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# HARNESSING ARTIFICIAL INTELLIGENCE FOR DEVELOPMENT IN THE POST-COVID-19 ERA

## A Review of National AI Strategies and Policies

### THE GLOBAL AI LANDSCAPE

Artificial intelligence (AI) has rapidly emerged as an important topic for the global development agenda. Policymakers are increasingly curious about how they can design an enabling environment for this new technology to not only thrive, but also accelerate progress towards sustainable development goals. AI's trajectory has been driven by rapidly increasing amounts of data, advances in machine learning algorithms and more powerful processing power than ever before. Increasing global digital connectivity is also supporting the growth of AI, through the expansion of broadband networks and adoption of digital platforms and cloud computing services.

The Covid-19 pandemic is also yielding new and innovative AI applications and solutions to help manage the spread of the virus, drive drug discovery and cope with social distancing requirements (OECD 2020). At the onset of the pandemic, AI was used to monitor the spread of the virus and predict where and when new outbreaks might occur (Raju et al. 2020). AI was widely used to accelerate the speed of vaccine research, yielding multiple vaccines in record time (Arshadi and others 2020). AI was also used to power web and mobile-based chatbots such as the World Health Organization's Health Alerts or the Center for Disease Control's Covid-19 portal to help people find information quickly as well as conduct self-diagnosis for coronavirus infection at home; these portals were emulated in many developing countries (Miner et al. 2020). And as the pandemic enters the vaccination phase, applications for AI are now being explored to inform triage planning across population groups, forecast demand, help manage supply chains and post-vaccination surveillance of any adverse drug reactions (Kahn & Vanian 2021).



However, the development of AI technologies remains heavily concentrated in a small number of advanced economies (Oxford Insights 2020). These countries are characterized by a strong local talent pool, a robust research and innovation base and access to capital to fuel growth through investments (Loucks and others 2019). Countries that lack these conditions and resources are at risk of missing out on the economic and developmental benefits that could be derived from this technology. This has immediate implications for global recovery efforts in the post-Covid era, considering AI's potential to help developing countries rebuild quickly across critical sectors once the pandemic subsides (Sonneborn & Graf 2020).

Countries that have seen early and broad adoption of AI such as South Korea, Canada and China demonstrate another common feature:

a national strategic direction for AI defined by their governments. Governments often try to shape the way in which new technologies affect market structure and societal outcomes. This is attempted in many ways, but one common feature is overarching national policy or strategies for technology development and adoption. These are intended to articulate government objectives and to shape their interventions in a way that supports its overall mission. Many countries have designed such policies and strategies towards AI, including countries that rank high in global indexes that benchmark key indicators of AI ecosystems such as Stanford's Global AI Index<sup>1</sup> and the Oxford Insights Government AI Readiness Index.<sup>2</sup>

The primary objective of this working paper is to develop a better understanding of governments' approaches to AI by presenting findings from a

<sup>1</sup> [https://hai.stanford.edu/sites/default/files/ai\\_index\\_2019\\_report.pdf](https://hai.stanford.edu/sites/default/files/ai_index_2019_report.pdf)  
<sup>2</sup> <https://www.oxfordinsights.com/government-ai-readiness-index-2020>





review of national AI strategies from around the world. It also includes a more detailed analysis of the strategic approaches taken by two early adopters. This article is organized in four sections. The first section discusses the increasing global AI divide in terms of availability of investments, talent and research before further exploring the balance of opportunities and risks of AI for developing countries. This section also notes the roles of different stakeholders in supporting AI development within countries. The second section presents details of eight policy domains and six

categories of tools and instruments that were used to assess national AI strategies. The third section presents findings from eleven countries, beginning with a more detailed analysis of the national AI policies of Finland and the United Arab Emirates (UAE). This section also includes findings from an analysis of a broader set of countries in Asia, Africa and South America, highlighting the approach taken to AI in some developing countries. The final section highlights future areas of research needed to expand upon this work.

## GLOBAL DIVIDES IN AI INVESTMENTS, TALENT AND RESEARCH

Investment in AI startups over the past decade has been dominated by the United States (US) and China (CB Insights 2019). A few other OECD countries including Japan, Sweden, Germany and France, as well as Russia and South Korea have also generated significant investment in AI (OECD 2019b). In terms of human capital, AI talent is also scarce and unequally distributed across industries, sectors, and countries. More than half of the population in the developing world lacks basic digital skills (World Bank 2019a), and the vast majority of those with digital skills lack more advanced skills in AI and machine learning (Gaskell 2020). The shortage of AI talent is even more acute amongst women, who remain highly underrepresented in the field (Gagne

and others 2020). The inadequate supply of highly skilled AI workers being produced combined with the movement of skilled workers to high-income countries means that there is a shortage of AI scientists in developing countries, particularly countries that lack AI research and industry hubs (McKinsey Global Institute 2020). Many countries therefore face a challenging problem of not only developing, but also retaining local AI talent. The constraints on investment and workforce talent inputs reflects the globally asymmetric outputs in AI research and development (R&D), which are concentrated in just a small number of countries (Savage 2020).



## AI and the Development Agenda: Opportunities and Risks

Globally, significant gains in overall productivity and economic growth have been projected from new AI related product offerings and improved supply chains. Deloitte (2019) estimates a \$6.4 trillion global AI market by 2025, while PwC (2017) estimates a 14% increase in global GDP in 2030 because of AI adoption, the equivalent of an additional \$15.7 trillion. These economic forecasts are being supported by the rapid uptake of AI in transport, agriculture, finance, advertising and marketing, science, health care, criminal justice, security and the public sector (Deloitte 2019). However, adoption of AI in many markets is still at an early stage, and much of its capability is yet to be tapped, particularly in developing countries.

AI applications have the potential to address some challenging societal problems and provide solutions to achieving targets in each of the Sustainable Development Goals (SDGs). AI innovation and adoption has the potential to help progress towards goals in education, climate change, disaster relief, health care and the delivery of public sector services, representing some of the most critical cross-sectoral SDG domains for developing countries (Vinuesa et al. 2020). A recent report by the IFC (2020) provides a comprehensive overview of AI development opportunities across several key sectors including power, transport, smart homes,



agribusiness, financial services, manufacturing and gender equality. AI-driven risk management may yield another major opportunity for developing countries, including disease prevention and natural disaster and crisis management (Strusani & Hounbonon 2019).

Alongside the potential benefits for developing countries, AI technologies are also associated with risks such as control, inequality and market concentration, amongst others. AI technologies can be used for surveillance applications, tracking individuals across digital, smart and connected devices, while powerful pattern recognition technologies can be used to identify individuals



and personal information in training datasets (Lyon 2009). Access to personal data can be exploited to predict and track individuals and groups and their behavior while governments and other actors can use facial recognition technologies to boost surveillance capabilities (Feldstein 2019). Furthermore, AI-generated realistic audio and video (“deep fakes”) and hyper personalized disinformation campaigns can manipulate,

persuade, and deceive citizens (Brundage and others 2018). In a commercial setting, the imbalance in power between data collectors and processors and the individuals providing their data may result in undesirable market outcomes (Klein 2020). In the case of governments, these technologies raise individual privacy concerns and can be used in ways that infringe human rights and individual freedoms (Risse 2018).





AI also threatens to contribute to widening income inequality in countries with greater disparities in access to education and high-skilled employment. While there is no consensus about the future impact of AI on jobs (Winick 2018), there is concern that AI will be linked to further worsening income inequalities both between countries and within countries (ILO 2018). Many types of jobs – particularly those that are comprised of routine and predictable tasks – are susceptible to automation using existing technologies (World Bank 2016). The further development and adoption of AI, alongside advances in robotization, can accelerate this process of automation, putting jobs at risk (ILO 2018). This process could widen existing inequalities across gender, education, rural vs. urban, age and income.

Additionally, the bias in some AI applications may reproduce and aggravate social marginalization for underrepresented groups. Biased analysis occurs when training datasets for machine learning models are either incomplete or unrepresentative of the entire population or range of examples (Smith & Rustagi 2020). As developing countries are less represented in digital data, and AI technologies are primarily formulated in developed countries, machine learning models could result in outcomes that are inaccurate, unsafe and may discriminate unfairly against underrepresented groups (Shankar and others 2017; Mehrabi and others 2019). The lack of explainability and accountability of some AI

systems exacerbate this problem (Floridi and others 2018). As AI systems begin to play a bigger role in decision-making processes in critical areas such as healthcare, education and criminal justice, such problems are likely to become more widespread and have more pressing political significance.

Market concentration is another potential risk of AI, due to the high levels of investment required for technology development. Well-resourced technology companies are able to collect more data, hire top talent and are able to build significant hardware and computing capabilities. Access to high quality training datasets, and the analysis that these companies are able to undertake using them, may give them an advantage which competitors would find difficult to challenge. In this way, first-mover advantage and economies of scale benefit a handful of large players and result in market concentration (ITU 2018).



## STAKEHOLDERS INVOLVED WITH SHAPING NATIONAL AI STRATEGIES

In the context of a rapidly evolving technology landscape, some governments have developed national AI strategies and policies to steer the development and adoption of the technology in order to manage the potential risks and rewards of AI. A multi-stakeholder approach can help facilitate appropriate policymaking and deliver national AI strategies. The private sector, civil society and academia, international organizations and governments can all shape and/or support national AI strategies, as with national innovation strategies more broadly (Sharif 2006).

