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Pushing forward:

**the future of AI in the Middle East
and North Africa**

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About this report

Pushing forward: the future of artificial intelligence in the Middle East and North Africa is a report written by Economist Impact and supported by Google. The report's findings are based on a programme of in-depth interviews with experts alongside desk research. Economist Impact would like to thank all participants for their time and insights, including the following interviewees and panellists (in alphabetical order):

Abdullah Amiri, founder, chief executive officer and chief scientific officer, Maverick Consulting Network

Fadi Salem, director of policy research and advisory, Mohammed bin Rashid School of Government | Artificial intelligence ethics advisory board member, Smart Dubai

Golestan Radwan, artificial intelligence adviser to the minister, Ministry of Communications and Information Technology, Egypt

Paul Morris, chief digital officer, AlShaya Group

Rizwan Rajpoot, group chief digital officer, L'azurde Company for Jewelry

Ronnie Varghese, vice president, Digital Product, Seera Group

Sachin Gadoya, co-founder and managing director, Musafir

Suhail Kadri, senior vice president, Hamad International Airport

The participants from our internal panel include:

Benedict Craven, principal economist, Middle East and Africa, The Economist Intelligence Unit

Dexter Thillien, technology and telecoms lead analyst, The Economist Intelligence Unit

Ed Dehnert, senior analyst, Economist Impact

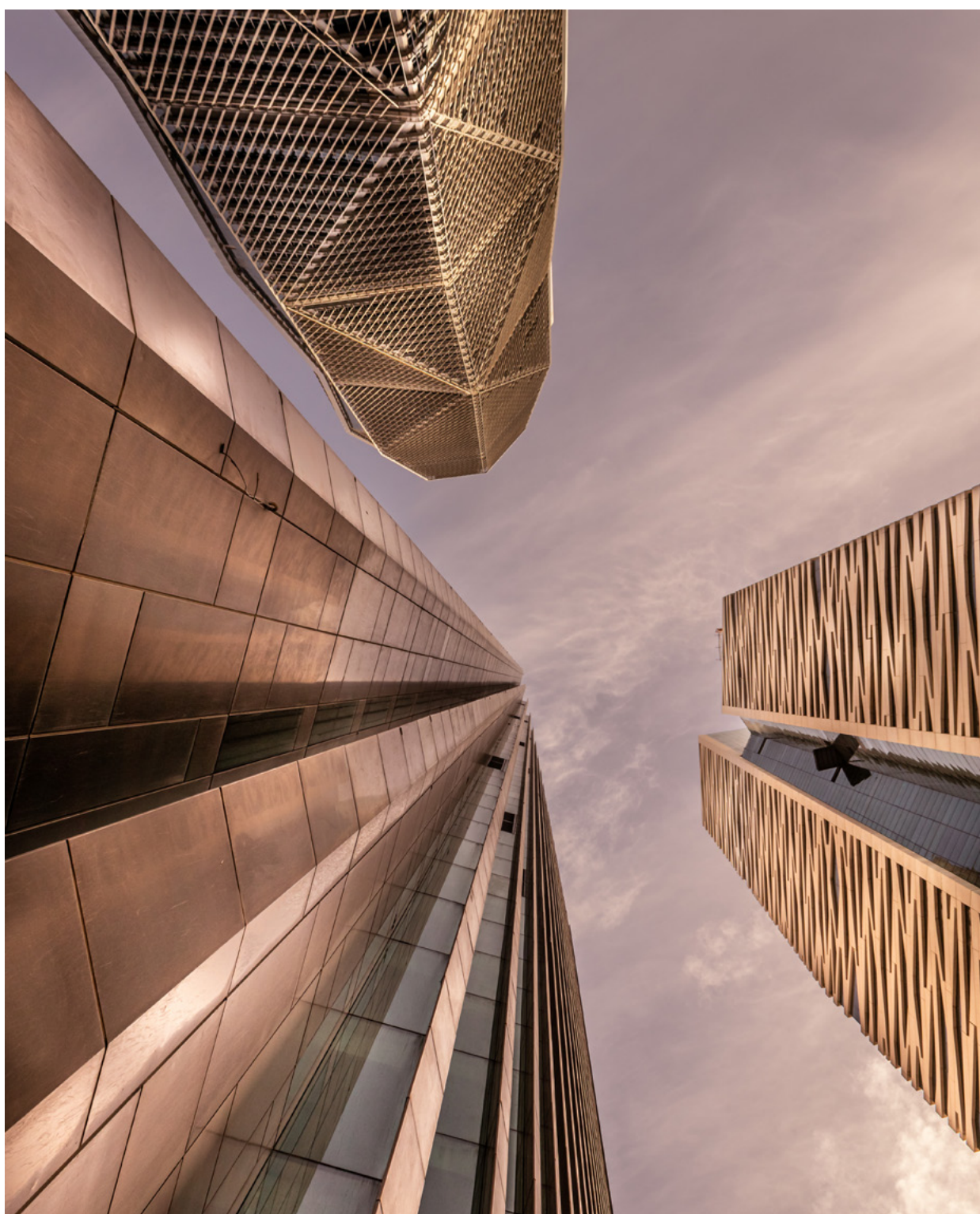
Jeremy Kingsley, senior manager and regional lead for technology and society, Economist Impact

Keren Uziyel, analyst, country risk service manager, The Economist Intelligence Unit

Laveena Iyer, research analyst, industry briefing team, ICT, The Economist Intelligence Unit

Pat Thaker, editorial and regional director, Middle East and Africa, The Economist Intelligence Unit

Executive summary



In the past decade artificial intelligence (AI) has shifted from the peripheries of policy attention to the centre of investment and political focus. Global investment in AI has soared since 2010, increasing from a mere US\$0.8bn to US\$78bn in 2021.¹ In 2019 The Economist Intelligence Unit (EIU) forecast the economic impact of AI in Saudi Arabia and the UAE, estimating that US\$200bn and US\$122bn, respectively, could be added to their GDP if their governments introduced policies to build talent and capital.²

In this report, three years later, we explore the developments in AI in the Kingdom and the UAE, but we widen our lens to consider other countries in the region, with a specific focus on Saudi Arabia, the UAE, Qatar, Egypt and Kuwait. Momentum and new initiatives in the field of AI policy have continued throughout the pandemic. But are countries in the Middle East and North Africa (MENA) region moving fast enough and putting in place the right policies to maximise the benefits of AI while minimising its potential for a negative impact?

As the region is looking into a post-covid future, this report examines the current state of AI in the MENA region and provides a high-level outlook for the next decade. It examines AI investment, industry trends in the region, the policy environment and challenges, and a series of policy takeaways based on international good practice for policymakers looking to develop their AI ecosystems and capabilities.

Key findings include:

The potential economic impact of AI on the region's economic growth is significant, with the MENA region estimated to accrue US\$320bn by 2030 from value added by AI.³ This derives mostly from costs saved through automating processes as well as improving products and services across the region's industries. Annual growth in the economic contribution of AI is expected to reach 20-34% per year across the region, with the highest rates expected in the UAE and Saudi Arabia.⁴ The potential economic impact of AI in the region, however, is likely to rise even further, with a more recent country-based study by The EIU forecasting that Saudi Arabia and the UAE alone will be accruing US\$200bn and US\$120bn, respectively.⁵

The growth of national AI strategies, departments and initiatives underscores the importance of AI to the region's economic transformation. In the past few years the UAE, Saudi Arabia, Qatar and Egypt have all published ambitious strategies and developed wide-ranging e-government initiatives. The UAE was the first to publish its AI strategy in 2017, followed by Egypt in 2019. These initiatives have continued in the past year, with both Qatar and Saudi Arabia unveiling their strategies in 2021. The UAE and Saudi Arabian AI strategies stand out globally for establishing specific AI-related governmental departments. According to one global benchmark that assesses government strategy for AI, Saudi Arabia and the UAE score more highly than the United States, while Egypt's score is higher than the scores of Brazil and Israel, which are both considered to be regional AI leaders.⁶ This is in large part due to the importance that MENA governments attribute to fostering AI capabilities, as opposed to Brazil and Israel, which are more private-sector led.

The region is characterised by a government-led investment strategy aimed at stimulating the nascent technology sectors. Governments in the region have freed up comparatively large budgets to invest in the development of their AI capabilities. At the national level, Saudi Arabia has pledged US\$20bn government investment with the aim of establishing 300 startups by 2030.⁷ These figures dwarf the ambitions of European leaders such as Germany, for example, which has pledged €5bn.⁸ The reason for this are the ambitions of both governments to diversify their economies as well the need to stimulate their relatively small tech sectors. In the UAE these investments are paying off, with Careem becoming the region's first tech unicorn and more companies, such as STC Pay, surpassing the US\$1bn mark.⁹

AI strategies published by MENA countries emphasise cultivating AI talent and creating an AI-friendly business environment, but they are behind on policies ensuring the responsible use of AI. In addition to a common focus on data, the business environment and technological infrastructure as key areas of policy and investment attention, nurturing domestic talent is one of the top policy priorities across the MENA countries' strategies. Saudi Arabia, for example, sets itself a key performance indicator (KPI) to make more than 40% of its workforce data- and AI-literate by integrating AI into the curriculum designed by the Ministry of Education as well as private educational institutions.¹⁰ Egypt's AI strategy proposes establishing technical and vocational training and declares an ambition to establish itself as a talent hub.¹¹ Some of these provisions, investments in AI education and solutions are also aimed at reducing risks related to unemployment, with Qatar's strategy aiming to transition the country to a sustainable knowledge-based economy.¹²

Currently no country in our set has published a national AI ethics / responsible AI framework.¹³ Qatar makes mention of ethics in its AI strategy, and Egypt has similarly been exploring the establishment of a responsible AI charter. At the city-level only Dubai provides an AI Ethics Toolkit, including principles and guidelines as well as a self-assessment form for developers wanting to ensure the trustworthy and safe use of AI.¹⁴

Governments in the region are deeply involved in the cultivation of their AI ecosystems as well as initiatives to integrate AI into government itself. AI is seen as a key tool for helping to increase the speed, accessibility and effectiveness of public-sector operations. This should reduce costs in the long run—one study forecasts that efficiencies generated by AI technology could support Middle Eastern government budgets by up to US\$7bn annually.¹⁵ However, across the region a high proportion of citizens are government employees, with at least two-thirds of citizens in Saudi Arabia, the UAE and Qatar working in the public sector. This preference for working in the public sector leaves the region with fewer candidates keen on founding or joining AI companies.

The covid-19 pandemic resulted in an increase in online retail and commerce, which has generated deeper pools of customer data that can be used for optimising AI algorithms and improving the customer experience. The retail sector has historically been known for gathering insights about customers, products, suppliers and purchasing behaviour. Because of the global pandemic there has been an increase in the production and availability of these



customer data, which are used for developing AI systems to analyse habits and patterns more effectively.¹⁶ For example, over 70% of Egyptian consumers have increased their online shopping habits since the onset of the pandemic.¹⁷ The e-commerce sector in the Gulf Cooperation Council (GCC) is now expected to grow to US\$50bn by 2025.¹⁸ As a result of this increased availability of customer data, AI is expected to become a more widely applied part of retailers' day-to-day operations.

The financial services and banking sector is predicted to become the highest spender on AI technologies, with 25% of all AI investments in the region going into the finance sector. The use of AI in the banking sector is expected to contribute as much as 13.6% to the region's GDP by 2030.¹⁹ This would take shape through a range of applications, such as deep learning for algorithmic trading, fraud analysis and investing, as well as smart portfolio management and customer profiling. However, in the MENA region there are still adoption challenges, including adapting AI applications to fit into the regulatory environment of Islamic law, the lack of available capital and the shortage of workers with the necessary technical skills to develop AI-based technologies.

The travel and tourism sector envisions various possible uses for AI, but obtaining the necessary and complete data remains a significant challenge. AI has the potential to help people and companies customise travel experiences. However, while there are several off-the-shelf applications, more useful applications are tailored based on a wide range of datasets, including route data, flight statistics data and data on government restrictions, all of which are found from different sources and in different formats and require contextualising for each of the region's markets.

The transport sector stands to benefit from AI, with its contribution to the economies of the Gulf countries and Egypt forecast to reach 15% of GDP in 2030.²⁰ AI is expected to be integrated across a wide range of applications within the transport sector, from predictive transport management, improving traffic safety and, most notably, autonomous vehicles. Countries in the region are setting ambitious targets to foster its development, with Dubai setting a KPI of 25% for all car journeys to be made via driverless cars by 2030.²¹

The impact of AI systems on the energy sector is expected to be substantial, contributing over 6% to the region's GDP by 2030.²² The UAE, Saudi Arabia, Qatar, Kuwait and Egypt have historically derived much of their wealth from oil and gas reserves. Through macroeconomic reform programmes such as Saudi Arabia's Vision 2030, countries in the MENA region are diverting investments away from traditional energy sources, including the use of AI technologies to achieve renewable energy targets. For example, AI and machine learning are being implemented in smart grids to refit electricity grids and reduce system losses and carbon emissions. In the transition towards renewables, AI is expected to play a major role in supporting countries in the region.

The efficacy of investment and technological development hinges on having a suitable policy environment, which presents some challenges across the region. The biggest policy challenges facing the MENA region include lack of AI talent, fragmented data governance and privacy regimes, and an insufficient focus on trust and safety. Political and competitive impulses have so far prevented the kind of centralised data regulatory mechanism that other regions, such as the Asia-Pacific Economic Cooperation (APEC) or the European Union (EU), were able to achieve. The UAE, Saudi Arabia and Egypt recently published protection of personal data laws, but these have not yet been fully implemented and are split among different government bodies, which makes compliance more challenging for companies and creates public uncertainty about the ways in which user data may be processed. Getting the balance right in establishing an appropriate policy and regulatory framework to facilitate safe and responsible AI deployment is a priority for the region.

Introduction: the AI opportunity



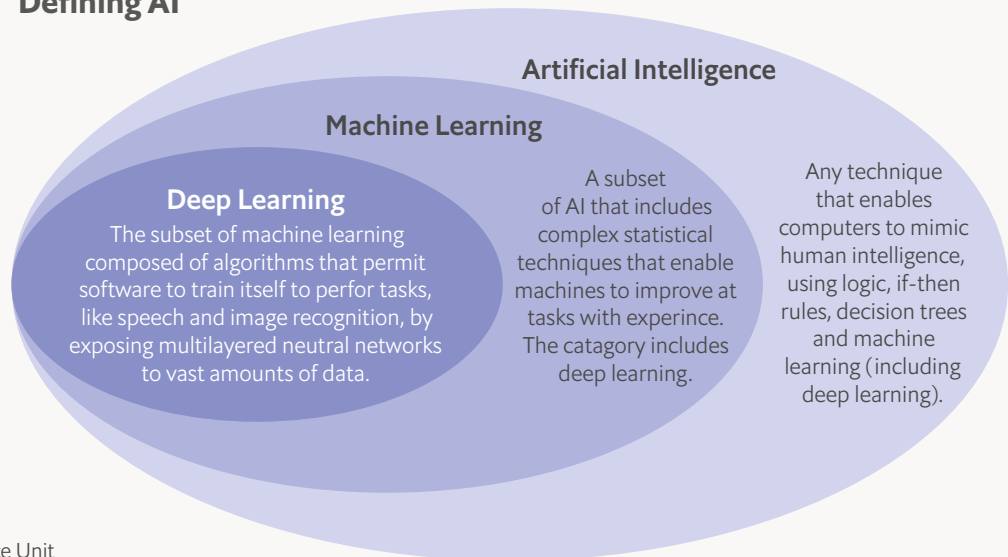
But first, what is AI?

The term artificial intelligence—AI—was coined in 1956 by John McCarthy, a cognitive scientist and Stanford computer science professor who proposed the possibility of replicating human intelligence “so precisely...that a machine can be made to simulate it.”⁴⁵ In the same decade Herbert Simon, an American political scientist, developed the General Problem Solver, a pioneer of AI programming, and by 1965 Simon had become convinced that “machines will be capable of doing any work a man can do”.⁴⁶

The concept of AI builds on these pioneering ideas, generally referring to computer software that “learns” from data, behaves intelligently and mimics human cognition and perception. As such, AI covers a wide range of models and processes, including “deep learning”, “machine learning” and “natural language processing”, that depend on the use of large amounts of data to train software in patterns and create corresponding outcomes.

