Government AI Readiness Index **2021**

OXFORD INSIGHTS

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This report has been produced by Oxford Insights.

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Executive Summary

Artificial Intelligence in Government

The past decade has witnessed a boom in artificial intelligence (AI) development. Throughout 2021, the commercial applications of AI research and development have become ever clearer to companies across the globe. However, the benefits of these technological trends are not reserved for the private sector. Globally, governments are turning to AI to improve their public services and gain strategic economic advantages. But positioning themselves to make the most of this AI-powered transformation requires governments to have the right tools and operating environment; governments need to be AI-ready. In this report, Oxford Insights presents the findings of the 2021 Government AI Readiness Index.

Government AI Readiness Index

The Government AI Readiness Index is now in its fourth edition. The 2021 index has the same 'exam question' as in previous editions: **how ready is a given government to implement AI in the delivery of public services to their citizens?**

To answer that question, we draw on **42 indicators** (9 more than last year's index) across **10 dimensions**. This expansion of the index gives a broader and deeper picture of government AI readiness. However, it makes it harder to make direct comparisons with last year's Government AI Readiness Index. Instead, we recommend that this year's index be used as a tool to compare the current state of government AI readiness in countries and regions across the globe.

As in last year's index report, we have split the world into **9 regions**: North America, Latin America and the Caribbean, Western Europe, Eastern Europe, Sub-Saharan Africa, the Middle East and North Africa, South and Central Asia, and the Pacific. For each region, we include a regional analysis based on a combination of the opinions of interviews held with regional experts, our index scores, and complementary desk research.

We have also included **one spotlight country per region**. These highlight any countries with exciting developments in the last year that we think could lead them to become an important AI player in the future or that solidify their position as leaders in AI readiness.

Last year, we published the first ever Responsible AI sub-index. This tool is set to be published again in 2022 as its own standalone project. As a result, further insights around the adoption of AI that adheres to the OECD's High-Level Principles on AI will be forthcoming, contributing to a more complete understanding of the global state of AI.

Our Findings

The **USA tops the global rankings**, in large part thanks to the unrivalled size and maturity of its technology sector. **Singapore ranks second** as a result of its institutional strength and government digital capacity. The other countries in the top 5 are Western European (United Kingdom, Finland, and the Netherlands).

For the first time, **East Asian countries make up one quarter of the top 20 ranked countries**. The top-scoring countries in the region are boosted by skilled workforces and advanced research and technological infrastructures, which drive the region's competitive research capacity.

Other high scoring groups in the 2021 index include the Nordic countries. Finland and its peers outperform their economic size (in terms of GDP) as a result of effective governments and innovative business environments.

The index unearths clear **inter-regional and intra-regional inequalities**. The average score of the 2 lowest ranked regions is 36.27 (Sub-Saharan Africa and Central & South Asia), whereas the average for the top 2 is more than double that with 76.75 (North America and Western Europe). There is also an evident divide within regions, with the greatest range of scores seen in East Asia and Middle East and North Africa.

We have found that 30% of the countries included in our rankings now have a national AI strategy and a further 9% have confirmed they are drafting one.

As governments are increasingly aware of the opportunities and risks presented by AI, we see a continued **proliferation of national AI strategies** globally. We have found that 30% of the countries included in our rankings now have a national AI strategy and a further 9% have confirmed they are drafting one. This has been paired with government action to create a resilient environment for the use of AI in both the public and private sectors, marked by **countries making advancements in cybersecurity and data protection legislation**.

While government action is increasing, the private **technology sector has also grown significantly**. Public technology companies have increased in size and private technology start-ups have found homes in a growing number of countries worldwide. We are hopeful that governments will be able to harness these private sector advancements to improve their public service delivery, especially with new services based on AI technologies.

These trends within the public and private sector are made possible by a backdrop of sufficient technological infrastructure and the availability of large amounts of data on populations. We find signs that **more and more data is becoming available across regions** as the use of the internet and mobile devices grows. However, the index exposes inequalities in access to the internet between genders and socioeconomic groups, presenting obstacles to the creation of AI tools which answer to all citizens' needs. As the public moves online and governments aim to keep up, ensuring the representativeness of data must remain a priority.

Introduction

Artificial Intelligence and Government

We first published the Government AI Readiness Index in 2017. At this time, governments were yet to realise the full potential of using AI in their public services. Since then, we have seen the wide-ranging adoption of AI across governments for use cases including:

- improving the citizen's experience of a public service: for example, the deployment of chatbots in US Citizenship and Immigration Services to help users receive feedback on their immigration queries immediately;
- supporting evidence-based decision making throughout the policymaking process: for example, the UK's Department for International Development and partners' use of a machine learning algorithm to analyse satellite images and predict population distribution in some developing countries, providing data essential for the planning of services; and,
- increasing democratic engagement amongst citizens: for example, the use of Consul (a platform that experiments with the use of Natural Language Processing techniques to bring together like-minded citizens) by the national governments of Uruguay and Colombia to facilitate debates, proposals, and participatory budgeting.

As use cases increase, the importance of AI readiness increases. Governments need the right tools and environment to successfully implement and manage AI in their public services. Oxford Insights' Government AI Readiness Index assesses these conditions in order to help governments better prepare for the adoption of AI in their services.

The Government AI Readiness Index

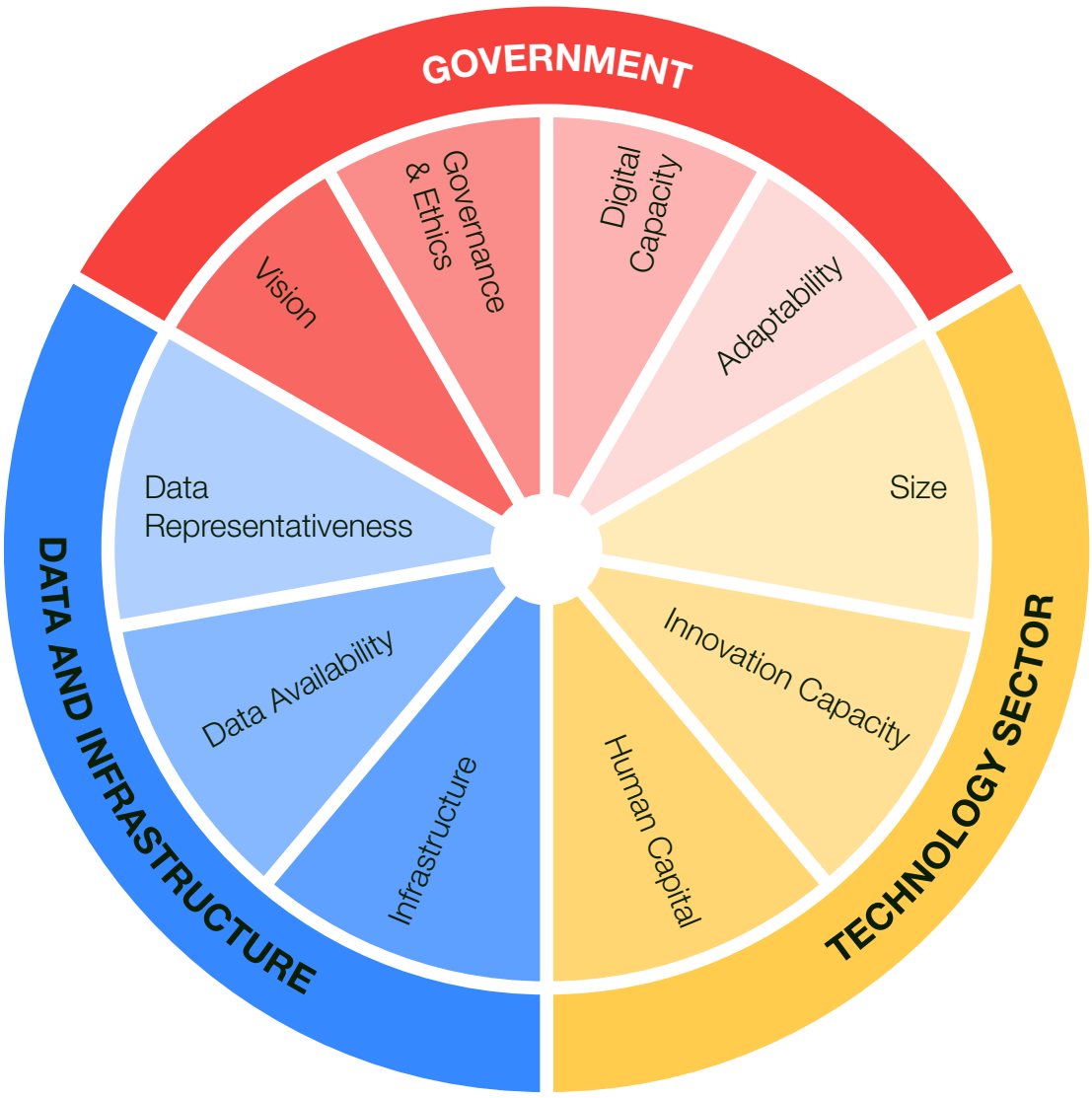
In the 2021 index, our ambition remains the same: to score governments on their readiness to implement AI in the delivery of public services. Our approach is defined by three hypotheses, each of which corresponds to a fundamental pillar of government AI readiness:

The **Government** pillar: a government should have a strategic **vision** for how it develops and manages AI, supported by appropriate regulation and attention to ethical problems (**governance & ethics**). Moreover, it needs to have strong internal **digital capacity**, including the skills and practices that support its **adaptability** in the face of new technologies.

The **Technology Sector** pillar: a government depends on a good supply of AI tools from the country's technology sector, which needs to be competitive and dynamic (**size**). The sector should have high **innovation capacity**, underpinned by a business environment that supports entrepreneurship and a good flow of R&D spending. The skills and education of the people working in this sector are also crucial (**human capital**).

The **Data and Infrastructure** pillar: AI tools need lots of high-quality data (**data availability**) which, to avoid bias and error, should also be representative of the citizens in a given country (**data representativeness**). Finally, this data's potential cannot be realised without the **infrastructure** necessary to power AI tools and deliver them to citizens.

Fig. 1: The pillars and dimensions of the Government AI Readiness Index



For a full description of the indicators that make up the dimensions to each pillar, refer to Annex II: Methodology.

Global findings

World leaders

- The **USA tops the rankings**, in large part thanks to the unrivalled size and maturity of its technology sector.
- **Singapore ranks second**, topping the Government pillar as a result of its institutional strength and digital capacity.
- **East Asian countries make up one quarter of the Top 20 ranked countries** for the first time as skilled workforces and advanced infrastructure drive the region's competitive research capacity.
- Finland outperforms its comparatively small economic power as effective governments and innovative business environments mean **Nordic countries again rank highly in the 2021 index.**

The USA is home to the most technology unicorns and most of the highest-valued large public technology firms.

The USA tops the rankings

The USA's top position in the index is in large part a consequence of its comparatively large technology sector, which drives much of the world's research into and commercialisation of AI. The USA is home to the most technology unicorns and most of the highest-valued large public technology firms. The USA also scores highest in indicators measuring *Computer software spending* and *Company investment in emerging technologies.* High scores in these indicators point to a mature stage of AI development in the USA; AI is being commercialised and adopted across the economy. This is important for government AI readiness. It indicates that: the pool of suppliers will have genuinely useful tools for government, and the country's workforce will be developing the skills required for the use of AI, which is likely to spillover into the government's internal capacity.

Singapore's advancements mark it as a highly proactive government in terms of promoting AI.

Singapore ranks second

Singapore places 2nd in the rankings and top in the Government pillar. Singapore's scores in the digital capacity dimension stand out, being top in indicators measuring *Government promotion of investment in emerging technologies* and *ICT use and government efficiency* (a measure of the extent to which ICT use improves the quality of government services). These scores reflect the government's huge efforts to digitalise public services, where their ambitions have been set out in their Digital Government Blueprint. This was most recently updated in December 2020 when the government added strategies that put greater importance on using AI technologies. The government also announced that 20 of its ministries have submitted plans to use AI since the creation of the Blueprint in 2018. Singapore's advancements mark it as a highly proactive government in terms of promoting AI. With its Na-

tional Artificial Intelligence Office sitting within the Prime Minister's Office, at the heart of government, the country's high ranking demonstrates the sustained, organised effort required for AI readiness.

East Asian countries make up one quarter of the top 20 ranked countries

For the first time in our index, one quarter of the countries in the top 20 are in East Asia: Singapore (2nd), South Korea (10th), Japan (12th), China (15th), and Taiwan (18th). These countries, other than Taiwan, all score significantly above the global average in both the Human Capital and Infrastructure dimensions, pointing to the region's global success in AI research and its advanced computing power.

China tops the *Number of research papers published in AI*, and the country outperformed the USA for the first time in 2020 in terms of the number of times an academic article on AI is cited by others. Similarly, Singapore produces a competitive number of AI research papers. Its research capacity has attracted and been added to by large industry players setting up in the country. Following the likes of Alibaba, Dyson, and DataRobot, Salesforce opened its first overseas AI research center in Singapore, citing the government's focus on developing AI talent as one of its motivations. Moreover, access to large-scale computing is a key enabler of AI development. Top-scoring East Asian countries score highly on the *Number of Top 500 Supercomputers* as well as other advanced infrastructure such as 5G.

Despite the advances of many of the top scoring countries in the region, East Asia is one of the most unequal regions in terms of AI readiness. Several countries score below the global overall average of 47.42 out of 100. These lower scoring countries are disadvantaged by the absence of national AI strategies, the lack of data availability compared to their regional peers, and having comparably small technology sectors.

Nordic countries rank highly in the index

Finland has the 41st largest economy in the world,[1] yet ranks 4th in the Government AI Readiness Index. Sweden has the 22nd largest economy in the world yet ranks 6th, higher than the Western European economic centres of Germany (8th) and France (11th). Denmark (9th in our index), Norway (13th) and the Nordics' close neighbour Estonia (22nd) also perform well. These results demonstrate how a country's size does not determine its ranking in the index.[2]

The Nordic nations tend to score well because of their governments' high internal capabilities, implying that they will successfully manage AI projects. The Finnish government is regarded as one of the most effective in the world in terms of its delivery of public services and the integrity of its policymaking, reflected in its high-scoring Adaptability dimension.

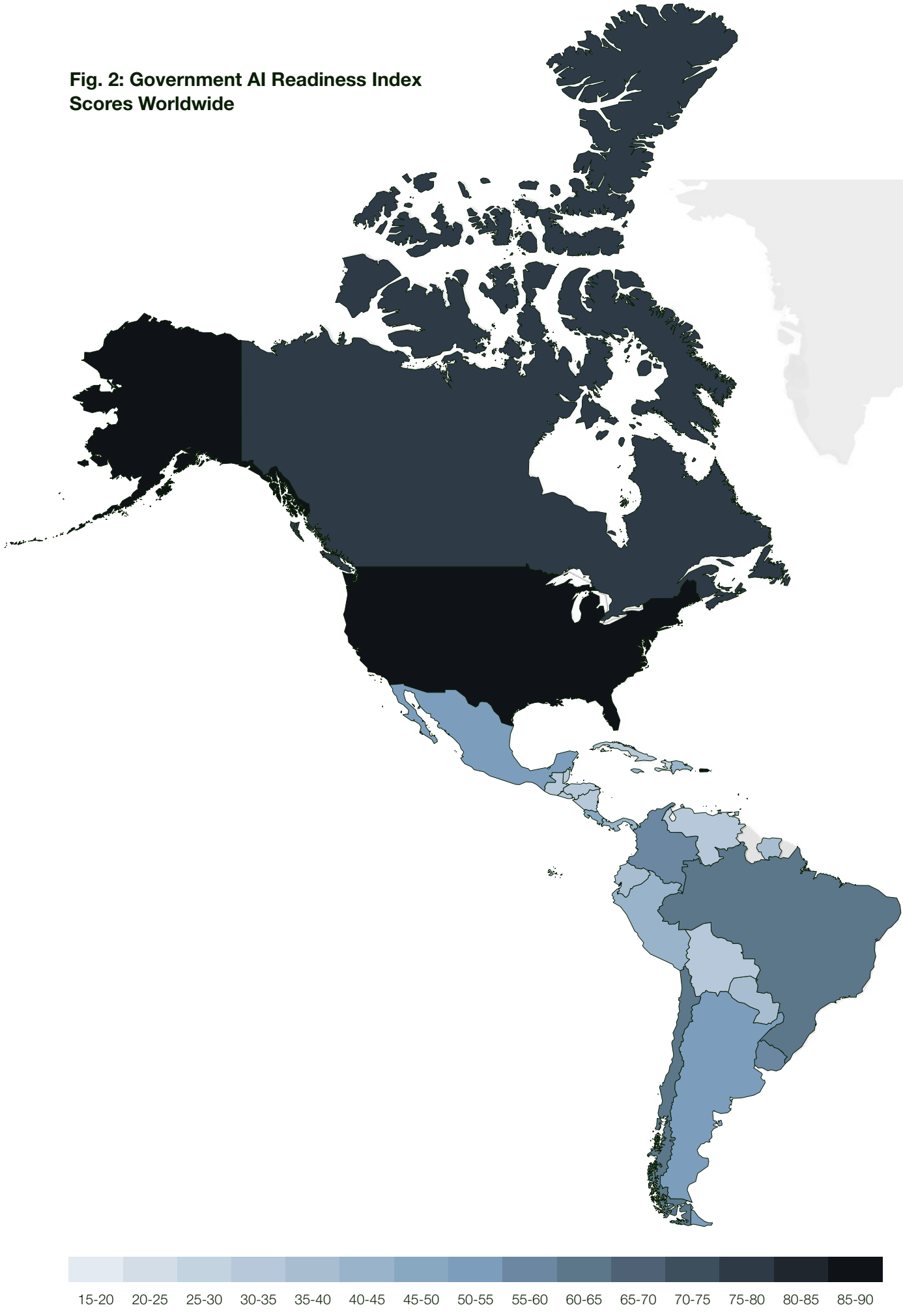
The Nordic countries combine institutional strength with business environments that allow for innovation.

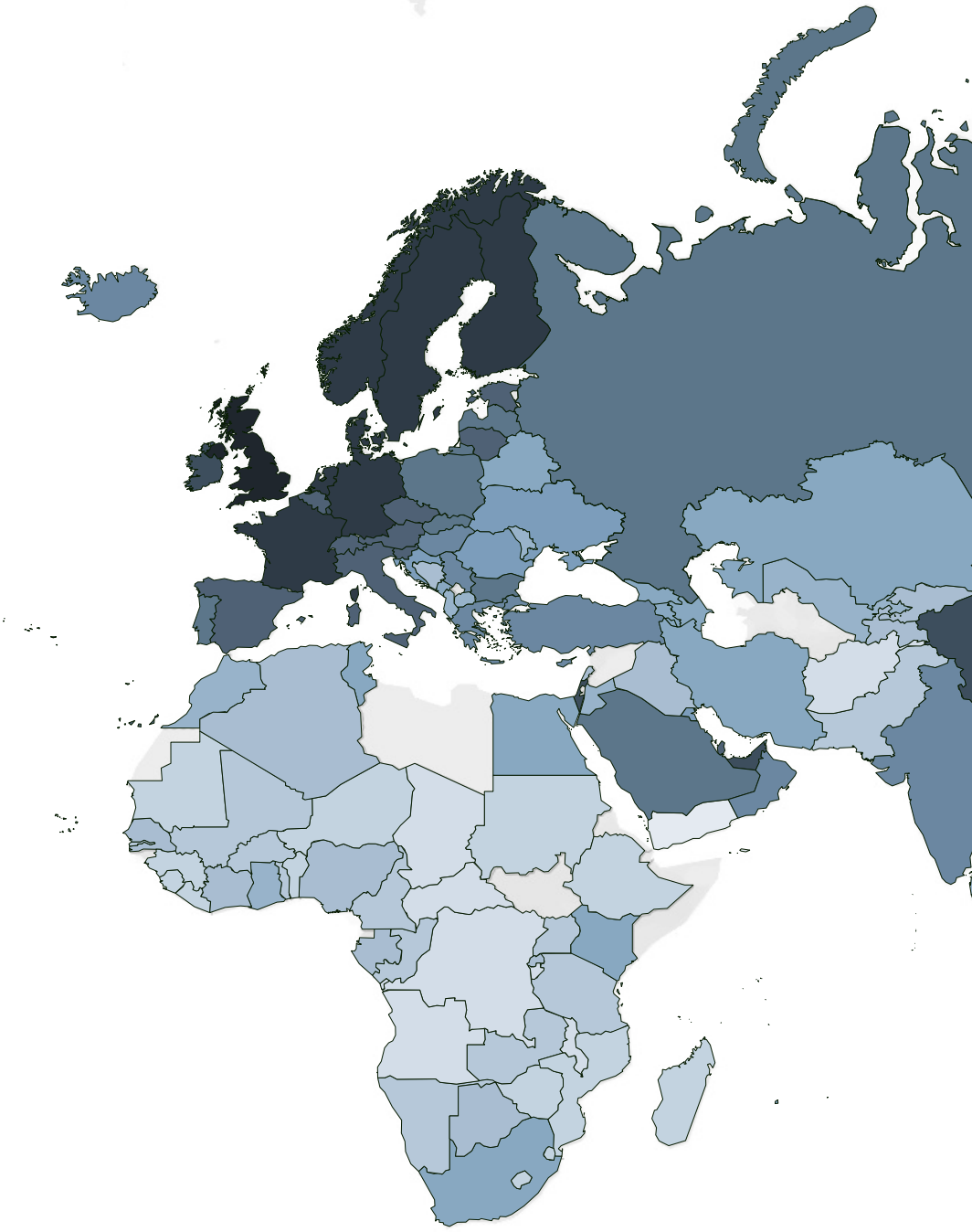
The Nordic countries combine institutional strength with business environments that allow for innovation. For example, Sweden scores highly in the Technology Sector pillar because of its strong entrepreneurial culture, its comparatively high R&D spending, and the willingness of its businesses to invest in emerging technologies.

1 2020 GDP (current US$), World Bank data: https://data.worldbank.org/indicator/NY.GDP.MKTP.CD?most_recent_value_desc=true.

2 We can point to other such cases, though they do not fall into such a clear geographic grouping. For example, Luxembourg has the world's 67th largest GDP but ranks 16th in the index. Malta is the world's 118th largest economy but ranks 32nd in the index.