### The Role of the Private Sector

The intertwined relationship between AI development and the digital economy makes the

private sector a crucial actor in AI development. The private sector – including large enterprises, small and mid-size enterprises (SMEs) and start-ups – plays a dominant role in the innovation, development and application of AI in the digital economy. AI research and product development is increasingly led by large technology companies which can afford to hire top talent, capture and obtain better data and employ large-scale computing facilities, experimentation labs and testbeds for product design. While more limited in scalability and resources, SMEs have an important role to play with diffusion of AI technology on the supply side, and adoption and usage of AI on the demand side. Start-ups can also help expand the overall AI ecosystem as they seek out scalable business models. Dynamic entrepreneurship and

[worldbank.org/digitaldevelopment](http://worldbank.org/digitaldevelopment)



well-developed innovation ecosystems can drive technology diffusion in new areas, with a growing number of start-ups developing AI applications for new and different contexts. One key way the private sector can help shape national AI strategies is through providing comments during consultation periods, where feedback on strategy proposals is solicited by government planning bodies, such as in Brazil.<sup>3</sup>

### The Role of International and Regional Organizations



International forums such as the G20 and G7, organizations such as the UN, ITU, OECD and UNESCO and supranational and regional organizations such as the African Union can coordinate policies and pool resources across countries to devise and implement AI strategies. Policies at international levels can also help to define and monitor regulation, practices, and standards in AI applications. Some international organizations have already proposed guidelines and approaches for building capabilities for governing AI, often leveraging soft law. The UN High-Level Panel on Digital Cooperation for example was convened by the UN Secretary-General to advance global multi-stakeholder dialogue regarding the potential of digital technologies to advance human wellbeing while mitigating any risks of these technologies.<sup>4</sup> The UN and the International Telecommunication Union (ITU) have also taken steps towards international coordination by articulating an approach for the UN system to support AI adoption in developing countries and by hosting the annual AI for Good conference. UN agencies also apply a baseline of standards in countries that may lack regulatory regimes, which can ultimately help guide and shape the formulation of national AI strategies.

International organizations also work on harmonizing data protection regulation across regions and promote access to data and markets.

<sup>3</sup> <http://participa.br/profile/estrategia-brasileira-de-inteligencia-artificial>

<sup>4</sup> United Nations, Secretary-General's High-level Panel on Digital Cooperation, <https://www.un.org/en/digital-cooperation-panel/>. Its final report (UN Secretary-General's High-level Panel 2019) makes five sets of recommendations: i) Build an inclusive digital economy and society, ii) Develop human and institutional capacity, iii) Protect human rights and human agency, iv) Promote digital trust, security and stability, and v) Foster global digital cooperation. The final report was submitted in June 2019 for a broad consultation process on the topics covered in the report.





The European Single Digital Market demonstrates one such example of a framework designed to facilitate access and trade concerning digital data. Similarly, the EU-AU Digital Economy Task Force (EU-AU DETF) is a platform for partnerships between the private sector, donors, international organizations, financial institutions and civil society to progress African digital transformation for cross-border digital integration and to bring benefits to all citizens (AI-HLEG 2019). In Asia, the ASEAN Framework on Digital Data Governance aims to harmonize data standards, data governance or data protection frameworks regionally to enable innovation, cross-border trade and cybersecurity.<sup>5</sup> While there is varying degree of involvement amongst countries reviewed in this study, the role of international and regional organizations in shaping national AI strategies continues to grow.

### The Role of Civil Society and Academia

Civil society and nonprofit organizations can serve as an independent monitor to influence the adoption and practice of trustworthy AI applications. They can further facilitate the scalability of capacity development programs for AI adoption. Examples include the ‘Ghana Code Club,’ which provides an after-school program for teaching programming skills;<sup>6</sup> and City.AI, a global nonprofit organization comprised of a network of AI practitioners who organize local meet-ups and

workshops to discuss challenges and support local practitioners and start-ups.<sup>7</sup> Additionally, citizen and civil society engagement and involvement in AI policymaking is often used to build trust in AI adoption among society. This can transpire through public consultations and workshops to inform the development of AI policies. Universities and academic institutions also play an active role in supporting local AI research and applications.

### The Role of Government

The role of government in conceiving and developing an AI strategy varies from a hands-off approach, to providing a suitable enabling environment, to more active direction of AI initiatives. While some countries have taken a laissez-faire approach, this is not prevalent among countries leading in AI adoption. An examination of the early adopters of national AI strategies shows that the government’s role typically varies from active driving of initiatives on AI development and providing a supportive environment for stakeholders, to playing a more passive facilitating role, as noted in Box 1. While various stakeholders participate in implementing AI strategies, governments play a fundamental role in setting AI policy direction and accelerating development and adoption. They can also lead AI adoption in public services to improve outcomes in health care, education, transportation, and administrative efficiency.

<sup>5</sup> ASEAN Framework on Digital Data Governance, [https://asean.org/storage/2012/05/6B-ASEAN-Framework-on-Digital-Data-Governance\\_Endorsed.pdf](https://asean.org/storage/2012/05/6B-ASEAN-Framework-on-Digital-Data-Governance_Endorsed.pdf)

<sup>6</sup> Ghana Code Club, <https://ghanacodeclub.org/pages/about>

<sup>7</sup> City.AI (<https://city.ai/>) focuses on practical discussions and meet-ups to help local AI practitioners and start-ups with challenges ranging from technical to business models. As an example, City.AI held its first event in South Africa in March 2018, with local AI practitioners in Cape Town. The goal was to encourage peers to share their actionable advice and insights on applied AI experience. See Edwards 2018.



### BOX 1: Different Government Approaches for Driving AI Policies

#### DIRECTING GOVERNMENT

In this approach governments play a leading role in directing the design and execution of national strategies, including elements of coordination among stakeholders.

#### ENABLING GOVERNMENT

An enabler government plays a less direct role while still collaborating across stakeholders to enable and support innovation. Government involvement focuses on supporting the private sector and building a regulatory and market environment conducive to innovation.

#### LAISSEZ-FAIRE GOVERNMENT

This approach relies primarily on private sector markets to drive AI innovation.

While there is much variation in the form a strategy takes – from a public announcement, to a guiding document, to a more comprehensive plan – governments are uniquely situated to consider the risks and opportunities of AI within their own national contexts and provide strategic direction. Previous research that has explored and compared national AI strategies and policies includes the annual Stanford AI Index (2021),<sup>8</sup> the OECD AI Policy Observatory launched in 2020,<sup>9</sup> the annual Oxford Insights Government AI Readiness Index (2020),<sup>10</sup> the Future of Life Institute’s review of National and International AI Strategies,<sup>11</sup> AiLab’s

National Artificial Intelligence Strategies,<sup>12</sup> Tortois’ Global AI Index spotlighting G20 nations,<sup>13</sup> the European Commission’s AI Watch,<sup>14</sup> HolonIQ’s AI Strategy Landscape (2020)<sup>15</sup> which represents one of the largest reviews covering 50 countries and CIFAR’s Report on National and Regional AI Strategies (Dutton et al. 2020), which embarked on one of the earliest global reviews of national AI strategies in 2017. This report complements the existing literature with a review of different government approaches to AI across eleven countries at varying levels of national digital development.

<sup>8</sup> [https://aiindex.stanford.edu/wp-content/uploads/2021/03/2021-AI-Index-Report\\_Master.pdf](https://aiindex.stanford.edu/wp-content/uploads/2021/03/2021-AI-Index-Report_Master.pdf)

<sup>9</sup> <https://www.oecd.ai/>

<sup>10</sup> <https://www.oxfordinsights.com/government-ai-readiness-index-2020>

<sup>11</sup> <https://futureoflife.org/national-international-ai-strategies/>

<sup>12</sup> <https://www.ailab.com.au/research/national-artificial-intelligence-strategies/>

<sup>13</sup> <https://www.theglobalaisummit.com/FINAL-Spotlighting-the-g20-Nations-Report.pdf>

<sup>14</sup> [https://knowledge4policy.ec.europa.eu/ai-watch/national-strategies-artificial-intelligence\\_en](https://knowledge4policy.ec.europa.eu/ai-watch/national-strategies-artificial-intelligence_en)

<sup>15</sup> <https://www.holoniq.com/notes/50-national-ai-strategies-the-2020-ai-strategy-landscape/>



## CASE SELECTION, INFORMATION GATHERING AND APPROACH TO ANALYSIS

The eleven countries reviewed for this study were selected based on four criteria: maturity of a country's AI ecosystem, level of digital development, geographic location and level of economic development. Finland and the UAE were selected for more detailed analysis due to their early adopter status of AI technology, with both governments ranking in the top 20 for AI readiness in the year this review commenced.<sup>16</sup> The findings presented reflect information on national strategies and policies that was gathered from

available documents and interviews with experts and advisors between February 2019-July 2020. Once the findings were collected, the approach was to review the content of national AI policy and strategy documents using a matrix of variables based on previous research on this subject (Dutton et al. 2018; European Commission 2018). Overall, a matrix of eight policy domain areas and six policy tools and instruments to implement national AI strategies were used for understanding the role of government, which is illustrated using heatmaps.