In this report we refer to AI as a catch-all term for techniques that enable computers to learn from data and behave intelligently, especially those that integrate machine-learning techniques, including deep learning.⁴⁷

Defining AI



Source: The Economist Intelligence Unit

Almost a century since its origins as a theoretical concept, artificial intelligence (AI) is finding increased application in the world economy. The 21st century has seen some of the most important AI milestones: the establishment of ImageNet, the first database of annotated images designed to aid in visual object recognition software research; the onset of autonomous vehicle development in 2009; and the defeat of Go champion Lee Sedol by DeepMind’s AlphaGo programme in 2016.²³ On the back of other innovations, such as high-performance computing and cloud technology, AI is poised to deliver on its promise.

As innovation surges, so does investment. Global investment in AI has soared since 2010, increasing from a mere US\$0.8bn to US\$78bn in 2021—an increase of over 9,000%.²⁴ However, the promise of AI is currently being experienced unevenly across the globe. For decades, interest in AI has been concentrated in countries such as the US, the UK, China and Europe. In 2020 private AI investment in the US reached US\$23.6bn, followed by China (US\$9.9bn) and the UK (US\$1.9bn).²⁵ According to CB Insights, a market intelligence platform, out of the 100 most promising private AI

companies in the world 64% were from the US, 8% from the UK, 6% each from China and Israel, and 5% from Canada.²⁶ None of the companies hailed from the MENA region.

As investment and innovation in AI continue to grow, so does its potential to have a tangible impact on day-to-day life. Multiple sectors, including healthcare, retail, finance, transport, manufacturing and government services, are set to experience change as a result of AI adoption and applications.²⁷ Across these sectors, AI applications can deepen our ability to automate, detect, personalise, predict and understand. For example, AI is being leveraged to automate repetitive physical labour in manufacturing;²⁸ detect objects surrounding autonomous vehicles;²⁹ personalise movie and TV streaming recommendations;³⁰ predict rider demand and traffic flows based on historical data;³¹ and understand trends between patient history and disease incidence.³² Global investment in AI applications in pharmaceuticals, for example, increased five-fold between 2019 and 2020 alone—the largest increase in investment, followed by the automotive sector (autonomous vehicles) and education.

Balancing the promises and pitfalls of AI

As AI permeates these sectors, the impact of the technology is forecast to be considerable. Analysis Group, an economic consultancy, argues that AI could add up to US\$2.95trn to the global economy within the next decade,³³ while the McKinsey Global Institute estimates that AI will deliver US\$13trn by 2030,³⁴ and estimates by PwC, a multinational consultancy, push this up to US\$15.7trn.³⁵

But with the promise of AI come potential challenges. Risks associated with AI include the possibility of biased and unexplainable outcomes, ethically challenging applications, privacy concerns, and intentional misuse

of AI.³⁶ These problems can have painful implications at the individual level, such as discriminatory algorithms excluding minority groups.³⁷ Another concern is AI's potential impact on the labour market. The proliferation of AI and automation is frequently linked to unemployment, with one study by PwC claiming that up to 30% of jobs could be automated by the mid-2030s.³⁸ However, other studies predict just a shift in skills without entire jobs being automated, whereas other research forecasts that AI will result in more jobs being created in the long term,³⁹ suggesting that this is still an area where future research will be crucial.

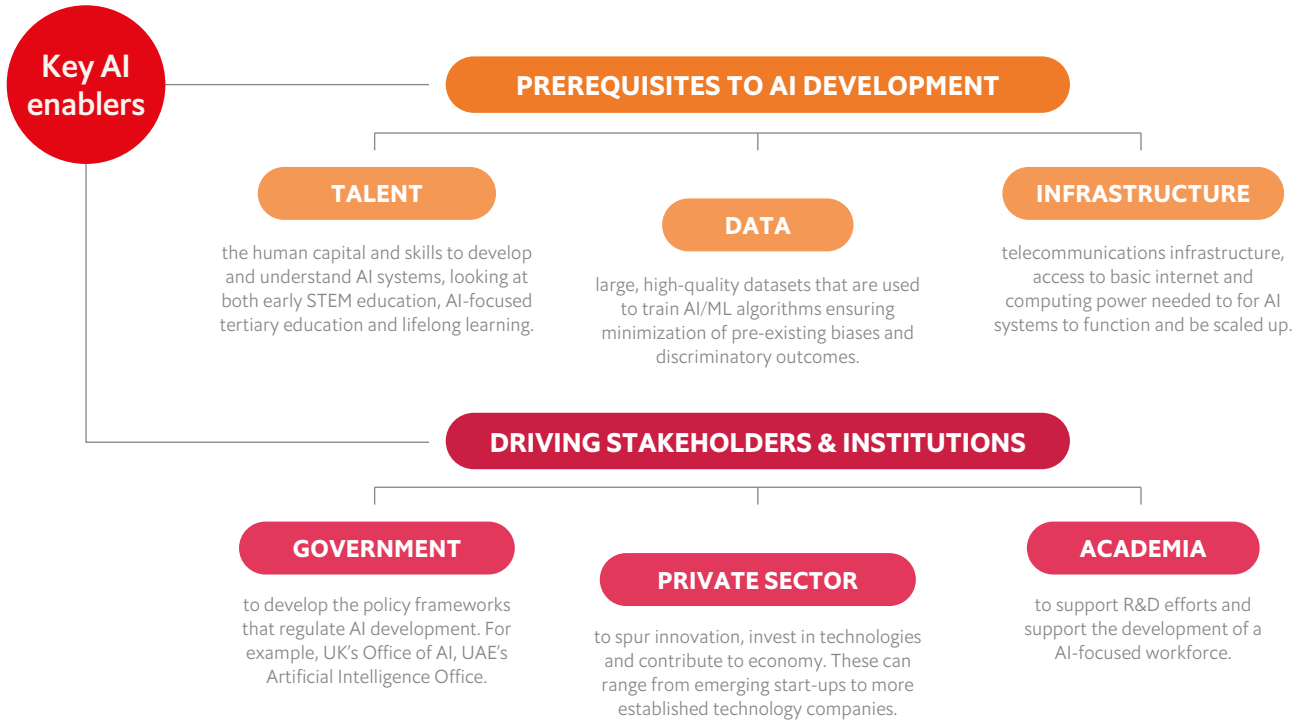
To minimise these drawbacks and fully harness the economic benefits of AI, governments need to put the right policies in place. This can range from implementing effective governance to guide the development and use of AI to developing initiatives to rectify any negative impacts of AI. For example, to address the issue of AI-induced unemployment, governments and private-sector actors will have to find the balance between producing new AI applications that will substitute and replace workers of repetitive tasks (substitution effect) and supporting workers in their day-to-day jobs by improving their capabilities through education and skills programmes (complementarity effect).⁴⁰

To address the issue of ethics, many companies, countries, and international organisations, including OECD, UNESCO, and the Global Partnership on AI, have adopted Responsible AI guidelines and principles.

Harnessing the potential

As evidence of the social and economic benefits of AI grows, countries have been grappling with the question of how they can develop the right capabilities and raw

FIGURE 1: Mapping the enablers of AI



Sources: Tortoise Media (2021); Oxford Insights (2021); Economist Intelligence Unit (2018).

materials to create an environment that is conducive to AI growth.

A number of benchmarking tools have been produced to assess countries' AI preparedness. We have analysed two of the most robust tools—Tortoise's Global AI Index⁴¹ and Oxford Insights' Government AI Readiness Index⁴²—to determine the key enablers needed to bring about advancements in AI. The Global AI Index measures the national ecosystems on which the creation and use of artificial intelligence depends, looking at levels of investment, innovation and implementation. Meanwhile, the Government AI Readiness Index hones in on whether governments are ready to implement AI in the delivery of public services to their citizens. The index covers three key pillars—"Government", which

explores the government's AI vision and capacity, "Technology sector", which looks at the supply of tools and human capital needed to drive AI development, and "Data and infrastructure", which looks at the inputs needed for development.

Similarly, in 2018 The EIU established five key pillars needed to facilitate AI development: data; talent; ethics and governance; R&D; and infrastructure, with the last two comprising an "AI ecosystem".⁴³ What brings these different frameworks together is an understanding that countries' AI capabilities are based on two factors: the raw capabilities needed to develop AI and the institutions needed to support this development. The raw capabilities include infrastructure, talent and data—the crucial inputs that determine success in

AI development. The institutions needed to invest in developing a responsible AI ecosystem range from government and policymakers such as the UK government's Office for Artificial Intelligence; the private sector, including the developers of and investors in AI; and academia, including the scientists contributing to AI R&D. These two factors intertwine with such raw capabilities being the prerequisites for enabling AI development that must be cultivated by countries' institutions.

Having the right policies in place can make a huge difference to the ability of countries to maximise the benefits and minimise the costs of AI. Greater investment in technology and access to open data could translate into hundreds of billions of dollars in economic value for countries such as the UAE and Saudi Arabia over the next ten years.⁴⁴

What is the future of AI in the MENA region?

To truly benefit from the promise of AI there is work to be done throughout the MENA region, from cultivating the talent to support a thriving AI ecosystem to developing robust regulatory frameworks to promote responsible AI use and development.

This report assesses the current AI landscape across the region and its potential evolution over the next decade for five countries at different stages of their AI journey: Saudi Arabia, UAE, Egypt, Qatar and Kuwait.

By exploring these five countries, the report aims to explore AI development in the region, including a discussion on key sectors of economic importance and a set of policy futures that can support this development.

The report begins by mapping out the current AI landscape in each priority country, from current investments in AI to how countries have been seeking to maximise key enablers of AI as set out in the introductory chapter.

In Chapter 2 we illustrate the wider impact that AI has had, and is expected to have, on the wider MENA economy. The chapter is divided into six sectors—government service, tourism, transport, finance, retail and energy—that are most likely to gain from AI adoption and are also economically important to our priority countries. This provides readers with an overview of where success has already been achieved and where it can still be achieved in the region.

While the potential of AI in the region is ample, Chapter 3 explores the challenges that may limit this potential, from limited policy harmonisation both within and between MENA countries to a need to shift priorities from AI to responsible AI.

Finally, the report concludes with a breakdown of government policies and a supplementary policy playbook that can contribute towards a thriving AI ecosystem in the MENA region.

Chapter 1

AI in the MENA region: state of play



The US and China are widely regarded as leading global AI development and its commercial application. The countries routinely top global rankings and are home to all ten of the top ten most valuable companies leveraging AI software today.^{48,49} These countries have benefited from a thriving AI private sector fuelled by a steady supply of talent, the right policy environment conducive to AI growth, and the availability of high-quality data to develop these technologies.^{50,51}

While the MENA region has not (yet) produced comparable AI giants, in the past decade its countries have been devoting increased policy and investment attention to developing their AI capabilities.

The MENA region pre-covid

Before the pandemic countries in the MENA region were gaining momentum in terms of AI policy and development. The UAE launched its AI strategy in 2017, established an AI ministry, opened the world's first AI university and hosted AI Everything/ GITEX, one of the largest AI summits in the world.

Similarly, Saudi Arabia has signalled its ambition to develop its capabilities in technology and AI. Recognising the long-term limitations of an economic model that depended on hydrocarbon exports, in 2016 Saudi Arabia launched Vision 2030, a development programme to diversify its economy. Vision 2030 aims for the country to become a global leader in technological innovation and a digital hub in the Middle East, with a particular emphasis on the role of AI. To achieve this, the country is introducing favourable legal frameworks to facilitate cloud computing and AI development, for example, and has partnered with international technology companies and is spurring global technology initiatives.⁵² It is championing

the smart city model for future urban development and is planning a US\$500bn high-tech metropolis called Neom at the northern end of the Red Sea.

In 2019 Egypt launched its Artificial Intelligence Strategy, charting a course for continued economic transformation. Its aim is to enable Egypt to reach the sustainable development goals (SDGs) through AI and become a regional hub of AI talent by benefiting from the large youth population among its 100m residents.⁵³

In Kuwait the government announced in 2019 that it would contribute US\$50m to an investment fund targeting the fields of technology and digital economy.⁵⁴ While the country has yet to establish a national AI strategy, in its Vision 2035, published in 2017, the Kuwaiti Communications and Information Technology Regulatory Authority emphasised the technology's strategic importance to the country's national development strategy.

In 2019 the Qatari government published a preliminary blueprint of its National AI Strategy with the aim of informing policymakers of the benefits and challenges of AI and a potential path forward.⁵⁵ Before this it had also established a range of AI research and development (R&D) initiatives, ranging from the establishment of its home-grown Qatar Centre for Artificial Intelligence⁵⁶ to branch campuses of world-renowned universities offering AI-related degrees and conducting AI research, such as the Carnegie Mellon University.⁵⁷

Government pulling its weight

Countries' investments in AI are a key part of government plans for economic diversification. In the past decade the region's policymakers have expressed concern about



the future of their economies, supported mostly by the region's vast oil reserves. In this new narrative, AI is seen as a pathway to a new economic future.

As such, one of the defining characteristics of the region is the central and active role of the government in forging progress in AI. For example, the Global AI Index includes a Government Strategy pillar that measures the level of governments' commitment to AI (e.g. having a specific government body designing AI policies), spending commitments (such as allocated R&D budgets), and quality of AI strategy (including a timescale of strategy and monitoring KPIs).⁵⁸ On this measure, Saudi Arabia, with a score of 91.6 out of a possible 100, ranks third out of 62 countries, and its score, along with that of the UAE (81.38), is higher than that of Singapore (79.82), the United States (77.3) and Denmark (74.23).⁵⁹

In Egypt the past two years have seen a period of heightened activity, with the government working to develop and implement an AI strategy that suits the country. Indeed, in the Government

Strategy pillar of the Global AI Index Egypt notably achieves a higher score (68.7) than Brazil (67.1) or Israel (43.9), which are both considered regional AI leaders.⁶⁰ "The established goal from the beginning was: Egypt didn't want to engage in AI just for the sake of doing AI, we're not interested in taking part in any kind of global race," notes Golestan Radwan, artificial intelligence adviser to the Egyptian Ministry of Communications and Information Technology. "What we're really interested in is how AI can add value to Egypt and the Egyptians—either economic value or better quality of life, just enhancing their lives in whatever way possible." Some key activities being targeted include developing strong teacher enablement programmes and allocating adequate funds to AI-related vocational programmes. Others include creating short and accessible lifelong learning opportunities for working professionals at different levels of their career.⁶¹

These governments' heavy involvement in the development of national AI ecosystems also reveals some of its weaknesses, namely the relatively low levels of private-sector initiatives in AI as well as the scarcity of talent.⁶² The scenario in other regions, such as Latin America or the US (for example, Silicon Valley), is fundamentally different. They are characterised by startup-led AI development (reaching US\$6.5bn⁶³ venture-capital investments in the first half of 2021 alone), and by generally speaking weaker government involvement.⁶⁴

For the MENA governments these initiatives highlight some of the areas where they lack resources, namely the availability of AI talent and a thriving AI sector, as some of our interviewees explained.⁶⁵ In the case of the UAE, this strategy looks as if it was paying off

through increased investments, and it was the first country in the region to produce a tech unicorn.⁶⁶ For Saudi Arabia, Egypt and Qatar it may be too early to tell, whereas Kuwait is still in the process of defining its role in the region. However, as pointed out by Mudassier Sheikah, co-founder and CEO of Careem, it looks as if the region is “not very far” from seeing the emergence of numerous tech unicorns.⁶⁷

Enter covid

The pandemic is largely seen as a catalyst for global AI uptake. Appen’s 2021 State of AI report, for example, mentions that 41% of companies have sped up their AI strategies during the pandemic.⁶⁸ Global private-sector investment in AI increased by 40% between 2019 and 2020.⁶⁹

Similarly, in the MENA region, among the uncertainty created by the pandemic and the ensuing economic consequences, there has been an acceleration in the proliferation of AI, according to some of the experts we spoke to. While the extent to which these efforts are responsible is unclear, it is worth noting that these countries have managed to exceed GDP forecasts, despite the impact of the pandemic, with GDP reaching 3.8% in the UAE, 3.3% in Egypt, 2.9% in both Saudi Arabia and Qatar and 2.7% in Kuwait.⁷⁰ According to our sister business, The EIU, this growth can in part be attributed to public and private investment to drive economic diversification into high-value sectors, including AI, as well as other factors, such as rising oil and gas production, strong global energy demand and high oil prices.⁷¹