Fig. 2: Government AI Readiness Index Scores Worldwide





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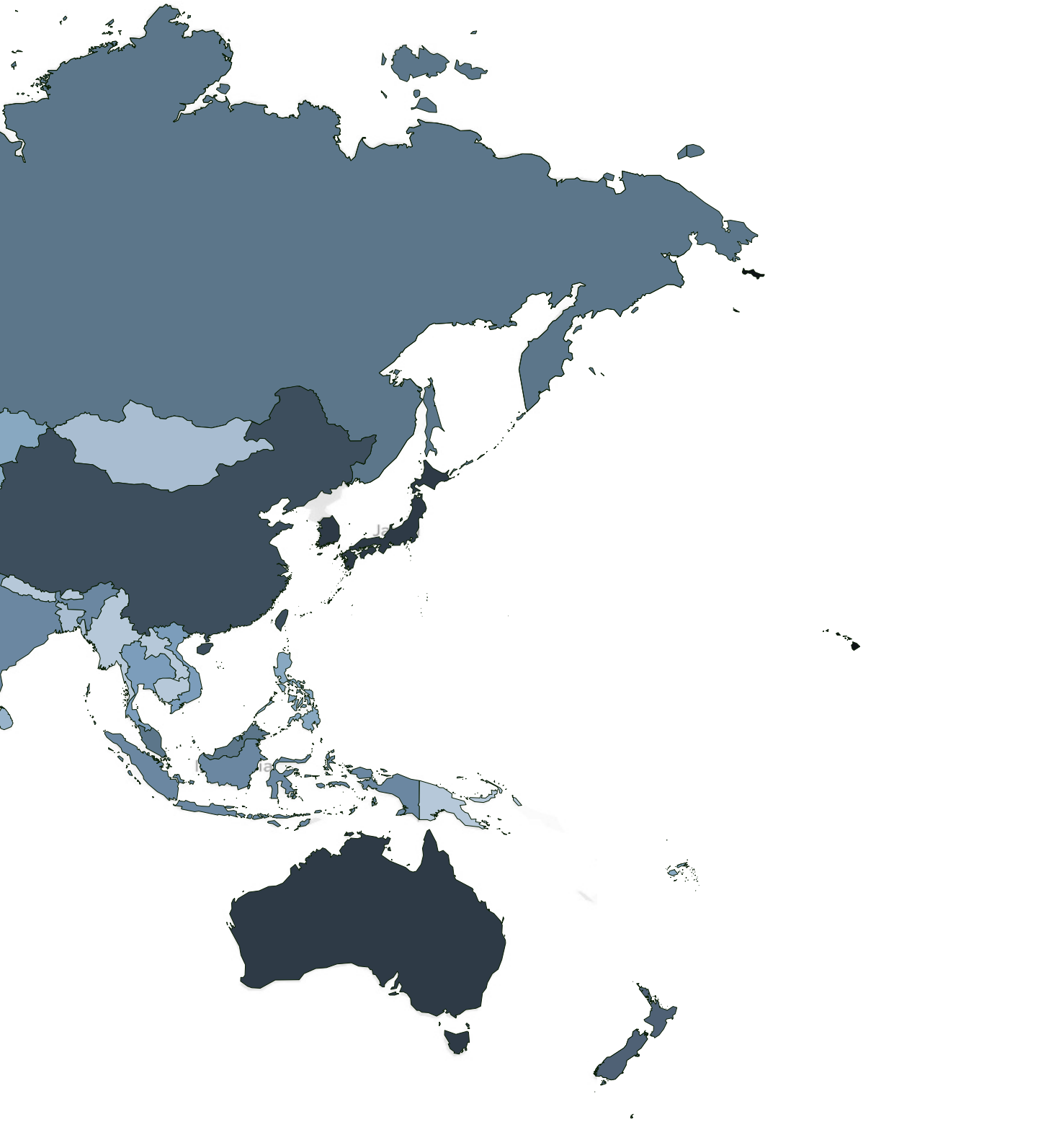


15-20 20-25 25-30 30-35 35-40 40-45 45-50 50-55 55-60 60-65 65-70 70-75 75-80 80-85 85-90

Global Inequality

- There are clear **inter-regional and intra-regional inequalities** in AI readiness across **all three pillars** of our methodology.

As in previous versions of the index, the scores of the Government AI Readiness Index 2021 show clear disparities amongst and within regions. The average score of the two lowest ranked regions is 36.27 (Sub-Saharan Africa and Central & South Asia), whereas the average for the top two is more than double that, with 76.75 (North America and Western Europe). There is also an evident divide within regions. We have come across the major differences within East Asia already. The MENA region is similar; here we find top 20 countries, like the UAE and Israel, alongside some of the lowest-ranked globally, like Yemen and Iraq.

The AI Readiness divide is present across our three pillars. Most of the business activity measured in our Technology Sector pillar is taking place in the developed world and in the biggest economies. For instance, the US and China host 52 AI unicorns, which is roughly three times more than the rest of the world. This feeds into the inequality we find in our Data & Infrastructure pillar. The levels of infrastructure and data availability required to support AI development is concentrated in the same countries. Low levels of technological infrastructure in developing countries contribute to Digital Capacity's status as one of the lowest-scoring dimensions of the Government pillar across developing countries. Arguably, with governments in some developing nations having limited capacity to build and deliver AI in their public services, few are at the stage in AI readiness to publish their vision for AI (see Figure 3 below).

The global picture is one of highly unequal government AI readiness.

The global picture is one of highly unequal government AI readiness. Reducing these inequalities will require policy action and international cooperation across our three pillars. As such, we welcome the incorporation of elements like R&D, digital infrastructure and innovation—amongst others—in international development initiatives like the UN 2030 Agenda.

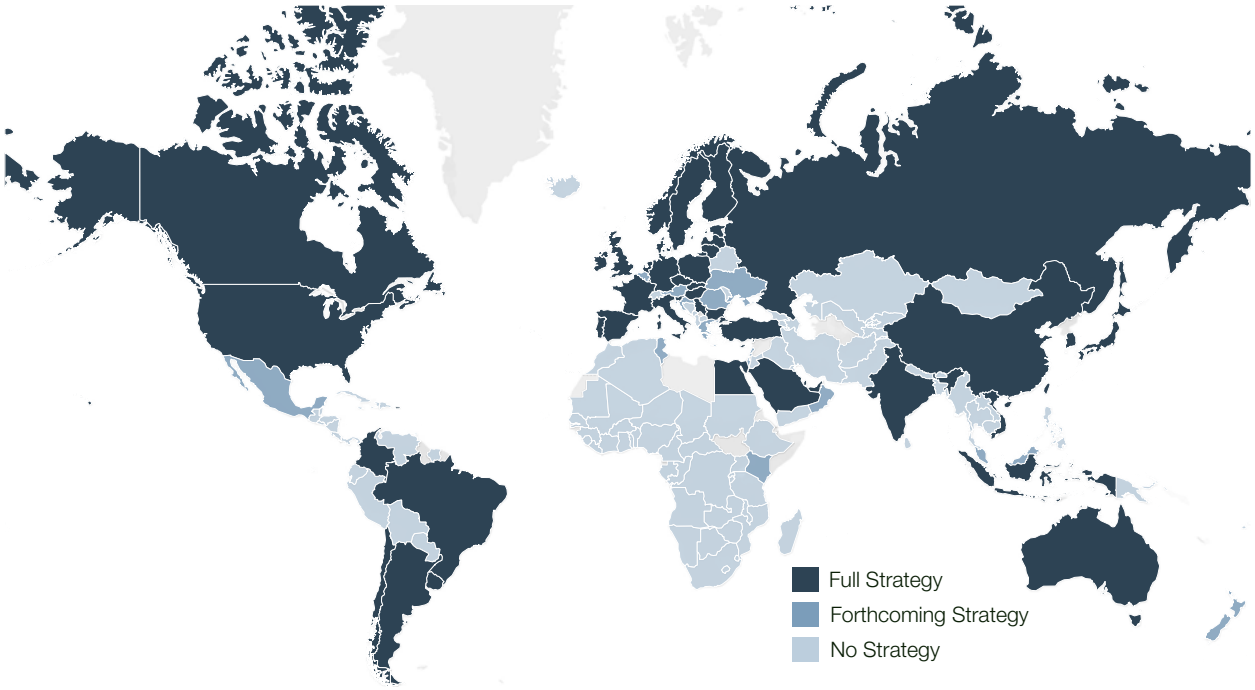
Government Pillar

- There is a continued **proliferation of national AI strategies** globally.
- Governance & Ethics is receiving attention from governments worldwide as **countries advance cybersecurity and data protection legislation**.

Within the Government pillar, we emphasise the importance of a national AI strategy. A strategy creates a unified definition of ambitions and priorities for AI in a country in response to the cross-sector, cross-departmental opportunities and challenges that AI presents. In 2021, countries have continued to publish or start work on national AI strategies.[3] We have found that 30% of the countries included in our rankings now have a national AI strategy and a further 9% have confirmed they are drafting one. Visible in the Figure 3 below, these national strategies remain concentrated in the Global North, contributing to the wider inequality in AI readiness globally.

3 New national AI strategies in 2021 from Brazil, Bulgaria, Chile, Ireland, Italy, Slovenia, Turkey, Viet Nam

Figure 3: National AI Strategies in 2021



Going beyond our Vision dimension, which tracks the major starting point that is a national AI strategy, we are seeing signs of more detailed approaches to AI governance emerging in some regions where governments are at a later stage in AI readiness. The USA's Office of Science and Technology Policy announced it has started work on an AI Bill of Rights to codify the rights and freedoms AI technologies must protect. Professor Gina Neff, Executive Director of the Minderoo Centre for Technology & Democracy at the University of Cambridge and Professor of Technology & Society at the University of Oxford, thinks the announcement signifies a maturation in the country's approach to AI strategy:

> *We're starting to talk less about AI ethics, and much more about what we actually do at the coalface in organisations, in workplaces, and in everyday life; it's getting more practical.*
>
> (Professor Gina Neff, Interview, November 19, 2021)

Similarly, the European Union's AI Act, proposed in April 2021, will create a unifying, horizontal regulatory framework that defines how AI will be developed and deployed in the region. While these steps at a supranational level do not impact index scores directly, many Western European countries build off the EU-level work in the creation and implementation of their own national-level strategies.

Implementing an AI strategy depends on further government action to create a safe environment for the use of AI in both the public and private sectors. In our Governance & Ethics dimension, we include measures of two crucial aspects of such an environment: cybersecurity and data protection. Promisingly, we have seen governments advancing in cybersecurity in this year's index. The ranked countries increased their cybersecurity score by an average of almost 10 (out of 100) since 2018. Moreover, 72.5% of countries included in index rankings have data protection legislation in place.

These indicators are crucial to assessing the government's capacity to integrate AI technologies into their public service delivery safely. As more and more governments integrate AI, more questions will be asked about whether they have the infrastructure and regulatory frameworks in place to do so. We look more closely at these questions in a sub-index focusing on responsible AI, to be released in early 2022.

Technology Sector Pillar

- **The tech boom increases Technology Sector pillar scores** for countries able to attract the sector's most successful companies.

Within the Technology Sector pillar, we can see a boom in the size of large public technology firms and number of private technology unicorns. The total market value of large technology firms as measured in our index has risen as a result of their growth in the COVID-19 pandemic, with the top 7 largest public technology firms adding $3.4 trillion in value in 2020.

Private markets have also poured capital into technology firms. Countries which are attractive to private technology firms saw an increase in the number of technology unicorns. For example, Canada, Israel, and Singapore all more than doubled their number of technology unicorns compared to 2020. The increase of their scores as a result is compounded by the introduction of the indicator *Number of AI unicorns* to the index. Countries such as Israel, where 4 of their 15 technology unicorns are within the AI sector, experienced a greater boost to their overall Technology Sector scores.

We hope that these private sector advancements will translate into improvements in public service delivery. There are many ways in which governments can harness these developments, whether through procurement (especially with the rise of GovTech startups), building in-house AI skills and capacity through strategic hires from the private sector, or by creating knowledge-sharing practices between the private and public sector via initiatives like AI Councils that provide multi-sectoral expert advice to governments.

Data & Infrastructure Pillar

- **Data & infrastructure pillar scores are the highest across all regions** as the world moves online.

The Data & Infrastructure pillar is the highest-scoring globally, with an average score of 58.56 out of 100. The trend continues at a regional level; it is the highest-scoring pillar across all regions. This can in part be put down to increasing scores in the dimensions of Data Representativeness and Data Availability, which measure the growing access to and use of the internet and mobile devices. Primarily, internet and mobile access act as an indication of the amount and coverage of data which can be collected on internet users for the training of AI models. Secondarily, these measures indicate whether a population has the means to make use of the digital public services which are likely to come with the adoption of AI by governments.

Despite the continued growth in internet users, a 2021 UN report found that 2.9 billion people have still never used the internet — 96% of whom live in developing countries. Similarly, within populations, our indicators continue to show differences in access to the internet between genders and socioeconomic groups. While we do not measure it, the total percentage of internet users in a country also likely masks urban-rural divides in internet access. All three of these divisions are obstacles to AI readiness; governments must reflect on them as they interpret their scores.

Additions to the 2021 Government AI Readiness Index

This year's index is based on a very similar methodology to the one used in the 2020 index. However, we felt the addition of certain indicators could provide a more robust and comprehensive measure of government AI readiness. In particular, we felt additional indicators could be included in our framework to hone in on a government's capacity for implementing AI specifically rather than its just digitalising more generally. We therefore added the following indicators:

- Number of AI unicorns;
- Number of research papers published in AI;
- Github commits per 1000 population; and,
- Number of Top 500 Supercomputers.

Within the Technology Sector pillar, we measure the size of a country's technology sector in part by looking at the number of unicorns. Previously, we included the sole indicator *Number of technology unicorns* within the size dimension. This year, we include both *Number of AI unicorns* and *Number of non-AI technology unicorns*. By making AI unicorns a separate indicator, a greater weight is put on companies operating in and making advances in the AI sector. However, we still retain the number of non-AI technology unicorns. We recognise that not all companies developing AI will focus solely on AI and that there are important spillover effects, like talent and knowledge exchange, that come from having a large technology sector more broadly.

We have also added two new indicators to the human capital dimension of the Technology Sector pillar: *Research papers published in AI* and *Github commits.* These act as indicators of the AI skills present within the population. The number of research papers published in AI indicates the scale of research being done at the highest level. Within the AI sector, there is significant crossover between researchers in academia and within private companies. Therefore, the indicator captures an important part of the AI sector's skills pool. *Number of Github commits* on the other hand recognises that the programming skills required to build AI systems can be developed without a formal education in the subject. Online platforms such as Github — the world's largest source code host — are often the centre for learning and project development within the programming community. A commit is an individual change to files in a user's code repository; the number of commits, therefore, measures the level of engagement on the platform within a country.

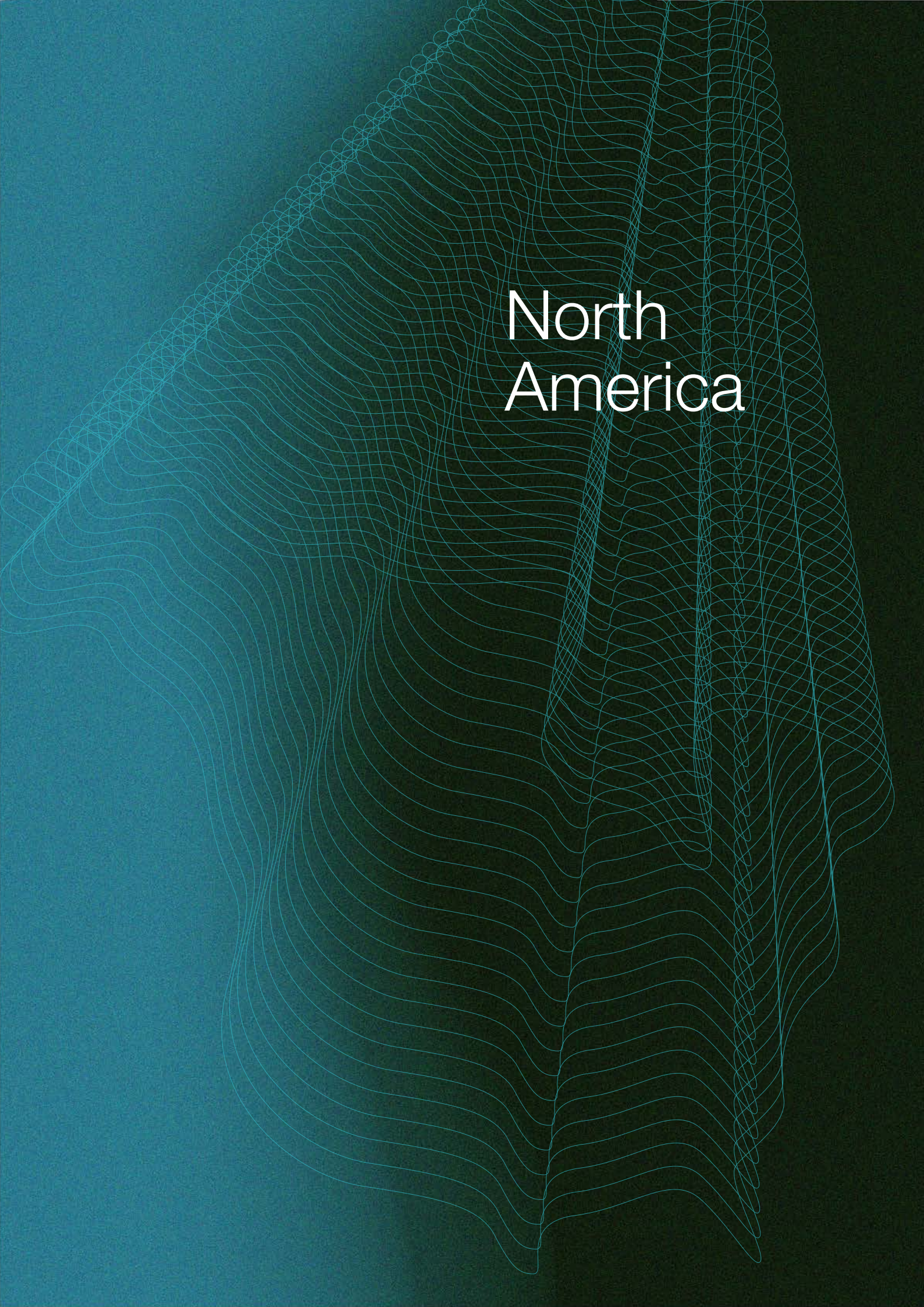
AI research and commercial development requires advanced technological infrastructure and a key part of this is computing power. We have thus added the *Number of Top 500 Supercomputers* indicator to the infrastructure dimension of our Data and Infrastructure pillar. The Top500 list of supercomputers maps out the location of the top 500 supercomputers globally. We have included the number of supercomputers a country has within the top 500 as an indicator of the level of large-scale computing infrastructure available within the country.

Regional analysis

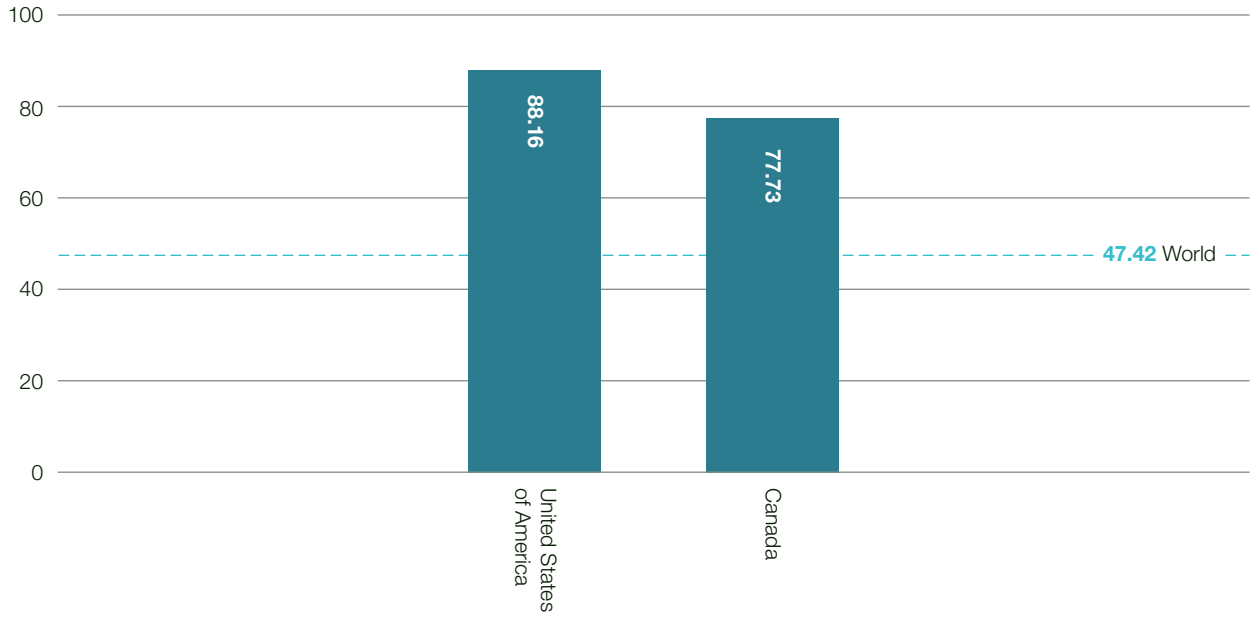
Our analyses of the major trends affecting a region's AI readiness are based on combinations of: the opinions of regional experts interviewed for this report; examination of our index scores; and complementary desk research and analysis. Due to the complexity and breadth of the index, it is not always possible to draw a clear causal line between a particular policy or event and a change in score in a specific indicator. Our goal has been to provide broader insights into countries' and regions' AI policy contexts than can be provided by numerical scores alone.