<sup>16</sup> <https://www.oxfordinsights.com/ai-readiness2019>



## Eight Policy Domains within AI Strategies

National strategies target a range of sub-goals or domain areas. Based on work by Dutton et al (2018) and the findings of the European Commission's Coordinated Plan on Artificial Intelligence published in 2018<sup>17</sup>, the variety of sub-goals in national AI strategies can be categorized in the following eight domain areas. These represent distinct thematic areas that are the object of policymaking to accelerate AI development and adoption at the country level. These domains are influenced by various tools and instruments as described in the subsequent section, which in turn can simultaneously target multiple domains noted below:

1. **Scientific research:** Policies include the creation of new research centers, hubs, partnerships or programs in AI research.
2. **AI talent development:** Policies include measures to train domestic talent or to attract and retain international talent, including funding for AI-specific Master's degree, PhD and other academic programs. This category also includes

policies, partnerships, and programs to prepare the labor force for changing skills demands, including STEM education and digital and AI skills training in new learning models.

3. **Entrepreneurial ecosystem:** Policy approaches for supporting entrepreneurs include reducing the regulatory or tax burden for start-ups, or direct funding for new AI start-ups.
4. **Standards for ethical or trustworthy AI:** Policies and measures to uphold ethics, safety and security in the development and use of AI, such as regulation for data privacy, funding research into explainable AI or developing or endorsing ethical guidelines.
5. **Data access:** Policies to increase access to quality data for machine learning models by improving data sharing infrastructures and rules for data portability. Initiatives include opening public datasets, creating new open data platforms, data marketplaces, data trusts or local annotated datasets.

<sup>17</sup> <https://digital-strategy.ec.europa.eu/en/library/coordinated-plan-artificial-intelligence>





**6. AI adoption in the public sector:** Policies to accelerate the adoption and use of AI in the public sector to improve public service performance outcomes and efficiency. Approaches include PPPs, piloting programs, AI training courses for public administrators and spreading awareness about AI opportunities.

**7. Strategic sectoral targeting of AI:** Policies to accelerate the adoption and application of AI to boost productivity and efficiency in key sectors.

Approaches include fostering partnerships between technology companies and sectoral or industry actors, funding or support for national champions in target sectors, and spreading awareness about opportunities for productivity and efficiency gains.

**8. Building capabilities for AI governance:** Policies include consultations with, and forming advisory bodies of, industry and academic experts, public consultations and pilots for applications of AI to learn about opportunities and risks.

## Six Tools and Instruments to Implement National AI Strategies

There are a range of policy tools and instruments to implement the components of AI strategies, and the choice and combination of tools depends on national and industrial contexts. While the government is a lead facilitator for several tools such as legal and regulatory reform, the private sector, academia and civil society might lead others such as establishing new research centers and skills training programs. In some areas, the boundary between tools and instruments is less defined, and there is some overlap. The tools and instruments that were used in this review of national strategies were developed and refined through consultation between The Future Society<sup>18</sup> and The World Bank team.

**1. Legal and regulatory reforms:** This form of hard law refers to the safeguarding of basic human rights and values and enforcing safety and ethical precautions. Reforms can clarify rules or support innovation, for example through strengthening intellectual property regimes or competition policy. Use of regulatory sandboxes can also provide testing environments with relaxed rules to support the development of AI.

**2. Expansion of public services and programs:** This includes public services and programs that support development of entrepreneurship and innovation – particularly in AI talent development and data access. Expansion

<sup>18</sup> The Future Society was engaged by the World Bank to carry out research and write a background report which has informed this working paper. For more information see <https://thefuturesociety.org/>



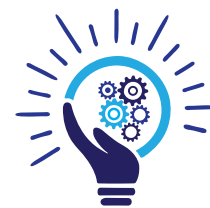
of public services and programs can support several AI strategy domains around AI talent and skills development. This includes education reform targeting STEM or other relevant skills and offering new training programs for machine learning and digital skills. It also includes increasing salaries for public sector researchers and expanding benefits such as maternity/paternity leave and childcare to help attract skilled talent. This category also includes public-sector led initiatives and projects for AI adoption in public services, such as the establishment of open data initiatives and platforms or data trusts or exchanges. This also includes pilot studies to explore the impacts of AI, and training programs for public administration regarding AI capabilities and skills.

**3. Soft law, standards and industry self-regulation:** Soft law refers to technical standards, norms and codes of ethics and conduct. It addresses some of the rigidity, time-lag and other shortcomings of standard policymaking processes. Soft law also includes industry self-regulation.

**4. Multi-stakeholder partnerships:** This includes partnerships and engagements with other stakeholders to implement AI strategies. These engagements include public consultations, collaborations with industry to define technical or ethical standards and public-private partnerships (PPPs) for AI adoption in key public services.

**5. New centers and collaborations:** This refers to collaborations among research centers and scientists to pool resources (funding, technology, human capital, expertise) across regions to overcome shortcomings at local levels. This also includes national centers of excellence to bolster scientific research, AI talent development and entrepreneurial activity. This category also includes development of digital innovation hubs (DIH) and clusters to connect SMEs, industry and academia to share expertise and resources.

**6. Strategic investments and funding:** Avenues for funding can include public procurement, research grants, awards or “grand



challenges.” The public sector can support the creation of new research centers or programs in basic or applied AI research or provide direct investment for start-ups to compensate for shortages in venture capital funding. Funding can target specific research needs based on priorities,

including projects using AI applications for societal good such as biomedicine, education or climate research. This category also includes scholarship funding for Master’s degree or PhD students in machine learning.

## FINDINGS FROM A REVIEW OF NATIONAL AI STRATEGIES

This section presents emerging practices in AI policymaking across a broad geographic range of eleven countries. It begins with a more detailed re-

view of the national AI strategies of Finland and the UAE to better understand the actions and motives of early AI-adopter countries.

### Finland's National AI Strategy

Finland was among the first European countries to launch an AI strategy in October 2017,<sup>19</sup> and its latest AI strategy document was published in June 2019.<sup>20</sup> Finland has one of the most advanced digital economies in Europe and is well positioned to reap the benefits of AI technologies (Foley and others 2020). Their 2019 AI strategy positions Finland as a piloting environment spearheaded by agile, innovation-friendly public administration and enabling legislation. However, it recognizes that the country lacks economies of scale, internationally connected companies and foreign direct investment, and exhibits slow commercialization. Finland’s 2019 AI strategy report identifies eleven areas of action, as outlined in Figure 1.



<sup>19</sup> [https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160391/TEMrap\\_47\\_2017\\_verkkojulkaisu.pdf](https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160391/TEMrap_47_2017_verkkojulkaisu.pdf)

<sup>20</sup> <https://julkaisut.valtioneuvosto.fi/handle/10024/161688>



FIGURE 1: Finland's National AI Strategy: 11 Key Actions

1. INCREASING COMPETITIVENESS OF FINNISH COMPANIES THROUGH AI
2. INCREASING USE OF DATA AND DATA AVAILABILITY
3. SPEEDING UP THE DEPLOYMENT OF AI
4. ATTRACTING AI TALENT AND EXPERTS
5. INCREASING INVESTMENTS IN AI
6. AUGMENTING PUBLIC SERVICES WITH AI
7. CREATING NEW TYPES OF COLLABORATION
8. RAISING FINLAND'S PROFILE AND BECOMING A LEADER IN AI APPLICATIONS
9. PREPARING FOR THE FUTURE OF WORK
10. CREATING TRUST-BASED AND HUMAN-CENTERED AI, BEING A LEADER IN AI ETHICS
11. ADDRESSING CYBERSECURITY AND SAFETY CHALLENGES OF AI TECHNOLOGIES

Finnish AI strategy exhibits a mostly bottom-up approach, leveraging several multi-stakeholder consultations to form the basis of their strategy. Their initial 2017 strategy document states this call for multi-stakeholder consultation,<sup>21</sup> which informed the foundation of proposals in their 2019 strategy document which includes the eleven key actions in Figure 1 and some specific measures for fostering AI.<sup>22</sup> The government places significant value in

learning from different actors. The representatives they invited included people from the private and public sectors, research institutes and employers, and also included employees, individual experts and influencers to form the basis of the steering group and its subgroups. Citizen participation was also encouraged through online platforms that facilitated interaction and discussion on a variety of queries around AI.<sup>23</sup>

<sup>21</sup> [https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160391/TEMrap\\_47\\_2017\\_verkkojulkaisu.pdf](https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160391/TEMrap_47_2017_verkkojulkaisu.pdf); 61-63

<sup>22</sup> [https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161688/41\\_19\\_Leading%20the%20way%20into%20the%20age%20of%20artificial%20intelligence.pdf](https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161688/41_19_Leading%20the%20way%20into%20the%20age%20of%20artificial%20intelligence.pdf); 12.

<sup>23</sup> [https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160391/TEMrap\\_47\\_2017\\_verkkojulkaisu.pdf](https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/160391/TEMrap_47_2017_verkkojulkaisu.pdf); 68.





