Republic of the Congo, Eswatini, Gambia, Ghana, Guinea, Lesotho, Namibia, Nigeria, Rwanda, Seychelles, Sudan, Togo, Uganda, Zambia

22 For instance, New Zealand, in partnership with the World Economic Forum is running a pilot project that seeks to address the need for upgrading the existing regulatory environment to ensure the trustworthy design and deployment of AI. For more information see http://www3.weforum.org/docs/WEF_Reimagining_Regulation_Age_AI_2020.pdf. The European Commission's White Paper on AI also discusses regulatory proposals for AI. The white paper is available at https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf

Recommendations for building capacities to address legal implications of AI and uphold fundamental human rights to intergovernmental organizations, development organizations and UNESCO Member States include:

- Integrate programmes for sensitisation around AI and its human rights and legal implications as part of ongoing trainings for government decision makers. Information on the risks of potential propagation of gender biases through AI systems, and how to avoid such propagation, should be part of the training modules. [23]
- Develop and launch training modules for judicial actors to address legal implications of AI and the use of AI in judicial systems and for law enforcement, in ways that respect the fundamental rights to freedom of expression, access to information, privacy, and non-discrimination. As part of these training modules raise awareness about gender biases and stereotypes that risk being embedded and propagated through the use of AI systems.
- Develop policy guidelines to address gender bias and other forms of implicit and explicit discrimination in AI algorithms in cooperation with governments, private sector, academia and the civil society.
- Raise awareness about the legal and policy implications of AI among parliamentarians through representations to Parliamentary Committees, committees addressing the questions of emerging technologies and their governance, and organisation of forums for parliamentarians to exchange knowledge.

Raising public awareness and understanding of AI:

- Train journalists to report accurately on issues related to AI and its social impacts, as well as to understand the opportunities and challenges of integrating AI tools in the production of news content.
- Contribute to multi-stakeholder dialogue at country level with internet platforms and other key stakeholders on the use of AI-driven content moderation, in lines with international standards of human rights and tailored to local needs.
- Train journalists on uncovering and reporting on explicit or implicit gender biases that can be embedded and propagated through the use of AI systems.

23 See UNESCO publication "I'd blush if I could: closing gender divides in digital skills through education" that discusses gender based biases in AI systems in more detail at https://unesdoc.unesco.org/ark:/48223/pf0000367416.page=85

Box 5: AI governance instruments implemented or under development in different countries

Benin has enacted legislation titled "Code du Numérique du Bénin" that covers many issues pertaining to digital technologies and their applications. Congo has published Vision Congo Digital 2025, which was adopted by the government in 2019. Uganda, Zambia and Zimbabwe have reported that work on AI strategy and policy is underway but is not available on the internet yet.

Capacities to Develop Standards for AI Products and Services

AI design, development and deployment standards play an important role in providing guidance to the private sector in developing products and services, while also enabling interoperability for the products and services developed.

In the case of industry standards for AI, 23 countries have reported unavailability of the financial resources or human resources to advance this aspect of AI governance.[24]

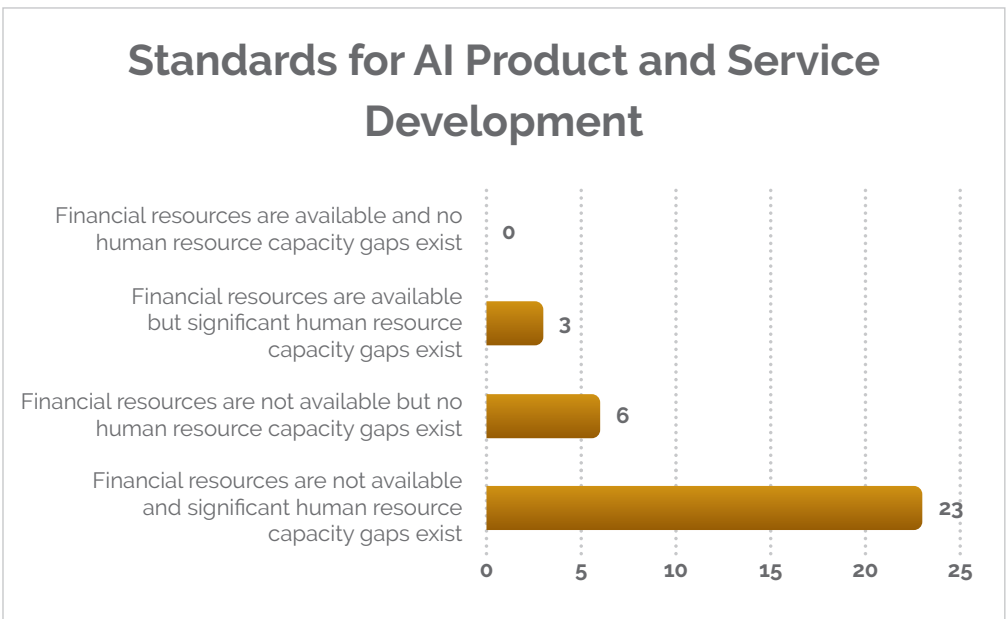


Figure 3: Capacities to Develop Standards for AI Products and Services

24 Countries include Benin, Cabo Verde, Cameroon, Chad, Comoros, Côte d'Ivoire, Democratic Republic of the Congo, Eswatini, Gambia, Ghana, Guinea, Lesotho, Namibia, Nigeria, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone, Somalia, Togo, Uganda, Zambia, Zimbabwe

Recommendations for strengthening capacities for the development of standards for AI products and services to intergovernmental organizations, development organizations and UNESCO Member States:

- Facilitate multi-stakeholder cooperation for development of industrial standards in cooperation with technical standards organisations like the Institute of Electrical and Electronics Engineer (IEEE) and the International Organization for Standardization (ISO).
- Support training for development and implementation of AI technical standards for the development of products and services using AI in a manner that respects human rights.
- Ensure equal participation of men and women in the development of standards for products and services through multistakeholder processes and ensure that the standards developed have measusres against potential gender biases and stereotypes that can be embedded and propagated through AI products and services.

Capacities to address the ethical challenges of AI

There is a significant human resource gap in addressing the ethical implications of AI in the surveyed countries.

AI-based technologies blur the boundary between human subjects and technological objects. In doing so, they not only have societal implications, which can be ethically evaluated, but they also affect concepts of moral agency and responsibility. Therefore, it is important to understand and respond to the ethical implications of AI, as this understanding may underpin modes of AI governance.

In the survey, 26 countries reported significant human resource gaps in addressing the ethical implications of AI.[25] Only six countries reported having the capacities to address the ethical implications of AI.[26]

UNESCO has embarked on a two-year process to develop a recommendation on the Ethics of AI that will be considered for adoption by UNESCO Member States in 2021. Regional and national consultations have been organized to gather feedback on the draft recommendation that addresses a myriad of issues including AI-related bias, discrimination, privacy, freedom of expression, education, skills, training, digital divide and governance.[27]

---

25 Benin, Botswana, Cabo Verde, Cameroon, Chad, Comoros, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Eswatini, Gambia, Ghana, Guinea, Lesotho, Malawi, Namibia, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Uganda, Zambia, Zimbabwe

26 Countries include Angola, Congo, Equatorial Guinea, Madagascar, Sudan, Togo

27 For more information on the elaboration of the recommendation on Ethics of AI, see https://en.unesco.org/artificial-intelligence/ethics. For a detailed treatment of ethical issues raised by AI, see 'Toward a draft text of a Recommendation on the Ethics of Artificial Intelligence: working document' at https://unesdoc.unesco.org/ark:/48223/pf0000373199

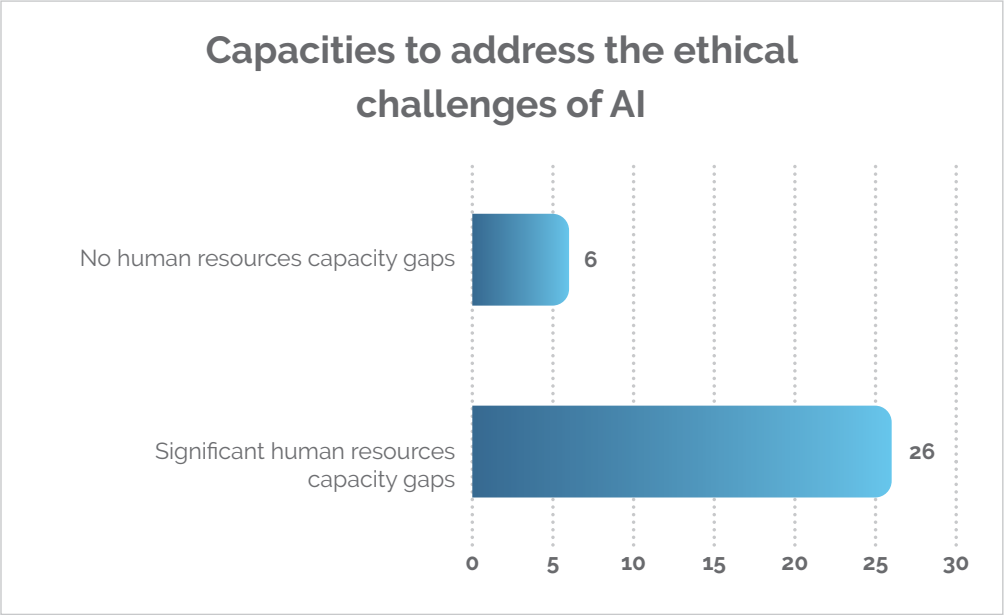


Figure 4: Capacities to address the ethical challenges of AI

Recommendations for strengthening capacities to address the ethical challenges of AI to intergovernmental organizations, development organizations and UNESCO Member States:

- Building upon the process for the elaboration of a Recommendation on the Ethics of artificial intelligence at UNESCO, develop training programmes for inclusion of AI ethics education at different levels of the school and university system, and to other stakeholders.
- Facilitate knowledge exchange on ethical dimensions of digital technologies among policymakers, including on the gender digital divide in terms of participation of women in STEM fields and the gender biases and stereotypes that can be propagated through the use of AI systems if not designed in an ethical manner.

Box 6: Nigeria's approach to digital technologies and their role in society

In Nigeria, the Federal Ministry for Communications and Digital Economy is tasked with coordinating the National Digital Economy Policy and Strategy that has eight pillars:

1. **Regulation for Digital Development** - The National Information Technology Development Agency (NITDA) has released a series of regulations and guidelines to support digital transformation in Nigeria. These including the Nigeria Data Protection Regulation, 2019 and Nigeria Cloud Computing Policy, 2019 among others.

2. **Supporting Digital Literacy and Skills** - Nigeria provides policy backing for massive training of Nigerians from all walks of life in order to enable them to obtain digital literacy and other digital skills.

3. **Strong Infrastructure** - Deployment of fixed and mobile infrastructure to deepen the broadband penetration in the country.

4. **Service Infrastructure** – In 2019, the ICT sector contributed 13.85 percent to Nigeria's Gross Domestic Product (GDP). As per estimates from UNCTAD, by 2025, the e-commerce market in Nigeria would be valued at around USD 75 billion. The digital services platforms developed by the government would play an important role in driving the digital economy.

5. **Soft Infrastructure** – It involves strengthening public confidence in the use of digital technologies and participation in the digital economy.

6. **Promotion of Digital Services** – This pillar would support Innovation Driven Enterprises (IDE) and Micro Small and Medium Enterprises (MSMEs) in a way that engenders innovation.

7. **Well-being in Digital Society** – The pillar has a focus on indices of well-being in the lives of the ordinary citizens; mentoring start-ups on emerging technologies and deploying solutions.