We have divided the world into 9 regions, based on a combination of the UN and the World Bank regional groupings, each with a regional expert as an interviewee and contributor:

- North America (**Elissa Strome**, Executive Director of the Pan-Canadian AI Strategy at CIFAR)
- Latin America and the Caribbean (**Claudia May Del Pozo**, Executive Director of the Eon Resilience Lab at C Minds)
- Western Europe (**Gina Neff**, Executive Director of the Minderoo Centre for Technology and Democracy at the University of Cambridge, and Professor at the University of Oxford)
- Eastern Europe (**Radu Puchiu**, Open Government Partnership Envoy)
- Middle East and North Africa (**Fadi Salem**, Director of Policy Research, Senior Fellow in Future Government, MBR School of Government)
- Sub-Saharan Africa (**Abdijabar Mohamed**, AI Specialist and Affiliate of The Future Society)
- South and Central Asia (**Raj Shekhar**, Lead of Responsible AI at NASSCOM [National Association of Software and Service Companies])
- East Asia (**Karthik Nachiappan**, Fellow at National University of Singapore)
- Pacific (**Yaseen Ladak**, AI Leader)


North
America

North America



By Pablo Fuentes Nettel with Elissa Strome as interviewee and contributor

Summary

North America, comprising the US and Canada, is the highest ranked region in the 2021 Government AI Readiness Index with an overall score of 82.94 out of 100. This is in large part a consequence of the USA's dominance: it is the highest-ranking country in the whole index, and also ranks highest in both the Technology Sector and Data and Infrastructure pillars. Canada ranks 7th overall and 6th in the Government pillar.

Both countries have leading innovation ecosystems supported by high-skilled labour forces and data infrastructures highly conducive to developing AI. Moreover, AI is a priority in both governments' policy agendas. It is also worth noting their efforts to improve data availability, which will potentially feed into higher scores in this dimension in the next few years.

Key Developments

A key factor in the region's overall success in AI is the existence of institutions that are continually implementing new initiatives in terms of R&D as well as fostering cross-sector cooperation. This year, the National Artificial Intelligence Initiative (NAII) came into force in the US following a bipartisan bill approved in 2020. The main purpose of this bill is to coordinate AI R&D across all U.S. Departments and Agencies, as well as to foster cooperation with academia, the private sector, and civil society through the NAII Office located at the White House Office of Science and Technology Policy.

In Canada, the Canadian Institute for Advanced Research (CIFAR) has been fundamental in promoting AI innovation. CIFAR plays a major role in bringing together renowned researchers and scientists in various fields. Since its creation in 1982, artificial intelligence has been one of the institution's priorities, fostering research in areas like machine learning, robotics and computing. Besides being a research body, CIFAR is also

involved in AI policy having led the work of the Pan-Canadian AI Strategy since 2017. Earlier this year, there was an announcement regarding the renewal and expansion of the Pan-Canadian AI Strategy, which will bring an investment of roughly half billion dollars for research and development in AI. If well-spent, this spending should filter through to improved scores in the Technology Sector dimension in future years.

The region's Technology Sector pillar sets it apart from other regions with an average score of 73.53 compared to the second-highest regional average of 56.70 (Western Europe). The difficulty of tracking the exact impact of particular policies on specific indicators notwithstanding, active and committed governmental support for R&D and developing human capital is crucial in creating the conditions for success in this pillar. To deepen this, the US National Science Foundation (NSF) has announced the creation of 18 AI Research Institutes embedded in universities across the US. This initiative represents a total investment of $360 million USD aimed at boosting multidisciplinary research on AI. Moreover, the White House recently announced the creation of the National Artificial Intelligence Research Resource Task Force. This will establish an action plan for improving educational tools related to AI. Consolidating high-quality academic institutions has been crucial for the US, given the increasing demand for AI talented human capital from tech companies.

As stated above, the US ranks the highest of all countries in the Technology Sector pillar, scoring 83.31 out of 100. The size and value of American tech firms stand out from the rest. Today, the US has the largest number of unicorns globally with 297 (more than three times that of China). Similarly, Canada presents one of the most notable stories globally in terms of startups: it had 2 unicorns in 2020, but this has risen to 13 in 2021. This is arguably an effect of the Pan-Canadian AI Strategy's focus on fostering innovation and establishing research centres in cities with outstanding potential: Montreal, Toronto, and Edmonton, for example. According to Elissa Strome, Executive Director of the Pan-Canadian AI Strategy, these cities host very dynamic startup ecosystems, whilst attracting significant amounts of both investment and talent.

It is also worth mentioning that the COVID-19 pandemic has catalysed innovation amongst Canadian and American startups, particularly in areas like GovTech and healthcare. Our regional expert Elissa Strome emphasised that Canada is developing pilots to enhance data availability with the purpose of boosting research on applied AI for public health services. At the same time, the healthcare sector in the US—which is one of the largest industries in the American economy—is receiving large amounts of venture capital for tech R&D purposes with close to $40 billion USD in 2021.

Looking Ahead

Both Canada and the US are planning new initiatives to enhance data availability for innovation purposes. It will be important to monitor the progress of the National Research Cloud in the US, which is being promoted by the federal government in coordination with tech giants like Microsoft and Oracle. This platform will be focused on improving data sharing amongst academic institutions and tech companies, with the goal of spurring data-based innovation and attracting further investment. Similarly, our regional expert highlighted that Canada is in the process of building a national computing platform. This is the first year since its creation that the Pan-Canadian AI Strategy establishes investment in AI computing as one of its main objectives. It will be important to follow these developments closely to track their impact on the regional AI spectrum.

Canada

Index Score

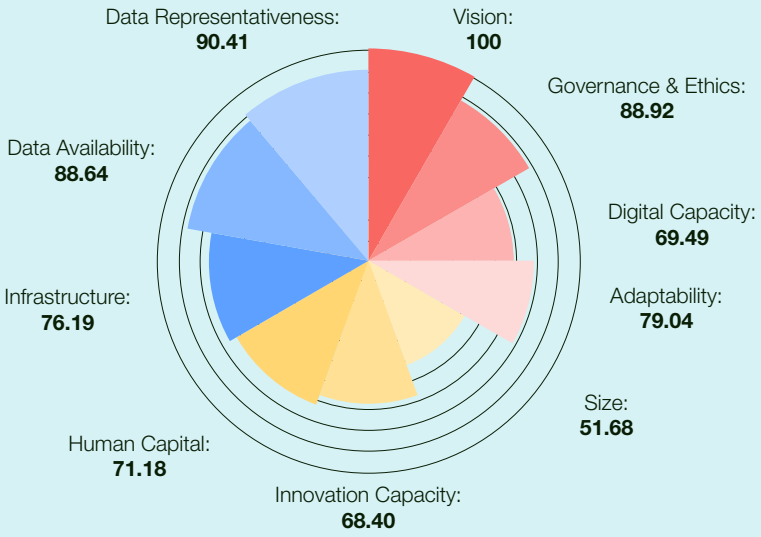
77.73/100

Rank

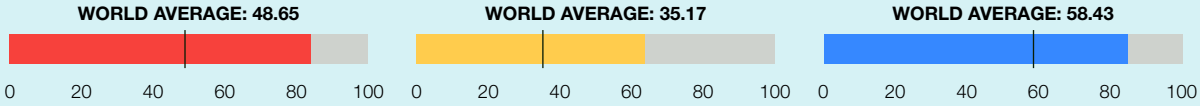
7/160

Regional Rank

2/2

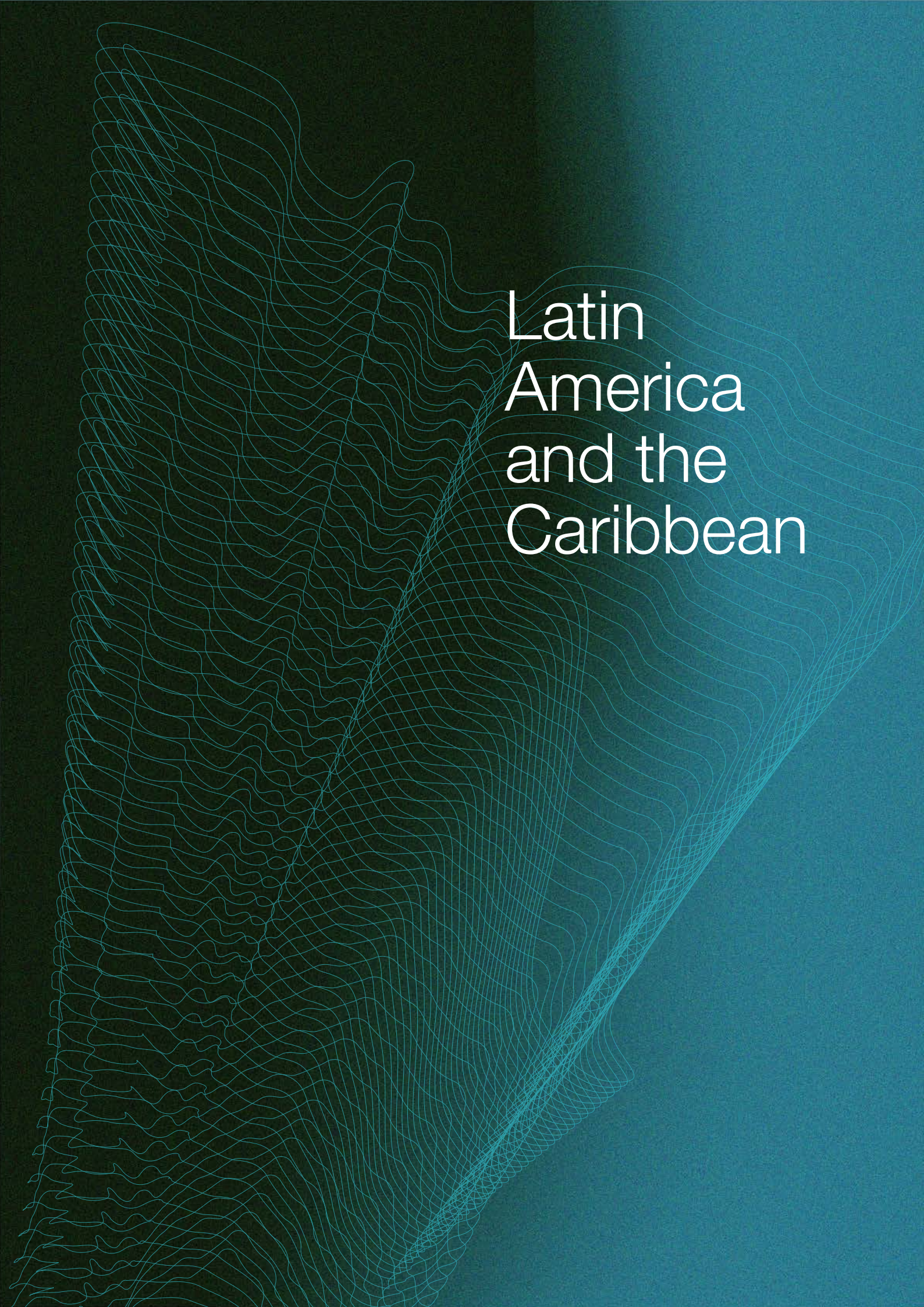


Government			Technology Sector			Data and Infrastructure		
Score	**Rank**	**Region Rank**	**Score**	**Rank**	**Region Rank**	**Score**	**Rank**	**Region Rank**
84.36/100	**6**/160	**2**/2	**63.75**/100	**10**/160	**2**/2	**85.08**/100	**14**/160	**2**/2



The significant increase in the number of Canadian unicorns is one of the most notable stories of this year's index. It had 2 in 2020 but has 13 in 2021, 3 of which are AI unicorns (TensTorrent, Coveo and Ada Support). As mentioned by our regional expert, consolidating a rich pool of highly skilled individuals has been one of the priorities for Canada's tech policy. This has been achieved through investment in capacity building amongst Canadians, but also attracting human capital from all over the world.

In this regard one of the top priorities for CIFAR is bringing global leaders in AI research to Canada, while also developing local talent and avoiding human capital flight, through programmes like the AI Chairs programme. This initiative has resulted in a total investment of $86.5 million USD aimed at funding research programmes in AI and training young researchers on the matter. Today, 109 researchers take part in the AI Chairs programme in three AI Institutes across the country: Amii in Edmonton, Mila in Montreal, and Vector Institute in Toronto.
These research centers are currently developing cutting-edge work in different applied AI topics — from health and machine learning to transport and language prediction. Furthermore, they are attracting talent and investment. An example of the latter is the fact that Edmonton hosts Google DeepMind's first international research lab. DeepMind is one of the leading organisations globally in terms of AI research and development. Actions like this will potentially have a positive impact on Canada's AI innovation capabilities.


Latin
America
and the
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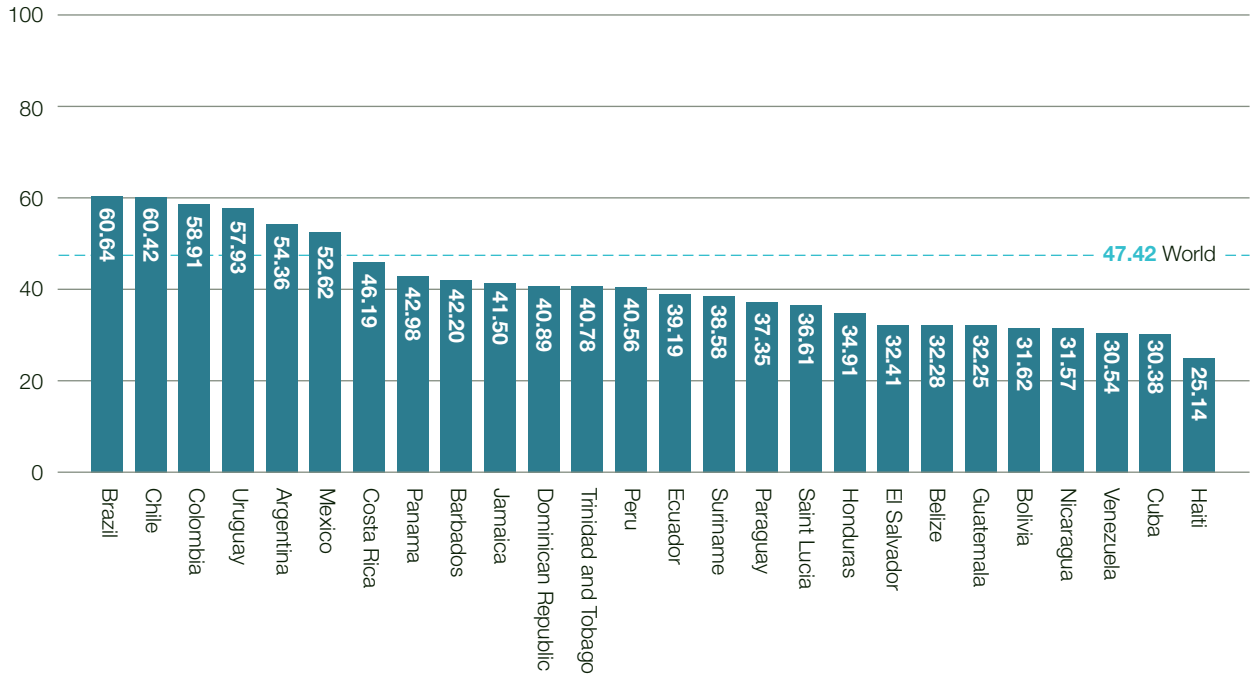
Latin America and the Caribbean



By Pablo Fuentes Nettel with Claudia May Del Pozo as interviewee and contributor

Summary

Latin America and the Caribbean had a regional average score of 41.26 — the third lowest globally after the Middle East & North Africa and Sub-Saharan Africa. The region is comparable to South & Central Asia both in terms of average score and the disparity between countries. The top four countries in the region (in order, Brazil, Chile, Colombia, and Uruguay) score similarly overall, with Brazil at 60.64 and Uruguay at 57.93. They also cluster in the overall rankings, with Brazil at 40th and Uruguay at 48th. Colombia enters the global top 50, consolidating its role as a leader in Latin America. Barbados, meanwhile, is the highest-ranking Caribbean country in the region, at 9th out of 26 countries.

Key Developments

In 2021, Latin America and the Caribbean made important progress in terms of developing AI strategies and policies aimed at fostering innovation in the field. Today, there are a total of 5 AI national strategies compared to 3 in 2020. In that vein, the launch of national AI frameworks by the governments of Chile and Brazil has been one of the main events in the subcontinent and had an impact on the regional ranking. Considering that Brazil is the biggest economy in the region and has the largest tech sector, the incorporation of a solid policy framework could catalyse AI-innovation within the region at large.

As the region moves towards an AI-ready ecosystem, one of the most interesting trends, according to our regional expert, C Minds' Claudia May Del Pozo, is the incorporation of development-sensitive initiatives. A common thread amongst most of the existing AI strategies, as well as other regional programmes, is the focus on the social impact of fostering AI readiness. In that sense, the fAIr initiative led by the

Inter-American Development Bank (IDB) and co-designed with C Minds has the purpose of impacting public policy and the entrepreneurship spheres to reduce social inequalities through the promotion of responsible artificial intelligence. To that end, reducing the digital gap and improving public services through digital transformation will be crucial.

In 2021, some Latin American countries presented developments relevant to the Government pillar. Colombia is a notably high-ranked country in this pillar, where it is positioned 26th globally; this is reflected in the policy framework around artificial intelligence that it has built in recent years. In 2020, the Colombian government launched the National Policy for Digital Transformation (AI Strategy) and recently created an AI Task Force comprising government officials and subject matter experts. The AI Task Force has the objective of offering technical guidance across government institutions. It also seeks to facilitate AI deployment through the design of policies to enhance data sharing mechanisms and improve capacity building within the Colombian civil service. These developments could potentially improve tech governance whilst spurring innovation in the private sector. Similarly, Uruguay, the second-highest ranked Latin American country in the Government pillar, has consolidated a solid governance framework for AI and is also focusing on civil servants' AI skills. The AI Community for Public Administration, launched earlier this year, demonstrates this. This initiative aims at having a more AI-ready public sector.

Compared to the rest of the region, Central American and Caribbean countries have room for improvement in terms of the Government pillar, and particularly the Vision dimension. So far, none of the countries that we measure in these sub-regions have presented a national AI strategy. However, there are some important efforts aimed at creating more AI-ready environments in these countries. Most notable is the Caribbean Artificial Intelligence Initiative led by UNESCO, which seeks to create a sub-regional strategy on the responsible, inclusive and human adoption of AI in the Caribbean. As an international initiative, however, this will not be picked up in our index.

With regards to Data & Infrastructure, there is evidence of solid cross-sector cooperation within the region. Currently, Meta Inc, the IDB, and C Minds are working with the industry sector to develop an AI transparency prototype in Mexico, with the support of local regulators (INAI) This initiative will be the first of its kind and seeks to create recommendations for more explainable and transparent AI systems, serving as input to the local and international conversations on how to design and implement AI systems responsibly.

Looking Ahead

Despite big improvements in the Government and Data and Infrastructure pillars, the regional leaders still have a long way to go to be more competitive globally in the Technology Sector pillar. It will be important to monitor progress in the Technology Sector pillar in the short and medium term. So far, the region only hosts 9 unicorn companies — 5 in Brazil, 3 in Mexico, and 1 in both Chile and Argentina. It will thus be intriguing to closely follow the emergence of startups in countries like Colombia, which, according to Claudia May Del Pozo, have embraced efforts to enable innovation amongst their technology firms. Also, the COVID-19 pandemic has triggered investment flows in sectors like GovTech and healthcare, which could bring a boost to the Latin American innovation ecosystem.

In addition, one of the main challenges of the region will be to reduce disparities in terms of infrastructure, access to digital services, and capacity building. According to the Wilson Center, more than half of the households in Latin America & the Caribbean (55%) don't have access to broadband internet. There is an evident socioeconomic angle here. As reported by the Wilson Center, the difference in terms of internet access between the top and bottom income quintiles is about 40% and only 23% of the rural population in the region have access to the internet. For countries like Haiti, Nicaragua, Belize, Guatemala, and Honduras, where the share of rural population is above 40%, the digital divide has serious implications in terms of infrastructure, education, and capacity building. Reducing this gap, especially in Central America and the Caribbean, will be fundamental to achieving a more AI-ready region.