Overall the Finnish government mostly acts as a facilitator, focusing on creating platforms, networks and ecosystems for AI innovation to emerge from the bottom up. One illustrative example of this bottom-up process is their approach to ethical guidelines. Rather than issuing ethical principles for companies to apply, the Finnish strategy set up an ecosystem – the AI Finland Ethics Challenge – where companies could commit themselves to devising ethical guidelines anchored in their practice which can then be shared with each other.<sup>24</sup> The Finnish AI strategy seeks to position the government within public-private-people partnerships and actively explores cross-sectoral models of collaboration to support AI.

Finland's government acknowledges the need to build digital ecosystems and platforms to fortify the foundation needed to enable AI development and applications. As Finland's small population impedes the development of such platforms, the country directs its efforts to building digital platforms that are scalable. Finland is prominent in the EU's Digital Single Market and works on digitalization and designing human-centered platforms scalable to the European Union such as MyData – a personal data management platform that seeks to develop an internationally scalable interoperability model for personal data management.<sup>25</sup> Additionally, in order to accelerate AI research and adoption in Finland, the Finnish Center for AI (FCAI) has partnered

with NVIDIA to establish a joint AI technology center. This collaboration provides the Finnish AI ecosystem with significant computing power, graphical processing units (GPU) and AI software for AI applications for research and industry use (FCAI 2020). Finland has also set up a 5G network pilot (5GTNF) with private partners and research and academic partners to establish an environment for research and business development purposes.<sup>26</sup>

Finland's government has directly invested towards various AI capacity building initiatives including research, learning reform, data management and computational infrastructure. In 2018 the government announced €160 million for AI investment, which includes €34 million in funding for the AI Business program,<sup>27</sup> a fund which focuses on developing new value from AI and the platform economy.<sup>28</sup> This program has been authorized to allocate €100 million in funds over a four-year period to Finnish-registered startups, SMEs and larger companies engaging in AI research and development, and €60 million in capital loans to 'growth engines.'<sup>29</sup> In terms of economic impact, Finland is forecast to achieve a €20 billion increase in GDP by 2023, equivalent to an additional 8% (Microsoft & PwC 2018). Overall, a review of Finland's national AI strategy illustrates a government that is focused on engaging stakeholders, developing partnerships and acting as a facilitator to drive AI development.

<sup>24</sup> <https://www.tekoalyaika.fi/en/background/ethics/>

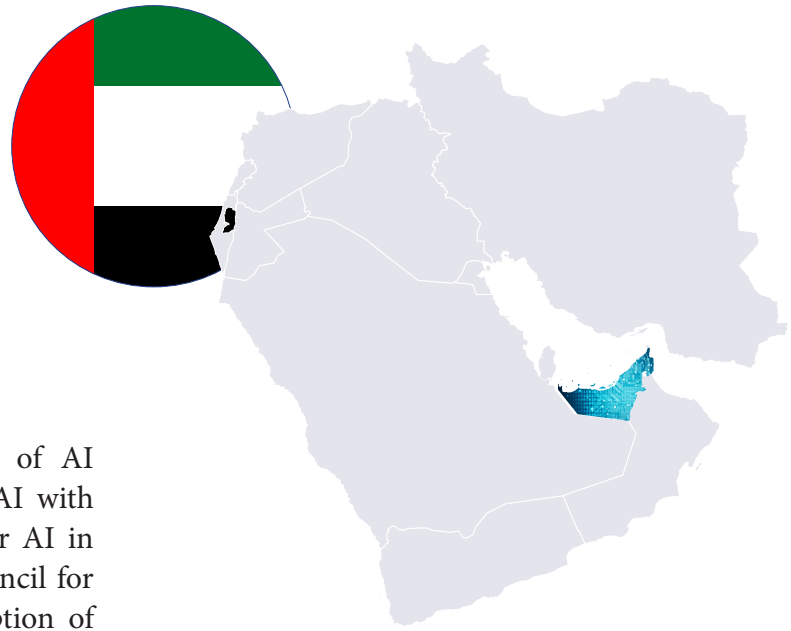
<sup>25</sup> [https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161688/41\\_19\\_Leading%20the%20way%20into%20the%20age%20of%20artificial%20intelligence.pdf](https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161688/41_19_Leading%20the%20way%20into%20the%20age%20of%20artificial%20intelligence.pdf); 52-57

<sup>26</sup> <http://5gtnf.fi/overview/>

<sup>27</sup> <https://www.businessfinland.fi/en/for-finnish-customers/home>

<sup>28</sup> [https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161688/41\\_19\\_Leading%20the%20way%20into%20the%20age%20of%20artificial%20intelligence.pdf](https://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/161688/41_19_Leading%20the%20way%20into%20the%20age%20of%20artificial%20intelligence.pdf); 83.

<sup>29</sup> Ibid, 83



## United Arab Emirates' National AI Strategy

The UAE has been an early proponent of AI adoption, having launched its vision for AI with the appointment of a Minister of State for AI in October 2017,<sup>30</sup> the creation of a UAE Council for AI in March 2018,<sup>31</sup> and the official adoption of a National AI Strategy in April 2019.<sup>32</sup> The UAE's government views AI as a critical component for the advancement of key sectors and to bolster overall economic productivity.<sup>33</sup> The government's strategy aims to establish and brand the country as a hub for AI adoption, and become one of the leading nations in AI by 2031.<sup>34</sup> This strategy was supported by the launch of the National Program for Artificial Intelligence (BRAIN) which focuses on the UAE's objective to become a leader in responsible use of AI,<sup>35</sup> and the Think AI initiative which encourages private companies to engage with the government through a series of strategic roundtables to accelerate the adoption of AI.<sup>36</sup> The themes for the first five roundtables focused on attracting and fostering talent, enhancing the adoption of AI, regulation and governance, preparing suitable infrastructure and developing national standards.<sup>37</sup>

The UAE's national strategy lays out a sectoral approach with priority sectors identified to pilot AI adoption.<sup>38</sup> These priority sectors include resources and energy, logistics and transport, tourism and hospitality, healthcare and cybersecurity.<sup>39</sup> Their strategy for building momentum for AI development is to begin with existing strengths they identify as industry assets and emerging sectors and smart government before focusing on opportunities where they hope to lead such as data sharing and governance and developing a new generation of regional talent.<sup>40</sup> The UAE's national strategy also defines eight strategic objectives to help the country move from an AI adopter to an AI innovator and exporter, bringing together their foundational priorities, activities and leadership vision as illustrated in Figure 2.

<sup>30</sup> <https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/federal-governments-strategies-and-plans/uae-strategy-for-artificial-intelligence>

<sup>31</sup> <https://ai.gov.ae/uae-ai-initiatives/>

<sup>32</sup> <https://uaecabinet.ae/en/details/news/uae-cabinet-adopts-national-artificial-intelligence-strategy-2031>

<sup>33</sup> <https://u.ae/en/about-the-uae/strategies-initiatives-and-awards/federal-governments-strategies-and-plans/uae-strategy-for-artificial-intelligence>

<sup>34</sup> [https://ai.gov.ae/wp-content/uploads/resources/UAE\\_National\\_Strategy\\_for\\_Artificial\\_Intelligence\\_2031.pdf](https://ai.gov.ae/wp-content/uploads/resources/UAE_National_Strategy_for_Artificial_Intelligence_2031.pdf)

<sup>35</sup> <https://ai.gov.ae/about-us/>

<sup>36</sup> <https://ai.gov.ae/the-uae-government-launches-think-ai-initiative/>