8. **Local Content Development and Adoption** - Provision of a policy framework that gives preference to digitally skilled Nigerians working on government funded projects.

The strategy provides specific targets under each pillar and takes a whole of government approach to digital transformation in Nigeria with different ministries, regulatory bodies and civil society playing an important role in its implementation.

More information at: https://www.ncc.gov.ng/media-centre/public-notices/822-national-digital-economy-policy-strategy

Government Initiatives to Strengthen Capacities of the Executive, Legislature, Judiciary

Governments play a critical role in addressing the social, legal, economic, and ethical challenges and opportunities associated with AI. The findings of the survey show that there is a widespread need to strengthen capacities of decision makers within the government with respect to the development, use and governance of AI. In the survey, out of the 32 countries that responded, five reported initiatives taken to strengthen knowledge and capacities of personnel within the government.[28] Only one country has done the same for its legislature[29] and two have taken initiatives to strengthen capacities of the judiciaries in their countries.[30]

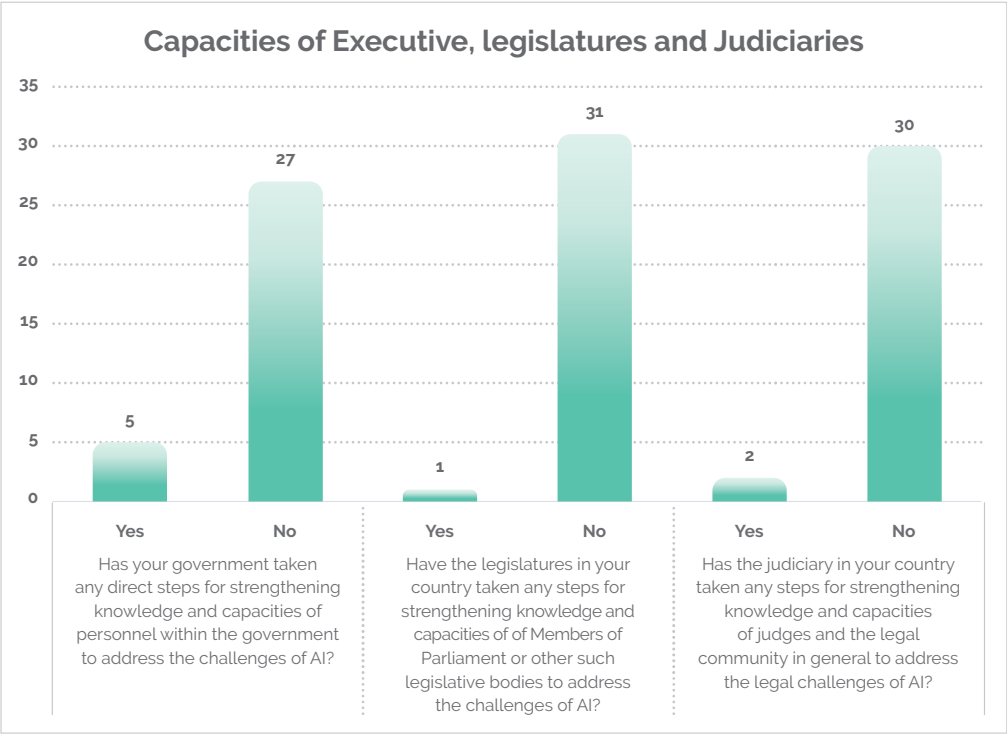


Figure 5: Capacities of the executives, legislatures and judiciaries in Member States to address the challenges of AI.

28 Egypt, Malawi, Rwanda, Sao Tome and Principe, Uganda

29 Equatorial Guinea

30 Equatorial Guinea, Rwanda

In terms of capacity building support for the executive branch of the government, 68 per cent of the respondents i.e. 22 countries, have requested initiatives for knowledge exchange concerning AI and its governance,[31] 78 per cent of the respondents, i.e. 25 countries, have requested trainings for government officials[32] and 68 percent of the respondents, i.e. 22 countries, have requested support in the development of policies for AI.[33]

Box 7: UNESCO Engages Technology and Policy Experts for Human Centred AI in Africa

With the objective of facilitating engagement between the technology and policy communities working in the field of AI, UNESCO organised workshops on Artificial Intelligence and Fairness at the Deep Learning Indaba 2019, the annual gathering of the African Machine Learning Community at Kenyatta University in Kenya. The workshop brought together experts in the domains of law, gender, AI, ICTs and community development from Africa to present their insights and exchange ideas with AI researchers and students at the Indaba.

In terms of capacity building support for the legislatures, 75 per cent of the respondents, i.e. 24 countries, have requested support for facilitating knowledge exchange[34], 90 per cent of the respondents, i.e. 29 countries, have requested support for training parliamentarians and officials working in parliaments[35] and 75 per cent of the respondents, i.e. 24 Member States, have requested for support in the development of policies.[36]

---

31 Angola, Benin, Botswana, Cameroon, Chad, Comoros, Côte d'Ivoire, Democratic Republic of the Congo, Eswatini, Gambia, Ghana, Guinea, Lesotho, Namibia, Nigeria, Senegal, Seychelles, Sierra Leone, Sudan, Togo, Zambia, Zimbabwe

32 Angola, Benin, Botswana, Cabo Verde, Cameroon, Chad, Congo, Democratic Republic of the Congo, Equatorial Guinea, Eswatini, Gambia, Ghana, Guinea, Lesotho, Madagascar, Namibia, Nigeria, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Togo, Zambia, Zimbabwe

33 Angola, Benin, Botswana, Cabo Verde, Cameroon, Chad, Comoros, Democratic Republic of the Congo, Eswatini, Gambia, Ghana, Guinea, Lesotho, Namibia, Nigeria, Senegal, Seychelles, Somalia, Sudan, Togo, Zambia, Zimbabwe

34 Angola, Benin, Cabo Verde, Cameroon, Chad, Congo, Democratic Republic of the Congo, Eswatini, Gambia, Ghana, Guinea, Lesotho, Namibia, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Togo, Uganda, Zambia, Zimbabwe

35 Benin, Botswana, Cabo Verde, Cameroon, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Eswatini, Gambia, Ghana, Guinea, Lesotho, Madagascar, Namibia, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Togo, Uganda, Zambia, Zimbabwe

36 Angola, Benin, Cabo Verde, Cameroon, Chad, Comoros, Democratic Republic of the Congo, Egypt, Gambia, Ghana, Guinea, Lesotho, Malawi, Namibia, Nigeria, Sao Tome and Principe, Senegal, Seychelles, Somalia, Sudan, Togo, Uganda, Zambia, Zimbabwe

In terms of capacity building support for judiciaries, 78 per cent of the respondents, i.e. 25 countries, have requested activities for knowledge exchange[37], 90 per cent, i.e. 29 countries, have requested support for training of officials[38] and 71 per cent, i.e. 23 countries, have requested for support in the development of policies.[39] A detailed account of the capacity building need for the judiciary is provided in the Box 8.

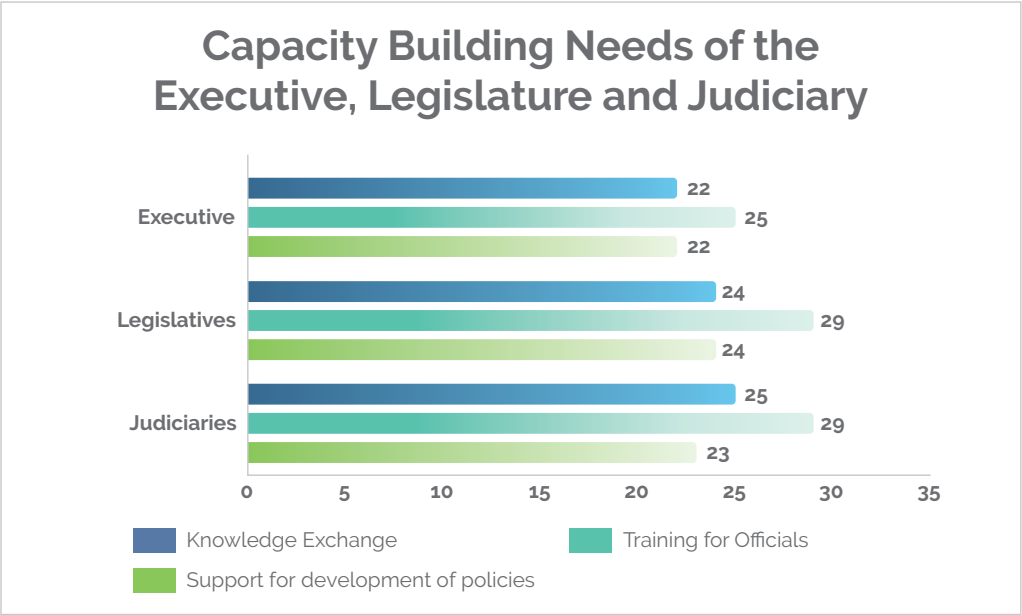


Figure 6: Capacity Building Needs of the Executive, Legislature and Judiciary

"[There have been] several education programs to introduce different levels of government workers (technical, business experts, leaders) to AI each in their capacity. General awareness programs for all factions of society" – Respondent from Egypt

"Workshops have been organized for Government IT Officers" – Respondent from Uganda

37 Angola, Benin, Botswana, Cabo Verde, Cameroon, Chad, Congo, Democratic Republic of the Congo, Eswatini, Gambia, Ghana, Guinea, Lesotho, Namibia, Nigeria, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Togo, Uganda, Zambia, Zimbabwe

38 Angola, Benin, Botswana, Cabo Verde, Cameroon, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Eswatini, Gambia, Ghana, Guinea, Lesotho, Madagascar, Namibia, Nigeria, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Togo, Uganda, Zambia, Zimbabwe

39 Angola, Benin, Cabo Verde, Cameroon, Chad, Comoros, Democratic Republic of the Congo, Egypt, Gambia, Ghana, Guinea, Lesotho, Malawi, Namibia, Nigeria, Sao Tome and Principe, Senegal, Seychelles, Somalia, Sudan, Uganda, Zambia, Zimbabwe

Box 8: UNESCO's Judges Initiative Strengthening Capacities of Judicial Actors in Latin America and Africa

Since 2014, UNESCO and its partners have been training judges and judicial actors on freedom of expression, public access to information and safety of journalists, mainly through Massive Open Online Courses (MOOC). More than 17,000 judicial actors have been trained in Latin America, in partnership with the Inter-American Court of Human Rights, as well as in Africa, where UNESCO has partnered with the Center for Human Rights of the University of Pretoria, the African Commission on Human and Peoples' Rights, the African Court on Human and Peoples' Rights and the Economic Community of West African States.

These training courses improve freedom of expression, public access to information and safety of journalists by reinforcing the capacities of judges and other actors of judicial systems on these issues. The courses provide judicial actors with an overview of relevant international and regional legal frameworks as well as new challenges brought by the Internet and other digital technologies.

Through a better understanding and knowledge of international and regional standards of freedom of expression and safety of journalists, judges and other members of the judiciary can better align their decisions with international and regional standards and good practices on these issues.

Building on the above experience, UNESCO and partners are developing a programme for capacity building of judicial actors concerning the use of AI in courts and by law enforcement, as well as to address the legal implications of AI judicial decisions based on international human rights standards.