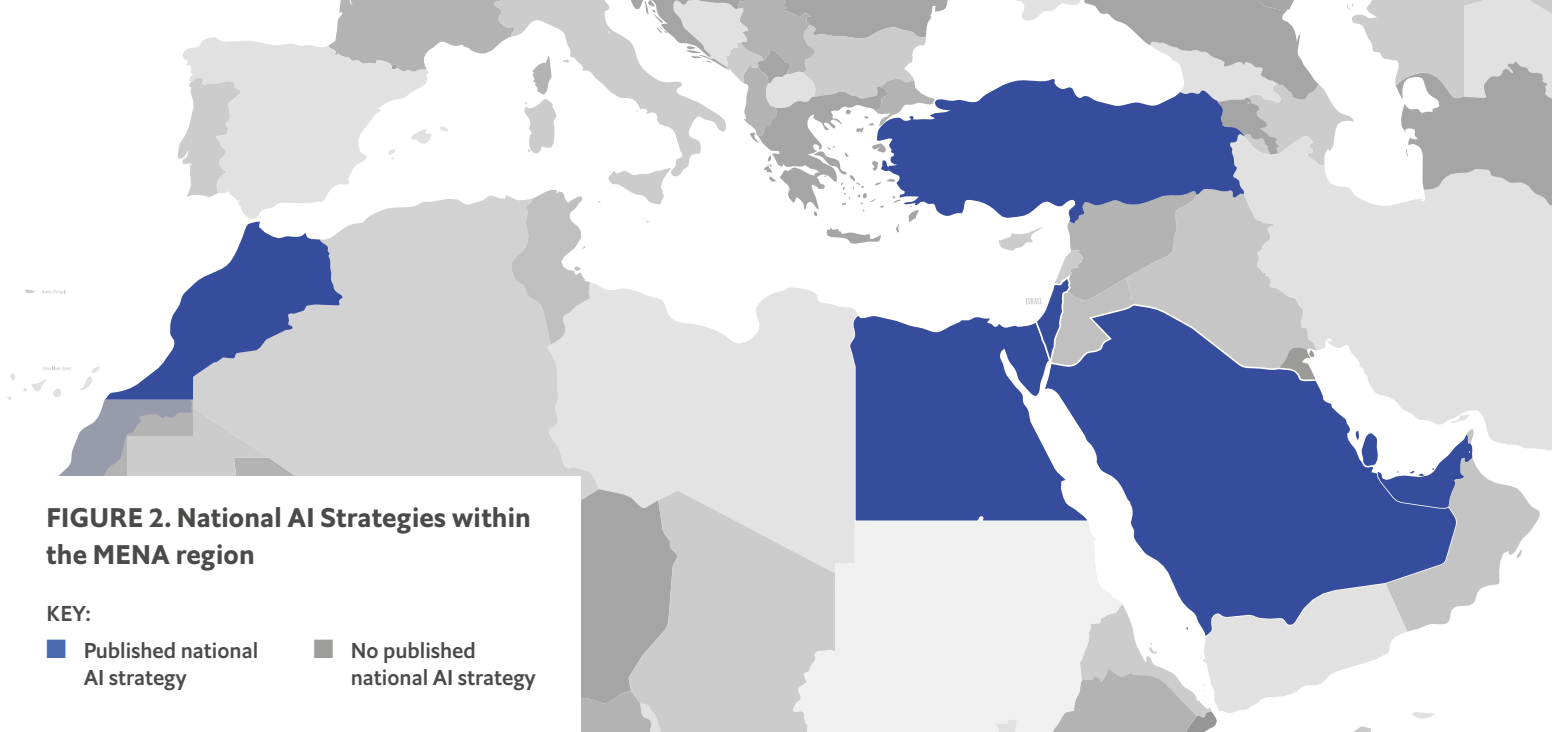
Initially, the effects of the pandemic were felt strongly through declining oil prices and slower economic growth and productivity. Similarly, the transport sector initially witnessed a decrease in investments.

According to the World Bank, in the MENA region the pandemic is estimated to have cost around US\$227bn, with the tourism sector, in particular, receding by about 50%.⁷²

“Funds have had to be redirected more towards public health and vaccination projects, so priorities have had to be shifted a little bit, which has impacted funding of AI projects all over the world really,” says Mr Radwan. “To some extent that’s slowed us down a little bit, also with issues in supply chains around the world... But it has highlighted the importance of having a digital strategy and using AI tools.”⁷³

Precisely because of this reason the pandemic seems to have laid the foundation for faster adoption of AI. Fadi Salem, director of research and advisory at the Mohammed bin Rashid School of Government, notes that during the pandemic the adoption of digital technologies for remote work, remote education, telemedicine and other functions “became a necessity, and that generated a huge amount of data, and therefore some governments that were sceptical or not that quick to adopt utilised this data, which generated a lot of opportunities for utilising AI by governments and the private sector within these countries in this region.”⁷⁴

Investments in AI were driven by the necessity to keep things running as the region’s countries entered a lockdown. AI-driven initiatives included, among others, the introduction of advanced contact tracing and lockdown programmes, alongside new e-government services.⁷⁵ For example, Saudi Arabia’s Data and Artificial Intelligence Authority (SDAIA) launched an AI-based covid-19 tracing app, Tabaud,⁷⁶ similar to the UAE’s AI Hosn app.⁷⁷ Also in the UAE, Dubai’s Roads and Transport Authority (RTA)



Source - OECD.ai

leveraged AI technologies, such as computer vision and machine-learning algorithms, to detect and report violations of covid-19 prevention measures in taxis.⁷⁸ In Qatar, Hamad International Airport deployed AI and augmented reality systems to detect similar violations, which are discussed further in the Qatar Overview section of this report.⁷⁹

Continuing activity

At the country level, activity in the field of AI has continued at the same pace. If Saudi Arabia is able to complete even 80% of Neom City (the planned completion date being 2025), it remains on track to reach its other AI targets.⁸⁰ Similarly, Qatar released its national AI strategy in 2021, outlining a six-pronged approach to boost economic competitiveness using AI. In 2021 the government also approved the establishment of an AI Committee under the country's Transport and Communications Ministry (MoTC), setting out its mandate to co-ordinate with national ministries to develop national AI plans and programmes.⁸¹

Moving forward: building on current momentum

There are longer-term trends that are in the MENA region's favour. Both the Gulf and Egypt have relatively young and urbanised populations by global standards—both

demographics more likely to be digital adopters—facilitating high rates of digital adoption and demand, which will in turn drive technological improvement and innovation.⁸²

Notably, the region is also rebuilding relationships with Israel.⁸³ Israel was able to rely on its large AI startup sector to develop solutions to contain the spread of covid.^{84, 85} As such, the normalisation of relations with Israel is enabling the creation of partnerships in the development of emerging technologies, allowing for knowledge- and technology-sharing,⁸⁶ as demonstrated by the agreement between the UAE and Israel on facilitating the use of AI in healthcare.⁸⁷ One such example of this UAE-Israel co-operation on healthcare includes a recent Memorandum of Understanding (MoU) between Abu Dhabi's Department of Health (DoH) and Israel's Clalit Health Services, a state-mandated health service organisation. The aim of this partnership is to work together on issues including digital health initiatives related to AI, professional education, research and clinical trials.⁸⁸ The region is now well positioned to build on this momentum. Years of investments in developing comprehensive AI policies, their demographic make-up as well as the catalysing effect of the covid-19 pandemic have provided countries in the region with the right raw materials to improve their AI capabilities and foster their uptake across its industries.

Chapter 2

AI's impact across industries



Forecasts suggest that AI can make a significant contribution to economic growth. PwC estimates that by 2030 AI will add US\$320bn to the MENA region.⁸⁹ This value is anticipated from the application of AI in enterprise supply chains, enhancing trust in the nature, quality and quantity of goods purchased, delivered, received and invoiced, as well as reducing working-capital requirements.^{90,91}

The annual growth in the economic contribution of AI is forecast to reach between 20% and 34% per year across the region, with the fastest growth occurring in the UAE and then Saudi Arabia. Key sectors that are likely to drive this growth include the retail sector (19% contribution to the region's GDP), the public sector, including health and education (19%), transport and logistics (15%), technology, media, and telecommunications (14%), and financial services (14%).⁹²

The impact of AI can thus be expected to be highly disruptive, producing innovations to increase efficiency and enhance productivity while at the same time automating away certain parts of jobs and reducing the labour force in some industries. Its effects will be

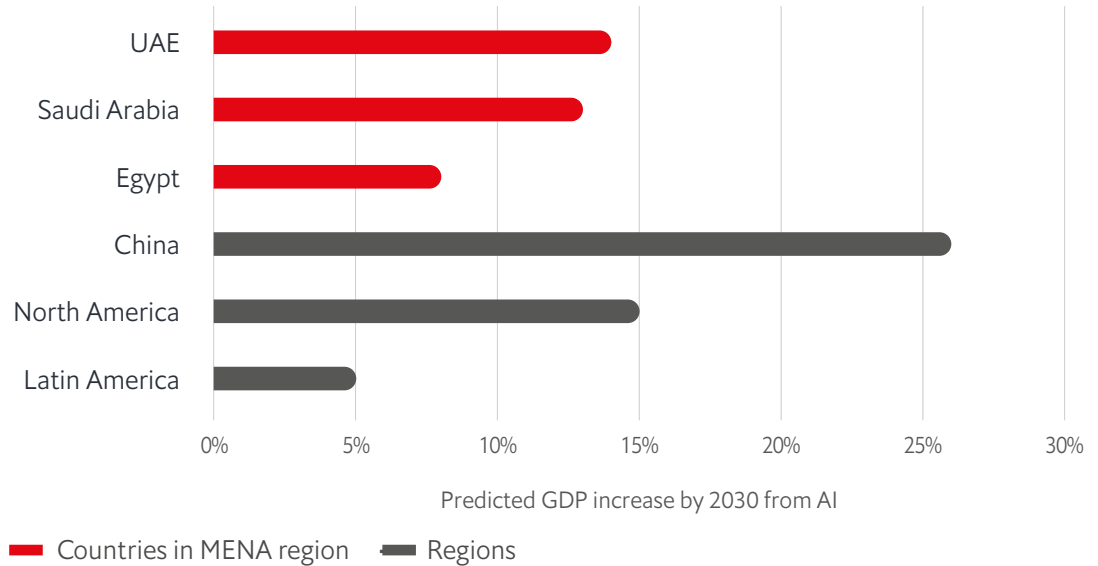
felt across every industry, but for the purpose of this study our focus is on the following six industries: government services (including healthcare and education), retail, finance, transport, tourism and energy. They were selected by considering the potential impact of AI in the next decade and because these are the industries that are the most relevant to our target countries. For each industry we highlight some of the initiatives currently being taken in the region as well as expert views about some of the barriers to progress and what we might expect for the future.

2.1. GOVERNMENT SERVICES

According to forecasts by PwC, AI's absolute contribution to the public sector in the MENA region, including health and education, could be US\$59bn in 2030 (18.6% of regional GDP).⁹³ Governments stand to save significant financial resources, with efficiencies generated by AI technology having the potential to add up to US\$7bn to regional government budgets annually.⁹⁴ Saudi Arabia, Egypt and the UAE mention government services, including healthcare and education (apart from Egypt) as key areas to focus on in their AI strategies.



FIGURE 3.



Source: <https://www.pwc.com/m1/en/publications/potential-impact-artificial-intelligence-middle-east.html>

Healthcare

Healthcare is one of the major areas serviced by the governments in the MENA region, accounting for 5.8% of government expenditure as a percentage of GDP.⁹⁵ One of the principal use cases of AI in healthcare is in predicting and preventing illnesses by scanning through large amounts of patient data. Qatar’s healthcare system, the Primary Health Care Corporation (PHCC), underwent a significant digital transformation with the establishment of patients’ electronic health records.⁹⁶ These records and the data they contain can be synchronised with further datasets collected by patients (e.g. through smartphones) and generate a comprehensive picture of a patient’s health and potential risks, such as whether the patient is at risk of being hospitalised due to a covid-19 infection.⁹⁷ Using these data allows clinicians to suggest to patients changes in lifestyle, such as reducing sugar intake, stopping smoking, or even designing preventative care programmes. Prior to the pandemic, the PHCC had established a number of online health offerings servicing approximately 50,000

citizens.⁹⁸ Since then this number has grown to 500,000, allowing for increased access to patient data.⁹⁹ There are currently no specific figures showing the financial benefits MENA governments could expect from the application of AI in healthcare. However, given the high expenditure as a proportion of GDP these figures can be expected to be substantial. Nonetheless, it should be mentioned that patient data are considered to be highly sensitive as they contain deeply personal and medical information of citizens. Ensuring that these data are kept safe by providing the appropriate cybersecurity infrastructure and regulations will be a key priority for policymakers to ensure that citizens deem them sufficiently trustworthy to handle their data.

Education

As mentioned previously, countries in the Middle East have set themselves the target of fostering domestic AI talent through education as a policy priority. However, integrating AI as part of students’ curriculums includes not only what people are taught but especially also how they are taught.¹⁰⁰

Applications of AI in the education sector range from using previous performance data on students to generate grading and assessments, to applying facial recognition systems for classroom monitoring or designing personalised learning programmes.¹⁰¹ Across the MENA region there seems to be insufficient evidence that AI has become an integral component of public schools' facilities. However, some international schools in Egypt have worked with Edtech companies to improve students' learning experiences by analysing performance data on a very granular level. AI systems can evaluate whether students are in need of either subject-related knowledge or whether they simply require a different learning approach, such as video- versus audio-based learning content.¹⁰² Qatar Foundation, a state-led non-profit organisation, has been holding its annual World Innovation Summit for Education (WISE), which explores issues such as AI in the classroom, since 2019.¹⁰³ The foundation also runs the WISE Edtech Accelerator Programme, with OBRIZUM, an AI-driven learning platform, winning first place in the AI Innovation of the Year category of the 2019 Digital Leaders 100 list.¹⁰⁴ It should be noted that more novel AI applications are not yet widely available, reflecting both their level of development and related costs. As such it will probably be some time before students across the MENA region will be able to benefit from these technologies.¹⁰⁵

Smart government

The UAE, Saudi Arabia, Qatar, Kuwait and Egypt are all working on "smart" government initiatives, seeking to incorporate data analytics and AI to increase the speed, accessibility and effectiveness of government operations. These initiatives look to incorporate AI technology in order to personalise, predict and improve user

experience. Qatar, for example, aims to digitise its state services sector and has launched an online national employment platform (Kawader) to match citizens with suitable job opportunities and simplify the employment process.¹⁰⁶

Smart cities

Countries in the MENA region, particularly the UAE and Saudi Arabia, are focused on the application of AI at the city level. "Smart cities" utilise AI and data analysis to increase the efficiency of urban services and respond to residents' needs. Dubai is a prominent example of such technological integration, using AI-powered public service virtual assistants ("Rashid" and "Mahboub") to respond to queries about municipal and transport matters.

Smart city designs have, however, raised privacy alarms, with growing concerns over the ways in which their extensive monitoring and surveillance operations encroach on free speech, privacy and data protection.¹⁰⁷ This is further aggravated by a lack of AI ethics policies compared with other leading AI nations globally, such as the UK, Canada, the EU or Colombia, which have witnessed a sharp increase in their adoption and where further AI regulation has been announced.¹⁰⁸ In the UAE only Dubai has a policy specifically designed to address the ethical implications of AI, and on the country level only Egypt has announced that it is working on a responsible AI charter.^{109,110}

Making governments more responsive

However, achieving the economic benefits that AI can bring to government services depends on overcoming a number of challenges.

One barrier to achieving this is the reluctance of governments in the region regarding the cost and complexity of AI projects, which can be

unpredictable, making it harder for leaders to accurately plan their budgets and timeframes. In another scenario there is also the risk that an AI solution might end up not being the right solution for the specific problem of the project it was tasked with addressing.¹¹¹

Another aspect is the composition of the workforce, with a high proportion of citizens employed in the public sector. At least two-thirds of all nationals in Saudi Arabia, the UAE and Qatar work in the public sector, making it a dependable but bloated employment destination (around 25% of Qatari workers are employed in clerical positions).