<sup>37</sup> Ibid

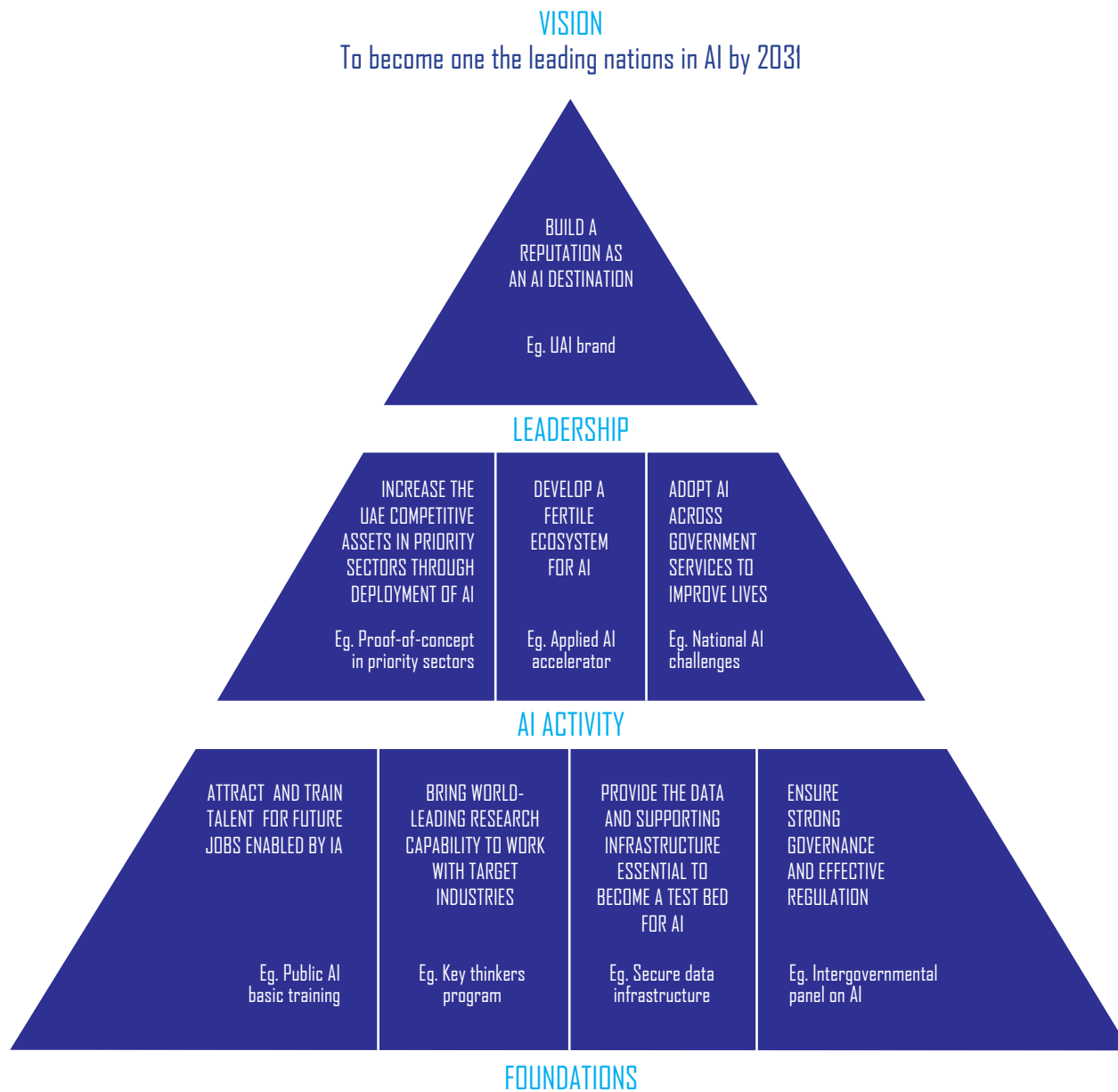
<sup>38</sup> [https://ai.gov.ae/wp-content/uploads/resources/UAE\\_National\\_Strategy\\_for\\_Artificial\\_Intelligence\\_2031.pdf](https://ai.gov.ae/wp-content/uploads/resources/UAE_National_Strategy_for_Artificial_Intelligence_2031.pdf)

<sup>39</sup> Ibid, 10.

<sup>40</sup> Ibid, 10.



FIGURE 2: UAE National Strategy Objectives



Source: UAE National Strategy for Artificial Intelligence (2018), p18.  
[https://ai.gov.ae/wp-content/uploads/resources/UAE\\_National\\_Strategy\\_for\\_Artificial\\_Intelligence\\_2031.pdf](https://ai.gov.ae/wp-content/uploads/resources/UAE_National_Strategy_for_Artificial_Intelligence_2031.pdf)



The UAE has launched various programs to support the underlying foundation for which AI applications can be developed. A non-exhaustive list of initiatives includes Smart Dubai, Dubai's smart city transformation initiative which proactively engages in multi-stakeholder collaborations to co-develop AI applications,<sup>41</sup> the UAE Strategy for the Fourth Industrial Revolution, which focuses on AI as well as industries where AI can have impact like genomics and healthcare,<sup>42</sup> and the Dubai Internet of Things (IoT) Strategy, which aims to develop an advanced IoT ecosystem that can support AI-enabled IoT as it becomes available.<sup>43</sup> To support the development of these programs and initiatives and the UAE's goal of becoming a regional AI hub, the government is also investing in acquiring teams from other regions and incentivizing them to develop in the UAE.<sup>44</sup>

Finally, the UAE's AI strategy places significant importance on PPP and multi-stakeholder engagement. The AI Office is focusing on several partnering initiatives with the private sector. For example, they aim to launch an 'applied AI accelerator' to support domestic AI entrepreneurship and product development in the region.<sup>45</sup> Their national strategy also notes how existing funds for local innovators such as the Mohammed bin Rashid Innovation Fund can be used in collaboration with the AI Council to support partnerships with government.<sup>46</sup> Additionally, the government is providing incentives to encourage greater partnerships between the UAE and multinational AI companies through facilitating larger FDI schemes and AI-related investment funds.<sup>47</sup>

<sup>41</sup> <https://www.smartdubai.ae/>

<sup>42</sup> <https://government.ae/en/about-the-uae/strategies-initiatives-and-awards/federal-governments-strategies-and-plans/the-uae-strategy-for-the-fourth-industrial-revolution>

<sup>43</sup> <https://www.government.ae/en/about-the-uae/strategies-initiatives-and-awards/local-governments-strategies-and-plans/dubai-internet-of-things-strategy>

<sup>44</sup> [https://ai.gov.ae/wp-content/uploads/resources/UAE\\_National\\_Strategy\\_for\\_Artificial\\_Intelligence\\_2031.pdf](https://ai.gov.ae/wp-content/uploads/resources/UAE_National_Strategy_for_Artificial_Intelligence_2031.pdf); 28.

<sup>45</sup> Ibid, 27.

<sup>46</sup> Ibid, 26.

<sup>47</sup> Ibid, 28.





In the decade before the National AI Strategy was approved by the UAE Cabinet in 2019, the UAE ranked behind only Turkey in the Middle East and North Africa region in terms of total AI investments. From 2008-2018 an aggregate of \$2.15 billion was spent on AI transactions in the UAE through mergers, acquisitions and various forms of investment (Microsoft & EY 2019). Direct spending on AI systems – including AI software applications and platforms – is predicted to reach \$73 million in 2020 (IDC 2019). PwC estimates that AI will positively impact the UAE’s GDP by 13.6% in 2030, although this represents forecasts based on dynamic economic modeling carried out prior to the onset of the coronavirus pandemic (PwC 2018b). While the effect of the pandemic remains difficult to quantify, a 2020 survey of UAE business leaders found 68% stating that AI – along with automation and machine learning – will be even more important for their companies in the post-Covid era, and 40% responding more specifically that it will facilitate further innovation (GE Innovation Barometer 2020). Overall, a review of the UAE’s national strategy illustrates a government that is very active in driving AI development, and focused on a sectoral approach.

### **Comparing the Role of Government in the Finnish and UAE National AI strategies**

This section synthesizes the findings from the review of AI strategies in Finland and the UAE. The heat maps shown in Figure 3 (Finland) and Figure 4 (UAE) indicate the role of government for initiatives in each category as either “directing,” “enabling”, or having no initiative, reflecting government approaches defined earlier in Box 2. The assessment in these heat maps is based on a broader review of the national strategies for these countries included in the background paper of this report, reflecting details that are not referenced in the shorter summaries included in this working paper. The authors acknowledge that some AI policies and initiatives may not have been available for consideration during the period of review between 2019-2020, and that different conclusions may be reached regarding the magnitude of government interventions across the domains, tools and instruments illustrated in the heat maps.

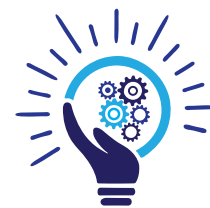
FIGURE 3: Finland: Role of Government in AI Heat Map

TOOLS and INSTRUMENTS						
AI POLICY DOMAINS	LEGAL AND REGULATORY REFORMS	EXPANSION OF PUBLIC SERVICES AND PROGRAMS	SOFT LAW, STANDARDS AND INDUSTRY SELF-REGULATION	MULTI-STAKEHOLDER PARTNERSHIPS AND PPPS	NEW CENTERS AND FACILITATING COLLABORATIONS	STRATEGIC INVESTMENTS AND DIRECT FUNDING
SCIENTIFIC RESEARCH				ENABLING	ENABLING	DIRECTING
AI TALENT DEVELOPMENT		DIRECTING			ENABLING	
ENTREPRENEURSHIP ECOSYSTEM				DIRECTING	DIRECTING	
ETHICAL AI STANDARDS	DIRECTING		ENABLING	ENABLING		
DATA ACCESS					ENABLING	
AI IN THE PUBLIC SECTOR					ENABLING	
SECTORAL ADOPTION OF AI						
BUILDING CAPABILITIES FOR GOVERNING AI						

FIGURE 4: UAE: Role of Government in AI Heat Map

TOOLS and INSTRUMENTS						
AI POLICY DOMAINS	LEGAL AND REGULATORY REFORMS	EXPANSION OF PUBLIC SERVICES AND PROGRAMS	SOFT LAW, STANDARDS AND INDUSTRY SELF-REGULATION	MULTI-STAKEHOLDER PARTNERSHIPS AND PPPS	NEW CENTERS AND FACILITATING COLLABORATIONS	STRATEGIC INVESTMENTS AND DIRECT FUNDING
SCIENTIFIC RESEARCH		DIRECTING		DIRECTING	DIRECTING	ENABLING
AI TALENT DEVELOPMENT		DIRECTING		ENABLING		DIRECTING
ENTREPRENEURSHIP ECOSYSTEM				ENABLING	DIRECTING	DIRECTING
ETHICAL AI STANDARDS		ENABLING	DIRECTING			
DATA ACCESS		ENABLING				
AI IN THE PUBLIC SECTOR		DIRECTING			ENABLING	
SECTORAL ADOPTION OF AI		DIRECTING		DIRECTING	DIRECTING	DIRECTING
BUILDING CAPABILITIES FOR GOVERNING AI		DIRECTING				