More information on the AI and the Rule of Law MOOC is available at https://en.unesco.org/artificial-intelligence/mooc-judges

AI PRIORITIES FOR COUNTRIES IN AFRICA ARE VARIED BUT OFFER AN OPPORTUNITY FOR COOPERATION

Countries were asked to map their priorities across the following 13 areas in an urgent-important matrix:

1. Personal data protection and mechanisms for data governance
2. Leveraging AI for economic growth, development and digital transformation
3. Encouraging digital innovation and start-ups working on AI
4. Updating education, skills and training systems to strengthen human capacities for the development and use of AI
5. Facilitating AI research and development
6. Applying AI for environmental protection, disaster risk reduction and natural resources management
7. Addressing the gender biases in the development and use of AI systems
8. Encouraging the use of AI for the protection of human rights
9. Encouraging the use of AI to strengthen access to information in multiple languages
10. Addressing the ethical issues raised by the use of AI systems

11. Addressing the impact of AI in the labour market, for instance, on employment opportunities and decent work
12. Influence of AI on reducing cultural diversity
13. Measures to address bias and discrimination against some groups in decisions taken by AI systems

As per Figure 7, the five areas that are considered to be urgent and important by more than half of the countries who responded to the survey are:

1. Protection of personal data and data governance
2. Leveraging AI for economic growth
3. Supporting start-ups and digital innovation
4. Updating education, skills and training systems for imparting AI skills and knowledge,
5. Facilitating AI research and development

- **Personal data protection and data governance** is an urgent and important area of work for 71 per cent of the countries, i.e. 23 countries,[40] while another five consider it to be important but not urgent.[41]
- **Leveraging AI for economic growth, development and digital transformation** is of urgent importance for 69 per cent of the countries i.e. 22 countries,[42] similarly encouraging digital innovation and start-ups working on AI is an urgent and important concern for 65 per cent of the respondents, i.e. 21 countries.[43] Whereas the impact of AI on employment and decent work is considered to be urgent and important by 31 per cent of the respondents i.e. ten countries,[44] while another 50 percent, i.e. 16 countries, consider it to be important but not urgent.[45]

---

40 Angola, Benin, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Gambia, Ghana, Lesotho, Madagascar, Namibia, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Togo, Uganda, Zambia, Zimbabwe

41 Botswana, Comoros, Eswatini, Guinea, Nigeria

42 Angola, Benin, Botswana, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Gambia, Ghana, Madagascar, Malawi, Namibia, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone, Togo, Uganda, Zambia, Zimbabwe

43 Angola, Benin, Botswana, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Gambia, Ghana, Madagascar, Namibia, Rwanda, Sao Tome and Principe, Senegal, Somalia, Togo, Uganda, Zambia, Zimbabwe

44 Benin, Congo, Democratic Republic of the Congo, Egypt, Madagascar, Malawi, Rwanda, Sao Tome and Principe, Togo, Zimbabwe

45 Angola, Cameroon, Chad, Côte d'Ivoire, Equatorial Guinea, Eswatini, Gambia, Ghana, Guinea, Lesotho, Namibia, Senegal, Seychelles, Sierra Leone, Uganda, Zambia

- **Updating education, skills and training systems** to strengthen human and institutional capacities for the development and use of AI is important for 84 per cent of the respondents, i.e. 27 countries.
- **Facilitating AI research and development** is important for 84 per cent, i.e. 27 countries out of 32, who responded.[46]
- **Addressing ethical implications of AI systems** is important for 84 per cent, i.e. 27 countries,[47] of which 12 consider it to be urgent.[48] Similarly, 71 per cent, i.e. 23 countries,[49] consider the **use of AI for the protection of human rights** as important, with 14 considering it to be urgent.[50]
- **The implications of AI for cultural diversity** are considered to be important by 20 countries,[51] with ten considering the issue to be urgent.[52]
- **Addressing gender biases in the development and use of AI systems** is considered to be important by 81 per cent, i.e. 26 countries[53], with 16 considering it to be urgent.[54]

---

46 Angola, Benin, Botswana, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Equatorial Guinea, Eswatini, Gambia, Ghana, Guinea, Lesotho, Madagascar, Malawi, Namibia, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone, Somalia, Togo, Uganda, Zambia, Zimbabwe

47 Angola, Benin, Botswana, Cameroon, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Equatorial Guinea, Ghana, Guinea, Lesotho, Madagascar, Malawi, Namibia, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Togo, Uganda, Zambia, Zimbabwe

48 Benin, Congo, Democratic Republic of the Congo, Lesotho, Malawi, Namibia, Rwanda, Sao Tome and Principe, Togo, Uganda, Zambia, Zimbabwe

49 Benin, Cameroon, Chad, Comoros, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Equatorial, Guinea, Gambia, Ghana, Guinea, Madagascar, Namibia, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone, Somalia, Togo, Uganda, Zambia, Zimbabwe

50 Benin, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Madagascar, Namibia, Rwanda, Sao Tome and Principe, Sierra Leone, Somalia, Togo, Zimbabwe

51 Angola, Benin, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Gambia, Ghana, Guinea, Lesotho, Madagascar, Malawi, Rwanda, Sao Tome and Principe, Togo, Uganda, Zambia, Zimbabwe

52 Angola, Benin, Côte d'Ivoire, Democratic Republic of the Congo, Lesotho, Madagascar, Malawi, Sao Tome and Principe, Togo, Zimbabwe

53 Angola, Benin, Botswana, Cameroon, Chad, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Equatorial Guinea, Ghana, Guinea, Lesotho, Madagascar, Malawi, Namibia, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Togo, Uganda, Zambia, Zimbabwe

54 Benin, Botswana, Congo, Democratic Republic of the Congo, Egypt, Ghana, Madagascar, Malawi, Namibia, Rwanda, Sao Tome and Principe, Sierra Leone, Somalia, Togo, Uganda, Zimbabwe

AI Priority Areas for Member States

Figure 7: AI Priority Areas for Member States

In addition to the priority areas presented in Figure 7, some countries responded with additional priority areas. These are presented in Table 2 below.

Country	Other priority areas for the use of AI
Botswana	• AI in mining to reduce costs • Use in Tourism for immersive experiences
Cabo Verde	• Energy and water monitoring • Agriculture data processing
Congo	• Employment creation • Establishment of centers of excellence specialized in AI application and training
Guinea	• Communication and information
Egypt	• Using AI to increase government efficiency and transparency, AI for SDGs
Madagascar	• Education • Health
Malawi	• ICT programme in community area in Malawi
Senegal	• Telemedicine
Somalia	• National Security, Risk and Disaster Management

Table 2: Additional priority areas for the use of AI as per countries that responded

MORE EFFORTS ARE NEEDED TO ADVANCE ON AI EDUCATION, RESEARCH AND TRAINING

Countries responded to the question on their engagement in developing AI-related education, research and training programmes under the categories of 'High', 'Medium', 'Evolving', 'Uneven' and 'None'. The 'High' category indicates that the government has organized several conferences and workshops across different ministries to discuss the impact of AI on society. The 'Medium' category indicates that a specialized agency in the government is working on specific priority areas. The 'Evolving' category indicates that the government has not launched discussions or concrete actions to address the challenges and opportunities of AI but there is interest to do so. The 'Uneven' category indicates that the level of incorporation of AI in research and education varies widely across universities and educational institutions. The 'None' category indicates that this issue is yet to be discussed.

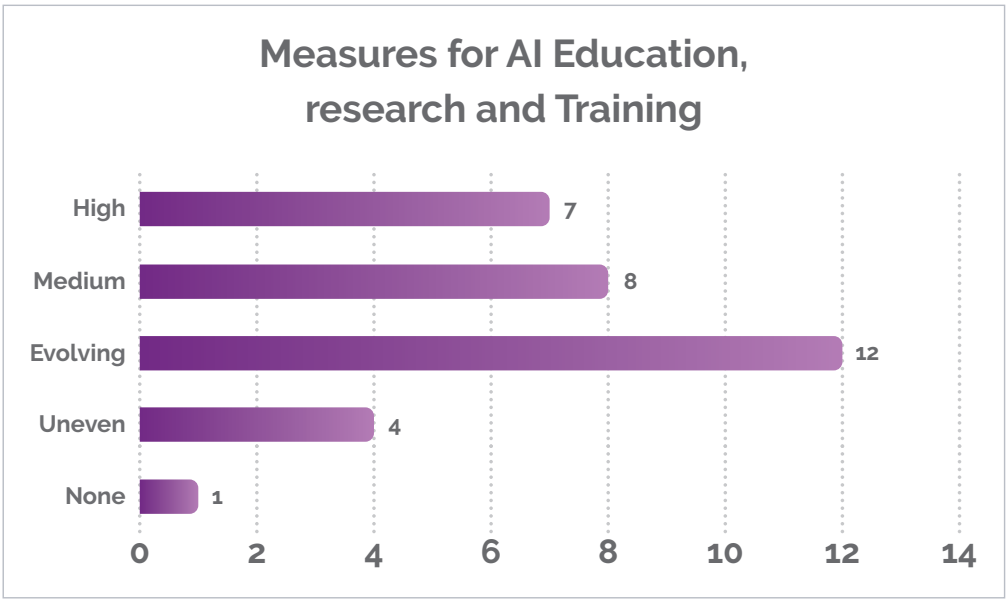


Figure 8: To what extent are Member States engaged in supporting AI Education, Research and Training

In seven countries, universities and educational institutions have developed specialized courses for AI, and initiatives have been launched to strengthen media and information literacy among students and citizens through schools. [55] [56]

In eight countries, universities are in the process of developing courses for AI and there is interest in incorporating AI education at the secondary school level.[57] In 12, no specific measures for AI skills and education have been implemented at university or school level but there is an interest to do so.[58] In four, the level of incorporation of AI in research and education varies widely across universities and educational institutions.[59]

In the COVID-19 crisis, finding solutions has become a priority as shared by the respondent from Angola below.

---

55 The countries include Egypt, Ghana, Malawi, Namibia, Sudan, Uganda, Zimbabwe

56 A survey of AI-related initiatives at universities in Africa conducted by the AI4D Network in Africa provides more details on this aspect. The respondents of that survey were universities in Africa.

57 The countries include Cameroon, Congo, Equatorial Guinea, Eswatini, Madagascar, Sierra Leone, Togo, Zambia

58 The countries include Botswana, Cabo Verde, Chad, Comoros, Democratic Republic of the Congo, Gambia, Guinea, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Somalia

59 The countries include Benin, Côte d'Ivoire, Lesotho, Nigeria

"At present the country is implementing contingency measures to address the principal issue of the moment - Covid-19. E-learning is the first step (to address disruption in classroom teaching), but the solutions are very expensive. We need to strengthen capacities of teachers to work in a context of digital instruments, and the families in rural zones." – Respondent from Angola

Egypt has launched several dedicated AI programmes in schools; these include programs on data science for technical and non-technical disciplines. Further, the government is supporting scholarships in AI related fields for MSc and PhD. In the case of Benin, the government is supporting training of teachers in the production of digital knowledge resources.

Some countries are actively seeking and building partnerships, for instance, in Eswatini, the University of Eswatini's Faculty of Science and Engineering has established a partnership with Eswatini's Royal Science and Technology Park to implement joint programmes and activities, including research.

Diaspora networks also play an important role in facilitating knowledge exchange and development of capacities within a country. The University of the Gambia, in partnership with Gambian experts in the diaspora and Google AI West Africa, organized a conference in 2019 to strengthen knowledge and capacities for teaching and learning of AI related technologies. Table 3 lists initiatives implemented or being planned to support AI, Education, Research and Training as shared by the respondents.