The attractiveness of the public sector to much of the MENA workforce poses a problem for entrepreneurship in the region, whether specifically related to AI or not.¹¹² With citizens' tendency to seek out public-sector jobs, the potential for a home-grown startup scene—a crucial component of a successful AI ecosystem—is limited. Some countries in the region have already begun to address this issue, for example Saudi Arabia with its Nitaqat programme, which requires private Saudi companies to ensure that a share of their workforce is made up of qualified Saudi nationals.¹¹³

However, supporting a shift to establishing a culture of stronger entrepreneurship can be expected to take considerable time and effort, especially considering the attractiveness and comfort offered by public-sector roles in the region.

2.2. RETAIL

Data about products, suppliers and customers have long been critical to the major actors in the retail industry, the vast majority of whom predate the internet era. How they use and process data has evolved over time,

however, and the arrival of machine-learning technologies offers ways in which insights can be extrapolated more quickly, helping to inform decisions around product ranging, pricing, promotions and wider efficiencies. As a result, the retail sector is expected to contribute 19% of GDP to the MENA region's economy, equivalent to US\$23bn, by 2030.¹¹⁴

The covid-19 pandemic has resulted in an increase in online retail and e-commerce, which has generated deeper pools of customer data that can be used for optimising AI algorithms and improving the customer experience. For example, over 70% of Egyptian consumers have increased their online shopping habits since the onset of the pandemic.¹¹⁵ The e-commerce sector in the GCC is now expected to grow to US\$50bn by 2025.¹¹⁶ Through this increased availability of customer data AI is expected to become a more widely applied part of retailers' day-to-day operations.

A notable shift in how retailers are interacting with data can be seen in the move away from a marketing model that employs third-party



data from publishing platforms to one of direct customer interaction. “B2B companies are now becoming B2C companies because of privacy and because of data,” says Paul Morris, chief digital officer of AlShaya Group, a retail franchise operator headquartered in Kuwait. “The case for change is clear, because what we have known for the past 15+ years is going away—we have got to build more trusted pools of data that you might call first-party data. Then utilising that to make your service, your product or your proposition better for customers, so that you better meet their wants and needs.” He cautions against the impulse among retailers to boost margins by seeking to monetise their data, as that could result in heavy spending without long-term returns and a loss of customer trust.

Range planning and supply-chain optimisation

When it comes to investments in AI developments in the retail sector, experts encourage simplicity and data integrity. The tools should be useful and usable—realistic rather than weighted with hype and miscomprehension. One suitable application is range planning, argues Rizwan Rajpoot, group chief digital officer of L’azurde Company for Jewelry: “Range planning is what products every store has, and generally retailers buy stock or produce products, then distribute them equally across all of their stores depending on the size of the store. Where data and AI can start to come in is to predict what’s most likely to sell in that particular area based on what consumers are behaving like in that particular area online. Where that becomes magical for you is you start to range locally, for each and every individual store. This is relatively new in this region, and globally.” On a larger scale this will enable retail companies to optimise their

supply-chain operations, save resources and buy products in a more cost-effective manner.

Natural-language chatbots

Furthermore, retail companies are using chatbots to automate their customer service. In the past these included mainly chatbots, which used rule-based testing and had only limited intelligence. But now, as natural-language processing advances, chatbots are increasingly able to engage in more in-depth conversations and make interactions with customers (perhaps ironically) less robotic. One such company is Italy-based VIAFONE Technologies, which develops chatbots for the retail industry across the MENA region. Their idea is simple: allow customers to connect with companies via the platform on which they are most frequently present, including Facebook, Whatsapp, etc. As the founder and COO of VIAFONE Technologies, Souffiane Houtie, explains: “AI chatbots that engage with customers in two-way communication is the answer to these, as it opens a whole new world of possibilities for businesses to build a more interactive and personalised customer



experience.”¹¹⁷ Ultimately, the goal is to reduce errors that might occur in human customer interactions and allow unlimited numbers of customer interactions simultaneously.

The data imperative

Digital developments represent new frontiers for the sector, offering both opportunities and challenges. Mr Morris notes that in the Middle East “the retail market is still less mature, more fragmented, growing very fast,” while data governance standards are evolving.¹¹⁸ This presents risks for retailers racing to achieve lofty outcomes without investing in the quality of the data being used, then falling victim to bias or poor results. But if done right, by building up trained teams, focusing on the quality of data and infrastructure and proactively adopting wider privacy regulations, retailers can gain commercial and customer advantage through better service, trust and loyalty. “Over the last few years power has shifted from brands—being a power brand—to customers. They have control, demand what they want, and are not as loyal as they used to be—loyalty is driven by giving them a personalised experience,” says Mr Rajpoot. Online shopping is still only a small part of the Middle East retail market, but as it grows, consumers are more likely to appreciate brands that respect their data rather than sell them on. This is also in line with a previous EIU analysis on responsible AI, which argues that using AI and data more responsibly can result in a

competitive advantage. As businesses increase their dependence on customer data, developing new AI applications requires better data handling and provisions for guaranteeing security and privacy.¹¹⁹

Risks of job losses in the sector may be offset by growth in the supply chain. As automation reduces the number of cashiers on shop floors, Mr Morris notes there are “thousands of colleagues in the supply chain that’s moving products to that physical location... You’re actually employing more people because you’re moving more products to more places.” The labour context is also different from that of more developed markets—the ready availability of labour in the region suggests that functions such as warehousing will remain staffed by humans rather than expensive robotics and shelf-to-man packing technology.¹²⁰ Ultimately, whether there will be increased unemployment will depend on two main factors: the general complexity of tasks as well as the level of skills of the individual workers. Depending on these factors, AI can either complement workers’ tasks or substitute them altogether.¹²¹

2.3. TOURISM

The impact of AI on the travel and tourism sector is less clear-cut than in other major sectors. The travel and tourism sector has changed dramatically in the internet era, with the ability to book flights and hotels online putting many traditional travel agents out of business. Yet the demand for customised holiday experiences, travel advice or customer support has not disappeared. The tourism industry contributes almost 9% to the MENA region’s GDP, although between 2019 and 2020 the region saw its tourism industry contract by over 50% due to covid-19.¹²² AI can help travel companies to personalise travel planning and the holiday experience

Online shopping is still only a small part of the Middle East retail market, but as it grows, consumers are more likely to appreciate brands that respect their data rather than sell them on.

for customers, but data and language standardisation issues present particular difficulties for this sector in the Middle East.

Matching customers’ travel personas

Paradoxically, the possibilities that online travel booking enables can be off-putting for customers. Ronnie Varghese, vice president of digital product at Seera Group, a Saudi Arabia-based travel and tourism company, finds that the biggest challenge most customers face is the glut of available options, which makes the choice too wide and decision-making difficult. He notes that every customer may have multiple travel “personas” (travelling on business, solo or with family), “but every time they search they are presented with the same results and have to sift through all that information to figure out the right option.”¹²³ Mr Varghese envisions presenting each customer with only the best and most relevant options for them in their travel context. Where AI can help here is by knowing the customer and understanding their past behaviour and preferences, and then correlating this with what the market offers.

Enhancing the customer travel experience

Many other current initiatives are focused on the customer experience—seeking to offer greater personalisation and assistance. The Emirati travel website Musafir offers customers flights, hotel stays and holiday

experiences using AI to identify and segregate different audiences. Musafir and many of its competitors are also developing virtual assistants to provide contextual messaging, plus sales and service support. As the covid-19 pandemic has made clear, flight cancellations or changes to travel plans can happen at short notice, so Seera Group is prioritising enhancements to the post-booking experience to make it more predictive through large-scale data analysis. Musafir’s managing director, Sachin Gadoya, notes that travel companies are increasing their investment in areas such as cybersecurity, technical product management and DevOps.¹²⁴

Applications offering greater personalisation and responsiveness have the potential to improve the booking and travel experience, but they require more time and resources before widespread adoption is likely. As Mr Gadoya explains: “There are some off-the-shelf products that are more artificial than intelligent. It is critical that travel industry-specific tech is developed and utilised rather than one-size-fits-all robotic systems.”¹²⁵ However, Mr Varghese warns of the scale of the task the industry faces in collecting the many different dimensions of relevant data to meet its ambitions, from route data to flight statistics data and data on government restrictions—all of which come from very different sources and in different formats and must then be translated into the right contextual language for each Middle Eastern country’s base market. Still, this is the kind of thorny problem that excites him and other technologists working in the AI space, and it may attract further talent if properly supported.

2.4. FINANCE

The expected payoff from AI to the financial sector is significant. Forecasts currently foresee that in 2030 AI’s absolute contribution to the financial, professional and administrative services sector will be US\$38bn, accounting for 13.6% of the



region's GDP.¹²⁶ Egypt's AI strategy mentions the financial services sector as a key target for AI-driven transformation.¹²⁷

Within the private sector, the financial and banking sector is on track to be among the highest-spending industries on AI solutions. The International Data Corporation (IDC), a market research company, estimates that in 2021 one-quarter of all AI investment in the region, or US\$28.3m, will be spent on developing AI services in the financial sector (followed by the public sector and the manufacturing sector).¹²⁸ This includes using technologies such as deep learning to enhance fraud analysis and investigation, as well as financial portfolio management.¹²⁹

Current use cases serve both business operations and the customer experience. For example, in 2021 MNT-Halan, an Egyptian fintech, deployed Neuron, a proprietary core banking software that integrates business functions through machine learning to aid productivity and minimise the risk of default and credit exposure.¹³⁰ Similarly, BankOnUs, a major financial services aggregator in the UAE, has introduced an AI-powered app offering different financial products and services in one place, with the aim of enabling more cost-effective financial solutions.¹³¹ More traditional industry players are also changing with the times. For example, the state bank Kuwait Finance House has started adopting emerging technology, such as robotic process automation, to keep up with customer expectations, claiming to have reduced the retail credit-application process time by 50%.¹³²

Financial inclusion and ethical use

Digitalisation and AI offer ways to widen the scope of financial inclusion, creating economic

opportunities for previously unbanked sectors of society and helping small and medium enterprises (SMEs) in the informal sector join the mainstream economy and grow their business.¹³³ However, the application of AI to determine creditworthiness has recently raised questions of fairness and the responsible use of AI. As documented by the Stanford Institute for Human-Centred AI (HAI), the use of datasets that reflect real-world AI biases in the credit market, such as discrimination against women, minority groups and those with limited or no credit history, can result in the same biases in outputs generated by algorithms. Because of these flawed datasets, groups that are already at a disadvantage are continuously unable to access financial credit.¹³⁴

Navigating the world of Islamic finance

Adapting AI applications to fit with the requirements of Islamic finance requires additional work. Islamic finance differs from conventional finance in that interest is prohibited in Islam, with risk sharing facilitated by profit-and-loss sharing instead.¹³⁵ As such, AI finance applications in the region will need to incorporate these additional considerations to cater to the wide Muslim customer base. However, a growing fintech market, both in the region and abroad (for example, UK-based Alibra), is working to offer products that address customer demands and requirements. According to the 2021 Global Islamic Fintech Report (GIFR), the volume of Islamic fintech transactions globally is projected to grow from US\$49bn in 2020 to US\$128bn by 2025 at a 21% compound annual growth rate, with the UAE and Saudi Arabia leading in terms of volume and capacity. Further challenges that remain in this sector stem from a lack of capital, consumer education and talent sourcing.¹³⁶

2.5. TRANSPORT

The transport sector has broad potential to harness AI and technology-based solutions, with many applications under development to identify and segment different audiences, provide chatbots and understand consumer patterns. In cities this ranges from streamlining commuter flows to the development of autonomous vehicles, which employ machine learning to identify a vehicle's surroundings. The development of self-driving cars has been largely welcomed in the Middle East, particularly in the UAE. Dubai has set a target of 25% of all car journeys to be made via driverless transport by 2030, and in 2021 Abu Dhabi launched a pilot programme for driverless taxis.¹³⁷

The importance of the transport sector to the region's countries is also reflected in their AI strategies, with Saudi Arabia and the UAE both mentioning mobility and traffic as key areas of focus. The prospective economic impact of AI in the transport and logistics sector is also noteworthy. Its contribution to

the economies of the Gulf countries and Egypt is forecast to be US\$12bn in 2030, equivalent to about 15.2% of GDP.¹³⁸

Congestion prediction

Other recent initiatives include ride-hailing apps and congestion management. In 2021 UAE-based Careem, whose 2019 purchase by rival Uber for US\$3.1bn was hailed as a sign of the UAE's ability to produce high-value tech companies, announced that it was turning to the development of internal AI and machine-learning capabilities. The move followed changes in customer behaviour during the covid-19 pandemic, which spurred a push for more responsive algorithms and services.¹³⁹ Meanwhile, the Roads and Transport Authority of Dubai has been trialling the use of AI to ease congestion on the Dubai Metro during peak hours by mapping demand patterns in order to propose optimal transit timing for passengers.¹⁴⁰ Most of these forecasts are based on historical data, but as the availability of data increases and machine-learning models increase in accuracy, live congestion prediction will be enabled as well. The forecast impact of applying congestion management could be significant for the region. The World Bank estimates that 5.5% of GDP in the region may be lost annually as a result of poor roads and accidents, which could be reduced with the help of predictive transport management and related improved safety mechanisms.¹⁴¹

Securing biosafety at international airports

Suhail Kadri, senior vice president at Qatar's Hamad International Airport (HIA), notes that "our first production implementation of AI, related to biosafety, came during the outset of the covid pandemic in 2020, wherein we used computer vision and machine learning to enforce the use of masks by the large



workforce at HIA—way before off-the-shelf solutions became available in the market.” The airport has subsequently implemented two safety systems that use AI to mitigate runway safety hazards caused by unexpected “debris” and to detect and neutralise commercial drones to avoid operational disruptions that adversely affect other global airports. Several other projects are under development in partnership with research and commercial organisations.¹⁴²

Investment in the sector has been healthy, but it diminished in 2020 with the onset of the pandemic. Analysis from MAGNiTT, a data platform for startups, found that in 2019 a total of US\$121m was invested across 45 investment deals in the delivery and transport sector across the MENA region as a whole.¹⁴³ “Most investments, specifically in the airport industry, appear to be limited to proof of value and pilot projects rather than large-scale investments,” says Mr Kadri. “The key drivers for AI-related investments in the MENA region are consistent with global trends, namely to increase revenue through personalisation; enhance customer experience; optimise

capital investments for asset expansion; improve safety and security; increase productivity; and reduce operating costs.” While pandemic restrictions have limited mobility for many, the increase in online purchases has also provided momentum for e-commerce delivery and transport startups. Parallel research valued the market size of the region’s intelligent transport systems at US\$2.82bn in 2017 and forecasts that it will reach an annual growth rate of 11.6% by 2025, with a key driver being the development of real-time traffic information.¹⁴⁴

2.6. ENERGY

The economies of the GCC countries were built on energy sectors dominated by the extraction of oil and gas. This has generated huge amounts of wealth: according to Moody’s, a credit rating company, oil and gas account for over 20% of GDP in the region and at least 50% of state revenue in most Gulf countries.¹⁴⁵ However, this dependence has also left the economies of these countries susceptible to price fluctuations and finite supplies. More significantly, the global transition to green energy has given momentum to economic diversification programmes. Both the UAE and Saudi Arabia identify energy as one of their target sectors in their AI strategies.