Chile

Index Score

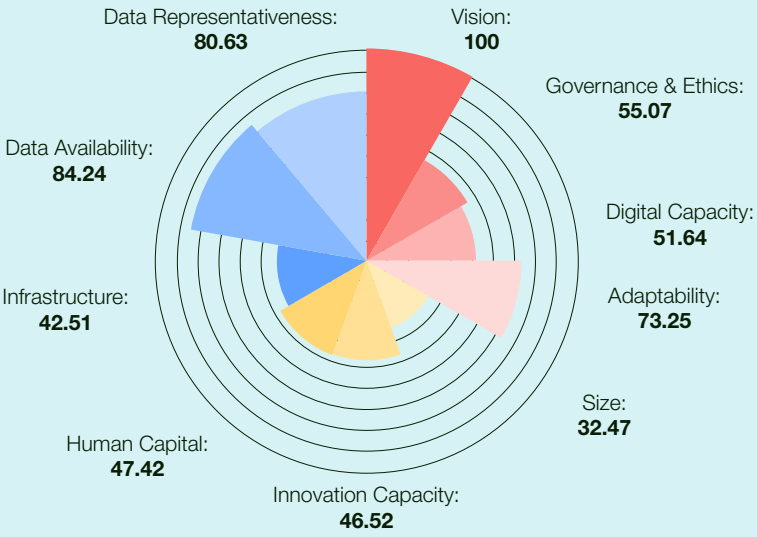
60.42/100

Rank

41/160

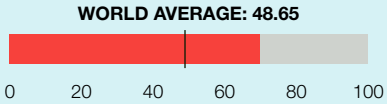
Regional Rank

2/26



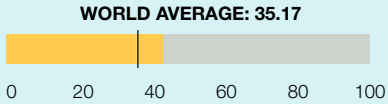
Government

Score	Rank	Region Rank
69.99/100	**33**/160	**2**/26



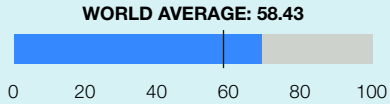
Technology Sector

Score	Rank	Region Rank
42.14/100	**42**/160	**2**/26



Data and Infrastructure

Score	Rank	Region Rank
69.13/100	**52**/160	**3**/26



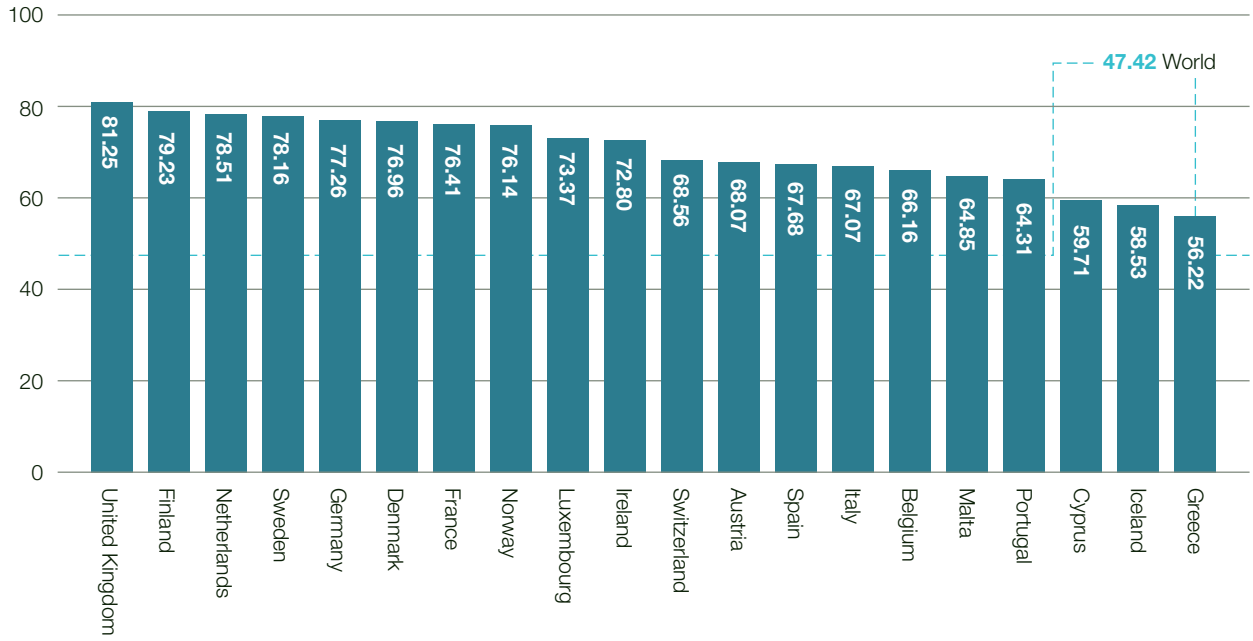
In 2021, the government of Chile launched the National Policy for Artificial Intelligence. This initiative sets an action plan for the next 10 years and incorporates an AI approach across the Chilean ministries and other government bodies. The strategy represents a public investment of roughly $30 million USD and is divided into 3 main areas: developing AI enabling factors; use and development of technology; ethics and security.

One of the most innovative elements of the Chilean national strategy concerns education and training in AI-related fields. The action plan includes increasing government funded scholarships for AI-related programmes in foreign universities through the already existing scheme Becas Chile. In addition, it seeks to foster greater cooperation between Chilean universities and the private sector with the purpose of incentivising the employment of PhD professionals in tech companies. In terms of infrastructure, the National Policy for AI seeks to accelerate the deployment of the 5G network across the country as well as to increase the availability of data. According to their vision, undertaking these actions could transform Chile into one of South America's tech hubs.

It will be relevant to follow new developments in the country as their national AI strategy gets to the implementation phase. Having a solid policy framework could potentially bring positive impact to the Technology Sector pillar, which, despite being one of the highest in the region, still has room for improvement in the global arena.

Western Europe

Western Europe



By Annys Rogerson with Gina Neff as interviewee and contributor

Summary

Countries from Western Europe dominate the top places in this year's rankings, making up half of the top 20 and 6 of the top 10 ranked countries. The region's high scores are broadly attributable to political will amongst governments to harness the benefits of AI, strong economies geared towards digital business models and populations with advanced digital skills.

Within the region, the United Kingdom ranks first with a score of 81.25, followed by Finland with a score of 79.23. Beyond these two leaders, there is a cluster of countries with similar scores, in the range of 76 to 79 (Netherlands, Sweden, Germany, France, Denmark, Norway). This cluster partly reflects the cross-border approach to AI readiness taken within the region, with much of the recent capacity building on AI happening at the EU level, according to our regional expert, Professor Gina Neff, Executive Director of the Minderoo Centre for Technology & Democracy at the University of Cambridge and Professor of Technology & Society at the University of Oxford.

Key Developments

Europe's Vision for AI

The region stands out for its governments' visions for AI. The vast majority of countries in the region have either published their national AI strategy or confirmed that there is one in progress. Professor Gina Neff emphasises the importance of national AI strategies for laying out the opportunities and challenges faced by different parts of government as a result of AI development. Such strategies can offer a unified plan to deliver multidisciplinary, multi-sector, multi-actor solutions to these.

In 2021 we saw the UK publish its National AI Strategy, following the recommendations of its AI Council's AI Roadmap earlier in the year. Ireland

also published its national strategy, AI - Here for Good, boosting its score in the Government Pillar. Ireland's national strategy recognises the benefits of AI for public service delivery and, importantly, assigns responsibility to its GovTech Delivery Board for its approach to AI adoption in the public sector as part of its wider function to drive digital transition of the public sector.

The strategy also emphasises the need to build trustworthy AI, which Ireland plans to achieve in a large part via its activities at the EU level.[4] In particular, Ireland wants to do this through actively contributing to the EU's proposed regulatory framework for AI, its AI Act put forward in April 2021, which defines a regional vision for AI that aims to incentivise transparent, accountable, responsible, and inclusive AI.

Ireland's collaborative, international approach to its AI strategy is common across EU member states. Italy has taken a similar approach with its three-year Strategic Program for Artificial Intelligence, released in November 2021, which includes as its first guiding principle that "Italy's AI is a European AI".

Notably, those countries in Western Europe who are not developing national AI strategies (Iceland and Switzerland) are not EU member states. They have nonetheless made strategic commitments on AI. Iceland became a part of the 2018 Declaration on AI in the Nordic-Baltic Region and Switzerland adopted guidelines in November 2020 on the use of AI within the administration. However, the lack of unified vision in part explains why we see them falling below the cluster of countries at the top of the rankings for Western Europe.

European Tech

Although the Technology Pillar scores in Western Europe still lag significantly behind North America, Western Europe has seen progress within this pillar of AI Readiness. In particular, many Western European countries (Switzerland, Sweden, United Kingdom, Germany, Finland, Netherlands) score on a par with USA and Canada in the Human Capital dimension. This could in part be explained by high investment in higher education across Western Europe, resulting in both high scores in indicators measuring technical AI skills, including *Quality of engineering and technology higher education* and *number of AI Research papers,* and high scores in the broader *Digital Skills* indicator. Having digital skills across the population is crucial for the workforce readiness required to implement AI technologies in workplaces. Western European countries have shown initiative in preparing their workforce through programs such as Elements of AI, a short, publicly available course on the basics of AI. Having started in Finland, where 1% of the entire population has enrolled, the program has since expanded to other countries in the region.

In another sign of development for the Western European technology sector, we've also seen the number of AI and non-AI technology unicorns rise from 43 to 62 in the region. The Netherlands is home to the highest number of new tech unicorns, adding 3 in the past year. This growth is paired with increased venture capital investment in the region, with startups in the UK, France, Germany, Sweden and the Netherlands raising more money in the first six months of 2021 than any previous whole year.

Challenges remain for the technology sector. Companies building AI systems depend on access to data and computing infrastructure. Promisingly, the United Kingdom scores the highest globally in the Data Availability dimension and Belgium the highest in Data Representativeness. However, Professor Neff suggests that governments will play an important role in determining how the data available for AI development can reach more varied kinds of companies that support a wide range of national economic goals, rather than a narrow range of companies and industries. In the future, Professor Neff believes that this challenge will be one that shapes the divisions we see between regions in the levels and kinds of growth in AI capacity.

4 Strand 2 of Ireland's strategy "A Governance Ecosystem that Promotes Trustworthy AI"

Looking Ahead

With a backdrop of enormous financial, legal and ethical capacity, Western Europe is at a mature stage of its AI readiness that puts it in a good position to consider the fine-grained details of AI implementation. Turning lofty plans and principles into practical actions, Professor Neff suggests, now requires bringing together concerns from a wide array of citizens and organisations to have country-specific conversations about how to have responsible technology development and investment in the AI space.

Moreover, Western Europe is on a clear path to emerging as a global leader in responsible AI. The EU approach, as detailed in its proposed AI Act, is one that takes accountability, inclusivity, and privacy as pillars to successful AI implementation. We are already seeing the benefits of such thoughtful consultation at the national level as countries in Western Europe use this work as scaffolding from which to build national consultations of the same kind.

United Kingdom

Index Score

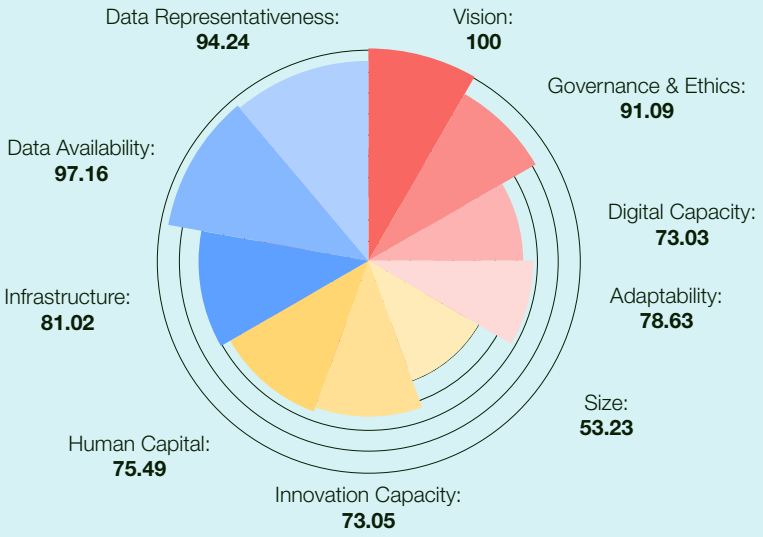
81.25/100

Rank

3/160

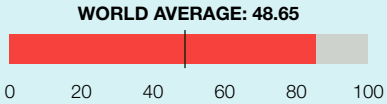
Regional Rank

1/20



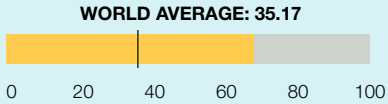
Government

Score	Rank	Region Rank
85.69/100	**4**/160	**2**/20



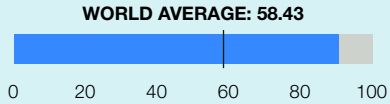
Technology Sector

Score	Rank	Region Rank
67.26/100	**5**/160	**4**/20



Data and Infrastructure

Score	Rank	Region Rank
90.81/100	**2**/160	**1**/20



The UK government has a track record of taking AI readiness seriously. The government has invested £2.3bn in AI since 2014 and the sector is likely to benefit from its pledge to increase overall public and private sector R&D expenditure to 2.4% of GDP by 2027. In 2021, the government took further significant steps to define its vision for AI in the country. Most significantly, the UK launched its National AI Strategy, which aims to position the country as a global AI superpower.

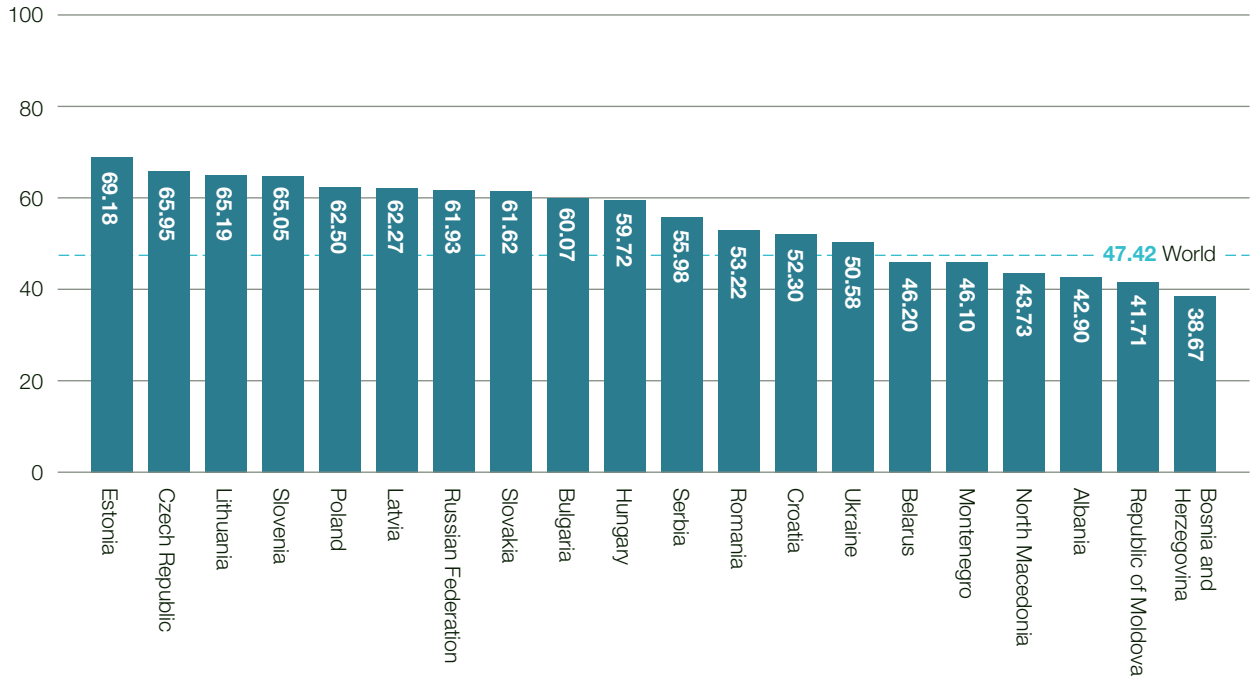
The strategy sets out one of the UK's priorities as the commercialisation of AI, one of the areas we highlighted as needing most attention from the government in our 2020 Index report. The strategy introduces the National AI Research and Innovation Programme as a key mechanism for supporting the translation of research discoveries into real-world AI applications. This focus is likely to boost the UK's already globally high-scoring Technology Sector pillar in the future.

The strategy recognises the demands the AI sector makes on the country's data and infrastructure availability, including its computing resources. As an aspiring global superpower, the UK should be concerned that there are fewer supercomputers from the Top 500 located in the UK than existing global leaders in AI such as the US and China as well as some other Western European countries including France and Germany. The UK's Office for Science recognised this in a recent analysis of the UK's large-scale computing capacity which calls for a long-term roadmap to address research needs.

The UK sits in third place in the global rankings. Singapore, in second, outperforms the UK across indicators within the Digital Capacity and Adaptability dimensions, suggesting that a priority for the British government should be an intensified focus on the highest-quality digital services, the further adoption of AI and new technologies within government, and an increased capacity to respond rapidly to disruptive events.


Eastern
Europe

Eastern Europe



By Tom Westgarth with Radu Puchiu as interviewee and contributor

Summary

Eastern Europe scores above the global average, with a regional average of 55.24 out of 100 compared to 47.42 for all countries. The top three scoring countries are Estonia (69.18 out of 100); the Czech Republic (65.95); and Lithuania (65.19). Ranking 22nd overall, Estonia's position is, in large part, a consequence of its long-term investment in cybersecurity (it ranks 4th overall in the *Cybersecurity* indicator). The Czech Republic's main strength, meanwhile, is in the Technology Sector pillar, in which it ranks 27th overall. Like Estonia, Lithuania ranks strongly in the *Cybersecurity* indicator (11th out of all countries), supporting its strong regional ranking.

Key Developments

The 2021 Government AI Readiness captures the publication of four new national AI strategies in Eastern Europe: Bulgaria, Slovenia, Hungary, Latvia. These countries all therefore increased their scores in the Vision dimension. Ukraine, in fact, released its national AI strategy in December 2021, though this was after the data for the index had been collected. National AI strategies in Croatia and Romania apparently remain in development.

The region is notable for the existence of blocs with different strategic approaches, our regional expert Radu Puchiu suggested. EU member states (such as Czech Republic, Estonia and Lithuania) naturally want to align their AI readiness aims with the European Union's approach. Other countries — in the Balkans, Moldova, and Ukraine, for example — may have similar policy goals, but are more nationally self-reliant, Puchiu said.

With this in mind, the most relevant recent government initiatives were arguably not national, but transnational. For example, The European Union's Coordinated Plan on AI signals a series of actions which the EU must take to create global leadership for the bloc regarding trustworthy AI. As this implies, in the EU there are plenty of discussions around civil liberties taking place, along with deliberation over what to do on issues such as data privacy and the regulation of big technology companies. Decisions here will shape output in the technology sector, and will have major consequences for AI companies. Likewise, attention should also be paid to the EU's macroeconomic resilience and recovery mechanism, given its heavy emphasis on "digital transitions".

Puchiu also reflected on other trends in Eastern Europe. A new, Western-oriented, government was elected in Moldova, for example. While this happened too late in 2021 to have influenced this year's index scores, Puchiu suggested that the new administration was likely to take a more strategic approach to AI development, and that this should translate into improved AI readiness scores in the future. Albania is another country to watch. Puchiu noted that e-government has been a recent priority (potentially leading to a better future score in the Digital Capacity dimension), and the country is making advances in other advanced technologies (for example, drone technology).

Generally, Eastern Europe is a startup cornucopia. Puchiu suggested that Poland, in particular, would be a beneficiary of this, and that improvements in its future Technology Sector Pillar scores are therefore likely. Hungary can be similarly described, with notable AI startups including Turbine, Talk-a-Bot and Almotive.

However, the picture in the region remains mixed. Puchiu noted that many of the countries in Eastern Europe are struggling due to their political environment. Without political stability and good governance, it is difficult for states to build the infrastructure and institutions necessary to manage AI's development in a strategic manner. The same can be said of approaches to embed digital skills in the economy. Another potentially damaging trend is for innovative technology startups to migrate from Eastern Europe to the US, Asia, and China, Puchiu suggested. Indeed, this creates an analytical problem for measuring the size of the technology sector, as it will require a judgement about where a company is and is not headquartered, potentially to the detriment of Eastern European economies in future editions of the Government AI Readiness Index.

Czech Republic

Index Score

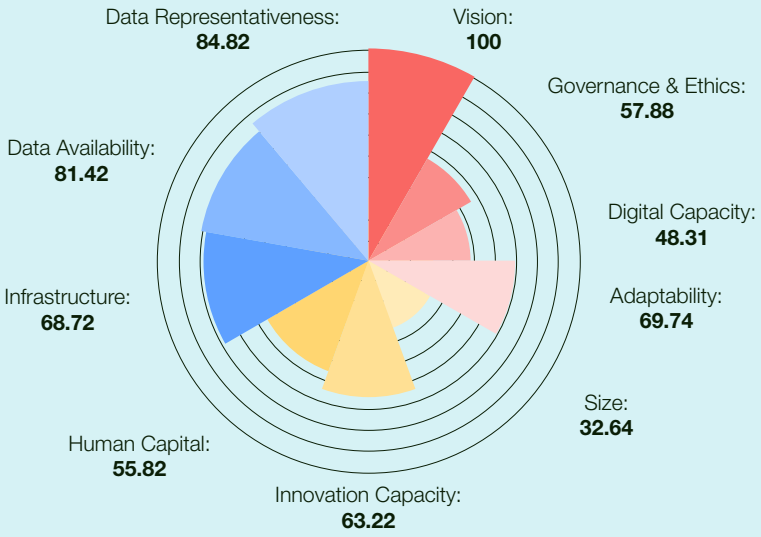
65.95/100

Rank

29/160

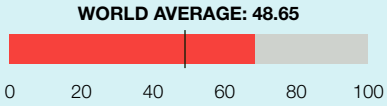
Regional Rank

2/20



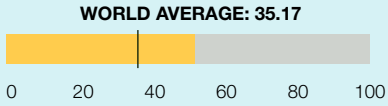
Government

Score	Rank	Region Rank
68.98/100	**36**/160	**4**/20



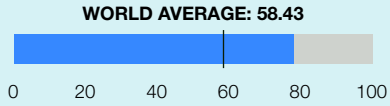
Technology Sector

Score	Rank	Region Rank
50.56/100	**27**/160	**1**/20



Data and Infrastructure

Score	Rank	Region Rank
78.32/100	**30**/160	**4**/20



The Czech Republic ranks 27th overall; this is predominantly a consequence of its strong ranking in the Technology Sector pillar, where it also ranks 27th. It ranks solidly in each dimension within the pillar: 28th in terms of Size, 28th in terms of its Innovation Capacity, and 30th in terms of Human Capacity. Notably, it is in the top 20 countries in the world in terms of its R&D spending as a proportion of GDP.

Radu Puchiu said that the presence of overlapping national strategies has been effective in creating an environment to allow AI innovation. Aside from their own national AI strategy, in recent years the Czech government has also implemented open access and education plans, along with an innovation strategy aligned with previous digital strategies. Puchiu suggested that this has "helped a lot of things to advance": for example, a "National Catalogue" of roads suitable for testing autonomous vehicles, and the AI Observatory and Forum, a site for government and academia to collaborate in supporting further AI development.

Other policy interventions have expanded the scope of digital services, increasing the amount of data held by the government and enhancing the conditions that support AI readiness. For example, the government has rolled out new health portals and IT systems to manage and coordinate healthcare communication (including the Tecka mobile app). This has been complimented by cybersecurity innovation. A survey by the Ministry of Industry and Trade shows that priority investment is being directed towards data and cybersecurity, particularly for SMEs. The new 2020 National Cybersecurity Strategy has begun to build additional capabilities for the provision of cybersecurity services, especially for public administration and critical infrastructure. We would hope that this translates into improvements in the Czech Republic's *cybersecurity* indicator score in the future.

Other investments include €450 million being spent on e-services from the Recovery and Resilience Plan. Capital will be allocated to build a robust back-end infrastructure to link multiple public administration IT systems, as

well as setting up specialised competency centres to guide and advise in the process of public sector digitalisation. Furthermore, the rolling out of 5G infrastructure has led to improved data speeds. Together, these changes will likely boost both the Government and Data and Infrastructure pillars in future versions of the Government AI Readiness Index.