Country	Education, Research and Training Initiative
Cabo Verde	Establishment of an ICT Competence Centre
Eswatini	Strengthening Distance Learning Systems
Senegal	Work on Digital Technologies at Université virtuelle du Sénégal and the development of a supercomputer in Senegal
Sierra Leone	Courses on AI have been developed and are currently being taught at Njala University. Facilitating exchange with other universities that have AI Capabilities
Uganda	AI and Data Science Lab at Makerere University College of Computing and IT. In addition, review of curriculum to include AI elements at different levels
Zimbabwe	Establishment of incubation centers at universities
Botswana	Inclusion of AI in education curriculum
Congo	Development and use of datasets for advancement of science
Malawi	Introducing AI related topics at the university
Namibia	The universities are offering courses on machine learning language that drives AI
Rwanda	Introduction of AI in teaching and research agenda
Madagascar	Inclusion of AI education in the three tier "licence, master, doctorat" system

Table 3: List of initiatives implemented or in planning for supporting AI Education, Research and Training in different countries

However, gaps in human and institutional capacities when it comes to addressing AI in education systems, research, and development remain. The following segments present the findings concerning capacity gaps for AI education, research, training and data.

Gender Equality

Cross-cutting: Structural change; Consideration of harm, visibility, empowerment; Differentiated realities/impacts; Participation; Priorities and tradeoffs

Women's Rights & GE (a samppling)

- Non-discrimination; intersectionality
- Patriarchal and neo-liberal systems
- Persistent: chanllenges in social norms and violence against women
- Vertical and horizontal segregation in STEM
- Underrepresentation in political participation, policy and investments
- Gaps in: education, formal sector employment, wages, technology/internet access, legal rights/access to justice
- Invisible or undervalued work: unpaid care; ways of knowing ('local/informal' knowledge, 'crafts', storytelling, etc.) and communication (collaboration), vertical segregation and discrimination in all fields leading to invisibility
- More vulnerable to economic, environmental, political shocks
- Gasp in women from the Global South (and in humanitarian contexts) setting globla technology norms and enjoying technology benefits.

Representation
Bias
Participation and Consultation
Accontability
Decision-making
Women in Tech

Positive and negative impacrs on women and gender equality

Intelligence artificielle

Social Issues & Context

Current

- Corporate and profit driven, neo-liberal
- Gouvernments: AI race and efficiency
- Risk and gaps in potentail
- Disparate governance efforts
- Lack of widespread understanding
- Abstract universalism
- Onus on the individual and personal
- Limited problems being addressed
- Digital divides
- Lack of representation

Areas for Change

Values/Rights	laws/Regulation
Governance	Awareness
Ownership	Education
Priorities	Participation
Funding	Access

Principles Backed by Implementation

Transformative

- Structural change
- Human rights reinterpreted for AI
- Non-exploitative data regimes
- Use of foresight
- Meeting existential crisis (e.g. climate/ecological)
- Global framework (binding?)
- Power dynamics
- Community and onus on systems change
- Diverse and rights oriented priorities
- Universal access
- Fully representative

Technical Lifecycle
Data, Technology, Teams, Process

Inputs
Data quality/source
Data classification
Etc.

Development
Problem Id
Algorithm
Modeling
Verification/Validation
Etc.

Implementation
Deployment
Use/Decision-Making
Tracking/Monitoring
Etc.

Impacts

Show impacts in clear terms
Learn what is and is not working, and why?
Adjust approches to maximize positive impacts
Redress for harm
Expand successful application of AI

Figure 9: A 'food for thought' map for a more holistic approach to gender equality and AI. Source (UNESCO 2020)

AI educational resources

Nineteen countries highlighted gaps in the availability of educational resources for teaching and learning AI and in the availability of trained individuals to develop and use AI.[60] In another 10 countries, educational resources related to AI are available but there are significant human resource capacity gaps.[61] [62]

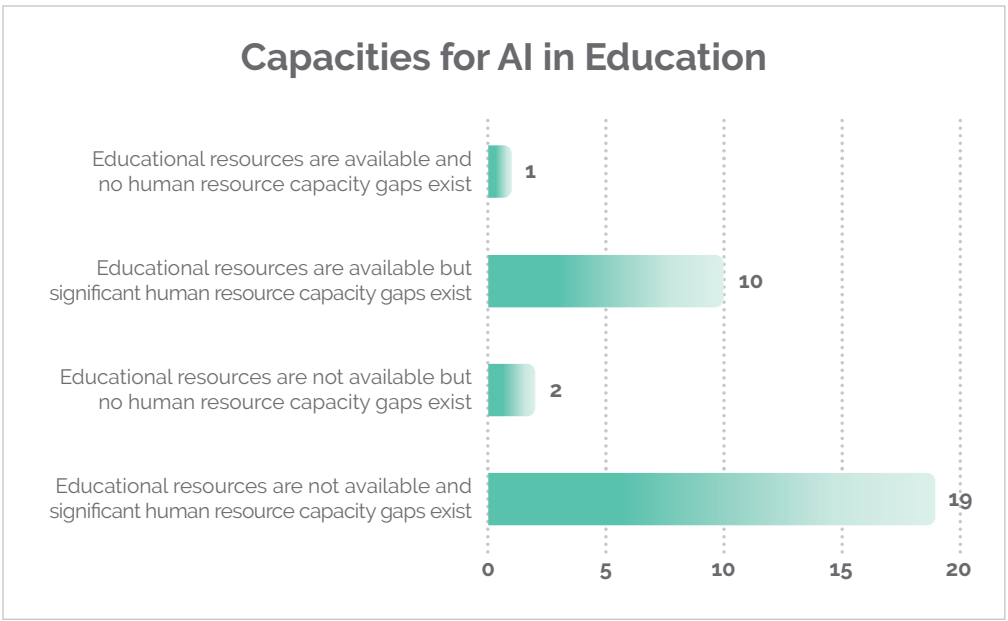


Figure 10: Capacities for AI in Education Systems

The survey did not probe the issue of Open Educational Resources (OER) but given its relevance for capacity-building and enhancing access to education, it could be an area to be considered for further research.

60 Botswana, Cabo Verde, Cameroon, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Eswatini, Gambia, Lesotho, Namibia, Nigeria, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone, Togo, Zambia, Zimbabwe

61 Benin, Congo, Equatorial Guinea, Ghana, Guinea, Madagascar, Malawi, Senegal, Somalia, Uganda

62 This pertains to all levels of education in general. Further discussions with Member States would help identify the educational resources gap at different levels of education.

"Universities provide a reasonable amount of AI education at undergraduate, graduate and research levels. There is some research using AI in Arabic Language Processing such as translation, summarization and speech recognition. There is some research in biometrics using AI. This has very little impact on government, organization and society." – Respondent from Sudan

Recommendations concerning AI educational resources to intergovernmental organizations, development organizations and UNESCO Member States:

- Support the development of open learning resources for AI education at all levels of the education system.
- Support the development of open learning resources for AI literacy among citizens in general through programmes for digital literacy.[63]
- Support the development of educational curriculum and teaching competencies for AI skills and knowledge education.
- Ensure equal participation of men and women in the development and use of educational content and faciliate the participation of girls and women in AI education and training programmes to bridge the gender divide in terms of participation of women in AI development and use. At the same time ensure that the educational content is at minimum gender sensitive, and does not propagate or perpetuate gender stereotypes, for example by highlighting examples that undermine or discourage participation of women in STEM fields.

©Daisy Daisy, Shutterstock

63 Several countries have launched programmes to increase awareness about AI among citizens. Finland is targeting 1 per cent of its population to attend the course 'Elements of AI' offered by the University of Helsinki in partnership with Reaktor. More information at https://www.elementsofai.com

Research capacities for AI

The digital and knowledge divide regarding the quality and the quantity of AI research are growing between and within countries. A challenge is whether AI can be used to help reduce the research imbalance. Figure 10 from the 2019 AI Index Report shows that only 0.3 per cent of the AI Journal citations are attributed to Sub-Saharan Africa.[64] In line with the research metric presented below, 22 countries have reported having limited research facilities and significant human resource capacity gaps.[65]

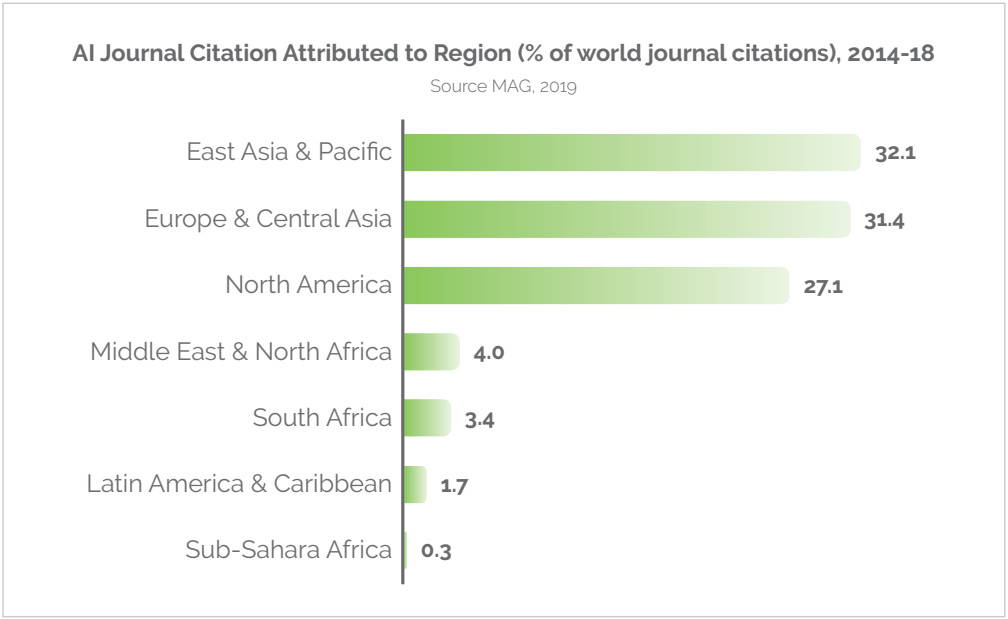


Figure 11: AI Journal Citation Attributed to Region (Source: 2019 AI Index Report)[66]

64 For general information on the methodology of that report see Appendix of the 2019 AI Index Report and further details concerning dataset-defining AI, country affiliations, and AI sub-categories can be found in the 2018 AI Index Report Appendix.

65 Benin, Botswana, Cabo Verde, Cameroon, Chad, Comoros, Côte d'Ivoire, Democratic Republic of the Congo, Eswatini, Gambia, Ghana, Guinea, Lesotho, Nigeria, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone, Togo, Uganda, Zambia, Zimbabwe

66 For more details see Page 26 of the Artificial Intelligence Index Report 2019 at URL: https://hai.stanford.edu/sites/default/files/ai_index_2019_report.pdf

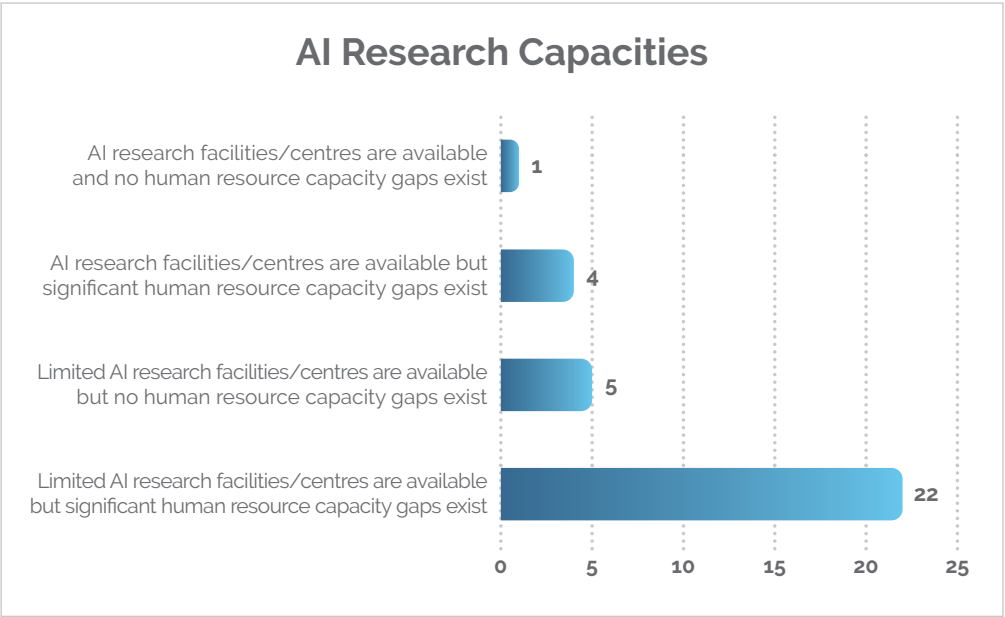


Figure 12: AI research capacities

Recommendations concerning Research capacities for AI to intergovernmental organizations, development organizations and UNESCO Member States:

- Strengthen AI research collaborations between universities in Africa, and those between African universities and universities across the world.
- Strengthen AI research collaboration between the universities and private sector actors working on the development and use of AI.
- Invest in knowledge exchange through academic exchange programmes between universities across the world.
- Invest in launching new Masters and Doctorate programmes for AI research and development in Africa and ensure that these programmes are accessible to people of all genders.