KEY: DIRECTING ENABLING NO INITIATIVE



The governments of both Finland and the UAE have demonstrated active roles in developing and executing AI policies and initiatives. Four areas of flagship policies emerge in Finland's AI strategy including supporting scientific research and developing AI talent, supporting entrepreneurial ecosystems for AI, enhancing data access and establishing ethical data and algorithm governance guidance through collaboration with stakeholders, and finally a focus on developing AI for public service delivery. Similarly, the UAE government's approach to AI adoption also focuses on the expansion of AI in public service, developing local scientific research capabilities, and developing AI training programs for students and government employees through public-private partnerships. The UAE strategy has limited reference to regulatory or

hard law approaches for managing AI development across any of the key policy domains, though it has indicated committing to ethical standards through frameworks and toolkits, and providing strategic investments and partnerships to advance adoption of AI within targeted sectors. Both governments also place high strategic importance on engaging multi-stakeholder collaborations to facilitate AI. However, while the UAE has taken a hybrid approach with more top-down directed initiatives to accelerate the development of an AI ecosystem, Finland has instead exhibited a mostly bottom-up approach. Other key differences include the greater focus the UAE has had on acquiring AI talent from abroad, as well as their more emphatic role in directing sectoral adoption of AI.

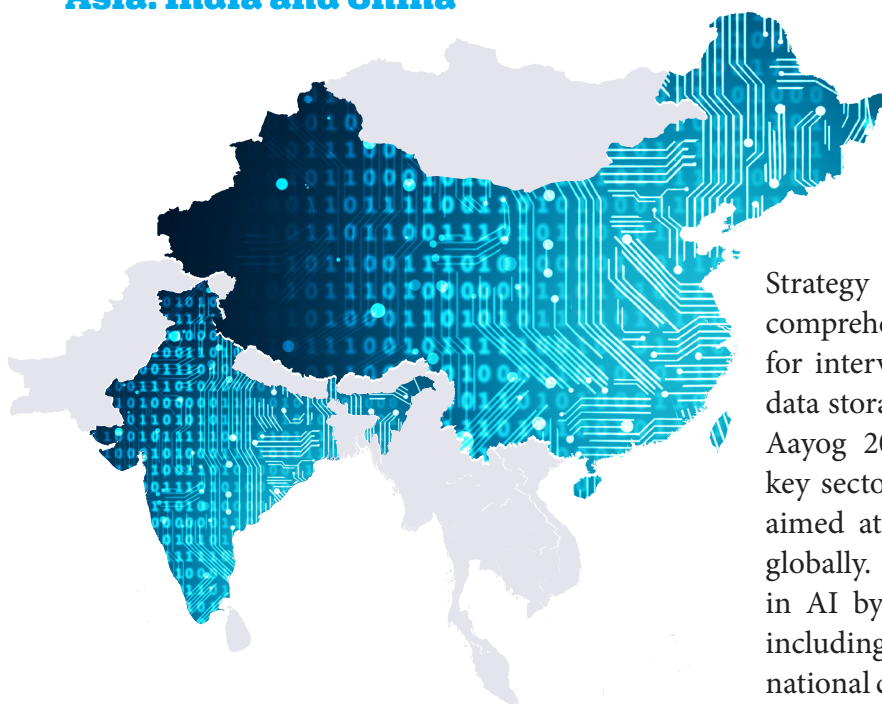


## NATIONAL AI STRATEGIES ACROSS THE DEVELOPING WORLD

This section presents a summary of findings from a review of AI strategies in Asia, Africa and South America to yield greater insight into how

governments are approaching AI in a mix of nine emerging markets and developing countries.

### Asia: India and China



While both India and China exhibit global leadership in developing comprehensive national AI strategies, China's AI ecosystem is more mature, and its government has committed a greater number of resources towards it. Both governments take charge in defining priorities and designing their AI strategies. The Indian federal government's NITI Aayog think tank is tasked with designing its national strategy,<sup>48</sup> and the resulting 'National

Strategy on Artificial Intelligence' outlines a comprehensive approach, including key sectors for intervention and crosscutting themes such as data storage and privacy as national priority (NITI Aayog 2018). The Chinese strategy also targets key sectors along with numerous other initiatives aimed at leading in AI research and technology globally. China's plan to become a world leader in AI by 2030 outlines comprehensive measures including directly funding start-ups, selecting national champions and limiting foreign companies in domestic markets (Ding 2018).

Both India and China's AI strategies are also defined by the central government in a top-down approach, while relying on local governments to execute strategies. Decision-making power rests in the hands of central government to design and develop the targets and policies of the AI strategy. Compared to India, China's policies more frequently reflect a directing role of government, such as direct

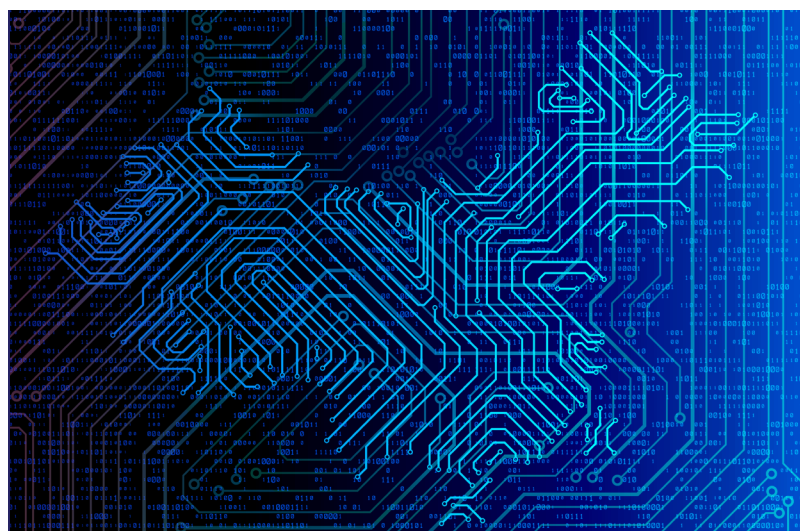


funding for start-up accelerators, scholarships for AI graduate students, establishment of national AI research centers or innovation hubs, and financing rewards and “grand challenges.”

To accelerate AI adoption, both India and China adopt a mix of policies aimed at both establishing digital foundations that can enable AI ecosystems, as well as directly supporting AI development. Both use strategies across domain areas including skills development, investment in scientific research and data access. For example, China’s strategy supports new AI academic degrees, new public national datasets and cloud service platforms, and the development of hardware to support AI research, including supercomputing facilities, funding for quantum computing and encouraging national champions to acquire chip technologies by signing deals with international firms (Ding 2018). India’s strategy applies AI in target development sectors, such as applying computer vision for traffic management or natural language processing (NLP) to reduce language barriers and improve interoperability across states, while at the same time investing directly in AI talent and skills development, data access and governance and ethical frameworks.<sup>49</sup>

The strategies of both countries focus on enabling technological development. China’s approach to AI applications has been characterized as “experiment first and regulate later,” yielding rapid innovation and implementation, especially in healthcare (Nesta 2020, p3). In terms of stakeholder engagement, China has less involvement from stakeholders outside central government, whereas NITI

Aayog in India has sought numerous stakeholder consultations in designing India’s AI strategy. NITI Aayog has also designed recommendations for India’s strategy and sectoral applications based on wide consultation with technical and sectoral AI experts and academics.<sup>50</sup> In contrast, there is less evidence of stakeholder consultation in China’s strategy development. Both countries rely on cooperation with the private sector to



implement AI in sectoral applications. India’s strategy outlines that, while the government is responsible for providing an enabling environment and infrastructure, the private sector must lead the implementation and adoption in use cases. The Chinese government encourages cooperation between the public and private sectors, especially in terms of sharing data between the government and companies. Furthermore, since 2018, China’s government has been publicly encouraging several domestic “AI Champions.”<sup>51</sup>