According to the Digital Economy and Society Index (which is not a component of the Government AI Readiness Index), the Czech Republic has the highest share of enterprises in the EU that use AI. Similarly, according to the World Robot Federation, Czechia is the world's 15th largest market for industrial robotics. Hopefully, projects such as the development of new AI excellence centres will continue in the nation to boost talent and knowledge production. Embedding greater human capital into the digital economy could make the Czech Republic rival the likes of Estonia as a regional AI leader.

In terms of the Czech Republic's index scores, the most notable area for potential improvement is the Digital Capacity dimension, where it ranks 73rd out of all countries. This is, in large part, a consequence of a low ranking in the *ICT use and government efficiency* dimension, which measures the perceived impact of digital technology on the quality of public services.[5] We hope to see the measures described above push this score up in future years. Similarly, Czechs have an apparently low level of trust in government websites: if the planned investments listed above can resolve this, this provides an instructive theory of change for countries in similar positions.[6]

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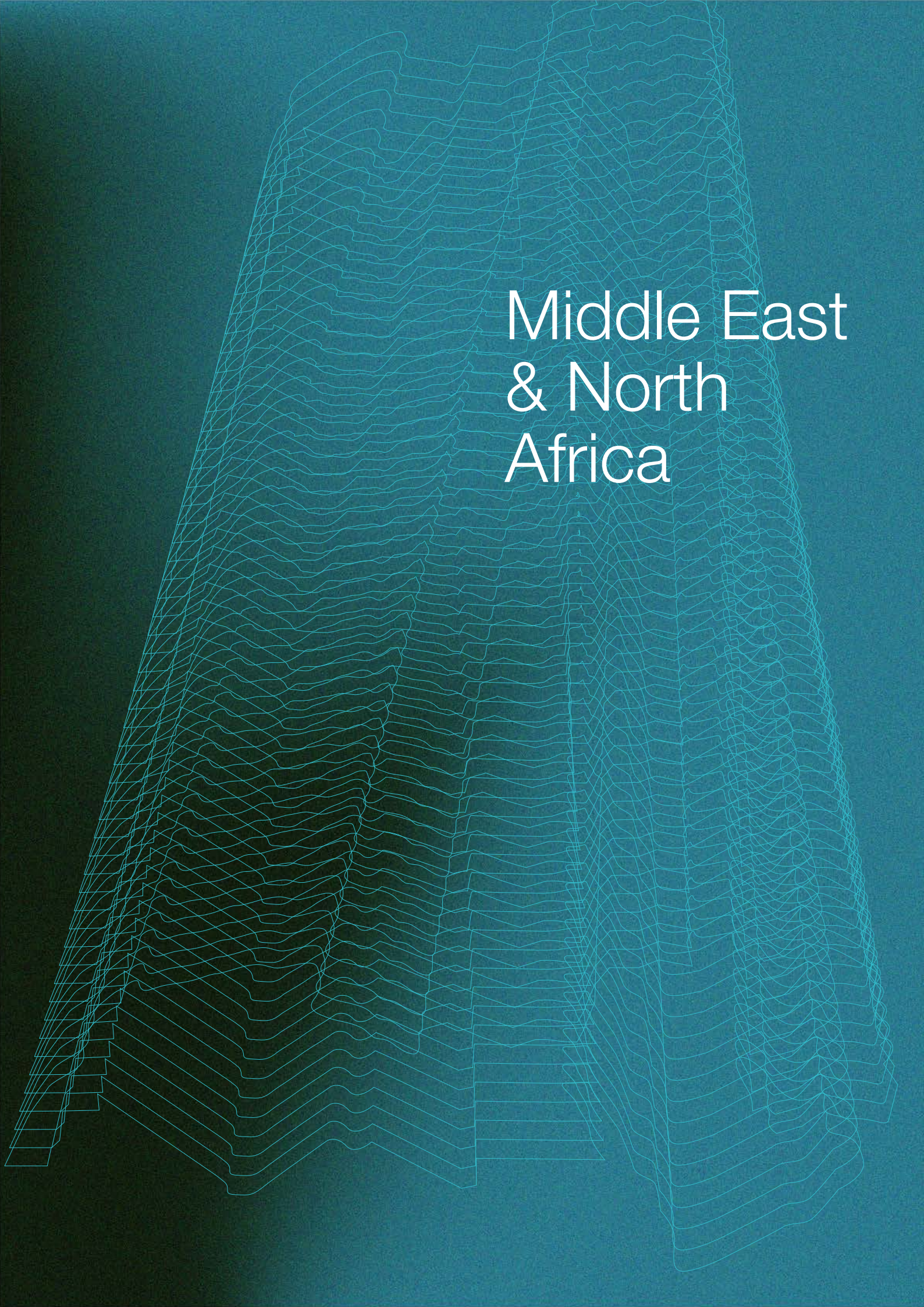
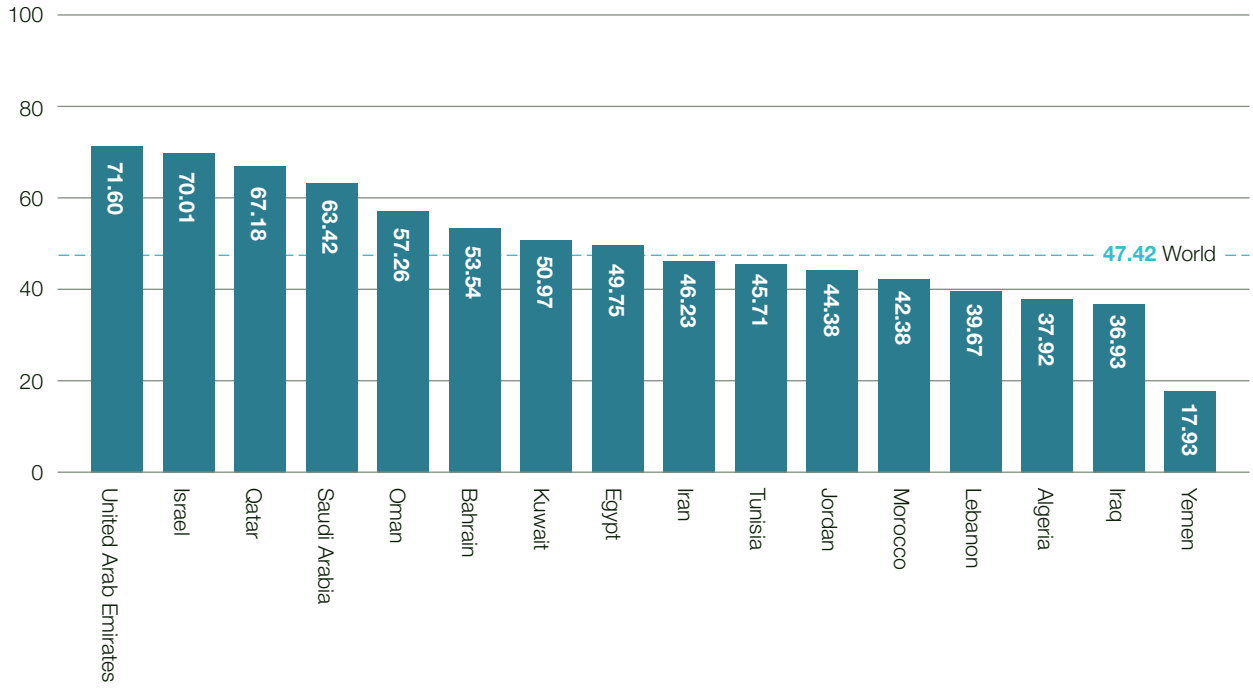
5 This ranking is taken from indicator 2.3.3 in the 2019 Network Readiness Index.

6 This is based on ranking 4.2.3, "Trust in government websites and apps" from the 2021 Inclusive Internet Index.



Middle East & North Africa

Middle East & North Africa



By Alejandra Finotto, Sulamaan Rahim and André Petheram with Fadi Salem as interviewee and contributor

Summary

The MENA region is one of the most diverse in the world in its Government AI Readiness scores. In fact, it has the largest range of scores, with the lowest being 17.93 out of 100 (Yemen) and the highest being 71.60 (the United Arab Emirates). Three countries in the region (the UAE, Israel and Qatar) sit in the top 30 countries in the overall index. The average score for countries in the MENA region, meanwhile, was 49.68 out of 100, just above the global average of 47.42.

Yet, Lebanon (94th overall), Algeria (99th) and Iraq (104th) have comparatively low rankings. In large part this is due to the absence of strong public sector institutions. For example, Iraq and Lebanon respectively score 151st and 152nd out of 160 in the Government Adaptability dimension, which includes a measure of a civil service's ability to respond to challenges posed by social and technological changes. Yemen, meanwhile, is the lowest-scoring country in the overall index, reflecting the instability, war, and famine that have devastated the country.

The top two countries in the region, the UAE (1st out of 16 countries) and Israel (2nd) do well for different reasons. The UAE ranks fairly consistently in each of the three pillars that make up the index (18th overall in the Government pillar; 22nd in Technology Sector; 20th in Data and Infrastructure). Most notably, it has the third highest overall score in the *Government promotion of investment in emerging technologies* indicator; reflecting a perception in the country that the Emirati government has made good efforts to marshall investment in artificial intelligence.[7]

7 https://networkreadinessindex.org/wp-content/uploads/reports/nri_2021.pdf, see p.235.

Israel, meanwhile, scores strongly in the Technology Sector pillar, in which it ranks 8th among all countries. In fact, it ranks first of all the countries in the index in two indicators within this pillar. Firstly, *Entrepreneurial culture*, measuring the perception of how willing companies in a given country are to take risks in the pursuit of innovation. Secondly, *R&D spending*, measuring the amount a country spends on R&D per capita. And Israel ranks second among all countries in terms of its companies' perceived willingness to invest in developing new digital technologies (the *Company investment in emerging technologies* indicator[8]).

Taken together, this implies that Israel's readiness to incorporate AI into its public services is dependent on the government tapping into the dynamism of the private sector. The UAE government, meanwhile, is arguably more internally proactive about directing and managing innovation in AI.

Key Developments

The most relevant developments in the region this year took place in the Gulf, given that both Qatar and Saudi Arabia unveiled their National AI Strategies. Qatar's National Artificial Intelligence Strategy focuses on six main pillars: education, data access, employment, business, research, and ethics. Additionally, the strategy aligns with the overarching Qatar National Vision 2030, which identifies artificial intelligence as a central component in the country's transition from an oil-based economy to a knowledge-based economy. Similarly, Saudi Arabia released its National Data and Artificial Intelligence Strategy, with six goals: to be amongst the top 15 countries in the world in the development and application of AI by 2030; to train the ICT skills of its population; to partner with international organisations and businesses; to boost investments in data and AI; to foster a business-friendly regulatory environment; and to enable the creation of an ecosystem of data and AI startups in the Kingdom by 2030.

COVID-19 has also affected the region this past year, particularly driving changes in the sector of education. Different countries in the region created and developed e-learning platforms, such as Darsak in Jordan or the National e-Learning Center in Saudi Arabia. Such initiatives arguably reflect these governments' broader commitments to digitising government services, with potential future spillover effects on AI readiness. Indeed, a focus on digitisation has increased the need for improved broadband networks in countries across the region, resulting in investment in the "bandwidth of Internet packages and speeds for users without additional cost". This will likely affect the *Internet Bandwidth* and *Telecommunications Infrastructure* indicators' scores in the future. The pandemic has also influenced the private sector, as some businesses have seen this as an opportunity to shift their business models, adapting them to a more heavily digitised economy and pushing for AI adoption.

Looking Ahead

The MENA region is diverse, making it difficult to develop policy recommendations tailored to its entirety. However, there are three things that most MENA countries in the region can focus on to establish the strong innovation ecosystem and digital economy necessary for AI readiness: government reform, human capital, and data availability and representativeness.

Given that the majority of the countries in the region have medium to low scores in the Government pillar (with a regional average of 49.63), this is certainly a priority. Focusing on digitisation agendas or national AI strategies is a good route to improvement, and Oman could become the next country to do so. The Omani Ministry of Transport, Communications and Information Technology (MCTIT) is currently formulating an action plan that envisions the adoption of AI to drive the economic development of the country as well as the development of ethical standards to ensure the fair use of these technologies.

8 https://networkreadinessindex.org/wp-content/uploads/reports/nri_2021.pdf, see p.231.

The second regional priority relates to our index's Human Capital dimension, which has a regional average of 41.09 out of 100. In particular, developing digital skills among the region's people should be an important focus area. The comparative youthfulness of the region is an asset here, but realising this potential is dependent on sustained and strategic government investment in education and jobs. However, in many countries education investment remains dependent on declining resource revenues or indeed is truncated entirely by conflict and instability.

The third important focus area for the region is that of data availability and data representativeness. Some countries — the UAE and Saudi Arabia, for example — have already realised that enabling individuals, businesses, and governments to have access to large amounts of data is an crucial element of a flourishing digital economy and AI-based innovation. As such, supporting open data is a priority within their future planning. However, initiatives to promote data sharing in the region (and to improve data infrastructure more generally) may not be sustainable due to possible changes in government, new regulations, and regional instability. They will depend on continued attention to properly support AI's development.

Oman

Index Score

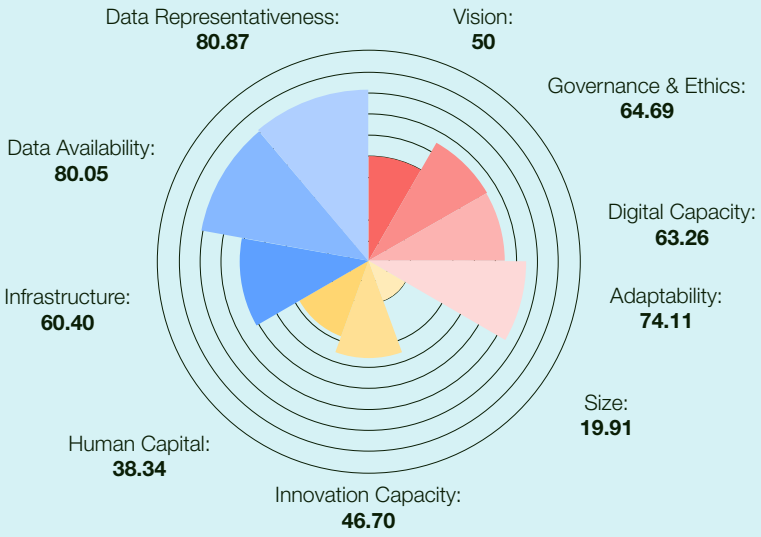
57.26/100

Rank

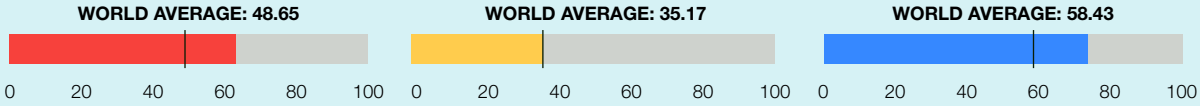
49/160

Regional Rank

5/16



Government			Technology Sector			Data and Infrastructure		
Score	**Rank**	**Region Rank**	**Score**	**Rank**	**Region Rank**	**Score**	**Rank**	**Region Rank**
63.01/100	**52**/160	**5**/16	**34.99**/100	**65**/160	**9**/16	**73.77**/100	**41**/160	**6**/16



In October 2021, Oman unveiled its Digital Economy Programme. As part of this, the Sultanate is also in the process of developing its very own National AI Strategy. This strategy will revolve around the 'four main pillars' of:

i) enhancing the productivity of the economic diversification of sectors via AI;
ii) developing human capabilities in AI;
iii) accelerating AI adoption by service sectors such as Defence, Healthcare, and Education; and,
iv) governance of AI and [advanced technologies] to ensure fair and ethical use of these technologies.

The development of such a strategy will mark a significant positive step for Oman's capabilities to adopt AI. Currently, Oman ranks 52nd in the Government pillar. This is below its overall ranking of 49th. However, within the Government pillar, the country is notable for its in the strengths in the *Cybersecurity* indicator (in which it ranks 28th out of all countries in the index[9]), the *Legal framework's adaptability to digital business models* indicator (where Oman ranks 16th overall), and the *Government responsiveness to change* indicator (in which it is an especially strong 10th overall[10]). The upcoming AI strategy will complement these strengths and is likely to significantly improve Oman's ranking in the Vision dimension and the Government pillar overall.

Following a trend in the region, Oman has room to grow when it comes to improving the human capital it has to implement AI effectively. Despite having a high proportion of students enrolled in STEM subjects (Oman in fact ranks 3rd overall in the *Graduates in STEM* indicator[11]), Oman ranks less favourably in indicators measuring the

9 See the Global Cybersecurity Index 2020 https://www.itu.int/dms_pub/itu-d/opb/str/D-STR-GCI.01-2021-PDF-E.pdf.

10 See the Global Competitiveness Report 2019 https://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf

11 See the *Percentage of graduates from Science, Technology and Mathematics programmes in tertiary education, both sexes (%)* indicator here: http://data.uis.unesco.org/

Number of Github commits in the country, the number of *Research papers in AI* published nationally, and the proportion of its employees working in *Knowledge-intensive employment*.[12] This demonstrates the need for a much wider proliferation of AI and AI-adjacent knowledge within the population. Policies which drive this kind of diffuse AI understanding would be welcome in any national AI strategy.

The size of Oman's technology sector should also be an area of focus. In particular, the country spends a comparatively small proportion of its GDP on computer software,[13] implying a small local pool of digital and AI tools that might be adapted for use in public services, and also a likely lack of exposure to AI programmes among citizens (and civil servants).

We await the final release of Oman's AI strategy to determine its full impact, and to consider the extent to which the country might address these issues, but any AI strategy should provide a clear point around which any government can focus. It represents a positive step for Oman — a country which is now a top 5 regional player.

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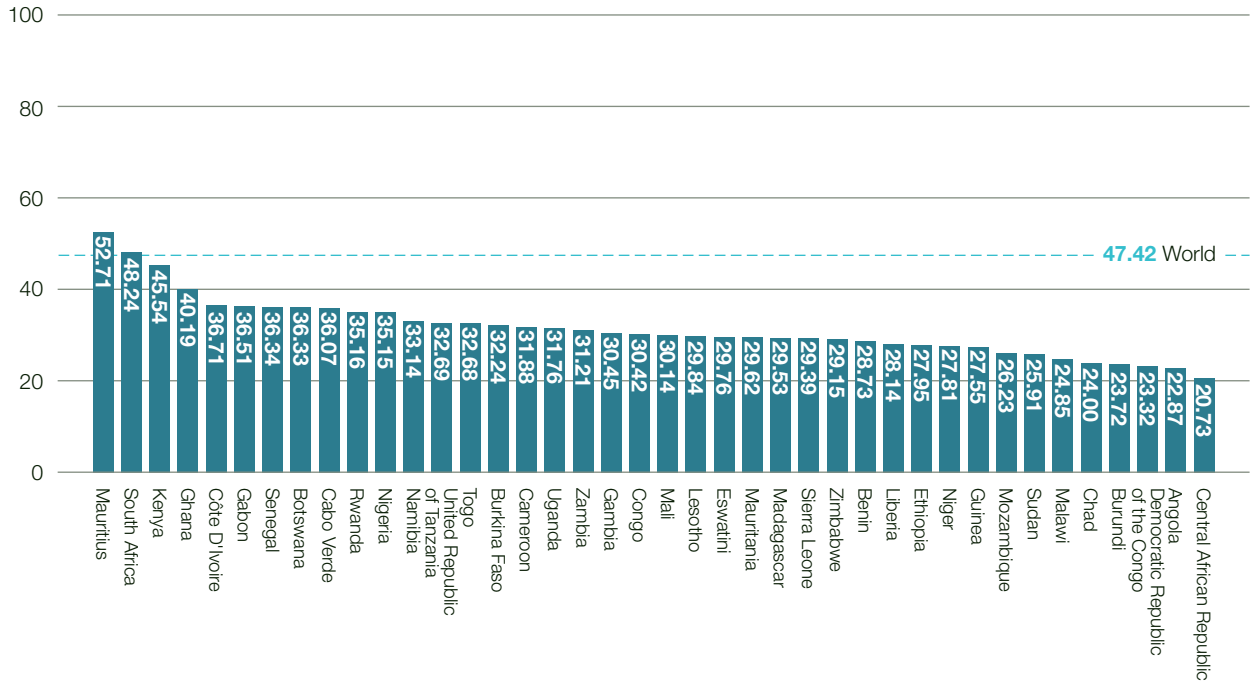
12 See the Networked Readiness Index 2021 (https://networkreadinessindex.org/), the Scimago Journal & Country Rank for AI (https://www.scimagojr.com/countryrank.php?category=1702&year=2020) and the Global Innovation Index 2021 (https://www.globalinnovationindex.org/analysis-indicator).

13 See indicator 6.2.3 in the Global Innovation Index 2021, https://www.globalinnovationindex.org/analysis-indicator

Sub-Saharan Africa

Sub-Saharan Africa



By Horlane Mbayo with Abdijabar Mohamed as interviewee and contributor

Summary

41 countries from the Sub-Saharan Africa region are represented in this year's Index. The region's average score is 31.61 out of 100, the lowest globally with many countries at the lower end of the ranking spectrum. Of particular note is the average score for the Data & Infrastructure pillar. At 39.36 out of 100 it is significantly lower than any other region, which all score above 50. This implies a lack of core infrastructure needed to support and establish an AI ecosystem.

Mauritius, with a score of 52.71, places first regionally and ranks 58th globally. It is not just the regional leader, but also remains the only country in the region with a national AI strategy. Our regional expert Abdijabar Mohamed pointed out that the five highest-ranked African countries, Mauritius, South Africa, Kenya, Ghana and Cabo Verde, are some of the most developed economies in sub-Saharan Africa, so their ranking is "not surprising". Mohamed also suggested that these countries have a stronger history of incorporating technology into their national economies, which naturally makes them better placed to adopt AI technologies.

Abdijabar Mohamed also indicated that sub-Saharan Africa might provide a unique methodological challenge. There is a paucity of official government data alongside a lack of robust governance structures and political conflict. Official data and structures feature heavily in our analysis, and so sub-Saharan Africa scores poorly. This, however, does not mean that citizens, in spite of any lack of structured government support, are not developing their own initiatives to ensure they are ready for AI. Political conflict, however, hampers the capacity to collect adequate data and generate strong roots for these kinds of initiatives. These methodological challenges presented by sub-Saharan Africa mean it is important we reflect some of the on-the-ground initiatives by citizens in our regional analysis.