Closing the gender divides in digital skills is the subject of UNESCO publication "I'd blush if I could: closing gender divides in digital skills through education" that provides further recommendations on how to facilitate the participation of women in STEM fields and also to address gender biases in AI systems (EQUALS - UNESCO 2019).

AI research networks

Sixteen countries indicated limited engagement between national and global AI research networks[67] and 15 indicated that no links exist between the national and international AI expert networks.[68]

Box 9: Cameroon's initiative to strengthen AI Education and Research

Cameroon has launched its first AI training centre through a partnership between state-owned telecommunications operator Camtel and the University of Yaoundé I. The partnership focuses on developing learning infrastructure, training of educators, design of curriculum, and supporting students through scholarships. The target is to train 100 students initially, beginning with 25 percent of the students receiving fully funded scholarships.

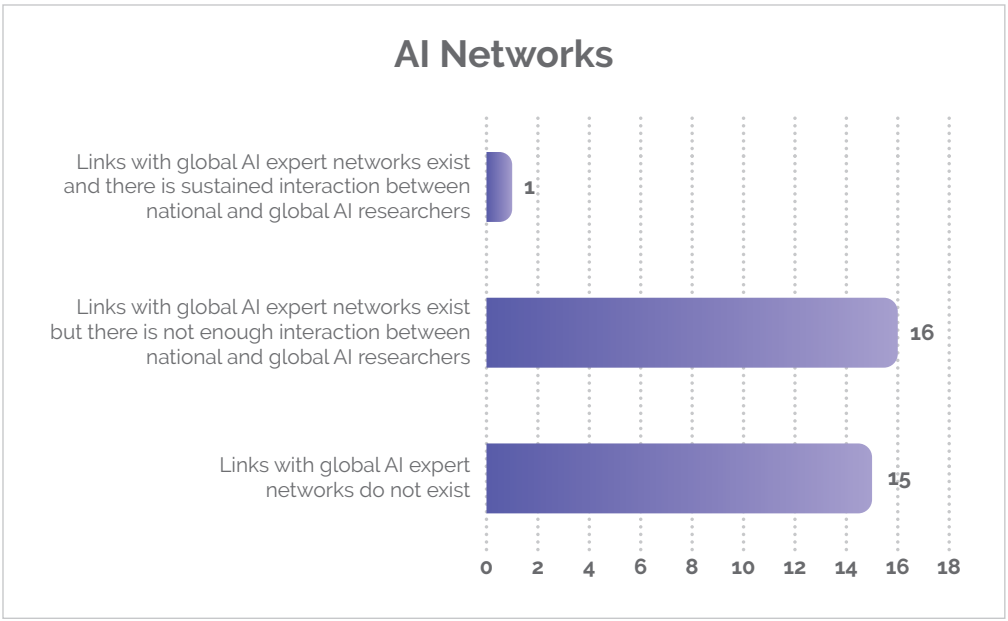


Figure 13: AI Research Networks within the framework of North-South and South-South Cooperation

67 Benin, Botswana, Cabo Verde, Cameroon, Congo, Côte d'Ivoire, Egypt, Eswatini, Gambia, Lesotho, Madagascar, Rwanda, Senegal, Sierra Leone, Sudan, Uganda

68 Angola, Chad, Comoros, Democratic Republic of the Congo, Ghana, Guinea, Malawi, Namibia, Nigeria, Sao Tome and Principe, Seychelles, Somalia, Togo, Zambia, Zimbabwe

Box 10: The Gambia's use of diaspora networks and partnerships to strengthen AI capacities in the country

The Gambia is working on becoming a 'Digital Nation' within the framework of the *ICT For Development (ICT4D) Policy Statement 2018-2028*. In 2019, Indaba-X Gambia was organised as a national conference for AI researchers and practitioners to learn and engage with each other. The Ministry of Information and Communication Infrastructure is spearheading digital transformation in the government and the Gambia. Besides, the Ministry of Higher Education, Research, Science and Technology is working on some AI Initiatives through bilateral initiatives, including one with the support from China, where the ICT Directorate of Government and other directorates are trained in batches annually on digital technologies in which AI is embedded as a subject.

Access to training data for AI is a major priority for all countries

UNESCO's report 'Steering AI and Advanced ICTs for Knowledge Societies' notes that access to data is an important determinant for the development of AI. For instance, access to data is essential for training algorithms and for their usefulness in large scale application. It notes that "in the absence of access to data, new firms face potential entry barriers in challenging the entrenched market actors". Further, even academic institutions face barriers in accessing data, which becomes a barrier to research and innovation (UNESCO 2019b). Nine countries have underlined the availability of datasets to train AI systems but a lack of human resources for developing datasets.[69] Another 16 do not have datasets to train AI systems nor the capacities to develop new datasets.[70]

69 Botswana, Cabo Verde, Cameroon, Côte d'Ivoire, Equatorial Guinea, Madagascar, Senegal, Seychelles, Togo

70 Benin, Chad, Comoros, Democratic Republic of the Congo, Eswatini, Gambia, Guinea, Lesotho, Malawi, Nigeria, Sao Tome and Principe, Sierra Leone, Somalia, Uganda, Zambia, Zimbabwe

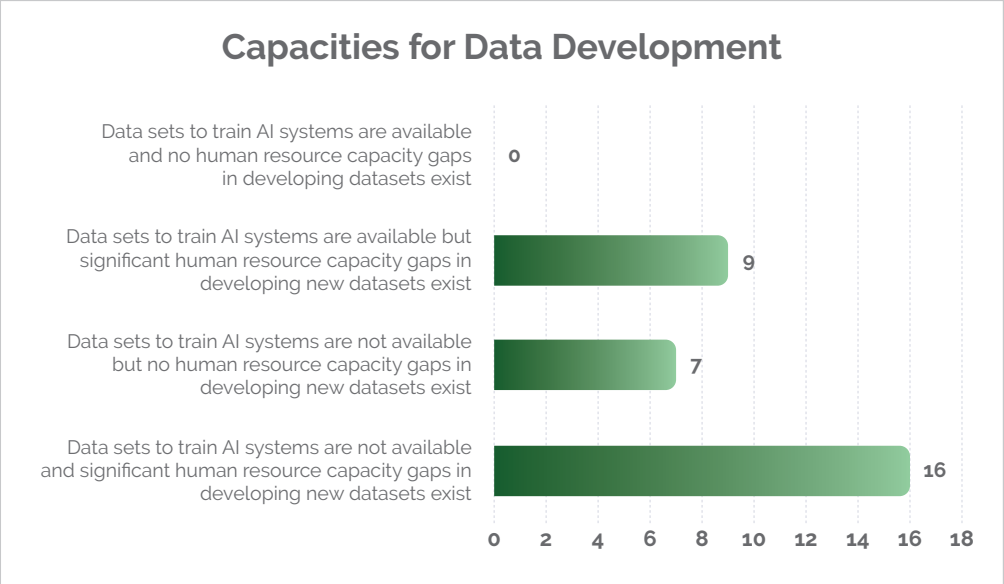


Figure 14: Capacities for the use of data for AI development

Recommendations concerning data and AI development to intergovernmental organizations, development organizations and UNESCO Member States:

- Support access to AI technology and data for learning and classification through the creation of research repositories and open access publishing.
- Create open repositories for publicly-funded or owned data and research including the creation of platforms for open government data.
- Ensure adequate safeguards are put in place with respect to open data in order to protect against the infringement of the right to privacy.
- Develop standards for interoperability between data sets while strengthening data commons and the availability of data for machine learning.
- Support existing and budding networks of big-data commons and data enthusiasts and explore possibilities to institutionalize the resulting datasets.
- Encourage the creation of public repositories of computer codes, text and speech taxonomies that are gender-sensitive.

Box 11: Project developing datasets for African languages to strengthen multilingualism and AI driven innovation

As per *Ethnologue: Languages of the World,* out of all 7111 (30.15%) living languages today, 2144 are African languages (Eberhard 2020). But only a small portion of linguistic resources for Natural Language Processing (NLP) research is built for African languages. Therefore, in the case of low resource languages, there are gaps in terms of access to data for training statistical machine learning systems that can be leveraged for developing downstream applications for digital inclusion of speakers of low resource languages and hence their active participation in knowledge societies.

As part of the AI4D initiative in Africa, UNESCO, along with its partners, is supporting the development of datasets in African languages that will be harnessed for AI-enabled innovation to strengthen access to information in these languages.

More details on this project are available at https://www.k4all.org/project/language-dataset-fellowship/

©Monkey Business Images. Shutterstock

SUPPORT REQUESTED FROM UNESCO

SUPPORT REQUESTED FROM UNESCO

The 32 Member States who responded to the survey have underlined the importance of UNESCO's work concerning AI in the fields of education, sciences, culture and communication and information. As per the survey, they have requested UNESCO's support in the following areas:

- 32 African countries have requested UNESCO's support for building human and institutional capacities in AI-related domains in its fields of competence.
- 26 countries have requested policy advice for the development of aspects of AI policy concerning education, sciences, culture and communication and information.[71]
- 21 countries have requested support from UNESCO in terms of setting standards.[72] [73]
- 27 countries have requested support in building partnerships for the development and use of AI to help them achieve their developmental priorities.[74]
- 17 countries have requested support for addressing gender equality related concerns in the development and use of AI.[75] [76]

---

71 Angola, Benin, Botswana, Cabo Verde, Cameroon, Chad, Comoros, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Eswatini, Gambia, Ghana, Guinea, Lesotho, Madagascar, Namibia, Nigeria, Sao Tome and Principe, Seychelles, Somalia, Sudan, Togo, Uganda, Zambia, Zimbabwe

72 Benin, Botswana, Cameroon, Chad, Comoros, Democratic Republic of the Congo, Eswatini, Gambia, Ghana, Guinea, Lesotho, Madagascar, Nigeria, Rwanda, Sao Tome and Principe, Seychelles, Sierra Leone, Somalia, Uganda, Zambia, Zimbabwe

73 A two-year process for the elaboration of a recommendation on the Ethics of AI is underway at UNESCO. African countries have been deeply engaged with this process through national and regional consultations and would be part of the final decision-making and follow up on this instrument. More information at https://en.unesco.org/artificial-intelligence

74 Angola, Benin, Botswana, Cameroon, Chad, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Equatorial Guinea, Eswatini, Gambia, Ghana, Guinea, Lesotho, Madagascar, Namibia, Nigeria, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, Sudan, Togo, Uganda, Zambia, Zimbabwe