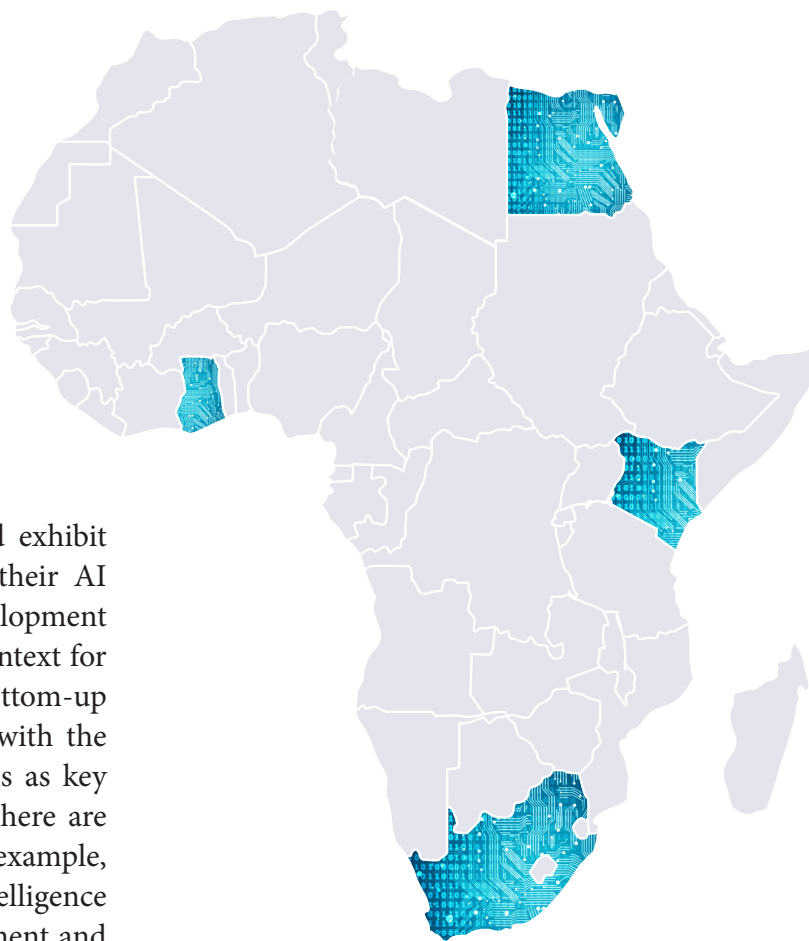
<sup>49</sup> Expert interview with member of NITI Aayog, May 9, 2019.

<sup>50</sup> Expert interview with member of NITI Aayog, May 9, 2019.

<sup>51</sup> Baidu’s focus will be on autonomous driving; the cloud computing division of Alibaba is tasked with a project called “city brains,” a set of AI solutions to improve urban life, including smart transport; Tencent will focus on computer vision for medical diagnosis; while Shenzhen-listed iFlytek, a dominant player in voice recognition, will specialize in voice intelligence. See Ding 2018.

## Africa: Egypt, Ghana, Kenya and South Africa

The four African country cases reviewed exhibit a nascent level of maturity concerning their AI strategies and ecosystems. Human development indicators are relatively low, setting the context for multi-stakeholder engagement and a bottom-up approach, particularly in skills training, with the private sector and nonprofit organizations as key stakeholders. Across the four countries, there are a range of initiatives to address AI. For example, Kenya’s “Blockchain and Artificial Intelligence Taskforce” aims to prioritize the development and implementation of AI and blockchain with the goal of supporting the government in leveraging and harnessing new technologies (Dutton et al. 2018). In Egypt, the Minister of ICT has recently announced a national AI strategy with four pillars including rapid adoption of AI in the government to increase efficiency and transparency; applying AI in key development sectors; capacity building and academic advances to boost innovation; and prioritizing digital cooperation in the region and globally.<sup>52</sup> While Ghana does not have a national AI strategy, the president has proposed a national strategy umbrella for science, technology and



innovation (STI) with a holistic approach to development.<sup>53</sup> South Africa is leading the continent in AI adoption with a strong start-up ecosystem predominantly driven by the private sector (Gadzala 2018).

Initiatives for AI adoption led by various stakeholders in the four countries exhibit a combination of both top-down and bottom-up strategies. The top-down approach is particularly observed in governments’ aspirations to invest in hubs and education programs. In Egypt for example, the government

<sup>52</sup> Egypt’s national AI strategy is available at <https://stip.oecd.org/stip/policy-initiatives/2019%2Fdata%2FpolicyInitiatives%2F26476>

<sup>53</sup> The seven pillars address the coordination of all sectors involving STI, the private-public partnerships (PPPs), the R&D funding, the STEM education, required legislation as well as the implementation of AI across key sectors of the economy. See Government of Ghana. n.d. “Gov’t using science, technology for national development.”



put forward multiple initiatives publicly advocated by the president (Ahran Online 2020). In Ghana, the government is also investing in innovation by launching a \$10 million initiative called the National Entrepreneurship and Innovation Plan (NEIP).<sup>54</sup> From a bottom-up approach, the government encourages private associations to create hubs and conferences for AI skills at the local level. In South Africa, private associations have been organizing conferences to teach deep learning and AI locally, such as the Deep Learning Indaba conference (Snow 2019).

Finally, some of these countries have demonstrated constraining policies to mitigate the risks of AI, with a particular focus on data protection. In Kenya the Open Data portal makes public government

datasets accessible for free in the context of a data protection law.<sup>55</sup> In Ghana the STI's policy pillars include start-up incubation centers and a National Entrepreneurship and Innovation Plan that falls under Ghana's 2012 Data Protection Act, which regulates how personal information is acquired, stored and disclosed. Similarly, Egypt has adopted the Personal Data Protection Law (Law No. 151 of 2020) which aims to protect and regulate the collection and processing of personal data of Egypt's citizens and residents. Overall, while the four African countries reviewed in this report do not have a single comprehensive and focused national AI strategy as seen in Finland and the UAE, they nonetheless exhibit a number of related initiatives to drive AI.

<sup>54</sup> <http://neip.gov.gh/page/2/>

<sup>55</sup> <http://www.opendata.go.ke/>



## Latin America and Central Asia: Argentina, Brazil and Kazakhstan

Argentina, Brazil and Kazakhstan represent countries at various stages in national AI strategy development. Argentina published an AI strategy document in 2019 called Plan ArgenIA (though not yet approved by resolution).<sup>56</sup> In late 2019 Brazil announced a round of public consultations to request feedback on their proposed national AI strategy.<sup>57</sup> Kazakhstan did not have a national AI strategy at the time of review. All three countries exhibit early-stage innovation ecosystems. Argentina's AI strategy highlights the use of AI for economic development (linked to SDGs) and R&D, while also calling attention to the importance of inclusiveness, sustainability and privacy. In Brazil, eight AI laboratories were created by the government to focus on priority application areas, including IoT, cybersecurity and AI in public administration.<sup>58</sup> Kazakhstan includes AI and digital development as part of its national 2050 Vision Modernization 3.0, through which the government is prioritizing the acceleration of technological modernization of the economy (Nos 2017). In Brazil, the government is adopting a more granular approach to digitalization at the industry level, with priority offered to health care, agriculture and smart cities (Mari 2017), while at the same time setting



up partnerships and goals to create an advanced AI center (Felipe 2019). As with other case countries at the “nascent” level of AI ecosystem maturity, AI initiatives in Argentina, Brazil and Kazakhstan more often prioritize enabling policies over constraining ones.

All three countries' governments exhibit a mix of top-down and bottom-up approaches to progress either digital or AI strategies (where they exist). Through collaboration with universities, governments support AI-specific laboratories, and Master's degree and PhD programs and fellowships.<sup>59</sup> Kazakhstan's government has invested in accelerating inclusion and innovation with their Technology Forum and the Start-Up Kazakhstan Tech Garden, and has also invested nearly \$47

<sup>56</sup> <https://www.lexology.com/library/detail.aspx?g=f9412c52-8d18-49ee-805e-4b7c3d66ab1d>

<sup>57</sup> For details of contributions received, see Brazil's public contributions website: <http://participa.br/profile/estrategia-brasileira-de-inteligencia-artificial>

<sup>58</sup> <https://agenciabrasil.ebc.com.br/en/geral/noticia/2019-11/brazil-unveils-eight-new-ai-labs>

<sup>59</sup> For example, Argentinian doctoral programs, the Graduate Program in Information Systems and Artificial Intelligence at the University of Sao Paulo (<http://ppgsi.each.usp.br/artificial-intelligence/?lang=en>), or the Nazarbayev University research labs in Advanced Robotics and Mechatronic Systems (<https://nu.edu.kz/research/laboratories>).