Key Developments

Many of the countries above have begun enacting measures and strategies to guide the development and use of AI, Mohamed noted. Mauritius has developed an official National AI Strategy, which sets out a plan from 2018-2022 to guide progress in this area. Although South Africa is yet to launch a national AI strategy, it has established a Presidential Commission on Fourth Industrial Revolution. This is thought to be a prelude to an official national AI strategy, Abdijabar Mohamed suggested. Kenya has developed an AI taskforce (consisting of 11 experts from relevant government agencies, the private sector, academia and other stakeholders) to provide a roadmap for how AI technologies can be applied in the national context. These initiatives can be seen to indicate a move towards more structured governance around AI in the region.

It is not, however, just those countries that rank in the top 5 regionally that have made recent progress. In 2020, the Ethiopian Council of Ministers established an artificial intelligence (AI) research and development centre. Our regional expert indicated that it has also begun sharpening its cyber defence capabilities (by training young people to detect cyber threats through its Information Network Security Agency) after a spate of attacks. The Botswanan Vice President is leading an initiative encouraging organisations to set up research labs around the country and gather AI talent.

A feature of sub-Saharan African countries in the Index is that they scored lower than countries in other regions in the Data and Infrastructure Pillar. The COVID-19 pandemic has demonstrated the necessity of collecting, storing, and marshalling robust and representative data; the importance of data infrastructure has thus never been clearer. In this vein, developments are being made in the region. Rwanda has begun implementing digital health practices; of particular note are, of course, contact tracing apps which collect data on the progression of the virus. This illustrates an important facet of what it means for data to be 'representative' — an important feature of the Data & Infrastructure pillar. Most data collected in sub-Saharan Africa comes from urban centres, according to our regional expert, with little focus on rural areas. In the case of COVID-19, this makes accurately tracking spread outside of such areas difficult; more generally, though, it also affects the demographic spread of data samples — groups that populate urban centres are not identical to those in rural ones.

Our regional expert Abdijabar Mohamed speculated that youth engagement with AI infrastructure, despite a lack of structured government support, has the potential to be an important driver of progress in the region. Some examples of such initiatives that have been developed in spite of an unsympathetic political climate include:

- iRise Hub in Somalia
- Simad University's Institute of Innovation, Tech, & Entrepreneurship (IITE Institute) in Mogadishu, Somalia
- Cinolu
- Kivuhub
- Ingenious City

Looking Ahead

The main priority for many sub-Saharan African countries is narrowing the skills gap that exists; without those with the skills to implement it, a national AI strategy is impotent. Many countries in the region suffer from a dearth of AI specialists; our regional expert noted that there were no trained AI specialists in Ethiopia (except a few from the diaspora). In a similar vein, Rwanda has no more than 10 AI engineers, according to the Minister of State for Information Communications Technology. The main priority for many sub-Saharan African countries is thus to develop talent and build capacity. Only then can strategies be developed and implemented to guide AI readiness and ethical considerations of AI.

Kenya has recognised this as a problem and begun to implement solutions. The government has decided to change its educational curriculum to make it more technically oriented. They have done this by integrating computer science and AI training models at all levels of the education system. More governments must follow suit. They should "encourage initiatives in which AI practitioners, academics, policymakers and future talent can interact", Abdijabar Mohamed said. These can borrow from existing innovative forms of "trans-continental collaboration" such as Deep Learning Indaba, which is helping develop communities of AI researchers in Africa, and Zindi, a platform that challenges African data scientists to solve the continent's toughest challenges. These initiatives are "gaining ground, buoyed by the recent homecoming of several globally-trained African experts in AI", Mohamed told us.

Mohamed also suggested that lowering barriers to entry for tech companies within a country will be vital to ensuring there are strong hubs of AI excellence within the region. He gave the example of Rwanda which he believes is positioned to be a regional leader in the medium to long term given the government-level willingness to provide investment to help tech companies.

Mauritius

Index Score

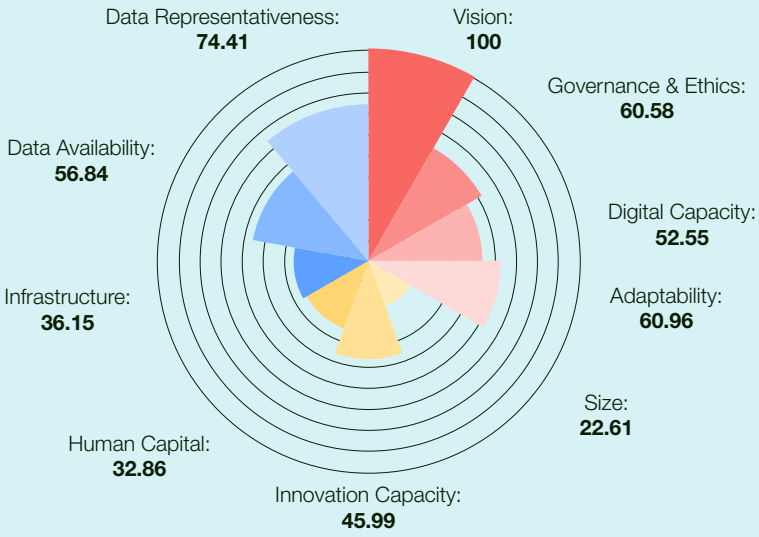
52.71/100

Rank

58/160

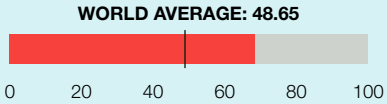
Regional Rank

1/41



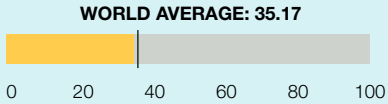
Government

Score	Rank	Region Rank
68.52/100	**38**/160	**1**/41



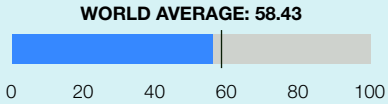
Technology Sector

Score	Rank	Region Rank
33.82/100	**73**/160	**3**/41



Data and Infrastructure

Score	Rank	Region Rank
55.80/100	**87**/160	**3**/41



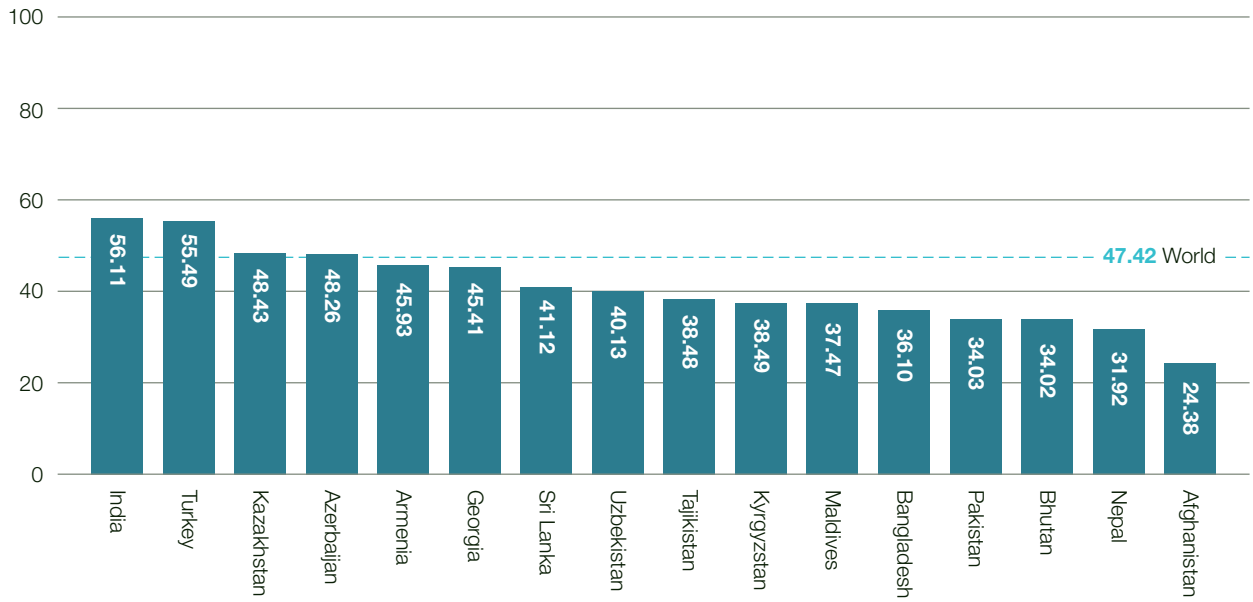
Mauritius is still the only country in Sub-Saharan Africa to have launched a national AI strategy. This includes an AI Council that advises the island nation's government on its AI ecosystem. Alongside this, Mauritius has the Digital Government Transformation Strategy 2018–2022, and the Digital Mauritius 2030 that are geared towards supporting Mauritius as a regional leader in ICT technologies and digital governance.

A major obstacle that exists in the region and impairs AI readiness is the "skills gap" that exists, Abdijabar Mohamed said. Mauritius, however, leads this area; our expert suggested they are at the forefront regionally with regards to nurturing potential AI talent. The country has the Human Resources Development Council (HRDC), which runs an AI skills development support programme in the capital city of Port Louis. This programme introduces students ranging "from pupils to industry executives" to the fundamentals of AI; it also helps students at undergraduate and postgraduate levels with scholarships for further, specialised training in AI.

Countries like South Africa and Kenya, which face talent shortages, should take a similar path to Mauritius and develop a human resource and development council, or platforms to train young learners and industry executives on how to develop and use AI skills.


South and
Central Asia

South and Central Asia



By Horlane Mbayo with Raj Shekhar as interviewee and contributor

Summary

This year's Government AI Readiness Index for South and Central Asia covers 16 countries. In 2021, the average score for South and Central Asia is 40.93, below the global average of 47.42. In the region, countries typically scored highest on the Data & Infrastructure pillar over the Government and Technology Sector pillars.

Both India and Turkey have recently passed the critical first stage of developing and releasing a national AI strategy, Raj Shekhar noted, defining their government's vision and comprehensive plan of action for AI adoption; unfortunately, they remain the only countries in this region to do so. This perhaps explains why they are regional leaders who score significantly higher than other countries; India, 50th in the global rankings, and the only country from the region in the top 50, continues to lead; Turkey follows closely behind with a difference of 0.7 points and ranks just two positions lower globally. Kazakhstan and Azerbaijan have retained their status as regional leaders, ranking third and fourth in the region, and Armenia has made it to the top 5 this year, having improved in both Technology and Data and Infrastructure pillars. Bhutan, Pakistan, Bangladesh, Nepal, and Afghanistan, are the five lowest ranking countries in the region. Crises and political turmoil have restricted their progress towards AI Readiness. From the crisis unfolding in Afghanistan post-US withdrawal, to the dissolution of the House of Representatives by Nepalese Prime Minister K.P. Oli in 2020, the political climate in the region does not foreground questions of AI.

India has maintained its position as a regional leader in AI. Our regional expert Raj Shekhar noted its "clearly defined" AI strategy, government and private-funded programs, and initiatives targeting data, technology, and human capital readiness for AI R&D. Turkey, too, shows promise in scaling up its AI readiness in the short and

medium terms. The country recently published its National AI Strategy with strategic priorities for the period 2021-2025. It focuses on bolstering the pillars of AI readiness, specifically in the areas of human capital, data, and technical infrastructure, entrepreneurship and innovation.

Key Developments

South and Central Asia's strongest performance remains in the Data and Infrastructure pillar, demonstrating existing capabilities to "expand and diversify the base of digitally literate internet users", Shekhar suggested. However, the low scores in the Technology Sector pillar across the region present an opportunity to develop an innovation ecosystem, by focusing on strengthening startups and innovation strategies.

In the last two decades, Raj Shekhar said, there has been a heavy emphasis in South and Central Asian governments on e-governance as a driver of the "efficient and transparent provisioning of public services" in the service of development. That said, the data and technology infrastructure needed for AI's deployment demands "significant government spending that may not be aligned with the immediate socio-economic developmental priorities of many countries in the region."

But the Indian government appears to see it as a priority, Shekhar emphasised. Working with various trade associations and industry bodies, they have launched an array of policies aimed at improving their AI readiness. For example, the FutureSkills Prime initiative is a portal focused on developing skills for emerging technologies, including artificial intelligence, in response to a perceived shortage in AI expertise. This is enhanced by public-private partnerships launching "Centres of Excellence" to offer training courses in AI and machine learning. Shekhar also noted the Ministry of Electronics & Information Technology's "ongoing efforts to understand and plug the gaps in India's open government data supply chain" via "the systematic curation and open sharing of AI-ready data to bolster domestic AI R&D and enterprise."

The COVID-19 pandemic has intensified the digitisation of the Indian economy, creating what Shekhar calls "an unprecedented surge in the data footprint of Indian residents, poised to be harnessed by AI developers." Specific developments in AI during the pandemic include the Centre of AI and Robotics, Defence Research and Development Organisation's developing an AI application called ATMAN AI for COVID detection using chest X-rays. The Government of India, in partnership with Accenture and Microsoft, launched MyGov Saathi: an AI chatbot to provide information about COVID-19.

Looking Ahead

Our regional expert Raj Shekhar said that the AI readiness priorities of the South and Central Asian region will be driven by its overall socio-economic development status. This is typically defined by its "primary reliance" on labour as a factor of production to meet "essential domestic needs and stay competitive in global markets," Shekhar suggested. The region also faces deeper challenges in "critical" sectors like energy, health, education, and finance than in more developed countries. Shekhar stressed that "the International Monetary Fund has predicted that AI-based business automation will likely exacerbate these challenges by widening the economic gap between developing (labour-intensive) and developed (capital-intensive) economies."

Given all of the above, it is imperative that countries take a more proactive stance towards drawing up best-fit strategies to increase their AI readiness. This would allow them to secure some of the gains associated with the sector, including the creation of jobs, the upskilling of tech employees, and intellectual property gains. Raj Shekhar noted that a potential avenue towards boosting AI readiness could be for countries to collaborate and build upon existing intra-regional partnerships. For example, India and Uzbekistan signed a Memorandum of Cooperation in which India provided credit to Uzbekistan to support its IT infrastructure and digital connectivity in 2020.

Also in India, the "long-pending resolution of regulatory uncertainty surrounding data protection" will have positive consequences for establishing ethical approaches to AI, Shekhar predicted. This was slated to be examined in the Indian parliament's 2021 Winter Session, with the establishment of a Data Protection Authority a possible consequence.

Shekhar also suggested that increasing diversity in terms of digitally literate citizens and Internet users should be a priority for South and Central Asia. Pakistan, for example, has low data representativeness due to unequal access to devices between men and women, which impacts the capacity of AI to be beneficial. Addressing this gap could help drive "myriad socio-economic developmental opportunities" based on digital goods and services, which, in turn, "would also critically contribute to the region's AI readiness."

Turkey

Index Score

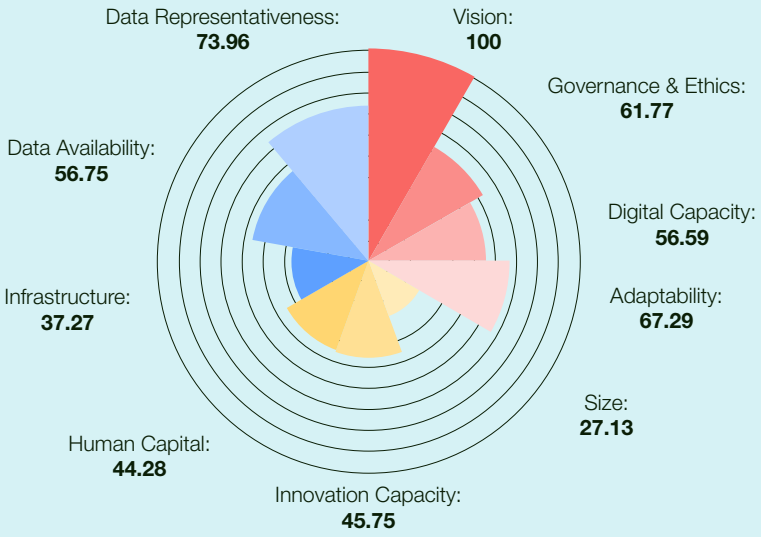
55.49/100

Rank

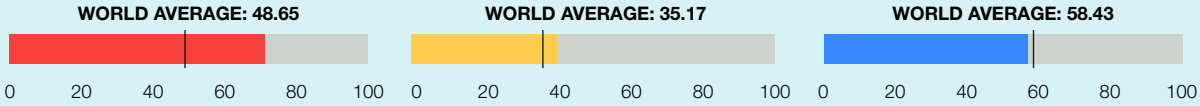
53/160

Regional Rank

2/16



Government			Technology Sector			Data and Infrastructure		
Score	**Rank**	**Region Rank**	**Score**	**Rank**	**Region Rank**	**Score**	**Rank**	**Region Rank**
71.41/100	**30**/160	**2**/16	**39.05**/100	**52**/160	**2**/16	**55.99**/100	**85**/160	**6**/16



Turkey ranks 2nd regionally, and 53rd globally. Its National Artificial Intelligence Strategy 2021-2025 sets out 6 national priorities, as well as the aim to establish a National Artificial Intelligence Strategy Steering Committee which will inform further AI policymaking on all things AI. The strategy's 6 priorities are:

1. Training AI experts and increasing employment in the sector;
2. Supporting research, entrepreneurship, and innovation;
3. Facilitating access to quality data and technical infrastructure;
4. Regulating to accelerate socioeconomic adaptation;
5. Strengthening international cooperation; and
6. Expediting structural and workforce transformation.

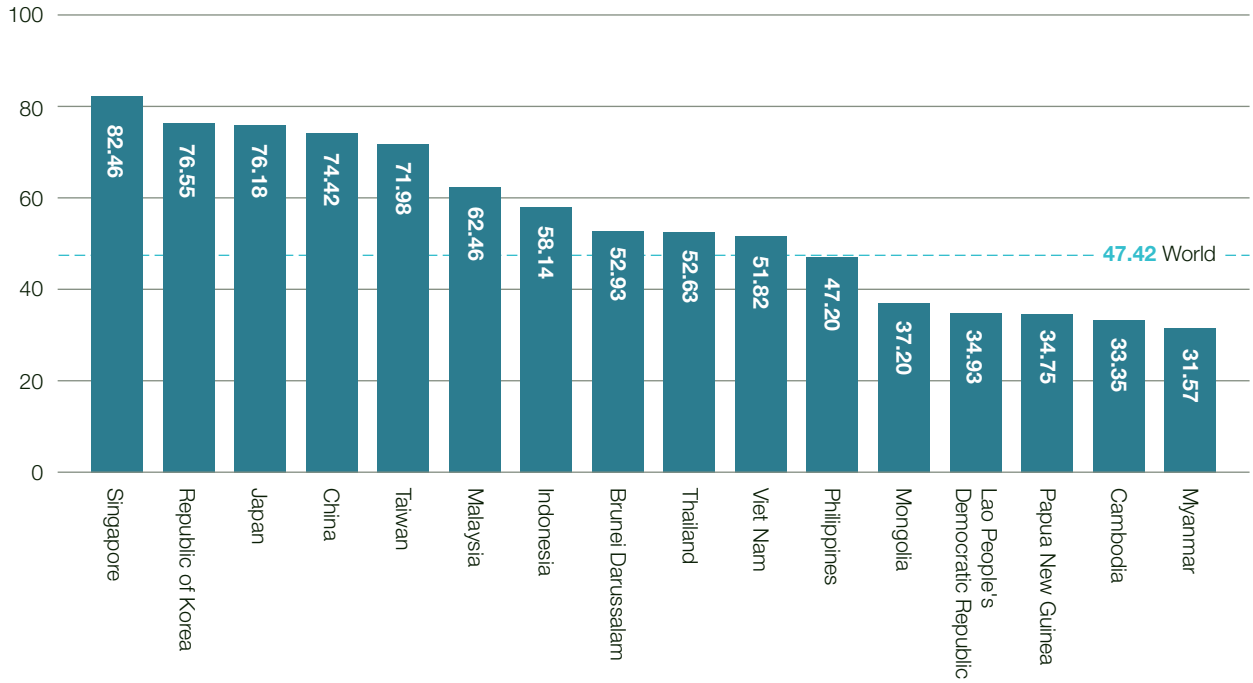
Turkey also hopes to increase AI's contribution to GDP to 5% and boost employment in the field of AI to 50,000 people, with specialists within central and local government institutions reaching 1,000 people.

The 2023 Industry and Technology Strategy of the Turkish Ministry of Industry and Technology further demonstrates Turkey's efforts to improve its AI readiness, Shekhar said. This focuses on:

- fostering a digital ecosystem for AI;
- enhancing investment in AI Research & Development, building AI talent;
- preparing domestic workforce for labour market transition;
- creating an enabling policy environment for AI; and
- international cooperation for trustworthy AI.

East Asia

East Asia



By Alejandra Finotto with Karthik Nachiappan as interviewee and contributor

Summary

East Asia deserves special attention this year: for the first time in our index, one quarter of the countries in the top 20 are in East Asia: Singapore (2nd), South Korea (10th), Japan (12th), China (15th) and Taiwan (18th). Apart from Taiwan, all these countries score significantly above the global average in both the Human Capital and Infrastructure dimensions, pointing to the region's global success in AI research and its advanced computing power.

Singapore is this year's protagonist, scoring 2nd in the overall index and being the top scoring country globally in the Government pillar (94.88). This reflects the country's Vision dimension score (it has a National AI Strategy), its commitment to addressing ethics in AI as shown in its Artificial Intelligence Governance Framework, and the government's strong score in the Digital Capacity dimension, which speaks to their commitment to building high-quality digital services and governmental support for new technologies. In fact, the country ranks 1st in the world in the *Government promotion of investment in emerging technologies* and *ICT use of government efficiency* indicators. The country also scores highly in the Data and Infrastructure pillar (with a score of 85.80 out of 100), which reflects, in part, Singapore's strong 5G infrastructure and high societal adoption of mobile technologies in the country.