75 Angola, Benin, Botswana, Cameroon, Democratic Republic of the Congo, Eswatini, Gambia, Ghana, Guinea, Lesotho, Nigeria, Sao Tome and Principe, Senegal, Somalia, Togo, Uganda, Zambia

76 For information on closing the digital skills gender gap and gender biases in AI systems refer to UNESCO publication "I'd blush if I could: closing gender divides in digital skills through education" at https://unesdoc.unesco.org/ark:/48223/pf0000367416.page=85

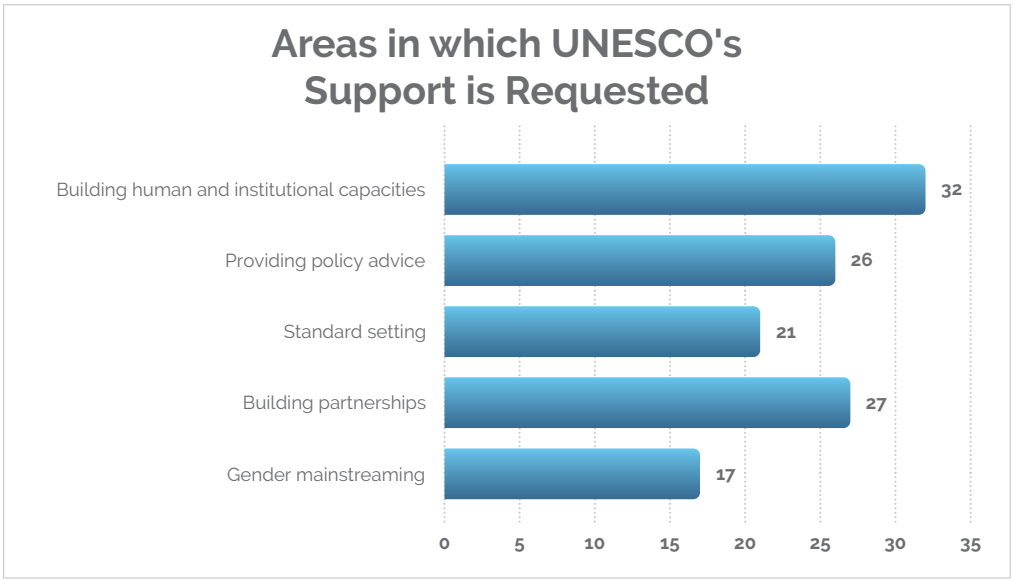


Figure 15: Areas in which UNESCO's support is requested by Member States

Box 12: Major findings of UNESCO's Internet Universality ROAM-X Indicators assessments in Benin, Senegal and Kenya

UNESCO's Internet Universality ROAM-X Indicators framework is a set of 303 indicators that aim to assess how well national stakeholders, including governments, companies, and civil society perform in adhering to the ROAM principles of Rights, Openness, Accessibility, and Multi-stakeholder participation.

Given the linkages between the ecosystem within which Internet and AI evolve, the ROAM principles can serve as a well-grounded and holistic framework for UNESCO and stakeholders to help shape the design, application, and governance of AI.

In Benin, as per the national assessment of ROAM-X indicators, the evolution of technologies and the importance of the issue of the universality of the Internet led experts to recommend the creation of an observatory of the Internet, digital and artificial intelligence as well as the adoption of a digital policy related to cultural heritage taking into account the issue of safeguarding, protection and exploitation. The national assessment also recommends the government to proceed to the proofreading of the Digital Code to take into account the emerging issues in the digital field including artificial intelligence, blockchain, open data and the Internet of Things.

In Senegal, the national assessment of ROAM-X indicators was welcomed by actors of the digital ecosystem in the country, as favoring the implementation of the 2025 Digital strategy for Senegal and of the High-speed national plan. The assessment recommended the government to establish effective mechanisms of online privacy protection and to strengthen the material and human resources of the National Digital Observatory so that it can provide relevant information to measure the development of the digital technologies including artificial intelligence.

In Kenya, the assessment found a robust Internet environment that is developing in line with international best practices. While there is significant growth in the access and use of ICTs, the collaboration of all relevant stakeholders remains necessary to bridge the digital divide. The assessment recommended that the government enforce and periodically evaluate the implementation of policies and laws affecting the Internet and human rights in the digital environment. It also recommended that the academia conduct more issue and evidence-based research on the use and impact of emerging technology (including AI) to inform decision and policy making.

Full reports of the national assessment of ROAM-X indicators are at: https://en.unesco.org/internet-universality-indicators/national-assessments

©Gorodenkoff, Shutterstock

CONCLUSION & RECOMMENDATIONS

©Wright Studio. Shutterstock

LEVERAGING DIGITAL COOPERATION IS ESSENTIAL FOR AI GOVERNANCE

The 74th session of the UN General Assembly deliberated and endorsed the Secretary General's Report on Digital Cooperation.[77] The Member States endorsed initiating a multistakeholder mechanism to make digital economy and society inclusive, enhance human and institutional capacities, ensure respect for digital human rights and safeguard trust, security and stability in the digital sphere. Within this context, AI Governance has emerged as an important area that requires close cooperation between multiple stakeholders, in order to leverage possible gains from pooling resources to achieve scale and to mitigate risks arising out of harmful uses of AI. For instance, on the one hand, data plays an important role in development and training of AI algorithms; on the other hand, the misuse of the same data can also create concerns about individual privacy, autonomy, bias, and discrimination against certain groups, including on the basis of gender. Therefore, in order to leverage the opportunity to create AI-enabled products and services, AI governance needs to cover aspects ranging from access to data, knowledge and hardware for reducing entry barriers for new innovation to creation of principles, norms and regulatory frameworks that would ensure that the development and use of AI respects human rights.

77 https://undocs.org/A/74/821

Management of some of these opportunities and risks requires coordination and governance at local, national, and international levels for them to be harnessed for the benefit of humankind. UNESCO is working on AI as a transversal theme across its programmes in education, sciences, culture and communication and information to support countries with knowledge exchange, standard setting on the ethics of AI, policy advise and capacity building.

Further, as noted in the UN Secretary-General's Roadmap on Digital Cooperation, digital capacity building "has been supply-driven as opposed to needs-based". In seeking to understand the needs of Member States, this survey has laid the ground for needs-based digital cooperation for policy development and capacity enhancement (United Nations 2020).

Initiatives on global scale like the UN Secretary General's Roundtables for Digital Cooperation provide a platform for exchange of best practices, ideas, and solutions for AI governance.

In December 2018, UNESCO organized its first Forum on AI in Africa, in close collaboration with the Mohamed VI Polytechnic University Polytechnic in Morocco, which hosted the event. At the final stage of these high-level discussions, the participants unanimously adopted the Benguerir Declaration, which highlighted the need to promote AI in Africa as a lever for development, centered on the human dimension and anchored in universal ethical principles, as well as in the standards of human rights. They called for the implementation of a detailed list of actions.

The African Union's recently launched Digital Transformation Strategy for Africa (2020-2030), identifies harmonization of policies, legislations, and regulations across Africa as an objective, with a view to strengthen intra-Africa trade, investment and socio-economic integration (African Union 2020).

In order to achieve these objectives, global initiatives for policy exchange and ideas would highly benefit from development cooperation to support capacity development. AI Governance in Africa can further be strengthened through the model of triangular cooperation where trilateral partnerships between a beneficiary, facilitator, and pivot country could be leveraged to implement policy exchange and capacity enhancement initiatives.

The findings of this survey provide baseline information on the current state of policy action on AI and capacity building needs in 32 countries in Africa. These findings can be leveraged to inform African and global policy communities in harmonizing digital policies and co-creating strategies and solutions for AI Governance that leave no one behind.

RECOMMENDATIONS

The survey has presented the policy making and capacity building needs and priorities of 32 countries in Africa. The policy priorities and capacity needs, as reported by public institutions and academic experts, across these countries are informed by each country's developmental context. Countries facing security challenges have expressed a need to leverage AI for building peace and inclusion in societies. Countries with tourism and agriculture as dominant sectors have identified applications of AI to support these sectors as priorities. Similarly, factors like geographic location and natural resource endowment also inform each country's priorities for AI development and use. For instance, fisheries are an important area in Small Island Developing States (SIDS).[78]

At the same time, the search for employment and growth opportunities for Africa's large young population is a priority that cuts across most countries that responded to the survey. Therefore, AI education, training and research are priorities as per 84 per cent of the countries that responded to the survey. Further, 96 per cent of the respondents underlined that links between AI research networks at the national and global level are either weak or non-existent. This presents an opportunity to strengthen links between educational institutions and research networks in Africa and across the world to work towards solving local and regional problems using digital technologies like AI. Gender equality within AI systems, in the form of embedded biases and discrimination, and how to enhance gender equality through the use of AI, is another common area of concern expressed by a majority of the countries.

For governments, the findings of the survey present an opportunity to work together to exchange knowledge, best practices, and jointly finance solutions to address common challenges. For instance, the common priority areas identified in this report provide an entry point for cooperation among UNESCO Member States seeking to achieve similar goals with respect to AI development, use and governance.

Therefore, the first set of recommendations of this survey focuses on processes that can facilitate development of better policies for AI Governance and that can support digital capacity building. These recommendations, addressed to intergovernmental organizations, development organizations and UNESCO Member States, are:

1. Facilitate digital cooperation amongst countries to exchange knowledge and ideas on the policy instruments that work for AI Governance at the national, regional and international level.

    - This could be implemented through the establishment of regional working groups in collaboration with the African Union and Regional Economic Communities (RECs) and led by Member States to address different priority areas with respect to AI Governance. Such processes would facilitate

78 See Table 2.

development of solutions through policy learning and may engender positive externalities from potential policy convergence. [79]

2. Adopt models for digital capacity building, including for AI, that consider local context and expertise while bringing in the best ideas and knowledge from around the world.

   - This could include models of triangular cooperation within the framework of North-South and South-South cooperation. Triangular cooperation would strengthen regional cooperation among countries in Africa and deliver technical advice in an impact-oriented way.

   - Further, setting up digital help desks at the national level, as part the UN Sustainable Development Frameworks and the UN Secretary-General's Roadmap for digital cooperation would provide on-time and context specific support to Member States. These digital help desks could also engage with internal country-level multistakeholder cooperation forums, for example the National Internet Governance Forums (IGFs).

3. Facilitate multi-stakeholder participation for AI governance, especially in rule making, through the involvement of citizens, private sector, academia and civil society organizations.

   - This could be achieved through organization of regional dialogues on AI, facilitating joint research and development and development of communities of practice that test and implement government policies under regulatory sandboxes.

Recommendations for intergovernmental organizations, development organizations and Member States to address the implications of AI in the priority areas discussed in the survey include:

1. Policy Initiatives for AI Governance:

   - Develop an AI Policy toolkit with science, technology, innovation, education, culture, and communication policy instruments for sustainable development that can inform national AI policies.

   - Develop implementation guides and model use cases to translate AI Ethics principles into practice.[80]

79 An African Union Working Group on AI is developing a common African vision and strategy for AI. Domain specific working groups to address the common priority areas identified in this survey could be considered. For more information see http://www.mcit.gov.eg/Media_Center/Press_Room/Press_Releases/40507

80 Notably, once UNESCO finalizes its recommendation on the Ethics of AI

- Launch pilot projects that provide evidence on how AI and training data can be leveraged to harness the opportunities in priority areas identified by Member States.

- Develop policy guidelines to address issues related to gender equality and AI, including bias and discrimination in AI algorithms, in cooperation with governments, private sector, academia and the civil society. This could notably include the use of AI to enhance gender-disaggregated data.