Forecasting energy demand

AI offers value for the transition to renewable energy in several ways. A World Economic Forum report finds that “by creating an intelligent coordination layer across the generation, transmission and use of energy, AI can help energy-system stakeholders identify patterns and insights in data, learn from experience and improve system performance over time, and predict and model possible outcomes of complex, multivariate



situations".¹⁴⁶ The technology can enable the more efficient management of decentralised grids, the balancing of electricity supply and demand needs in real time to optimise energy usage and renewable energy forecasting.¹⁴⁷ For example, the Abu Dhabi-based utilities company Tabreed has launched its Wet Bulb Globe Temperature (WBGT) Forecast initiative, which will use AI to accurately forecast consumer cooling demand 24 hours ahead. The company's approach is two-pronged: first, focusing on weather forecasting, and second, demand correlations. The initiative is part of Tabreed's broader goal to increase cooling-plant efficiency by 30%.¹⁴⁸

Improving operational efficiency

Energy companies have long invested in technologies to improve efficiencies, with new initiatives increasingly involving digital tools. Abu Dhabi's National Oil Company (ADNOC) has begun mining its terabytes of historical and current data for insights. The company's machine-learning initiative Panorama uses algorithms to run entire scenarios in two or three minutes, which previously took up to six months to complete. By leveraging machine-learning, the company's employees are able to simply "highlight the revenues and savings and capture future opportunities". In 2020 ADNOC estimated that its Panorama Digital Command Centre had generated more than US\$1bn in "business value" in three years of operations.¹⁴⁹

Smart metering energy consumption

Various countries are introducing smart meters to better understand power consumption patterns. Saudi Arabia stands out for an infrastructure project to establish 8.3m smart meters over the next seven years,

designed to reduce operational costs and water waste and to support further AI-based innovations using the information collected.¹⁵⁰ In Qatar the Spanish infrastructure company ACCIONA is financing the AI-run Umm Al Houl desalination plant, which aims to utilise state-of-the-art AI software called Maestro to optimise operations, limit reagent consumption and make considerable energy savings. By using AI, the company expects to reduce emissions by 12,000 tonnes of CO₂ per year, equivalent to approximately 3,000 cars.¹⁵¹

Significant investment in the energy sector is expected over the next decade, particularly around the upgrading of infrastructure. Electricity grids will be refitted to reduce system losses and carbon emissions, in part through the use of AI and machine learning in smart grids. Market intelligence firm Northeast Group forecasts that smart grid investment—smart metering, distribution automation, battery storage and other smart grid infrastructure market segments—in the region will reach US\$17.6bn by 2027.¹⁵²

The economic impact of AI tools on the energy and utilities sector is predicted to be sizeable. PwC forecasts that in 2030 the absolute contribution to the energy and utilities sector will be US\$78bn and that the contribution of AI in this sector to the region's GDP will amount to 6.3%.¹⁵³ Vision 2030 programmes among GCC countries and Egypt are channelling investment away from oil and towards technological advancement, including the use of AI to facilitate renewable energy targets (the UAE and Saudi Arabia have pledged that renewable energy will account for 50% of electricity generation by 2030).¹⁵⁴

Chapter 3

AI uptake: barriers and enablers



The policy environment for AI in our set of countries provides examples of both success stories and growing pains, as countries introduce new frameworks to which businesses and other bodies must adapt without regional alignment. This section sets out the policy context and ways to overcome constraints in order to facilitate safe and responsible AI deployment.

3.1. Talent and training

Human capital remains a singularly important element in achieving progress with respect to AI in the region.¹⁵⁵ Capacity building in this area depends both on attracting talent from elsewhere and, crucially, nurturing it at the domestic level from a young age. Historically the region has had to import talent from other countries. Attracting and retaining this type of talent is challenging, as even with attractive employment packages there is immense global demand for these skills and various factors can put off prospective employees, such as potential political and security risks, negative perceptions of the region, an immature research environment and discrimination or other rights violations.¹⁵⁶ Conversely, overdependence on foreign workers (almost 90% of the workforce in the UAE is imported)¹⁵⁷ can make generating local talent pools more difficult.

The impact of the shortage of talent is felt most at the industry level, as Mr Rajpoot of L'azurde, based in Saudi Arabia, observes: "The talent in this part of the region is relatively scarce—it's tough to build tools in-house." His company has purchased a Slovakian customer data platform with the goal of greater customer personalisation. "From the data science side, we're partnering with an [external] organisation... I think the way we are approaching it is a hybrid of getting the tool, but then having our own data science team."¹⁵⁸

Cultivating highly skilled local talent is also complicated by academic constraints. This is further demonstrated by the state of AI research, where the MENA region is regarded as a minor player globally. For example, the MENA region is behind in terms of leading universities producing high-calibre academic output, which is one of the main determinants influencing university rankings and attracting the brightest talent. The region achieves merely 5.5% of peer-reviewed AI publications, ahead of Latin America (2.7%) and Sub-Saharan Africa (0.7%) but significantly behind East Asia and the Pacific (36.9%), Europe and Central Asia (25.1%) and North America (17.1%).¹⁵⁹

AI-focused universities

Among the reasons for the MENA countries' low performance in cultivating domestic talent are in part their previous lack of AI-specific education systems and their inability to pioneer developments in the technology sector. However, governments in the region are increasingly taking steps to develop home-grown talent, both within the existing workforce and among rising generations. Various universities now offer AI-related degrees, such as Saudi Arabia's King Saud University, which has also partnered with the Saudi Arabian Federation for Cybersecurity, Programming and Drones to provide executive-level AI training, or the Saudi Data and AI Authority (SDAIA), which is involved in building AI capabilities across the country.¹⁶⁰ Further digital offerings are being developed among the Gulf outposts of foreign universities and sites of higher education. In Dubai, Britain's University of Birmingham operates a campus which offers a degree in AI that incorporates modelling, machine learning and computer vision.¹⁶¹

In 2010 the Qatar Foundation launched the Qatar Computing Research Institute (QCRI),



which was eventually folded into the Hamad Bin Khalifa University. More recently the QCRI established the Qatar Centre for Artificial Intelligence (QCAI), making the study of AI an integral part of the education curriculum at all levels and attracting top talent to teach AI, while also aiming to establish a research and policy centre in Qatar to coordinate AI programming and initiatives.¹⁶²

In the long term this approach makes sense, as a high number of tech companies such as DeepMind, for example, have historically been founded by peers who met in universities and academic research centres. Likewise, academic institutions can function as centres of expertise supporting both governments in the formulation of their public policies and the private sector with fresh talent.¹⁶³ Many examples across the world show how this can be achieved in practice. The UK's Alan Turing Institute, for example, brings together academics to research policy and industry applications of AI.¹⁶⁴ Some countries in the region, such as the UAE, have even established AI university KPIs for achieving a number of AI graduates as well as fully-paid

studentships.¹⁶⁵ However, it will take time for these initiatives to bring tangible results. Also, this same level of investment is not uniform across the region, with the likes of Kuwait still at risk of falling behind.

AI-relevant vocational programmes

Vocational programmes as well as German-style dual degrees, where university graduates spend half of their study time working for a company, can also help to develop practical enterprise skills.¹⁶⁶ The UAE, for example, has launched a National Coders Programme, which aims to train citizens in coding and programming skills in partnership with local companies. Evidence from Germany suggests that this approach could be promising for directly addressing the talent gap in the region by providing people with practical skills and supplying companies with the required talent.¹⁶⁷ Simultaneously it opens up a career path in the field of AI for individuals without an academic degree. For it to work, however, it will require significant scaling, suitable industry partners and acceptance on the part of the population as a viable career choice.

3.2. A lack of regional policy harmonisation

Harmonisation of AI-related policies could help the MENA region align priorities and create an environment of mutual growth.¹⁶⁸ But at the moment the region is characterised by a fragmented policy environment. Despite the shared priority of AI across GCC governments and Egypt, we were unable to find many examples of regional co-operation in the field of AI.

In part this is due to varying levels of AI development in the countries concerned, with resulting differences in policy priorities. As Mr Salem explains: "In contrast to regions that are more coherent, like Europe, this wide

The harmonisation of data governance policies appears to be one of the big opportunities for the MENA region.

diversity [of AI capabilities] effectively renders any potential co-ordinated approach towards AI governance less feasible in terms of policy, data and knowledge infrastructures.”¹⁶⁹ In other instances, e.g. in the field of data governance (discussed in the next section), matters of national self-interest have usually taken precedence over mutual growth.

For MENA governments there are a number of pathways to achieve greater regional harmonisation, based on international examples. Some countries and regions, such as the EU, have been loosely centralising the orchestration of AI policy through the European Commission, which has been working on the AI Act, the Data Governance Act and especially the General Data Protection Regulation (GDPR), while EU member countries have maintained autonomy over their national AI strategies. This approach would, however, seem challenging among countries which are fully sovereign and most likely reluctant to outsource autonomy to a supranational entity.

A more appropriate approach for countries in the MENA region could be the formation of non-binding working groups between government officials, which could provide a first step in enabling discussions on how policy priorities could be aligned for the benefit of the region while maintaining individual countries’ national interests. This approach could take inspiration from the OECD and the Global Partnership on Artificial Intelligence (GPAI), which brings together countries to deliberate all issues, including the

responsible use of AI, data governance and the future of work, which usually results in a list of principles and best practices on how to use emerging technologies.

Data governance

The issue of policy alignment is most relevant when it comes to data regulation. A level of harmonisation can facilitate the safe and productive flow of data across a region and beyond, as demonstrated by APEC or the EU. Within the MENA region foreign companies currently face different costs and processes. As shown in the previous analyses, for example, the lack of available data can slow down progress in AI adoption across sectors, including retail, tourism and transport.

The harmonisation of data governance policies appears to be one of the big opportunities for the MENA region. The countries share a language and cultural traits, and bringing policies closer together could help to create a large localised data pool and regional AI developments.

Yet harmonising data governance regimes is easier said than done. The reasons for this are both political and economic. Despite the formal resolution of the diplomatic crisis that saw Saudi Arabia, the UAE, Egypt and Bahrain sever ties with Qatar, political tensions remain a hurdle, limiting collaborative efforts. Even close diplomatic allies like Saudi Arabia and the UAE are increasingly competitive in other arenas, making it more difficult for them to abandon positions of national self-interest for the sake of collective benefit. The default position for Saudi Arabia, the UAE and Egypt has been a “cyber-sovereignty-centric” approach to data, which poses other challenges for innovation and economic growth.¹⁷⁰

By treating the digital realm as a central pillar of state sovereignty, countries may be limiting the immediate development of their technology sector. The last decade has seen the emergence of data localisation laws designed to keep citizens' data housed domestically, often mirroring the EU's GDPR. Safeguarding personal data and privacy is a state obligation, but unlike in the EU, where the GDPR is designed to protect citizens' privacy across the continent, MENA governments have shown less concern for privacy than for national security issues.¹⁷¹ In the business sphere, these recent data localisation requirements, or lack of guidance on data protection and sharing, can hurt international companies and startups working in these jurisdictions by raising costs, restricting data analytics using cross-border data, and hindering AI development.¹⁷²

To increase the availability of high-quality data for companies, countries have a number of options at their disposal. The most straightforward solution for countries is to establish and optimise their national open data platforms, providing a one-stop solution for companies and researchers to access high-quality government data for producing innovative solutions. A number of countries worldwide have been able to do this successfully, including Austria, Malaysia and Mexico.¹⁷³ Other countries in the MENA region, such as Saudi Arabia, have established their own platforms, but these have not yet reached the level of maturity that would make them the go-to solution for emerging startups. The main limitations of these platforms, however, are that they are limited by the number and types of datasets they can bring together, and that they can mostly provide only strictly non-sensitive data due to legal constraints.

A second option would be the establishment of industry-specific data governance institutions, including data trusts or data co-operatives. These institutions would pool data from different private-, public- and social-sector actors and make them conditionally available to third parties for a previously defined purpose. The idea was first proposed in 2004,¹⁷⁴ but it is slowly gaining traction across the world, with the MIT Technology Review describing it as one of the ten breakthrough technologies of 2021.¹⁷⁵

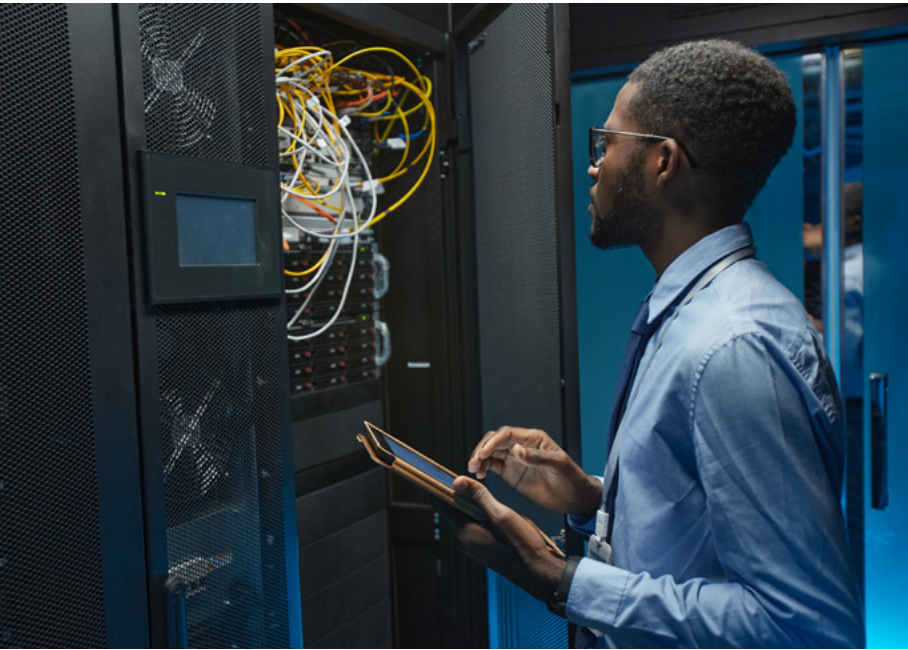
The most beneficial long-term option, however, is the harmonisation of data governance regimes. Simultaneously, for the reasons mentioned above, this is also the most difficult option to achieve. But as the world advances in the development of AI, chances are that the region's countries will have to set their differences aside to stay relevant in the future in order to compete with the US, China and the EU.

Finally, it should be noted that low availability of representative and high-quality data can present problems in terms of profitable applications that can be developed. However, by developing AI systems through datasets that do not represent the entire population, the chances of producing outputs and decisions containing bias increase drastically.¹⁷⁶ This will be discussed in the next section.

3.3. Trust and safety

Privacy and data protection

Countries in the MENA region do not currently have comprehensive and operationalised data protection regulations, which are necessary for ensuring people's trust that data about them will be collected and used responsibly. In the past few years there have been some



developments in the field of data privacy and regulation, with Saudi Arabia, the UAE and Egypt publishing protection of personal data laws. These are, however, still to be fully implemented. Qatar's Law No. 13 of 2016 grants some individual privacy rights to individuals, whereas Kuwait has not yet published a personal data protection law.

A digital governance survey by Boston Consulting Group (BCG) revealed that GCC respondents are not confident that their personal information is safe from hacking or inappropriate sharing and use. It suggests that for GCC governments to become leaders in digital service provision they must do more to earn and safeguard public trust by helping citizens understand how their data are collected and used, bolstering the protective measures governing their use and security, and sharing data that directly benefit citizens.¹⁷⁷

According to Mr Radwan, enabling an environment where high-quality data can be safely used "needs a lot of mechanisms

around governance and around accessibility of course, but also making sure that people trust the safeguards you put in place, so people are comfortable sharing their data while knowing that it won't be jeopardised."¹⁷⁸ Data protection regulations are critical tools to ensure that user rights are respected and governments and companies have rules that can keep personal information safe while fostering the responsible development and application of AI. A lack of data protection legislations and the resulting legal uncertainty, in turn, are burdensome for companies wanting to ensure the responsible development of AI applications. In order to produce regulations that are grounded in reality, however, expert and industry consultations remain of key importance to ensure that the resulting data protection regimes support innovation and the business environment.

Bias

In particular, AI poses risks that require caution from businesses and states, such as bias and inaccurate results. This problem is of particular magnitude in the MENA region, where there is an issue with the representativeness and quality of datasets used to develop AI. "Demographics such as gender are a big issue—so you'd have more male and young people connected and fewer females and from older generations, that can create unfair ways of utilising data and generating insights or decisions or applications of AI based on that," cautions Mr Salem. Using robust data in applications is critical—developers may not realise a data set is of poor quality or that the results are wrong or irrelevant, leading to incorrect conclusions from insights, which may then generate outputs that reinforce deep societal inequalities.¹⁷⁹

While some of these harms may affect everyone, others have greater potential to harm women and minority populations because of biases in the data or the programming or through the enforcement of discriminatory policies. Daniel Leufer, a senior policy analyst at Access Now, an NGO working in the field on digital civil rights, emphasises this point further: “This erasure [of certain groups from datasets], systematically and technically reinforced, has real-world consequences.¹⁸⁰ When you and your community are not represented, you lose the ability to advocate effectively for your fundamental rights and freedoms. That can affect everything, from housing to employment to healthcare.” As previously discussed, it can also affect people’s creditworthiness.¹⁸¹

Mr Kadri says that regulatory frameworks must be created to ensure (a) the ethical use of personal identifiable information (PII) data for AI applications that require personalisation for targeted marketing and sales, and (b) that AI systems maintain transparency and their outcomes are explainable in plain language so that humans don’t lose control over them.¹⁸²

Addressing this issue will be particularly important in the MENA region, where there have historically been divides between social and religious groups. Poorly functioning AI systems or their use to the benefit of a certain social group could result in significantly lower levels of trust in AI across the region.