Key Developments

Indonesia and Vietnam have both released national AI strategies in the time since our 2020 index was compiled, meaning that they both score the maximum in the Vision dimension this year. Indonesia's AI strategy focuses on health services, bureaucratic reform, education and research, food security, mobility, and smart cities. Vietnam's, meanwhile, sets out its ambitions to be amongst the top countries in the region for AI research, development, and application.

However, several countries, such as Myanmar (31.57), Cambodia (33.35), and Papua New Guinea (34.75), score below the global average in Government AI Readiness. Such countries are disadvantaged by the absence of national AI strategies, which affects their score in the Vision dimension, as well as their smaller technology sectors. In the latter case, these three countries score below 20 out of 100 in the Size dimension (within the Technology Sector pillar) compared to the region's leaders: China (61.42) and Singapore (50.94).

According to our regional expert, Karthik Nachiappan, COVID-19's impact has been critical in accelerating the digitalisation of services and data availability in the region, especially in the healthcare sector. For instance, countries such as Taiwan and Japan, which lead the Data Availability dimension in the region, established open data portals making COVID-19 data available for public use. There has also been a boom in healthcare-related innovation ranging from telehealth to remote patient analytics in countries such as Indonesia, Malaysia, and the Philippines. While it is hard to trace the effects of such developments on specific indicator scores in our index, it is feasible that they will trickle through to higher rankings in the private sector Innovation Capacity and government Digital Capacity dimensions in the future.

Other relevant developments in the region are focused in China. The country has released a new data privacy law that has been modelled after the European Union's GDPR and imposes restrictions on data collection and transfer. Companies in the region and globally will have to address this. Additionally, this year, Chinese researchers have produced more AI-related papers than any other nation, with the country having 27.68% of the global share of research papers in the field of AI and becoming the global lead in our *Research in AI papers* indicator, boosting its score in the Human Capital dimension.

Looking ahead

Karthik Nachiappan suggests the region's priorities in the near future should be: cybersecurity, stronger collaboration between governments and the private sector, and the development of stronger data governance models.

Across the region, many countries remain at imminent threat of cyberattacks. This will likely demand more investment in cybersecurity as government services become increasingly digitalised and social and economic interactions come to rely heavily on the consumption and generation of data. Nachiappan suggests firms and governments across the region will need to ensure they have sufficient backup and recovery solutions. This will ensure data is protected and fortify services and operations against severe disruption. Over time, one hopes that action here would increase countries' scores in the *Cybersecurity* indicator.

Secondly, Nachiappan argues that more communication and collaboration between governments and private companies is needed to help ease regulatory constraints (as governments develop a better understanding of companies' needs) and to increase R&D in the region. In turn, this has the potential to affect the scores in the Technology Sector pillar in the long-term. Furthermore, Nachiappan suggests that establishing AI centres within universities, with the support of tech companies, and creating links between research centres and firms more broadly, will cultivate AI talent in the region. Taiwan is a good example for other countries in East Asia, scoring 70.49 out of 100 in Innovation Capacity and having established an R&D framework based on co-innovation between Taiwanese and international companies.

Finally, Nachiappan suggests that a likely barrier to further regional development in AI readiness is the existence of a "litany of data governance models." These restrict the flow of data between countries, and impose "additional costs for data storage, data processing, data transfer, and analysis."[14] In turn, this makes it harder to develop and use AI-based products and services where they depend on accessing data from multiple jurisdictions.

14 Interview with Karthik Nachiappan, November 26, 2021.

Singapore

Index Score

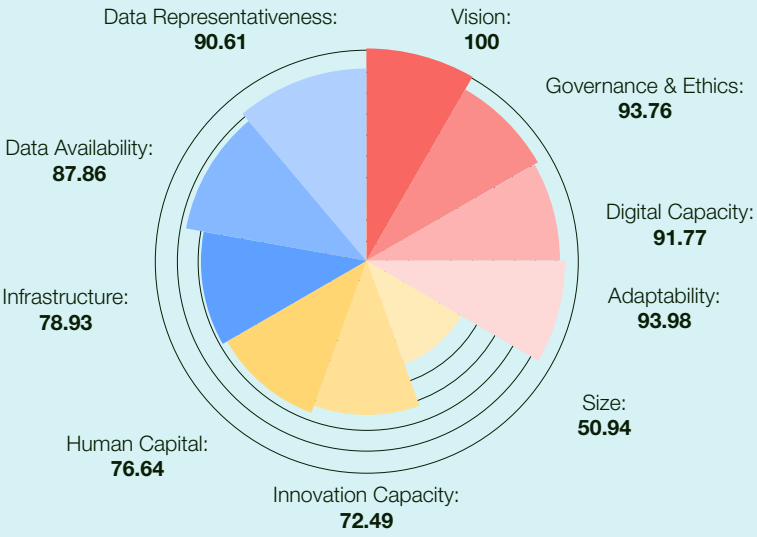
82.46/100

Rank

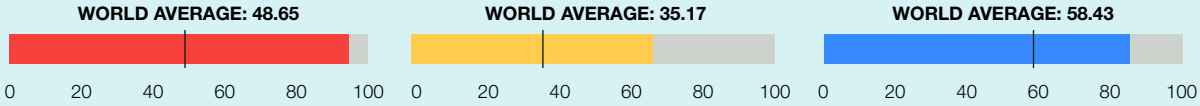
2/160

Regional Rank

1/16



Government			Technology Sector			Data and Infrastructure		
Score	**Rank**	**Region Rank**	**Score**	**Rank**	**Region Rank**	**Score**	**Rank**	**Region Rank**
94.88/100	**1**/160	**1**/16	**66.69**/100	**6**/160	**1**/16	**85.80**/100	**10**/160	**3**/16



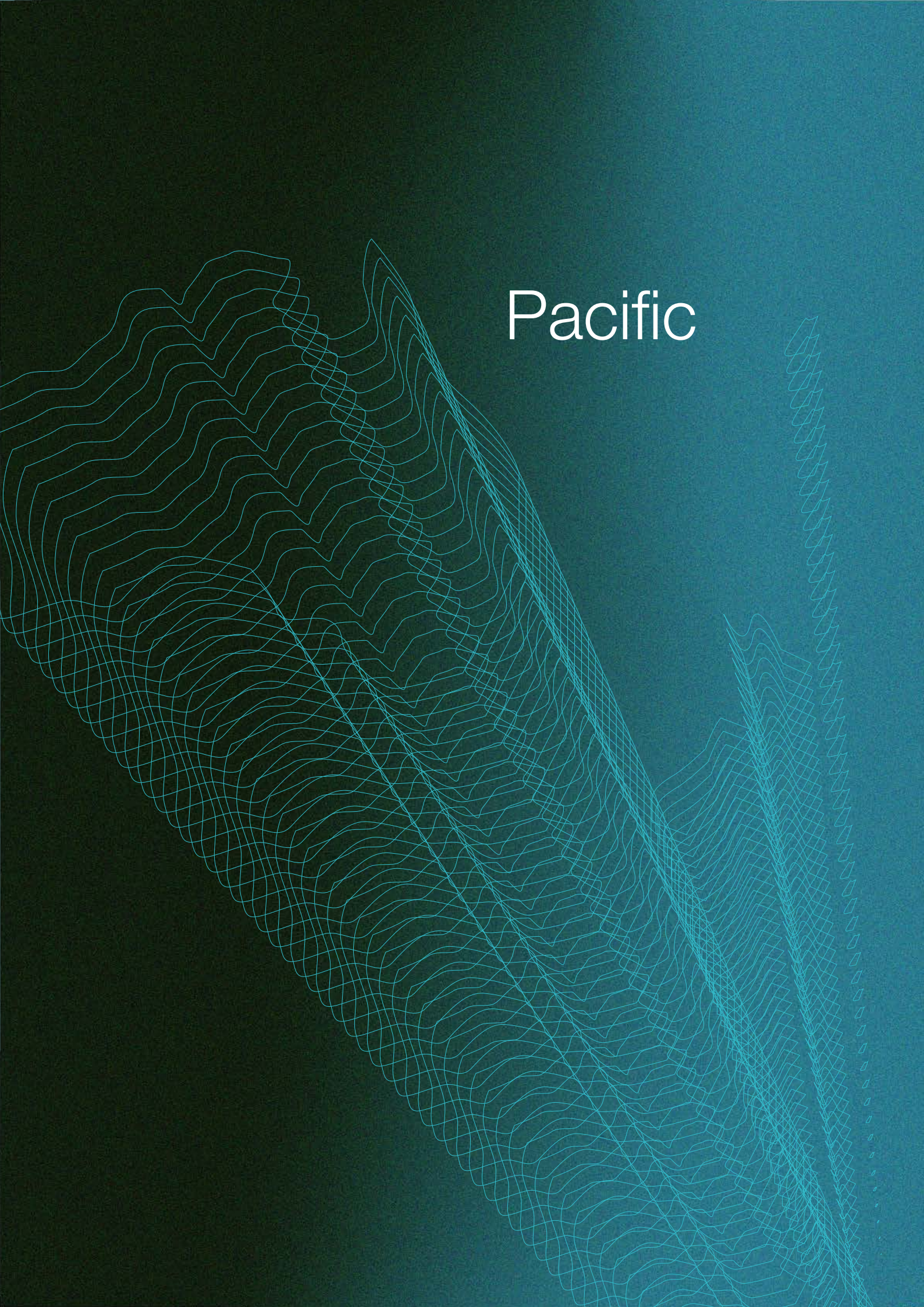
Singapore ranks first in the 2021 index's Government pillar, with a score of 94.8 out of 100. Their excellent performance across the pillar's dimensions (Vision, Governance and Ethics, Digital Capacity, and Adaptability) is arguably a consequence of the country's ambitious array of policies and initiatives that bolster its goal of becoming a "Smart Nation". These include the government's Digital Government Blueprint, which has the goal of digitising government services from end to end, closely integrating them with the needs of citizens and businesses. Furthermore, our regional expert Karthik Nachiappan argues that "the fundamental reason" that Singapore does well in most AI rankings is the strength of the relationship between the government and the private sector.

> *There's a deep institutionalized link between regulators and innovators, which other countries can emulate. COVID-19 has made those ties relevant and intimate.*[15]

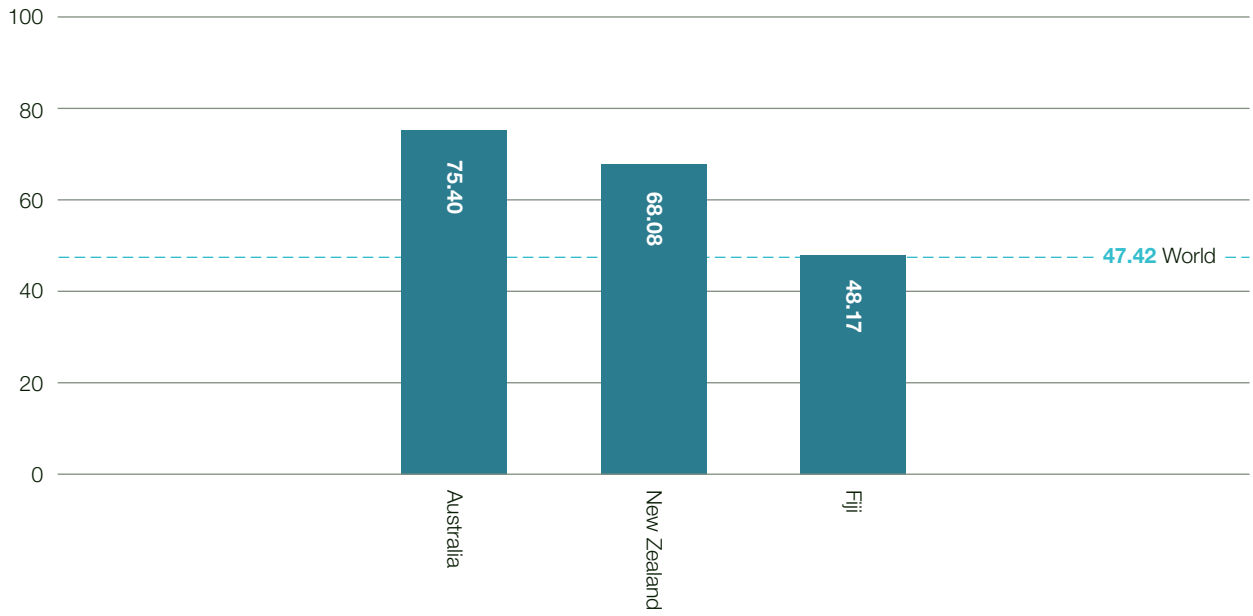
Initiatives such as CODEX - a shared digital platform between government agencies and private sectors to develop better, faster and more cost-effective digital services - exemplify this.

Outside the Government pillar, Singapore ranks 3rd in the world in the Human Capital dimension (within the Technology Sector pillar). Singapore has put in place different initiatives to boost the digital skills of its citizens, which have the potential to further improve its already high score. The government has also established AI centres and laboratories such as the Centre of Excellence for ICT and Smart Systems to raise the ICT capabilities and skills of public officers and government leaders, aiming to train 20,000 public officials in data science over the next five years. Moreover, the country is also focusing on attracting international businesses. Firms like Salesforce, Alibaba, Dyson, and DataRobot have recently established research centers in Singapore; it is likely that this will have the effect of nurturing a pool of local AI talents, with further positive consequences for Singapore's Human Capital dimension scores.

15 Interview with Karthik Nachiappan, November 26, 2021.


Pacific

Pacific



By Kate Iida with Yaseen Ladak as interviewee and contributor

Summary

The Pacific region, comprising the countries of Australia, New Zealand, and Fiji, scored the second highest globally this year at 63.89 out of 100, only falling behind North America. Australia leads the region, ranking 14th in the world, followed by New Zealand at 23rd. Fiji ranks lower, coming in at 69th.

At 83.79, Australia scores highly in the Government pillar, demonstrating their commitment to becoming a global leader in AI. They released multiple AI reports and strategies this year, including an AI Action Plan in June. Australia first launched their national AI strategy in 2018, allocating AU$29.9 million over four years to improve the country's efforts in AI and machine learning technologies. Though it does not impact Australia's index score directly, the 2021 AI Action Plan demonstrates a continuation and maturation of the Australian Government's commitment to and investment in developing AI. New Zealand scores lower in the Government pillar at 66.07, in part because they are still in the process of creating their national AI strategy. Both Australia and New Zealand score strongly in the Data & Infrastructure pillar, scoring above 85. Fiji's highest score among the three pillars is also in Data & Infrastructure, at 61.94.

The Technology Sector pillar is the weakest across all three countries. Australia and New Zealand both score below 60, and Fiji scores below 40. Regional expert Dr. Yaseen Ladak suggested that this may be because, despite the strength of universities in Australia and New Zealand, both countries face challenges in adapting academic findings to spur innovation in the public and private sectors.

Key Developments

Australia and New Zealand both show a commitment to improving digital inclusion, and they score highly in the Data Representativeness dimension at 95.70 and 96.12, respectively. It is interesting to note that both countries have started work this year to improve mobile networks in underserved areas: in Australia into the fire-prone regions on the fringe of major cities; and in New Zealand into rural areas to help relieve pressures on network capacity. New Zealand has also allocated NZ$5.7 million in their budget this year for a programme to support 5G in indigenous Maori communities. This could lead to improvements in the future in the *Telecommunications infrastructure* indicator for both countries.

Fiji scores 44.57 in the Government pillar, lower than Australia and New Zealand. This is in part due to their lack of a national AI strategy. It is interesting to note that this year's budget emphasises strengthening Fiji's digital infrastructure, and provides incentives for private investment to improve cable and internet connectivity. This might feed into improved scores in the Infrastructure and Data Availability dimensions in the future.

It is also interesting to note that Australia has demonstrated this year its commitment to responsible AI. In May 2021, the Australian Human Rights Commission released its Human Rights and Technology Final Report which focused heavily on AI ethics. It offered recommendations for the protection of human rights in the creation and use of AI, including calls for stronger community protections for AI technologies used in policing, social security, and banking. The report also called for the creation of an AI Safety Commissioner. It further proposed a moratorium on AI used in facial recognition software and halting the use of 'black box' or opaque algorithmic decision making. In February 2021, Australia's Department of Defence also published a report which detailed a series of recommendations to assist in the ethical use of AI in defence.

Impact of COVID-19

Across the region, the pandemic has spurred a desire to invest in technological innovation. Regional expert Dr. Ladak expects "to see a very significant role of AI in management of healthcare as a result of the pandemic effects." He said the technology sector was particularly affected by the pandemic because both Australia and New Zealand have invested significantly in health tech throughout the crisis. New Zealand's 2021 budget includes a NZ $170 million package to support digital transformation in the health sector. As part of this plan, the government has promised to strengthen Hira, New Zealand's national health information platform. Australia is also working to improve and expand on its digital health services, and has a plan in place to improve their national MyHealth Record online system with added support for COVID-19 testing and vaccinations. Australia has also allocated funding to improve telehealth and other virtual healthcare initiatives. Though we cannot yet track the impact of this in any of the indicators, this investment could feasibly impact indicators, such as *Online services,* that relate to the effectiveness and quality of public sector digital services.

Looking Ahead

In May 2021, representatives from government, industry and academia met for the Aotearoa AI Summit to begin work on New Zealand's national AI strategy. New Zealand now scores 50 out of 100 in the *National AI strategy* indicator, reflecting this preparatory government work. The summit sought a coordinated approach for the adoption and use of AI in New Zealand. Though the strategy has not yet been published, the government released its six cornerstones. They emphasise:

- a uniquely New Zealand approach to AI based on diversity and inclusion;
- human-centered, ethical and trustworthy AI;
- investment in the AI economy;
- developing a skilled workforce;
- using AI in collaboration with other nations to confront global challenges; and,
- enabling the governance and infrastructural foundations to create a strong core for the development of AI.

Australia

Index Score

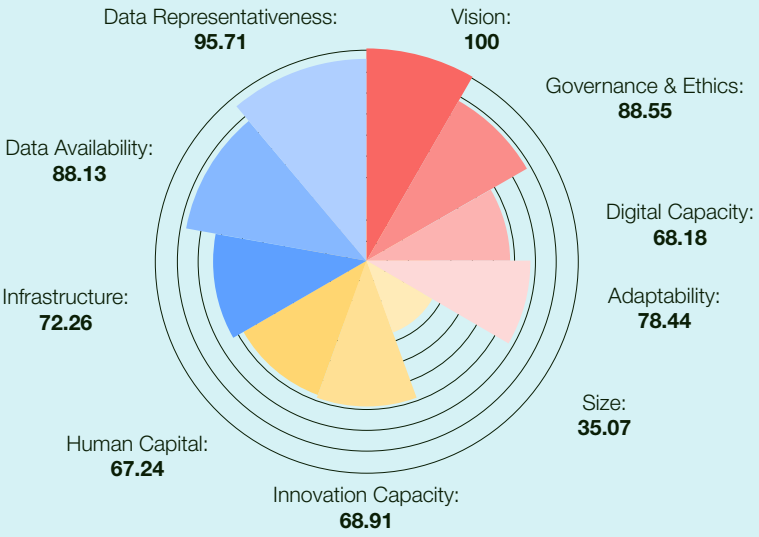
75.41/100

Rank

14/160

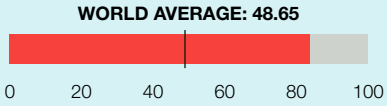
Regional Rank

1/3



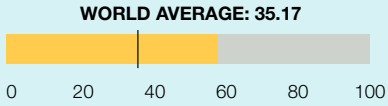
Government

Score	Rank	Region Rank
83.79/100	**8**/160	**1**/3



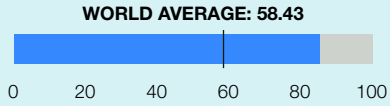
Technology Sector

Score	Rank	Region Rank
57.07/100	**21**/160	**1**/3



Data and Infrastructure

Score	Rank	Region Rank
85.37/100	**13**/160	**1**/3



In June 2021, Australia launched their AI Action Plan. It is a clear example of the government's commitment to investing in AI. The action plan focused on four key goals:

- developing and using AI in businesses;
- growing the country's expertise in AI;
- using AI to solve national challenges; and
- prioritising the use of AI responsibly and ethically.

Australia allocated AU$124.1 million to bring the plan to fruition. Australia currently scores 51.41 in the *Government promotion of investment in emerging technologies* indicator.[16] Australia's investment in AI this year may help to improve perception of their investment in this area, and consequently their score in this indicator in the future.

Australia is clearly prioritising the growth and development of a skilled and experienced AI workforce. Australia struggles in the Human Capital dimension, and seems to be working to address this relative weakness. At 43.07, Australia scores surprisingly low in the *Graduates in STEM* indicator. This score is 10 to 20 points below those of the comparable highly developed democracies New Zealand, Canada, and the UK. This year, Australia allocated AU$53.8 million over four years for the creation of a National Artificial Intelligence Centre, and also plans to launch several AI and Digital Capability centres. The Next Generation AI Graduates program will receive AU$24.7 million over six years and further funds went specifically to programs to support women in STEM.

The government also allocated AU $33.7 million over four years to support Australian businesses to partner with the government. In these partnerships, government and businesses will develop pilot projects to use AI to solve national challenges. The budget further provides AU$12 million over five years to co-fund 36 competitive grants for businesses proposing AI-based solutions for local or regional challenges. Australia scores 65.76 in the *Company investment in emerging technologies* indicator, and Australia has shown this year that it is incentivising the adoption and use of AI in the private sector. Based on these incentives, this score may potentially increase in the future.

16 This indicator is based on the results of the World Economic Forum's Executive Opinion Survey 2018-19. See https://networkreadinessindex.org/wp-content/uploads/reports/nri_2021.pdf p.235.