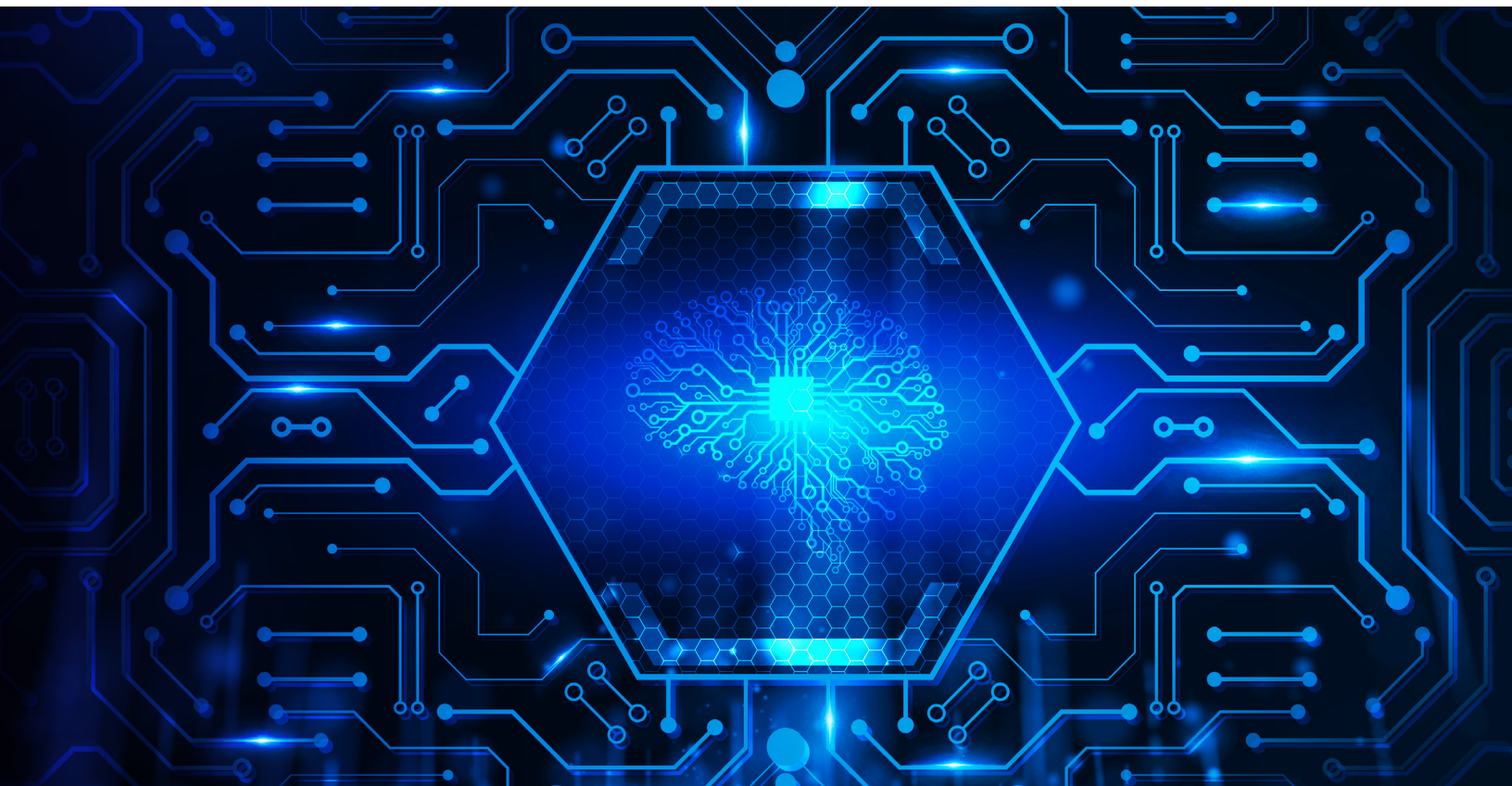


million in grants and loans to support more than 600 start-up projects under the national 2030 Vision (Egusa 2019). Brazil's National AI Strategy was launched with a round of public consultations in December 2019, and a small but growing AI start-up ecosystem is developing in private sector markets, supported by government-funded AI laboratories.<sup>60</sup> In both Brazil and Kazakhstan, academia and nonprofit organizations support local AI development.

Partnerships and multi-stakeholder engagement to drive AI adoption has been observed in all three of these countries that are characterized by nascent AI innovation ecosystems. In Kazakhstan, AI

adoption in key sectors is led by ministries and can include partnerships with technology companies. Argentina's strategy engages the public and private sectors, third sector (nonprofit organizations, civil society, and nongovernmental organizations), the scientific and technology sector and international organizations to provide input. It also includes efforts to develop PPPs for supercomputing capabilities (Presidencia de la Nation 2018). Regarding multi-stakeholder engagement, the Brazilian Association of Artificial Intelligence helps in upskilling the labor force and promoting the exchange of information between national and international companies (Yamamoto 2017).

<sup>60</sup> <http://thefuturesociety.org/2020/03/17/unesco-regional-forum-on-ai-in-latin-america-and-the-caribbean/>





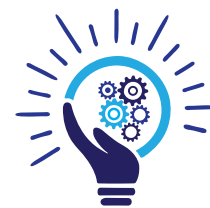
## Overview of AI Flagship Initiatives Observed

As observed across the eleven countries reviewed, the AI policymaking landscape has a wide range of policy and regulatory approaches. Some governments focus on regulation, policy reform, soft law and multi-stakeholder partnerships to create an “enabling” environment for AI adoption,

as in the case of Finland. Other countries opt for a more “directing” approach centered on strategic investments, direct funding and establishing new centers, such as in the UAE. The analysis of the country cases has also identified some common flagship initiatives which are summarized in Box 2.

### BOX 2: Overview of Common AI Flagship Initiatives Observed

- Supporting the development of AI innovation clusters and hubs including collaboration between government, academia and the private sector;
- Investing continuously in research capability including computing, data and algorithmic infrastructure starting from practical applications and moving towards fundamental research;
- Injecting direct financial investment in start-ups to compensate for gaps in venture capital funding;
- Developing AI talent via multiple pillars including digital skills and STEM education, funding for new AI academic and graduate programs, and foreign talent attraction and retention measures;
- Establishing a comprehensive data and algorithm governance framework enabling access to the flow of high-quality data, while ensuring fair, accountable, explainable, privacy-enhancing and secure processing;
- Targeting key sectors for AI adoption for economic growth and human development; and
- Adopting AI to improve public service delivery and resource efficiency while building capability and expertise.



As observed, “transitioning” countries – those with an established baseline digital economy and that are evolving towards universal Internet usage such as India and China tend to address several domain areas to accelerate their AI adoption. These domains include encouraging the growth of scientific research, building digital infrastructure, starting to address ethical questions, exploring AI in government applications, and working closely with start-ups for AI adoption. Also, countries at the intersection of “transitioning” and “transforming” digital economies – those with a relatively stable and widespread base of digital technology – provide examples of emerging practices for harnessing AI. These governments support both hardware and software developments and create new research centers in collaboration with both universities and the private sector. Moreover, they can build an

assessment of AI impact on their local economies and adequately reform national education to assure digital skills and STEM education at large, as well as upskilling the public administration. Some case countries also prioritize national champions for key sectors and collaborate with the private sector to create new platforms for data sharing.

More in-depth exploration is required on the role of government in countries with less developed innovation ecosystems and digital foundations. In these countries with nascent innovation ecosystems and weaker digital economy foundations such as Kenya, Ghana, Egypt and South Africa, governments have reduced capability, capacity and resources to drive AI at a national level. As such, in practice the ability of governments may be impeded.

## FUTURE RESEARCH

As policy and regulatory pathways for harnessing AI are still in their infancy, further time and research is needed to assess the outputs of these strategies, and their effectiveness in order to identify best practices for developing countries. Rather than concluding with best practices, this article provides an initial review of policy and regulatory practices currently deployed in AI policymaking, illustrating a wide range of tools and approaches that governments have taken in their attempt to harness AI technologies while mitigating anticipated risks. While many of the policies observed have been

in effect for a few years, more time, evidence and analysis is needed to measure and determine their effectiveness based on targeted outcomes.

An additional focus of further research should be to understand how to accelerate AI adoption in developing countries while implementing the right safeguards to ensure trust in the digital era within these national contexts. More research is needed to build consensus around best practices, particularly around how to effectively operationalize policies that are articulated in this report. A comprehensive



country AI readiness assessment framework and maturity assessment could help to analyze countries' implementation of possible roadmaps for development. In addition to focusing on countries' adoption of AI, additional analysis is needed in this evolving AI ecosystem to understand the economic impact of AI, and the extent to which AI strategies are achieving intended development outcomes within developing countries. This analysis should include the economic impact across different vertical sectors that rank high within development country agendas. And while previous studies have explored sectoral applications of AI in emerging markets (Strusani & Hougbonon 2019; IFC 2020), further research is needed with a narrower focus

on sectoral applications in countries at the lower end of the income scale. In terms of policy and regulation, future research is needed to address a) the mix of policy instruments such as legislation, technical interventions and standards, and industry guidelines; b) the additional range of potential risks to be addressed including data security, privacy, transparency, safety and data bias; c) scenarios to predict, preempt or mitigate unforeseen consequences and negative externalities, including rising unemployment, social and economic inequality; and finally d) legal and judicial systems to address new legal questions such as liability for autonomous systems and privacy concerns related to the processing or storing of personal data.







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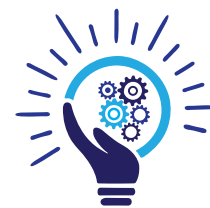
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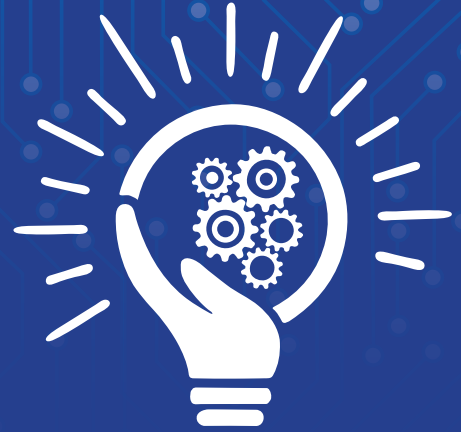
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