Misuse

While considerations regarding the representativeness of data are important to make accurate decisions, the responsible use of AI technologies is equally crucial.

Many new technologies carry the potential for misuse and abuse, and similarly, AI also

presents perils for society if developed and deployed irresponsibly. “It has to be mentioned that AI is not all good and nice, especially given the systems and the nature of governments in the region, so there are also potentially harmful utilisations that will definitely emerge,” notes Mr Salem.¹⁸³

Such risks require proactive attention through ethical and rights-based frameworks. As Mr Salem explains: “Some countries have put in place some ethical frameworks or at least realised and acknowledged the downsides, or the damage that can happen in certain elements of society based on AI adoption, but most countries have not. And it’s still in the hype cycle of things, as in the early days of digitisation of government.”

Some countries and coalitions are working to address these issues. In November 2021 the UNESCO General Conference passed the first global guidelines on the ethics of the development and deployment of AI.¹⁸⁴ Before that the OECD Artificial Intelligence Principles were adopted in May 2019 “to promote the use of AI that is innovative and trustworthy and that respects human rights and democratic values”.¹⁸⁵ The EU, the US Department of Defence and Colombia¹⁸⁶ have published AI ethics frameworks, and further AI regulation is imminent.¹⁸⁷

“In Egypt we’re working on reviewing our regulation as well, and introducing elements that have to do with AI. I think it’s extremely important for regulation and policy to be there,” says Mr Radwan.¹⁸⁸ “I understand the fears that some people have that it might stifle innovation, but it doesn’t have to be regulation in the traditional sense of creating more hoops for people to jump through, but I think things like an impact assessment, checklists for companies to determine

whether or not what they're doing really does qualify as safe and responsible AI, and having governments be a partner in this process of assessment."¹⁸⁹ The UAE has taken steps in this process, launching an Ethical AI toolkit in January 2019 that contains guidelines and principles for how AI systems can be used responsibly, and a tool for developers to assess their applications.

To ensure that this trust is maintained, clear actions from governments and industry are required. Responsible AI guidelines and a principles-based approach can function as a North Star to which companies and AI developers need to adhere. However, these frameworks have been criticised for failing to provide the necessary strictness to which AI developers have to adhere.¹⁹⁰ Opponents of non-binding responsible AI principles typically propose strict EU-style regulation, but the downside of this approach is that it then runs the risk of limiting companies' room for innovation.

Other countries have developed more flexible initiatives for managing the responsible use of AI and algorithms. Canada, for example, has developed an algorithmic impact assessment tool that allows government departments to assess the impact of their algorithms prior to their implementation.¹⁹¹ A myriad of other AI-specific certification schemes¹⁹² is emerging, allowing businesses to show to consumers that they are responsible developers and are therefore being perceived as more trustworthy. Showing the business case to AI companies could be the way forward to building trustworthy

AI applications. This is further supported by evidence from The EIU, which shows that responsible use of AI is becoming a competitive advantage for businesses.¹⁹³ However, there is currently no certification scheme that has accrued sufficient legitimacy and traction compared with other industry certification standards such as ISO. Future certification regimes should be aligned with international consensus standards to promote interoperability, limit barriers to trade and ensure that they can evolve as AI itself develops. Similarly, these should be based on multi-stakeholder input as well as deep technical expertise.

Finally, aside from managing the technical errors and inaccurate decisions generated by AI, there is also the human element. Frameworks and new policies can go a long way, but ultimately even in cases where humans have the final say over whether to implement a decision suggested by an algorithm, they will need to understand AI-generated outputs. Anecdotal evidence suggests that among government officials there is an absence of educational programmes focused on the nature, opportunities and challenges of AI. In part this is because of the complexity of AI systems, but it is also due to the novelty of the topic. Yet ensuring that policymakers and people with decision-making power over AI systems are well trained will be a key requirement for guaranteeing that, in addition to developing safe AI applications, it will enable them to partner with and use AI tools effectively.

Chapter 4

Policy futures



KEY DIMENSIONS

- a. **Nurturing local talent**
- b. **Fostering local R&D**
- c. **Safeguarding transparency and ethical use**
- d. **Creating a robust infrastructure and data environment**
- e. **Stimulating the private sector**
- f. **Refining AI policies**

The UAE, Saudi Arabia, Qatar, Kuwait and Egypt have all made significant investments for fostering an environment where AI can flourish and be deployed across industries. From national AI strategies pledging billions for the development of AI to new government-backed departments specialising in emerging technologies, countries in the region have ambitions to become key players both regionally and globally.

a. Nurturing local talent

As emphasised throughout this report, human capital is critical to realising a successful and thriving AI ecosystem. Policymakers in the MENA region must focus on policies that cultivate a highly skilled domestic workforce capable of both developing and leveraging AI systems while minimising the risk of graduates moving to more established AI hubs across the world. Similarly, governments should promote initiatives for basic digital literacy at a young age to ensure that future generations will have core AI competencies. At the same time, policymakers should create opportunities to attract expats to the region's AI research community.

As much as the region has advantages and ambitions for the development and proliferation of AI across key economic sectors, it also faces challenges around talent, the business environment, data regulation and trust and safety. To help policymakers in the MENA region consider how to tackle these challenges and what policies they should implement for the short- and long-term impact, Economist Impact has produced a policy playbook that analyses policies across six key dimensions.

Through a review of international case studies and academic literature and informed by expert interviews, Economist Impact's policy analysts have assessed a range of policy options based on priority, time for implementation (0-3 years; 3-5 years; 5-10 years) and complexity. Policy assessments were arrived at through a double-blind coding process.

The policy options that we offer are not designed simply to be taken off the shelf and implemented in a top-down manner. As with all policies, new AI-related regulations and laws should be subjected to consultations with relevant stakeholders across the public and the private sector and academia.

Our policy playbook, which details all policy options, is provided in the Appendix to this report. This can serve as a resource for policymakers who are interested in learning the details of what other countries in the region and globally are doing. In this final chapter of our report we provide the high-level takeaways from the playbook—presenting a selection of near-term solutions, medium-term approaches and longer-term strategic priorities.

Near-term solutions

Short-term policy options that can support the cultivation of AI talent can be targeted at supporting the existing batch of AI students and graduates and ensuring an effective transition from education to the local AI workforce.

Time to implement = 0-3 years

Introduce initiatives to support foreign inflows of AI expertise

- One of the most pressing issues for the MENA region is the availability of talent to develop AI systems. In addition to cultivating domestic talent, governments in the region should introduce immigration incentives to attract external knowledge, including a relaxed visa scheme targeted at AI and technology experts.
- AI-specific visas are becoming increasingly frequent. In the past decades, for example, the US was able to grow a world-renowned AI workforce through its H1B visa.¹⁹⁴ The UK has also implemented a similar visa regime through its Tech Nation Visa.¹⁹⁵ Some visa-specific initiatives have been put forward in the region, notably by the UAE and Saudi Arabia. However, other countries should follow their lead and make it easier for foreign talent to move to work in their countries.

Establish and scale vocational programmes in partnership with industry

- A common issue with graduates of theoretical science degrees related to AI is the lack of on-the-ground applicability. To overcome this, policymakers can work with universities and companies to design and trial vocational programmes which offer tangible skills that complement theoretical academic instruction. These programmes also allow students to build connections with industry players who can support career development and can prevent brain drain - where AI-talent leaves the country to pursue job opportunities abroad.
- One international example that policymakers can look to is the UK, where the University of Oxford's Department for Continuing Education offers short, online courses on AI that are taught by industry leaders and academic experts, including a series of courses on blockchain.¹⁹⁶ Some universities are also integrating industry experience with traditional AI and computer science degrees. For example, the University of Kent gives students the option to study for a bachelor's degree in AI with a year out in industry, including working with companies ranging from Intel to Disney.¹⁹⁷ Through this, students can gain work experience and increase their chances of getting a longer-term job after graduation.

Longer-term strategies

In the longer term, policymakers should focus on building a new and expanded constituency of AI graduates by targeting different groups that have previously been overlooked.

Time to implement = 3-5 years**Trial AI-based instruction tools in primary and high schools**

- To enhance the learning experience of students, governments should trial AI-based instruction tools to create a more effective learning experience for primary and high school students. These could be in the form of adaptive learning platforms that use AI to ensure familiarisation at an early age. As these platforms are still novel, governments should study their merits and consider how best to roll them out on a trial basis, and how to support teachers in the process.

By investing in programmes explicitly focused on women in AI, MENA governments can tap into a mostly overlooked source of knowledge and entrepreneurship.

Promote STEM skills development in primary and secondary schools

- AI education does not start at secondary education level but begins already in childhood. In order to cultivate young AI talent, governments in the region should invest in STEM-related subjects at school-level. This should include redesigning national school curricula to make AI and STEM-related subjects an integral part of it, while also investing in teacher training and equipment (through suitable laptops, software etc).
- A number of countries can offer a model for the MENA region. Australia, for example, has created a National Stem School Education Strategy 2016-2026.¹⁹⁸ The UK, on the other hand, has developed a Professional Development Teachers Fund, with a specific track preparing teachers with the necessary skills for teaching AI-related courses.

Develop policy to boost the number of applicants for AI-related/ STEM university degrees through fully-funded AI/ STEM

- Universities are a key source for highly skilled talent, but there need to be sufficient opportunities to attract students. AI-focused curricula could translate into improved job prospects if built with industry needs in mind, while scholarships could help to incentivise high rates of enrolment.
- The Government of Australia has dedicated A\$24.7m over the next six years to its Next Generation AI Graduates Programme to “attract and train home-grown, job-ready AI specialists”.¹⁹⁹ The government plans for this investment to translate into 234 domestic AI specialists through the funding of scholarships, which will be co-funded with universities and industry.²⁰⁰

Launch a Women in AI programme to educate women in STEM subjects and ensure their participation in the workforce

- In the Gulf states women comprise almost 60% of engineering students at university.²⁰¹ University enrolment more broadly varies in MENA countries, from only 40% in Egypt to over 80% in Kuwait.²⁰² However, there is a crucial mismatch between female graduates and job opportunities in STEM and also AI. By partnering with industry players and universities and investing in programmes explicitly focused on women in AI, MENA governments can tap into a mostly overlooked source of knowledge and entrepreneurship. Gender norms that exist in the region (although this has been changing in recent years) mean that this initiative may take more time to develop and implement than other policy measures.
- The Women in AI initiative is a non-profit organisation which is supported by industry partners and governments around the world and is working towards gender-inclusive AI across the world. The initiative offers members opportunities to learn through different courses and certifications; participate in women-specific AI accelerator and incubator programmes; and explore job opportunities from partner companies.²⁰³

b. Fostering local R&D

The MENA region has contributed to only 3.1% of AI publications in global journals between 2000 and 2020, indicating a dearth in research capabilities. Contributing to this is the global phenomenon of AI researchers and data scientists facing the temptation to move from academia to industry, attracted by lucrative salaries and better resources, such as higher computing power and better data. To counteract this, policymakers can implement strategies that attract researchers from leading countries and institutions to the MENA region.

Launch life-long learning programmes to ensure labour market resilience against automation

- Life-long learning programmes can support employees who are at risk of being displaced by AI automation by giving them opportunities to reskill to another profession. These programmes can also support mid-career professionals to upskill and improve their ability to work alongside and operate new technologies, including AI. Policymakers can work with local universities to develop continued learning opportunities, either specific to AI or not. In addition to this, they can incentivise employers to provide such lifelong learning opportunities to ensure that, in particular blue collar workers, continue to upskill alongside changing industry needs. Time and investment will be needed to facilitate the development, rollout and uptake of such programmes.
- Brussel's Vrije Universiteit Brussel (VUB) established its AI lab in 1983 with the aim of providing a range of AI-related educational offerings, starting with PhDs. Today the lab also offers AI-specific lifelong learning courses to working professionals, ranging from policymakers and journalists to CEOs and technology investors.²⁰⁴ The lab is partnered with the Belgian government and the European Commission.

Longer-term strategies

Although R&D efforts will take time to show results, e.g. increases in MENA-produced AI publications, policymakers have the opportunity to move quickly and invest in the steps needed to nurture the research community.

Time to implement = 0-3 years

Create an AI-specific R&D budget and allocate it to universities

- As any other research, AI research depends on access to resources, ranging from the necessary hardware, computing power and storage systems to high-quality and expensive datasets. Using existing sovereign wealth funds and oil rents, policymakers in the MENA region can set aside budget shares specifically to support researchers' access to such requirements through, for example, AI research grants at research centres and universities. This could help with researcher retention and also attract researchers from leading countries and institutions.
- On the back of its National AI Strategy, the UK government set aside funding specifically for research in "data science and AI", amounting to £300m, which complements the establishment of 16 New Centres for Doctoral Training at universities across the country, delivering 1,000 new PhDs over the next five years.²⁰⁵



Create new AI-specific fellowships to attract world-class researchers and professors

- In addition to resources, a thriving research community requires high talent and skills. MENA governments could consider funding local research fellowships to attract foreign expertise to support local research development and knowledge sharing, while simultaneously strengthening local universities' reputation in global AI academia.
- Singapore's National Research Foundation (NRF) launched a NRF Fellowship for AI, which offers successful candidates a five-year research grant of up to S\$3m and the freedom to conduct ground-breaking AI research in their discipline of choice.²⁰⁶
- The UK government has allocated £46m to the Turing AI Fellowship programme with the aim of attracting and retaining the world's most talented researchers in the field of AI and to build new domestic capability and capacity.²⁰⁷

Cultivate research partnerships between government and industry

- Governments rely on the insights and expertise from academia and industry to face some of their most pressing challenges. Academia brings together deep subject matter expertise in AI, while private-sector actors bring dynamism and innovation potential. As such, governments should develop research-focused partnerships between stakeholders in government, industry and academia to work together and develop solutions for some region-specific challenges. In the MENA region these could include flooding, droughts, agricultural challenges, or meeting sustainable development goals using AI-based solutions.
- There are a number of examples which can be found across the world. The UK government, for example, has partnered with the Alan Turing Institute to establish the Online Harms Observatory, with the aim of better understanding the environment of online harms and related trends.²⁰⁸ France, on the other hand, has partnered with the National Institute for Research in Digital Science and Technology (Inria) to manage and deliver the research element of its National AI strategy.²⁰⁹

c. Transparency and ethics

Globally, one of the most important conversations about AI centres on the risks that surround transparency and ethics. Such risks include the perpetuation of real-world biases in algorithmic decision-making, potentially resulting in the discrimination of already disadvantaged groups, such as ethnic minorities, women and people on low incomes. On top of this, governments are grappling with the risk of unexplainable and potentially untrustworthy outcomes.

Near-term solutions

Promoting the use of existing international guidance on responsible AI to foster the explainability and transparency of algorithms.

Time to implement = 0-3 years

Longer-term strategies

To make AI ethics, transparency and oversight the norm in the long run, policymakers need to invest in guidelines and tools that hold developers accountable for their AI systems.

Time to implement = 3-5 years

Integrate ethics and responsibility into AI ethics guidelines and principles and offer high-level guidance on best practices leveraging existing international principles

- Currently, policies and guidance regarding AI ethics are mostly non-existent in much of the world, including the MENA region. In order to create AI products and services that are safe, countries in the region should integrate ethics and responsibility into AI ethics guidelines and principles and offer high-level guidance on best practices leveraging existing international principles.
- The European Commission's High-Level Expert Group on AI has developed and published a set of 'Ethics Guidelines for Trustworthy AI' with the aim of promoting the development of AI systems that are (1) lawful, complying with all applicable laws and regulations; (2) ethical, ensuring adherence to ethical principles and values; and (3) robust, both from a technical and a social perspective.²¹⁰ Although these guidelines are non-binding, they provide a robust framework for MENA countries to turn to when developing their own frameworks and regulations.