2. Legal and Regulatory Frameworks for AI Governance:

   - Adapt and test frameworks for human rights risk assessments and due diligence on AI applications in order to ensure that they do not interfere with the full enjoyment of fundamental human rights and freedoms. Moreover, UNESCO is developing a larger framework on ethics of AI, which includes an Ethical Impact Assessment, that will include the whole range of human rights, fundamental freedoms, human dignity, which will provide with a more robust framework to properly assess and address the challenges and opportunities of AI for all individuals and communities. Such frameworks at:
     - Ex ante level: Ensure there is no discrimination in the selection of data-sets and programmers' design choices and make explicit the values informing these choices, including related to implicit and explicit gender biases.
     - Ex post level: Provide for close monitoring of outcomes that could infringe on the rights to expression, privacy and equality, as well as other rights.

   - Develop legal and regulatory frameworks updated for Personal Data Protection and Data Governance, including through development of model laws.

3. Building capacities to address legal implications of AI and uphold fundamental human rights:

   - Integrate programmes for sensitisation around AI and its human rights and legal implications as part of ongoing trainings for government decision makers. Information on the risk of propagation of gender biases and stereotypes, as well as the consequences of such propagation, through AI systems should be part of the training modules.[81]

   - Develop and launch training modules for judicial actors to address legal implications of AI and the use of AI in judicial systems and for law enforcement, in ways that respect the fundamental rights to freedom of expression, access to information, privacy, and non-discrimination. As part of these

81 See UNESCO publication "I'd blush if I could: closing gender divides in digital skills through education" that discusses gender based biases in AI systems in more detail at https://unesdoc.unesco.org/ark:/48223/pf0000367416.page=85

training modules, raise awareness about the risk that gender biases can be embedded and propagated through the use of AI systems, thereby reinforcing stereotypes and discrimination.

- Raise awareness about the legal and policy implications of AI among parliamentarians through representations to Parliamentary Committees, committees addressing the questions of emerging technologies and their governance, and organisation of forums for parliamentarians to exchange knowledge.

4. Raising public awareness and understanding of AI:

   - Train journalists to report accurately on issues related to AI and its social impacts, including as regards gender equality and other structural power issues, as well as to understand the opportunities and challenges of integrating AI tools in the production of news content.

   - Contribute to multi-stakeholder dialogue at country level with internet platforms and other key stakeholders on the use of AI-driven content moderation, in lines with international standards of human rights and tailored to local needs.

   - Train journalists on uncovering and reporting on explicit or implicit gender biases that can be embedded and propagated through the use of AI systems and to report on the structural inequalities that may limit the participation of different genders in the development,use and benefit of AI.

5. Capacities to Develop Standards for AI Products and Services:

   - Facilitate multi-stakeholder cooperation for development of industrial standards in cooperation with technical standards organisations like the Institute of Electrical and Electronics Engineer (IEEE) and the the International Organization for Standardization (ISO).

   - Support training for development and implementation of AI technical standards for the development of products and services using AI in a manner that respects human rights and promotes gender equality.

   - Ensure equal participation of men and women in the development of standards for products and services through multistakeholder processes, and at the same time ensure that the standards developed have checks against potential gender biases that risk being embedded and propagated through AI products and services. This could for example be done through gender equality markers for AI product and services.

6. Capacities to address the ethical challenges of AI:

   - Building upon the process for the elaboration of a Recommendation on the Ethics of artificial intelligence at UNESCO, develop training programmes for inclusion of AI ethics education at different levels of the school and university system, and to other stakeholders.

- Facilitate knowledge exchange on ethical dimensions of digital technologies among policymakers.
- Facilitate knowledge exchange on ethical dimensions of digital technologies among policymakers, including on the digital gender divide in terms of participation of women in STEM fields, as well as regards gender biases and stereotypes that can be established and propagated through AI systems if not designed in an ethical manner.

7. AI educational resources:
   - Support the development of open learning resources for AI education at all levels of the education system.
   - Support the development of open learning resources for AI literacy among citizens in general through programmes for digital literacy. [82]
   - Support the development of educational curriculum and teaching competencies for AI skills and knowledge education.
   - Faciliate the participation of girls and women in AI education and training programmes to bridge the gender divide in terms of participation of women in AI development and use.
   - Ensure equal participation of men and women in the development and use of educational content and faciliate the participation of girls and women in AI education and training programmes to bridge the gender divide in terms of participation of women in AI development and in benefitting of its use. At the same time ensure that the educational content is gender-sensitive at minimum, and does not foment gender stereotyping by highlighting examples that discourage the active participation and inclusoin of women in STEM fields, or through other means.
8. Research capacities for AI:
   - Strengthen AI research collaborations between universities in Africa, and those between African universities and universities across the world.
   - Strengthen AI research collaboration between the universities and private sector actors working on the development and use of AI.
   - Invest in knowledge exchange through academic exchange programmes between universities across the world.

82 Several countries have launched programmes to increase awareness about AI among citizens. Finland is targeting 1 per cent of its population to attend the course 'Elements of AI' offered by the University of Helsinki in partnership with Reaktor. More information at https://www.elementsofai.com

- Invest in launching new Masters and Doctorate programmes for AI research and development in Africa and ensure that these programmes are accessible to people of all genders.

Closing the gender divides in digital skills is the subject of UNESCO publication "I'd blush if I could" that provides further recommendations to facilitate the participation of women in STEM fields and for addressing gender biases in AI systems (EQUALS - UNESCO 2019).

9. Data and AI development:

- Support access to AI technology and data for learning and classification through the creation of research repositories and open access publishing.
- Create open repositories for publicly-funded or owned data and research including the creation of platforms for open government data.
- Ensure adequate safeguards are put in place with respect to open data in order to protect against the infringement of the right to privacy.
- Develop standards for interoperability between data sets while strengthening data commons and the availability of data for machine learning.
- Support existing and budding networks of big-data commons and data enthusiasts and explore possibilities to institutionalize the resulting datasets.
- Organize data challenge and hackathons to develop new dataset or enrich existing training datasets and encourage their downstream usage.
- Encourage the creation of public repositories of computer codes, text and speech taxonomies that are at minimum gender-sensitive.

UNESCO will continue to its Member States in leveraging AI for sustainable development and mitigating its risks for humanity. In 2021, building upon the findings of the survey UNESCO and its partners would organise a global conference on capacity building for AI that would see the launch of products and services for policy advise and capacity building based on the findings of this survey.

ANNEX

ANNEX 1: GLOSSARY

This glossary provides the broad meanings of key terms. Attribution to authors for ideas does not constitute an endorsement of their definitions.

Algorithm: A set of step-by-step instructions for solving a problem (Negnevitsky 2011)

Algorithmic decision-making: A form of decision-making based on outputs from algorithms (Andersen 2018).

Automated decision-making: A process of deciding by automated means. It usually involves the use of automated reasoning to aid or replace a decision-making process that would otherwise be performed by humans. It does not necessarily involve the use of AI but will generally involve the collection and processing of data (CoE CHR/Rec(2019)1 2019).

Artificial intelligence (AI): While there is no one single definition of 'artificial intelligence' (AI), this publication tends to define AI as an ensemble of advanced ICTs that enable "machines capable of imitating certain functionalities of human intelligence, including such features as perception, learning, reasoning, problem solving, language interaction, and even producing creative work" (COMEST, 2019).

Bias: An inclination or prejudice for or against a person or group, especially in a way that is considered to be unfair (societal definition); the difference between the estimated—or predicted—value and the true value – in other words, the difference between what a system predicts and what actually happens (statistical definition) (Andersen 2018).

Big data: Datasets that is too large or complex for traditional data processing software to analyze (Andersen 2018). Most AI systems rely on the collection, processing and sharing of such big data in order to perform their functions.

Data: Facts, measurements, or observations. Also, a symbolic representation of facts, measurements, or observations (Negnevitsky, 2011).

Database: A collection of structured data (Negnevitsky, 2011).

Data mining: Extraction of information and knowledge from data. Also, the exploration and analysis of large amounts of data in order to discover meaningful patterns and rules. The goal of data mining is to discover information and knowledge (Negnevitsky, 2011).

Deep learning: This technique enables a machine to independently recognize complex variations. An example is automated scouring and classifying of millions of images picked from the Internet that have not been comprehensively labelled by humans. The result of a combination of learning algorithms and formal neural networks and the use of massive amounts of data, deep learning powers AI (UNESCO 2018).

Information and communication technologies (ICTs): Diverse set of technological tools and resources used to transmit, store, create, share or exchange information. These technological tools and resources include software, computers, the Internet (websites, blogs and emails), live broadcasting technologies (radio, television and webcasting), recorded broadcasting technologies (podcasting, audio and video players and storage devices) and telephony (fixed or mobile, satellite, visio/video-conferencing, etc.) (UNESCO Institute of Statistics 2019).

Intelligence: The ability to learn and understand, to define problems and to make decisions to solve them. A machine is thought to be intelligent if it can achieve human-level performance in some cognitive task (Negnevitsky, 2011).

Machine learning: An adaptive mechanism that enables computers to learn from experience, learn by example and learn by analogy. Learning capabilities improve the performance of an intelligent system over time. Machine learning is the basis of systems that can adapt their response continuously (Negnevitsky, 2011).

Open data: Databases that are publicly available by download (CoE 2018).

Personal data: Information relating to an identified or identifiable natural person, directly or indirectly, by reference to one or more elements specific to that person (CoE 2018).

Personal data processing: Any operation or set of operations performed using automated processes and applied to personal data or sets of data, such as collection, recording, organization, structuring, storage, adaptation or modification, retrieval, consultation, use, communication by transmission, dissemination or any other form of making available, linking or interconnection, limitation, erasure or destruction (CoE 2018).

For more definitions, please see UNESCO report "Steering AI and Advanced ICTs for Knowledge Societies" at https://unesdoc.unesco.org/ark:/48223/pf0000372132.

ANNEX 2: SURVEY METHODOLOGY

DESIGN

A draft questionnaire was developed based on the detailed analysis of the AI ecosystem in Africa as covered in the UNESCO publication "Steering AI and Advanced ICTs for Knowledge Societies"; the discussions at the 2018 UNESCO Forum on AI in Africa; the K4A Global South map of emerging areas in AI; and with inputs from Neil Butcher Associates, which conducted the AI Universities and Communities Survey in Africa.[83]

In November 2019, feedback on the draft survey was requested from UNESCO's AI Task Team, comprising over 60 specialists working at UNESCO in the fields of education, the sciences, culture, communication, information and on global priority Africa. The survey was further revised with inputs from the Africa Department and UNESCO Chair in ICT for Development at Royal Holloway, University of London.

The survey consisted of six sections with 34 questions that captured information on 91 data points. These include:

- Section one: Basic information about the respondent and their affiliation
- Section two: Level of awareness about AI and its implications on society in the country
- Section three: National priorities for AI and digital transformation
- Section four: Information on the human and institutional capacities available for AI governance and the possible ways in which the capacity gaps could be addressed
- Section five: Information on the existence of legal frameworks for personal data protection, automated bias and discrimination, and open data policies
- Section six: Existing multistakeholder partnerships addressing the opportunities and challenges of AI within the country and the ways in which UNESCO could partner with the country.

83 For Global South map of emerging areas in Artificial Intelligence see: https://www.k4all.org/project/aiecosystem/

ADMINISTRATION

In March 2020, the survey was launched online in English and French for an initial period of one month between 5 March and 5 April 2020. The survey was shared with the UNESCO National Commissions in Africa for responses by relevant national authorities working on the development or coordination of AI programmes, within the ICT policy landscape. However, given the outbreak of the COVID-19 pandemic, the survey deadline was extended to 30 June.