Annex I: Global Ranking

Global Position	Country	Overall Score	Government	Technology Sector	Data and Infrastructure
1	United States of America	88.16	88.46	83.31	92.71
2	Singapore	82.46	94.88	66.69	85.80
3	United Kingdom	81.25	85.69	67.26	90.81
4	Finland	79.23	88.45	63.85	85.40
5	Netherlands	78.51	80.42	66.17	88.92
6	Sweden	78.16	80.76	67.37	86.36
7	Canada	77.73	84.36	63.75	85.08
8	Germany	77.26	78.04	67.68	86.07
9	Denmark	76.96	83.50	63.24	84.14
10	Republic of Korea	76.55	85.27	58.49	85.89
11	France	76.41	82.10	60.61	86.53
12	Japan	76.18	81.90	59.31	87.32
13	Norway	76.14	84.24	59.25	84.91
14	Australia	75.41	83.79	57.07	85.37
15	China	74.42	83.79	61.33	78.15
16	Luxembourg	73.37	82.67	50.66	86.80
17	Ireland	72.80	74.70	61.11	82.59
18	Taiwan	71.98	77.59	59.42	78.92

Global Position	Country	Overall Score	Government	Technology Sector	Data and Infrastructure
19	United Arab Emirates	71.60	79.41	53.33	82.05
20	Israel	70.01	64.64	65.87	79.52
21	Estonia	69.18	77.65	49.46	80.45
22	Switzerland	68.56	52.30	67.60	85.79
23	New Zealand	68.08	66.07	53.16	85.02
24	Austria	68.07	63.09	58.54	82.59
25	Spain	67.68	71.87	49.84	81.32
26	Qatar	67.18	79.56	43.02	78.96
27	Italy	67.07	72.75	48.19	80.28
28	Belgium	66.16	59.07	58.54	80.89
29	Czech Republic	65.95	68.98	50.56	78.32
30	Lithuania	65.19	72.79	44.27	78.50
31	Slovenia	65.05	70.10	45.48	79.58
32	Malta	64.85	83.62	41.52	69.41
33	Portugal	64.31	74.64	50.42	67.87
34	Saudi Arabia	63.42	67.23	45.14	77.89
35	Poland	62.50	67.27	42.82	77.42
36	Malaysia	62.46	68.37	52.67	66.34
37	Latvia	62.27	68.74	41.45	76.60
38	Russian Federation	61.93	67.44	46.46	71.90
39	Slovakia	61.62	67.59	41.39	75.89
40	Brazil	60.64	65.04	42.70	74.16

Global Position	Country	Overall Score	Government	Technology Sector	Data and Infrastructure
41	Chile	60.42	69.99	42.14	69.13
42	Bulgaria	60.07	67.03	39.19	73.97
43	Hungary	59.72	68.09	41.65	69.40
44	Cyprus	59.71	69.46	37.99	71.70
45	Colombia	58.91	73.03	34.66	69.04
46	Iceland	58.53	49.97	50.73	74.87
47	Indonesia	58.14	73.05	40.96	60.40
48	Uruguay	57.93	69.48	31.63	72.67
49	Oman	57.26	63.01	34.99	73.77
50	Greece	56.22	52.54	43.34	72.79
51	India	56.11	73.26	48.04	47.02
52	Serbia	55.98	68.15	36.35	63.42
53	Turkey	55.49	71.41	39.05	55.99
54	Argentina	54.36	64.86	33.62	64.59
55	Bahrain	53.54	51.46	31.54	77.62
56	Romania	53.22	52.09	37.50	70.09
57	Brunei Darussalam	52.93	41.05	43.50	74.23
58	Mauritius	52.71	68.52	33.82	55.80
59	Thailand	52.63	45.45	41.22	71.21
60	Mexico	52.62	54.70	40.22	62.94
61	Croatia	52.30	48.70	36.48	71.71
62	Viet Nam	51.82	70.81	32.78	51.87

Global Position	Country	Overall Score	Government	Technology Sector	Data and Infrastructure
63	Kuwait	50.97	46.53	34.37	71.99
64	Ukraine	50.58	52.36	38.19	61.19
65	Egypt	49.75	62.72	35.17	51.37
66	Kazakhstan	48.43	48.80	32.38	64.10
67	Azerbaijan	48.26	50.60	33.86	60.34
68	South Africa	48.24	40.92	39.14	64.66
69	Fiji	48.17	44.57	37.99	61.94
70	Seychelles	47.48	41.28	33.82	67.33
71	Philippines	47.20	41.97	37.20	62.44
72	Iran	46.23	36.42	35.20	67.06
73	Belarus	46.20	39.89	34.30	64.40
74	Costa Rica	46.19	40.64	34.57	63.36
75	Montenegro	46.10	40.71	34.61	62.96
76	Armenia	45.93	43.10	31.14	63.53
77	Tunisia	45.71	50.22	36.31	50.61
78	Kenya	45.54	57.15	28.75	50.72
79	Georgia	45.41	44.20	29.22	62.83
80	Jordan	44.38	38.26	38.31	56.56
81	North Macedonia	43.73	40.79	31.08	59.31
82	Panama	42.98	38.25	29.97	60.73
83	Albania	42.90	41.47	28.54	58.69
84	Morocco	42.38	42.13	31.74	53.27
85	Barbados	42.20	35.39	31.06	60.14

Global Position	Country	Overall Score	Government	Technology Sector	Data and Infrastructure
86	Republic of Moldova	41.71	40.03	29.80	55.29
87	Jamaica	41.50	36.76	31.68	56.06
88	Sri Lanka	41.12	34.84	32.54	55.97
89	Dominican Republic	40.89	41.25	24.57	56.84
90	Trinidad and Tobago	40.78	34.63	28.78	58.92
91	Peru	40.56	38.24	29.52	53.90
92	Ghana	40.19	41.78	24.75	54.05
93	Uzbekistan	40.13	37.95	31.32	51.13
94	Lebanon	39.67	38.23	33.47	47.30
95	Ecuador	39.19	35.42	26.12	56.03
96	Bosnia and Herzegovina	38.67	31.05	27.10	57.87
97	Suriname	38.58	24.97	26.62	64.16
98	Tajikistan	38.49	35.85	26.29	53.31
99	Algeria	37.92	32.96	29.57	51.24
100	Kyrgyzstan	37.61	35.16	23.62	54.04
101	Maldives	37.47	29.59	16.08	66.73
102	Paraguay	37.35	35.32	22.45	54.27
103	Mongolia	37.20	33.45	27.24	50.90
104	Iraq	36.93	25.51	31.27	54.02
105	Côte D'Ivoire	36.71	38.73	22.29	49.10
106	Saint Lucia	36.61	28.22	27.53	54.08

Global Position	Country	Overall Score	Government	Technology Sector	Data and Infrastructure
107	Gabon	36.51	32.40	26.50	50.62
108	Senegal	36.34	39.47	28.31	41.23
109	Botswana	36.33	36.27	28.18	44.53
110	Bangladesh	36.10	40.21	25.10	42.99
111	Cabo Verde	36.07	36.46	23.35	48.40
112	Rwanda	35.16	44.44	27.03	34.01
113	Nigeria	35.15	35.53	26.32	43.61
114	Lao People's Democratic Republic	34.93	29.22	24.69	50.88
115	Honduras	34.91	30.65	25.58	48.51
116	Papua New Guinea	34.75	35.50	27.83	40.93
117	Pakistan	34.03	39.58	35.00	27.50
118	Bhutan	34.02	36.52	26.15	39.40
119	Cambodia	33.35	32.66	22.53	44.87
120	Namibia	33.14	30.49	22.97	45.95
121	United Republic of Tanzania	32.69	39.90	22.99	35.18
122	Togo	32.68	32.67	20.71	44.65
123	El Salvador	32.41	26.16	23.69	47.39
124	Belize	32.28	27.97	22.57	46.29
125	Guatemala	32.25	24.30	23.28	49.18
126	Burkina Faso	32.24	35.71	21.31	39.71
127	Nepal	31.92	33.28	24.47	38.03

Global Position	Country	Overall Score	Government	Technology Sector	Data and Infrastructure
128	Cameroon	31.88	34.58	23.77	37.30
129	Uganda	31.76	35.97	22.20	37.11
130	Bolivia	31.62	23.50	21.49	49.87
131	Nicaragua	31.57	30.41	22.45	41.86
132	Myanmar	31.57	24.80	27.54	42.36
133	Zambia	31.21	35.08	21.93	36.63
134	Venezuela	30.54	18.77	22.44	50.40
135	Gambia	30.45	28.73	20.29	42.34
136	Congo	30.42	30.49	20.97	39.80
137	Cuba	30.38	20.75	29.67	40.71
138	Mali	30.14	31.81	22.00	36.61
139	Lesotho	29.84	23.26	20.78	45.49
140	Eswatini	29.76	28.59	21.53	39.16
141	Mauritania	29.62	25.74	21.54	41.59
142	Madagascar	29.53	31.16	20.44	36.99
143	Sierra Leone	29.39	32.59	19.65	35.93
144	Zimbabwe	29.15	26.45	22.28	38.71
145	Benin	28.73	34.76	21.61	29.82
146	Liberia	28.14	31.72	19.72	32.97
147	Ethiopia	27.95	34.65	20.57	28.62
148	Niger	27.81	33.31	20.09	30.03
149	Guinea	27.55	27.78	22.22	32.65
150	Mozambique	26.23	32.28	17.60	28.83

Global Position	Country	Overall Score	Government	Technology Sector	Data and Infrastructure
151	Sudan	25.91	24.83	21.62	31.29
152	Haiti	25.14	24.24	14.67	36.49
153	Malawi	24.85	28.57	18.43	27.55
154	Afghanistan	24.38	25.67	9.23	38.23
155	Chad	24.00	27.58	14.41	30.02
156	Burundi	23.72	28.40	19.06	23.70
157	Democratic Republic of the Congo	23.32	27.46	16.72	25.79
158	Angola	22.87	27.30	13.86	27.44
159	Central African Republic	20.73	15.01	19.21	27.98
160	Yemen	17.93	15.85	17.91	20.03

Annex II: Methodology Government AI Readiness Index 2021

Summary

As in 2020, the Government AI Readiness Index starts from the exam question: **How ready is a given government to implement AI in the delivery of public services to their citizens?**

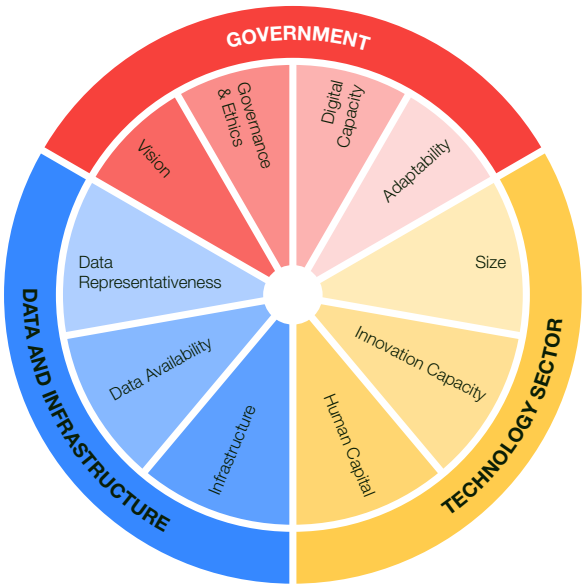
To answer this question, we have developed three hypotheses about government AI readiness, which correspond to the three pillars in our framework: Government; Technology Sector; and Data and Infrastructure.

The Government pillar
A government should have a strategic **vision** for how it develops and manages AI, supported by appropriate regulation and attention to ethical problems (**governance & ethics**). Moreover, it needs to have strong internal **digital capacity**, including the skills and practices that support its **adaptability** in the face of new technologies.

The Technology Sector pillar
A government depends on a good supply of AI tools from the country's technology sector, which needs to be competitive and dynamic (**size**). The sector should have high **innovation capacity**, underpinned by a business environment that supports entrepreneurship and a good flow of R&D spending. The skills and education of the people working in this sector are also crucial (**human capital**).

The Data and Infrastructure pillar
AI tools need lots of high-quality data (**data availability**) which, to avoid bias and error, should also be representative of the citizens in a given country (**data representativeness**). Finally, this data's potential cannot be realised without the **infrastructure** necessary to power AI tools and deliver them to citizens.

Thus, the 2021 index measures 10 dimensions across these three pillars, as summarised by the diagram below.



Dimensions and indicators

The table below summarises the dimensions and indicators used in the 2021 index.[17]

Government pillar

Dimension	Description	Indicator	Source
Vision	Does the government have a vision for implementing AI?	**National AI strategy (Y/N)**	Desk research (e.g. OECD AI Policy Observatory, Future of Life Institute)
Governance and Ethics	Are there the right regulations and ethical frameworks in place to implement AI in a way that builds trust and legitimacy?	**Data protection and privacy legislation**	UN data protection and privacy legislation worldwide.
		Cybersecurity	Global Cybersecurity Index
		National ethics framework (Y/N)[18]	Desk research (e.g. AI Ethics Lab Toolbox, STIP OECD Compass)
		Legal framework's adaptability to digital business models	Global Competitiveness Index
Digital Capacity	What is the existing digital capacity within government?	**Government promotion of investment in emerging technologies**	Networked Readiness Index 2021
		ICT use and government efficiency	Networked Readiness Index 2019
		Online services	UN e-Government Survey
		Trust in Government websites and apps	EIU Inclusive Internet Index
Adaptability	Can the government change and innovate effectively?	**Effectiveness of government**	World Bank
		Government's responsiveness to change	Global Competitiveness Index
		E-procurement capacity	Govtech Maturity Index

17 Collected pillar, dimension and indicator scores can also be found here.

18 Frameworks were counted where they were issued by a government or government agency (as opposed to an intergovernmental organisation, NGO or private company).

Technology Sector pillar

Dimension	Description	Indicator	Source
Size	How large is the technology sector that will supply governments with AI technologies?	**Number of AI unicorns**	CB Insights
		Number of non-AI technology unicorns	CB Insights
		Market value of public technology companies	Forbes Global 2000
		Value of trade in ICT services (per capita)	UNCTAD
		Value of trade in ICT goods (per capita)	UNCTAD
		Computer software spending	Global Innovation Index
Innovation Capacity	Does the technology sector have the right conditions to support innovation?	**Entrepreneurial culture**	Global Competitiveness Index
		Business administrative requirements	Global Competitiveness Index
		R&D spending	UNESCO
		Company investment in emerging technologies	Networked Readiness Index 2021
Human Capital	Are there the right skills in the population to support the technology sector?	**Graduates in STEM**	UNESCO
		Quality of engineering and technology higher education	QS Engineering & Technology rankings
		Digital skills	Global Competitiveness Index
		Github commits	Networked Readiness Index 2021
		Knowledge-intensive employment	Global Innovation Index
		Research papers published in AI	Scimago

Data and Infrastructure pillar

Dimension	Description	Indicator	Source
Infrastructure	Does the country have a good technological infrastructure to support AI technologies?	**Telecommunications infrastructure**	UN e-Government Survey
		5G infrastructure	VIAVI Solutions
		Number of supercomputers	Top500
		Internet bandwidth	ITU
		Adoption of emerging technologies	Networked Readiness Index 2021
Data Availability	Is there good availability of data that could be used to train AI models?	**Open government data**	Open Data Barometer
		Open data policies	EIU Inclusive Internet Index
		Statistical capacity	World Bank
		Mobile-cellular telephone subscriptions	ITU
		Households with Internet access at home	ITU
Data Repre-sentativeness	Is the data available likely to be representative of the population as a whole?	**Gender gap in Internet access**	EIU Inclusive Internet Index
		Gender gap in mobile access	EIU Inclusive Internet Index
		Cost of internet-enabled device relative to GDP per capita	GSMA Mobile Connectivity Index
		Socioeconomic gap in Internet usage	Global Findex Database

Missing Values

Only countries with values for **more than 50% of indicators** are included in the final index.

Peer Group Mean Imputation

For the majority of indicators with some data missing, we imputed the value of the peer group mean for each country (where peer group is their geographical region plus their World Bank income group).

For 2 countries, imputation of peer group means was not possible as they were the only country in their peer group. These countries were:

- Yemen
- Maldives

For these countries, no imputation was attempted where values were missing.

Linear Regression Estimation

The indicator *Statistical capacity* uses data from the World Bank that only covers developing nations. Consequently, for higher income countries, using peer group mean imputation was not an option. Therefore, to impute values for this indicator, we used a multiple regression model. The dependent variables were the values for the indicators *Online Services* and *Effectiveness of government*. The R^2 for this model was 0.4851. The p-values are given below.

Online service	2.4226×10^{-6}
Effectiveness of government	1.2704×10^{-3}

Calculating Scores

Normalisation

All scores were normalised to be between 0 and 100. The formula for normalisation was as follows:

$$\frac{x - x_{min}}{x_{max} - x_{min}}$$

For all indicators except *Effectiveness of government* (where x_{min} = -2.5), the value of x_{min} was set to 0.x_{max} was either the maximum possible value (in the case of data from other indices e.g. the Global Competitiveness Index), or the maximum observed value. The one exception was for the *Mobile-cellular telephone subscriptions* where we set the maximum value to 130 (i.e. above 130 subscriptions per 100 mobile-cellular telephones are sufficiently widespread to warrant a score of 100, and values any higher would not represent a significant improvement).

Treatment of Skewed Indicators

12 indicators were identified as skewed (either (a) absolute skewness > 2.0 *and* kurtosis > 3.5 or (b) kurtosis > 10). These were:

- Data protection and privacy legislation
- National Ethics framework
- E-procurement capacity
- Number of AI unicorns
- Number of non-AI technology unicorns
- Market value of tech public
- Value of ICT goods trade
- Value of ICT services trade
- R&D spending
- Supercomputers
- Research papers
- Internet bandwidth

As *Data protection and privacy legislation*, *National ethics framework* and *E-procurement capacity* are discrete indicators, these were left untreated.

The indicators *Number of AI unicorns, Number of non-AI technology unicorns* and *Market value of public technology companies* all have large numbers of countries scoring 0 for having no technology unicorns or no public technology companies featured in the Forbes Global 2000. We were therefore willing to tolerate a higher degree of skewness in these indicators. However, looking purely at the countries with a value of > 0 in these indicators, kurtosis was still > 10, so we still felt the need to treat them in some way.

The five skewed indicators were treated using the logarithmic transformation For indicators other than *Number of AI unicorns*, *Number of non-AI technology unicorns*, *Market value of public technology companies*, and *Supercomputers* this brought skewness and kurtosis down to acceptable levels. For the other two indicators, skewness and kurtosis in the subset of countries with values > 0 was brought down to acceptable levels, even if skewness and kurtosis were still higher in the indicator overall.

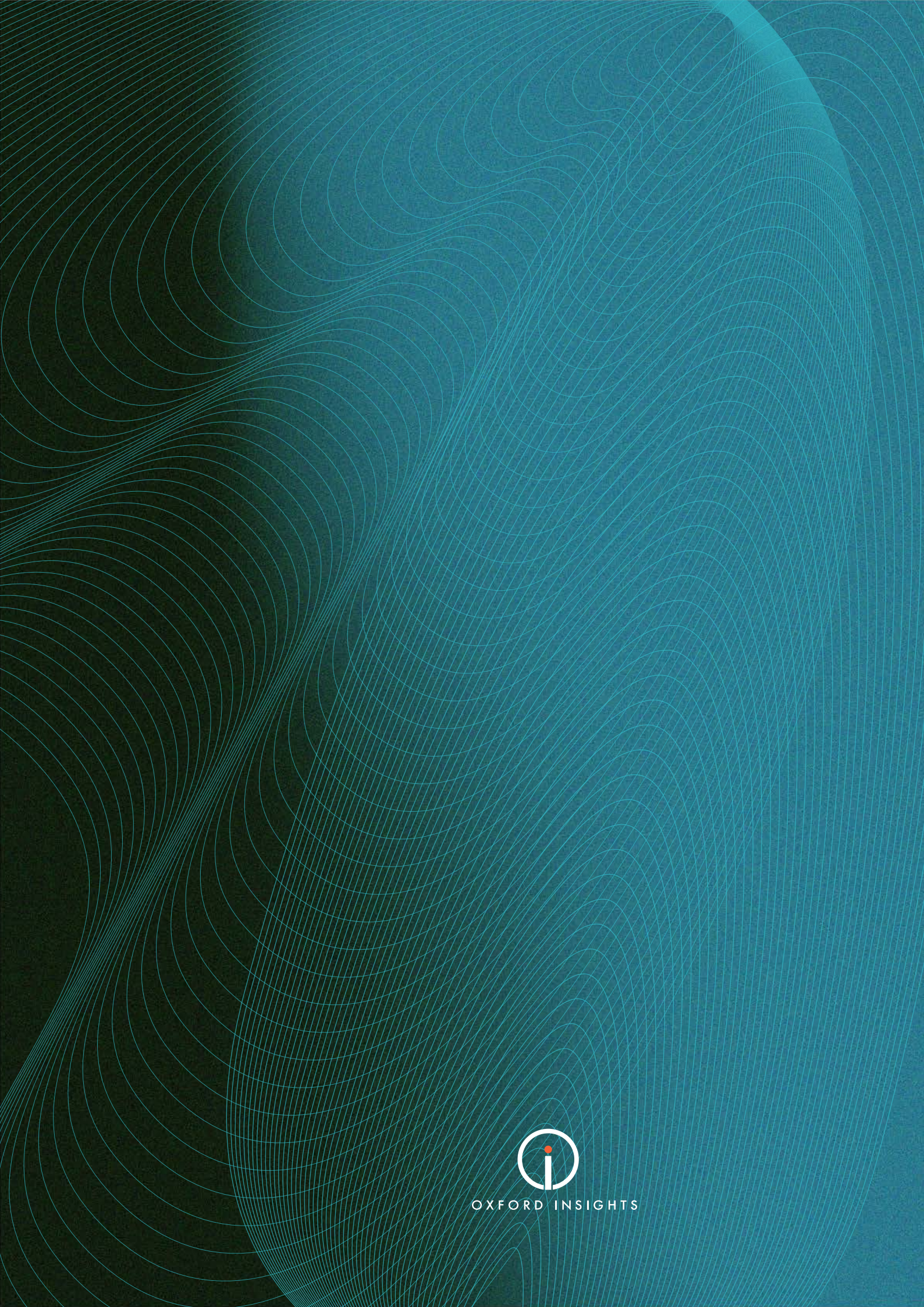
Following the logarithmic transformation, the indicators were normalised as above.

Total Score

To calculate the total score, we took the arithmetic mean of the indicators within each dimension. Then we took the arithmetic mean of each pillar. The final score is the arithmetic mean of the three pillars. All indicators, dimensions and pillars were weighted equally.

For any methodological or data-related questions, please feel free to contact info@oxfordinsights.com.

Government AI Readiness Index **2021**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