Trial responsible AI in government service delivery and policymaking. Publish case studies on AI in government to share learnings, success stories and challenges

- Governments should position themselves as role models in the responsible development and implementation of AI. A way forward in this is by trialling the responsible use of AI in government service delivery and policymaking through select pilot projects. This could be in the form of new AI applications developed in strict accordance with responsible use principles as well as other innovative tools, such as algorithmic registries.²¹¹
- These trials should be captured in case studies to be made available to businesses, academia and local governments. By publishing case studies on AI in government and sharing learning and success stories, governments can take an active approach in steering the development of AI implementation in a way that builds on previous efforts.

d. Infrastructure and Data

As mentioned above, infrastructure and data are two of the key enabling prerequisites of a robust AI ecosystem, along with skills and talent. As AI proliferates across sectors, so will the requirements needed to run such systems. While investment in AI is considerable in the region, this must be matched by accessible and robust data, which the region lacks at the moment.

To maximise the benefit of AI in the region, policymakers need to complement their investments in AI initiatives with improvements in data and enabling infrastructure.

Medium-term approaches

Building reliable datasets is no easy feat: it requires robust data collection methodologies and sufficient public trust levels that support data sharing, both of which can be built up over the medium term. Similarly, connectivity infrastructure is needed to enable faster and more efficient AI decision-making.

Time to implement = 3-5 years

Build/expand national open data platforms allowing startups and researchers access to high-quality data:

- AI systems rely on comprehensive datasets, but emerging startups and underfunded researchers may suffer from a lack of access and funds to gain access. The region already struggles with a dearth of data, so to overcome this “cold start” problem, a key solution that policymakers should leverage is the development of national open data platforms that are easily accessible and free for capital-strapped AI startups and researchers.²¹² By producing high-quality open data platforms that house all public data in a well-organised way, startups and researchers can build AI systems using large and reliable datasets.
- There are numerous examples of national open data portals around the world, with some leading examples including Denmark’s Datafordeler (Data Distributor),²¹³ which provides “stable and secure access to coherent basic data from public registers for the benefit of authorities, companies and citizens”, and Austria’s Open Data Österreich, which aims to record metadata from over 1,300 government catalogues and make them accessible to the public.²¹⁴

Invest in 5G infrastructure

- According to 2018 forecast data by the GSM Association, which represents the interests of mobile network operators worldwide, 16% of the GCC population is expected to have adopted 5G mobile connections by 2023—1% above the global average.²¹⁵ To increase this adoption rate further, especially as novel AI applications continue to require increasingly larger data transfers, policymakers can allocate/ increase 5G budgets while working with industry actors to supply the infrastructure for it. The focus should also be on enabling remote access to the internet and 5G, ensuring that the benefits of AI can reach the entire MENA population and not just select groups in urban areas.
- In 2021 the government of Singapore announced a new US\$30m fund focused on building the necessary infrastructure and industry partnerships to develop 5G talent and services to drive 5G adoption.²¹⁶

Debate and explore the establishment of industry-specific data trusts to facilitate data sharing

- Data trusts are a new legal model for sharing data with third parties, consisting of a managed data-sharing repository built around data privacy, security and confidentiality. Such data trusts allow organisations to leverage large, anonymised datasets that are consistent and easily applicable to different software systems, while minimising stakeholder concerns of privacy.²¹⁷ MENA policymakers can encourage academia and civil society organisations to consider the development of such data trusts, especially for data-rich industries, by hosting roundtables and producing frameworks on such models. However, data trusts are still a relatively new concept, and policies establishing data trusts should therefore be accompanied by metrics assessing benefits, drawbacks and risk mitigation.
- The UK Universities of Cambridge and Birmingham have launched the Data Trusts Initiative, which is focused on conducting research and engagement activities related to facilitating the development of data trusts.²¹⁸

Refined data privacy regulation

- While most MENA countries have already established their data privacy and protection strategies or laws, there is a need to revisit these policies and ensure that they align with the national AI strategies. By doing this, MENA policymakers can instil trust in citizens that their data are safeguarded, while also attracting foreign talent and foreign companies to establish regional hubs.

Longer-term strategies

In the longer term, policymakers in the region can support more strategic approaches to building access and quality of data with an emphasis on regional harmonisation. Such strategic approaches will require more time owing to the need for crossborder negotiations and greater diplomacy, given the competitive nature of the AI sector.

Time to implement = 5-10 years

Drive harmonisation of data governance laws across the region

- The harmonisation of data governance laws is critical for the MENA region as it enables a better flow of data necessary for developing AI applications. Furthermore, the MENA region is primarily Arabic-speaking, so there will be a need to develop AI systems that are trained in English-language as well as in Arabic-language data. However, each country in our sample lacks data nationally, therefore policymakers can engage in negotiations to develop a harmonised data governance legislation that would allow governments to share data across their borders and develop a region-specific database. This, combined with the above open-data portal approach, would support local startups' access to large, contextually relevant data while also attracting foreign technology companies to establish regional hubs without being discouraged by having to adopt different AI and data approaches for each country.
- Examples include the EU's GDPR,²¹⁹ which enforces data privacy principles across the European Union and the European Economic Area; the APEC Privacy Framework²²⁰ and the ASEAN Framework on Personal Data Protection,²²¹ which are binding if parties pledge to abide by them. However, they are not binding in and of themselves.

e. Stimulating the private sector

MENA governments have so far adopted a government-led approach to AI investment and associated initiatives. However, in addition to public-sector contributions there is a need to stimulate the private sector and the start-up ecosystem, which in turn can foster further innovation, drive economic growth and increase job growth in a fast-moving industry.²³³ Policymakers can allocate budgets to explicitly support local AI startups and encourage home-grown innovation.

Establish national compute resources for researchers without access to the needed level of compute

- Governments should ensure that AI innovation is inclusive and researchers and academic communities can participate irrespective of the resources at their disposal. To achieve this, governments should create a national AI research resource, providing computational, data and training resources. Stand-alone national AI research resources have not yet been fully implemented, although the US is currently in the process of establishing one, having created a specific task force.²²²

Near-term solutions²²³

MENA policymakers should look to global examples of short-term strategies to support the local AI private sector. Equipped with sovereign wealth funds, these countries can prioritise domestic AI companies, giving them the opportunity to catch up with more established players.

Time to implement = 0-3 years

AI procurement legislations

- Current AI procurement strategies tend to favour more established technology companies, often those that are foreign. This means that local startups may not have equal opportunities to win lucrative government procurement contracts. In MENA the push to e-government and AI-based public systems, as outlined in this report, opens up the opportunity for policymakers to focus on giving contracts to local companies. This may be achieved by adapting existing government procurement legislations, first, to incorporate AI-specific considerations, and second, to include in these new considerations quotas or requirements for a certain share of government contracts to be awarded to local technology companies.
- In 2020 the UK published its first Guidelines for Artificial Intelligence (AI) procurement with the aim of providing central public-sector bodies with a set of guiding principles for purchasing AI technology. The government aims to encourage the ethical adoption of AI in the public sector through the guidelines, along with providing opportunities for leveraging the most innovative solutions.²²⁴

f. Refining AI policy

All the MENA countries in our sample have published AI policies or strategies, apart from Kuwait. However, while this is essential, there is a need to revisit these strategies regularly, given that the field of AI is rapidly changing, particularly as attention on AI ethics grows. This will involve ensuring that the public sector, or a subset of it, is focused on AI and is equipped with the basic skills to understand it.

Create AI challenges by inviting startups to bid for solving particular local challenges through AI products

- Financial incentives can be a useful tool to encourage innovation in the private sector, for example through AI innovation challenges. Such challenges are typically focused on using AI to solve real-world challenges in areas such as transport and public healthcare. MENA governments can allocate budgets for awards to go to these challenges, which can support budding startups while solving actual problems and benefiting citizens at the same time.
- Multiple government-led AI challenges from which MENA policymakers can learn exist globally, including Singapore's National Research Foundation Trusted Media Challenges, which are aimed at developing AI-based solutions for combating fake news media. Cash prizes range from S\$25,000 to \$300,000 (US\$18,500 to US\$407,000).²²⁵ The foundation also organises non-cash-based challenges such as the AI Technology Challenge, which includes two types of challenges—open-theme challenges, which allow for participants to create original solutions, and thematic challenges, which target predefined problems in areas that are of strategic relevance to Singapore.²²⁶

Establish innovation fellowships to increase technological capacity in governments

- In addition to attracting AI talent into the private sector, countries in the MENA region struggle to attract tech talent into government itself. Being able to draw on AI talent is a major opportunity for governments to improve their performance and modernise their delivery of public service. Innovation fellowships, as those created in the US or the UK, could be a way forward to tackle this challenge. Innovation fellowships offer the government the opportunity to have skilled tech talent to join the government for a specific period of time and work on a particular challenge or project. This allows governments to benefit from experienced developers while allowing tech talent to become involved in the workings of government.
- The US was one of the first countries to launch such an initiative with the Presidential Innovation Fellows Programme. The UK government followed its lead and created the No.10 Innovation Fellows Programme, modelled after the American scheme.

Near-term solutions

Time to implement = 0-3 years

“Financial incentives can be a useful tool to encourage innovation in the private sector”

Create AI learning tracks for government officials teaching the nature, opportunities and risks stemming from AI

- AI expertise within government remains a major issue across the region and the world more broadly. MENA policymakers need to ensure that public-sector workers have the relevant skills to develop, refine and implement AI policy measures, track progress against set targets, and procure AI-related products and services. This could involve the provision of short courses through industry and university partnerships, linked to the above policy option focused on lifelong learning, and incentives for employees who complete them.
- Policymakers in MENA can look to Argentina, where the government has established its own university, the Design Academy, which teaches public servants skills that will be integral to the future of government work. In just three years over 15,000 government employees have received training in a number of fields, including AI and machine learning.

Longer-term strategies

Looking to the future, MENA policymakers should make the most of their national AI strategies by mobilising a team to implement them, align them with other regional strategies and further refine them as the technology advances further.

Time to implement = 3-5 years

Build dedicated offices within government empowered to co-ordinate cross-governmental AI policies

- To further develop and harness AI expertise in the government, MENA policymakers could consider a dedicated AI office empowered to co-ordinate cross-governmental AI policies through a clear mandate. By establishing such an office, MENA governments would be able to have a central point of expertise regarding AI investment, development and implementation, while simultaneously ensuring that policies are developed and implemented in the most effective manner.
- The UK government has established its Office for Artificial Intelligence, which is responsible for overseeing the implementation of the UK's National AI Strategy. The office also engages with different stakeholders to build public trust and support regarding AI development and innovation.²²⁷
- Colombia has also established an AI Task Force with a similar mandate, which also includes monitoring the use of AI systems by public entities and facilitating international co-operation and collaboration on AI-related issues.²²⁸

Regional AI working group with policymakers to align policies

- Given the similar goals of economic diversification and digitalisation across the MENA countries we surveyed, there is an opportunity for them to learn from each other, perhaps in the form of an AI working group between regional policymakers that focuses on common goals and could even facilitate some of the strategies mentioned above. These could include a common data privacy governance framework and a regional data-sharing initiative.
- There are multiple examples of regional and international collaborative initiatives focused on AI. For example, the European Commission's High-level Expert Group on Artificial Intelligence, which is made up of experts from across the EU and has the mandate of developing the European Commission's approach to AI, including guidelines for AI ethics.²²⁹

Establish multi-stakeholder working groups with representatives from academia, civil society, industry and government to provide independent expert advice on policy priorities

- Governments need to ensure that the new policies and laws they develop are grounded in reality and match both policy priorities and the demands of the market. In order to produce policies and regulations that stimulate innovation, governments in the MENA region should consult a wide range of relevant stakeholders across the AI community (e.g. private sector, academia, NGOs, civil society) in their policy formulation process. These interactions could be in the form of workshops, public consultations, surveys or even an AI council bringing together stakeholders from academia, industry and civil society and providing independent advice on policy priorities.
- AI councils have already been developed in other parts of the world, for example in Colombia and the UK. In the UK the government's AI Council is "a non-statutory expert committee of independent members set up to provide advice to the Government and high-level leadership of the AI ecosystem". Its main aim is to foster AI adoption and implementation across society while deliberating on policy priorities.²³⁰

Refine national AI strategies

- As all but one of our priority MENA countries have already established their national AI strategies, there is a need for these countries to establish a set timeline to review and revise their strategies. Policymakers should regularly track progress against their own targets, periodically revising them against a set deadline. By doing this, the government is able to ensure the successful implementation of its AI strategy while also taking into consideration changes in the AI landscape and related areas (e.g. changes in ethics regulation, data privacy, foreign investment etc.).
- One notable example of a government that regularly revisits its AI strategy is Finland. The government has published its initial AI strategy, along with one updated strategy, since 2017.²³¹ Alongside this the government has also published supplementary policy documents on the future of work in the AI age, for example, with a particular focus on the impact of AI on labour and the skills requirements needed to offset this.²³²

Annex A

Country profiles

The following section of country profiles presents policy snapshots and notable AI benchmark rankings for our country set: Egypt, Saudi Arabia, the UAE, Qatar and Kuwait. Each of the country profiles will include a section that includes policy options tailored to each individual country.



Egypt



Saudi Arabia



UAE



Qatar



Kuwait

Egypt



Overview

Egypt has experienced more interruptions in its AI development than the other members of our country set, reflecting political and economic instability in parts of the previous decade. However, in the past three years the country has accelerated its AI programmes, setting out a bold vision for the country's digital transition and diversification. AI is forecast to contribute US\$42.7bn to Egypt's economy, equivalent to 7.7% of GDP, by 2030.²³⁴

Benchmarks

Egypt's rank in the indicator for Government Strategy is relatively high (27th), although its overall position drops in the Global AI Index (59th out of 62 countries analysed) and 65th out of 160 countries in the Government AI Readiness Index. Moreover, although Egypt is ranked behind the other four countries in our survey in three other AI indices (Government AI Readiness; Network Readiness; Digital Adoption), the AI Policy Observatory records the country as having a relatively high number of AI policy initiatives (seven, compared with Saudi Arabia's five and the UAE's nine).

Initiatives and policies

- In November 2019 the Egyptian government formed the National Council for Artificial Intelligence to bring together government institutions, prominent academics and practitioners from leading businesses in the field of AI. The National Council's primary objective is to co-ordinate and develop Egypt's AI strategy, published in the same year.

- In 2020 the government passed the Personal Data Protection Law No. 151, prohibiting the transfer of personal data to recipients outside Egypt, except with the permission of the Egyptian Data Protection Centre.²³⁵
- The overarching development plan, Egypt Vision 2030, lists several other initiatives specific to the digital transition, from Egypt's digital transformation strategy to the "Digital Egypt" campaign, to help develop e-governance and digital services. In 2021 the National Council launched Egypt's National Artificial Intelligence Strategy, detailing use cases and implementation plans.²³⁶

Selected success stories

- MNT-Halan's Neuron: banking software that integrates business functions through machine learning to aid productivity and minimise the risk of default and credit exposure.²³⁷
- Swvl: a ridesharing bus-hailing app that leverages artificial intelligence and data analytics to create the best possible experience for both drivers and riders.²³⁸

Saudi Arabia



Overview

Saudi Arabia is investing heavily in AI as part of its Vision 2030 national development plan that has set a high bar for other countries in the region. While the covid-19 pandemic caused a partial realignment of resources and attention, the country continues to forge ahead in its AI development. Saudi Arabia is set to gain US\$200bn from AI by 2030.²³⁹

Benchmarks

As evidence of its progress, Saudi Arabia tops our country set in the Global AI Index (26th out of 62 countries). In other indices it scores reasonably well but it falls in the middle of our country set, trailing the UAE and Qatar in Government Readiness (34th out of 160), Network Readiness (40th out of 134) and Digital Adoption (50th out of 141).