In order to improve the response rate, UNESCO field offices in Africa (Kenya, Senegal, Zimbabwe, Egypt, Tanzania, Ethiopia, Nigeria, Morocco, Tunisia, Sudan, Mali, Mozambique, and Cameroon) reached out to National Commissions and ICT focal points in governments to follow up on the request for completion of the survey. By 30 June 2020, the survey received 121 responses, of which 48 were complete and submitted to UNESCO. The 48 complete responses represent 32 governments and/or state-linked bodies in Africa. The list of countries that responded to the survey, along with the number of respondents and the institution of the respondent, is available in Table 4 below.

Country	No. of Responses	Institution
Angola	1	Ministry of Education
Benin	1	University of Abomey-Calavi
Botswana	3	Department of Telecommunications & Postal Services, Ministry of Transport & Communications **Department of Research, Science and Technology, Govt. of Botswana** Department of Computer Science, University of Botswana
Cabo Verde	1	Ministry of Finance
Cameroon	1	Department of ICT, Ministry of Posts and Telecommunications
Chad	1	Ministry of Higher Education, Research and Innovation
Comoros	1	University of Comoros
Congo	1	Ministry of Communication and Media

Country	No. of Responses	Institution
Ivory Coast	1	INP-HB/ Ministry of Higher Education and Scientific Research
Democratic Republic of the Congo	1	Democratic Republic of Congo National Commission for UNESCO
Egypt	1	Ministry of Communications and Information Technology
Equatorial Guinea	1	Ministry for Culture, Tourism and Arts Promotion
Eswatini	1	Department of Journalism and Mass Communication, Faculty of Humanities, University of Eswatini
Gambia	1	ICT Directorate, Ministry of Information and Communication Infrastructure (MOICI)
Ghana	1	Ghana Investment Fund for Electronic Communications/Ministry of Communications
Guinea	1	Ministry for Higher Education and Scientific Research
Lesotho	1	Lesotho National Commission for UNESCO
Madagascar	1	Ministry of Post, Telecommunication and Digital Development
Malawi	3	**Malawi National Commission for UNESCO** Media Institute of Southern Africa, Malawi University of Malawi, The Polytechnic
Namibia	5	**Ministry of ICT** Department of Lifelong Learning, Arts and Culture, Ministry of Education, Arts and Culture Ministry of Higher Education, Technology and Innovation Namibia University of Science and Technology Faculty of Computing and Informatics Namibia University of Science and Technology

Country	No. of Responses	Institution
Nigeria	4	National Library of Nigeria **Federal Ministry of Communications and Digital Economy** ICT Department, Federal Ministry of Communications & Digital Economy National Information Technology Development Agency (NITDA)
Rwanda	1	INES-Ruhengeri University
Sao Tome and Principe	1	Ministry of Tourism, Culture, Commerce and Industry
Senegal	1	Ministry of Education
Seychelles	1	Department of ICT
Sierra Leone	1	Sierra Leone National Commission for UNESCO
Somalia	1	Ministry of Post and Telecommunication
Sudan	1	Sudanese Computer Systems Professionals Council, (Ministry of) Council of Ministers.
Togo	2	University of Lomé, Ministry of Higher Education and Research Togo National Commission for UNESCO
Uganda	2	Ministry of Science, Technology and Innovation E-Services Department
Zambia	1	Department of Science and Technology, Ministry of Higher Education
Zimbabwe	2	Zimbabwe National IFAP Committee Zimbabwe Library Association, Ministry of Primary and Secondary Education

Table 4: Countries and Institutions that have responded to the survey. Note: In cases where more than one response has been received from a country, the data is taken from the respondent in Italics as these are from ICT related department or the only response from a government entity. The free text data is taken from all respondents.

ANALYSIS

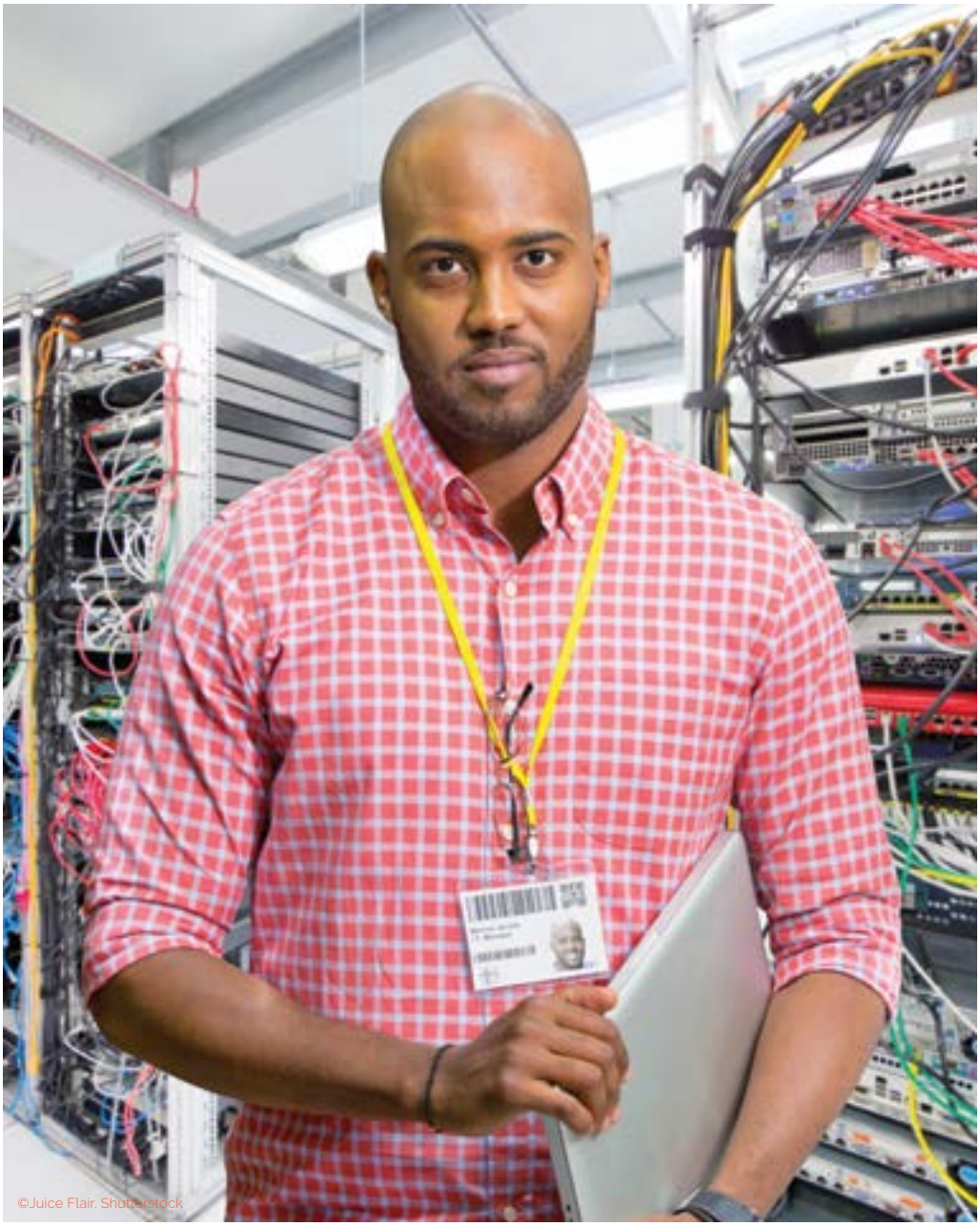
The findings of the survey are based on responses from the government-designated respondents aware of the government policy on AI or directly involved in the development of such policies. In cases where more than one response was received from the same country, the response from the ministry dealing with ICTs was reflected in the aggregate findings. The information in the free text responses to the survey is taken from all submitted responses.

Following analysis of the survey data, the draft report was peer reviewed by UNESCO's AI Task Team, Africa Department, UNESCO regional and country office focal points in Africa and experts from partners like International Development Research Centre (IDRC), Knowledge for All Foundation (K4A), which coordinates the AI4D network in Africa, and Neil Butcher Associates in South Africa.

The survey provides information across a wide range of concerns related to AI, based on responses from relevant government official(s). However, it may have several limitations. First, due to a wide range of respondents (in terms of ministries and other respondents represented) there may be heterogeneity in the knowledge of respondents in different countries to be able to authoritatively respond to all questions in the survey. Second, the survey was shared with all UNESCO Member States in Africa (not only Africa Group), but it elicited a response from only 32 Member States. Therefore, the report does not give a complete picture of AI Needs across Africa.

It may be noted that the survey does not offer any comparison between Member States and the data is presented at an aggregate level to present shared needs for policy support and capacity enhancement.

The survey questionnaire is available online at http://www.unesco.org/survey-ai-capacity-building/



©Juice Flair. Shutterstock

BIBLIOGRAPHY

UNCTAD. *Technology and Innovation Report 2018: Harnessing Frontier Technologies for Sustainable Development.* Geneva: United Nations, 2018.

UNDESA. 2020 *Digital Government in the Decade of Action for Sustainable Development.* Survey, New York: United Nations, 2020.

United Nations. *Report of the UN Secretary-General Roadmap for Digital Cooperation.* Roadmap, New York: United Nations, 2020.

African Union. *The Digital Transformation Strategy for Africa (2020-2030).* Strategy, Addis Ababa: African Union, 2020.

COMEST. *Preliminary Study on the Ethics of Artificial Intelligence.* Preliminary Study, UNESCO, Paris: UNESCO, 2019.

Rao, Anand S., and Gerard Verweij. *Sizing the prize: What's the real value of AI for your business and how can you capitalise?* PwC, PwC, 2017.

Negnevitsky, Michael. *Artificial Intelligence: A Guide to Intelligent Systems.* Boston: Addison Wesley, 2011.

Andersen, Lindsay. *Human Rights in the Age of Artificial Intelligence.* New York: AccessNow, 2018.

CoE CHR/Rec(2019)1. "Recommendation of the Commissioner for Human Rights on Unboxing Artificial Intelligence: 10 steps to protect Human Rights." *Council of Europe.* May 2019. https://rm.coe.int/unboxing-artificial-intelligence-10-steps-to-protect-human-rights-reco/1680946e64 (accessed September 4, 2019).

CoE. *Glossary.* 2018. https://www.coe.int/en/web/artificial-intelligence/glossary (accessed September 11, 2019).

UNESCO. *40 C/5.* 40th General Conference, Paris: UNESCO, 2019a.

—. *A Lexicon for Artificial Intelligence.* July-September 2018. https://en.unesco.org/courier/2018-3/lexicon-artificial-intelligence (accessed October 18, 2019).

UNESCO Institute of Statistics. *Information and communication technologies (ICT).* 2019. http://uis.unesco.org/en/glossary-term/information-and-communication-technologies-ict (accessed October 18, 2019).

UNESCO. *Steering AI and Advanced ICTs for Knowledge Societies.* Internet Freedom Series, Paris: UNESCO, 2019b.

EQUALS - UNESCO. *I'd blush if I could: closing gender divides in digital skills through education.* Paris: UNESCO, 2019.

UNESCO. *Artificial intelligence and gender equality: key findings of UNESCO's Global Dialogue.* Paris: UNESCO, 2020.

Eberhard, David M., Gary F. Simons, and Charles D. Fennig. *Ethnologue: Languages of the World.* 2020. http://www.ethnologue.com (accessed October 21, 2020).

IDRC | CRDI
International Development Research Centre
Centre de recherches pour le développement international
Canada

K4A
knowledge for all

nba

United Nations
Educational, Scientific and
Cultural Organization