Initiatives and policies

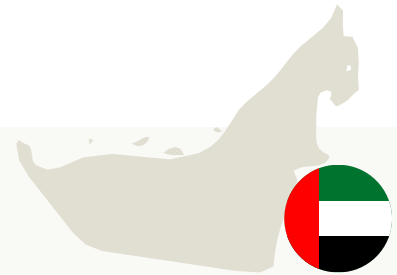
- The country's Vision 2030 initiative charts a path for diversification and digitisation. As part of Vision 2030, in 2019 the country launched the Saudi Data and Artificial Intelligence Authority (SDAIA) to advance the use of AI applications nationally. Two other entities were also created under SDAIA: the National Centre for Artificial Intelligence and the National Data Management Office (NDMO), while the Saudi National Cybersecurity Authority exists in parallel.

- Complementing the national ICT Sector Strategy 2023, SDAIA published a National Strategy for Data and AI in 2021, which aims to attract foreign and local investment worth US\$20bn in the next ten years and to train 20,000 data and AI specialists.^{240,241}
- The NDMO is helping with standard-setting around the ethical use of AI in the public sector and has issued National Data Regulations that mandate data protection practices for all entities processing personal data, followed by the enactment of the Personal Data Protection Law in 2021, which had, however, not yet been implemented at the time of writing.²⁴²
- Saudi Arabia organised the Global AI Summit, one of the largest AI-specific conferences in the region, bringing together leaders from academia, industry and government.

Selected success stories

- UnitX: automates safety and security monitoring systems such as CCTV and drones.²⁴³
- Saudi Arabia's Tawakkalna app gives real-time information on the number of covid-19 cases and enables citizens to request and manage movement permits while alerting them of nearby cases of infection.²⁴⁴

United Arab Emirates



Overview

The UAE has placed a high priority on digitisation and the adoption of AI applications, making it one of the first countries in the region to deploy new technologies such as autonomous vehicles and e-governance services. The country's economy is primed to benefit from an AI contribution of US\$96bn, or 12.6% of GDP, by 2030.²⁴⁵

Benchmarks

Across the benchmarks the UAE performs strongly, topping our country set in all indices except the Global AI Index (34th out of 62), while it scores notably well for Government Strategy (13th out of 62) and Commercial (27th out of 62). The country occupies a commendable 19th place out of 160 in the Government AI Readiness Index, boasts nine AI policy initiatives and is ranked a respectable 13th (out of 25) on the Automation Readiness Index.

Initiatives and policies

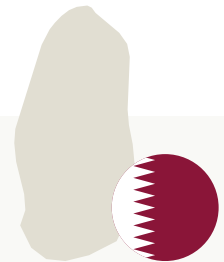
- The UAE's Artificial Intelligence Strategy 2031, launched in 2017, created the National Programme for Artificial Intelligence to highlight advances in AI and robotics, and in 2019 it established the Mohamed bin Zayed University of Artificial Intelligence for graduate research in this area.²⁴⁶ The strategy also includes the establishment of the world's first Ministry of State for Artificial Intelligence.

- As part of its National Cybersecurity Strategy, the UAE launched its first federal data protection law in November 2021. The law has similarities with the EU's General Data Protection Regulation (GDPR) but represents a significant shift for data practices in the emirates, which until now did not have data protections at the federal level. Executive regulations, however, have yet to be passed and will determine the application of the law.²⁴⁷

Selected success stories

- "Rashid" chatbot: an AI-powered government chatbot assistant, built to answer questions regarding the necessary government procedures, documents and requirements for conduct various transactions.²⁴⁸
- Tabreed's "Wet Bulb Forecasting": an AI-enabled cooling-demand forecasting system aimed at improving energy efficiency.²⁴⁹

Qatar



Overview

Qatar is showing its mettle in major industries, events (it will host the FIFA World Cup in November 2022) and digital advancement, achieving AI outcomes beyond its small size. The country has made arguably the greatest progress in the region over the past two years in terms of human capital, infrastructure, data availability and representativeness, and government use of digital tools. Qatar's gains from AI, combined with those of the other GCC4 countries (Kuwait, Bahrain and Oman), are expected to reach a total of US\$45.9bn (8.2% of GDP) by 2030.²⁵⁰

Benchmarks

Qatar performs well in the various AI benchmarks. It comes second in our country set in Government AI Readiness (26th out of 160), Network Readiness (38th out of 134), and Digital Adoption (30th out of 141). The Global AI Index places the Gulf state 45th out of 62 countries, behind Saudi Arabia and the UAE, and in last place (62nd) on the Commercial indicator, but in the top half of countries on the Infrastructure indicator (28th out of 62).

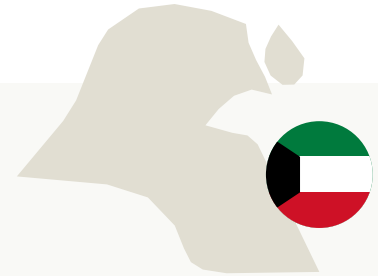
Initiatives and policies

- The Qatar Centre for Artificial Intelligence developed and published the National Artificial Intelligence Strategy for Qatar in 2021, aiming to deploy AI throughout business, governance and society. The strategy sets out six pillars: education, data access, employment, business, research and ethics. Its goals are to develop leading digital infrastructure, robust AI ethics and governance frameworks, and stronger guidance on use cases and algorithmic decision-making.²⁵¹
- On data policy, the Qatari Law No. 13 of 2016 on protecting personal data extends certain privacy rights to individuals.²⁵²

Selected success stories

- Hamad International Airport: use of AI and machine learning to support biosafety measures (e.g. detection of mask wearing) and prevent operational disruptions (e.g. caused by drones).²⁵³
- Umm Al Houl desalination plant: backed by Spanish infrastructure company, ACCIONA, and uses Maestro AI to optimise operations

Kuwait



Overview

Kuwait has less of a track record on AI than the other countries in our set. It lacks some of the developed strategies and policies but has embraced digitisation in its national development plan and has a relatively strong infrastructure foundation with which to introduce AI applications. However, the issues that may have slowed AI adoption so far are not so much technical as governance-related—the government has been criticised for ineffectiveness in this area—and two years of restrictive border policies that have made working in the country less attractive for foreigners and residents alike. Kuwait's neutral political positioning in the region may be to its advantage in achieving ambitions such as constructing an international data centre, but these goals still require progress in other fundamental elements, including suitable infrastructure, regulations and talent. The contribution of AI to the GCC4 countries, including Kuwait, is forecast to reach US\$45.9bn by 2030, equalling 8.2% of GDP.²⁵⁴

Benchmarks

Given the country's limited history of working on AI, Kuwait features in just three benchmarks but performs reasonably well in spite of being a relative newcomer. Kuwait ranks in the 60s globally for Government AI Readiness (63rd out of 160), Network Readiness (53rd out of 134), and Digital Adoption (51st out of 141), in each case coming fourth among our country set.

Initiatives and policies

- While the government has acknowledged the importance of AI for Kuwait's economic diversification, it has yet to publish a specific AI strategy for the country. Nor has it published a digital strategy, although technological advancement is central to the country's national development plan, Vision 2035. The government has introduced regulatory reforms to facilitate developments in the ICT sector.
- Similarly, Kuwait does not currently have a personal data protection law. The lack of clear guidelines as to how and when personal data may be collected and used (beyond what is contained in the e-commerce law—Law No. 20 of 2014) presents businesses, other entities and individuals with a less welcoming environment for the development and use of AI applications.

Selected success stories

- Talabat: AI-powered online food ordering company founded in Kuwait, acquired by German company Delivery Hero for US\$170m in 2016, making it the largest online food ordering company in the Middle

Annex B - Policy Playbook

Goal	Policy Option	Summary	1	2	3	International Initiatives	Regional Initiatives	Egypt	Kuwait	Qatar	Saudi Arabia	UAE
Nurturing local talent	Develop policy to boost the number of applicants to AI-related/STEM university degrees	<p>Provide subsidies to universities offering AI-focused degree programmes to facilitate lower tuition fees and encourage admissions</p> <p>By developing KPIs on the specific number of graduates in AI-relevant fields, including science, technology and mathematics, the government can ensure that sufficient talent is developed over time and progress is tracked.</p>	●	●	●	Australia's Next Generation AI Graduates Program .	<p>Saudi Arabia's National Strategy for Data and AI targets 20,000 Saudi national AI specialists and experts and ~40% of the total workforce trained in basic Data & AI literacy skills by 2030</p> <p>The UAE's National Strategy for AI aims to upskill 1/3 of the UAE's STEM graduates with AI-specific skills per year (2,000 students).</p> <p>Egypt's National AI strategy outlines a list of KPIs that can be used to track success, including "Number of applicants to graduate (yearly)", although a specific figure is not mentioned.</p>	Planning	No plan	Unknown	Implemented	Implemented
	Introduce initiatives to support foreign inflows of AI expertise	Introduce immigration incentives to attract external knowledge, e.g. a relaxed visa scheme targeted at AI and technology experts	●	●	●	UK's Tech Nation Visa scheme Chile's Chilean Tech Visa	UAE Golden Visa Saudi Arabia Instant Visa	No plan	No plan	No plan	Implemented	Implemented
	Trial AI-based instruction tools in primary and high schools	<p>Develop adaptive learning platforms that use AI to teach students to ensure AI familiarisation at an early age.</p> <p>Study the merits of these platforms and consider how to best roll them out, on a trial basis, and how to support teachers in the process.</p>	●	●	●	Enhanced education platform in China		No plan	No plan	No plan	No plan	No plan
	Promote STEM skills development in primary and secondary schools	Invest in STEM-related subjects at school-level, including investing in teacher training and equipment (e.g. laptops, software etc.)	●	●	●	Australia's National STEM School Education Strategy 2016-2026 UK Professional Development Teachers fund New Informatics course for primary students in Japan		No plan	No plan	No plan	No plan	No plan

Nurturing local talent	Establish fully-funded AI degrees to boost number of graduates working directly in AI	Provide subsidies to universities offering AI-focused degree programmes to facilitate lower tuition fees and encourage admissions.	●	●	●	UK government's <u>funding</u> for 18 different universities across England	Egypt - established "Faculties of AI" in universities such as Kafr El Sheikh , Monoufeya , and the Arab Academy of Science and Technology . Others, such as Cairo University, have renamed their Faculties from "Computers and Information" to "Computers and AI" to stress the emphasis on AI as a core subject. Qatar - Qatar University's College of Engineering offers computer science degrees which pave the way for careers in AI development Saudi Arabia's top universities, including King Abdulaziz University and King Saud University , already offer specialised courses in computer science, and the National Strategy for Data and AI aims to create further specialist AI university educational tracks UAE launched the world's first AI university - Mohammad Bin Zayed University of AI - in 2019, which specialises in graduate programmes in AI-related topics.	Implemented	Unknown	Implemented	Planning	Implemented
	Establish certified vocational programs in partnership with industry	Large-scale vocational programs can provide a fast track for developing specific relevant skills for people without higher education. This should be done in close co-operation with businesses to ensure that skills match market demands.	●	●	●	University of Oxford's Technology and AI online courses	Saudi Arabia's Technical and Vocational Training Corporation (TVTC) has partnered with Huawei to launch the Tech Track Initiative which aims provide vocational education to students in technical topics, including AI The UAE National Programme for Artificial Intelligence made an agreement with Dell EMC to train 500 Emirati students in artificial intelligence via an internship programme.	Planning	Unknown	Unknown	Implemented	Implemented
	Launch a Women in AI programme for educating women in STEM subjects as well as ensuring participation in the workforce.	Investing in tech education presents an opportunity to bestow close to half of the population with greater economic opportunity and productivity, and to promote inclusive economic growth. Beyond education, active measures are required to ensure female participation in the AI workforce, where gendered social norms remain a barrier to entry	●	●	●	Innovate UK's Women in Innovation programme .	None of the governments have yet developed programmes explicitly focused on women in AI, and the AI strategies do not mention the role of women.	No plan	No plan	No plan	No plan	No plan

Nurturing local talent	<p>Create new AI specific fellowships, including lab equipment (infrastructure and data) to attract world-class researchers and professors</p>	<p>Ground-breaking inventions in AI are frequently developed within universities by leading academics or PhD students. Creating prestigious AI fellowships would help attract world-leading AI professors and emerging academic talent, while simultaneously increasing the international reputation and ranking of local universities.</p>	●	●	●	<p>UK government funded Turing AI Fellowships</p>	<p>There is limited information on fellowships for attracting AI experts and professors in our set of countries.</p> <p>King Abdullah University of Science and Technology Fellowships</p>	Unknown	No plan	Unknown	Unknown	Unknown
	<p>Launch life-long learning programmes to ensure labour market resilience against automation</p>	<p>As AI will automate a significant number of increasingly complex tasks, countries need to ensure that progress in automation technologies won't result in widespread unemployment. Life-long learning and reskilling programs provide a starting point for ensuring that the countries' workforces remain resilient to automation.</p>	●	●	●	<p>Brussel's VUB AI Lab's Lifelong Learning Program (LLL) .</p>	<p>UAE's Telecommunications and Digital Government Regulatory Authority (TDRA)'s Virtual Academy.</p> <p>Egypt has established its UNESCO Learning City of Aswan aimed at providing programmes to ensure learning opportunities for all across different spans of life. The National AI Strategy also aims to support lifelong learning and reskilling programmes to contribute to workforce development and sustained employability.</p> <p>Kuwait Technical College has established its Center for Continuing Education</p> <p>Qatar offers continued learning and community classes to students at Qatar University's Community Service and Continued Education Center as well as branch universities such as Georgetown University Qatar</p>	Implemented	Implemented	Implemented	Implemented	Implemented
Fostering local research & development	<p>Cultivate research partnerships between government and industry</p>	<p>Develop research-focused partnerships between stakeholders in government, industry and academia to work together and develop solutions for some region-specific challenges, e.g. flooding, drought, agriculture or other sustainable development goals using AI-based solutions.</p>	●	●	●	<p>UK Government and Alan Turing partnership</p> <p>French government partnership with National Institute for the Digital Sciences</p>	<p>UAE Technology Innovation Institute and Mohammed Bin Zayed University partnership</p>	Planning	Planning	Planning	Planning	Implemented
	<p>Create an AI-specific R&D budget and allocate it to universities</p>	<p>Universities are key sources of research and development and innovation. By allocating explicit funds for local universities focused on AI, countries can foster home-grown AI innovation.</p>	●	●	●	<p>Innovate UK's 2019 research and development (R&D) spending reached £666m.</p>	<p>While most of the countries in our sample have invested in AI more broadly, specific data on investment into AI R&D is limited. Egypt's AI strategy has suggested "increasing AI research funding through local and international funding agencies" as a policy option to support AI research in the country.</p>	Planning	Unknown	Unknown	Unknown	Unknown

Transparency and ethics.	Integrate ethics and responsibility into AI ethics guidelines, and offer high-level guidance on best practices, AI principles, and leveraging existing international principles (such as OECD AI Principles)	Develop and publish an ethical framework for AI to supplement national AI strategies to guide companies on how to develop and implement AI responsibly.	●	●	●	Colombia's Ethical Framework for AI EU's Ethics guidelines for trustworthy AI	UAE's Digital Dubai (previously Smart Dubai) has established an Artificial Intelligence (AI) Ethics Advisory Board and has published a set of AI ethics guidelines to provide practical help across a city ecosystem. All other countries in our sample mention AI ethics as a key component of their national AI policy (apart from Kuwait).	Planning	Planning	No plan	Planning	No Plan
	Trial responsible AI in government service delivery and policymaking.	Governments should position themselves as role models in the responsible development and implementation of AI. By publishing case studies on AI in government, sharing learning and success stories, governments can take an active approach in steering the development of AI implementation in a way which builds on previous efforts.	●	●	●			No plan	No plan	No plan	No plan	No plan
	Develop tools to assess AI models', robustness, fairness, and explainability.	Collaborate with academia and industry to develop tools to help organisations describe models, inspect them, and make them more robust.	●	●	●	UK Statistics Authority - Ethics Self-Assessment Tool	Smart Dubai AI Ethics Toolkit	No plan	No plan	No plan	No plan	No plan
Infrastructure and Data	Data privacy regulation	Establishing data privacy regulations helps to ensure that citizens are able to maintain autonomy, but at the same time signalling to foreign talent that concerns around trust and privacy are taken seriously. The key challenge will be to balance data protection with providing enough space for innovation.	●	●	●	EU's GDPR APEC Privacy Framework ASEAN Framework on Personal Data Protection	Egypt's Personal Data Protection Law No. 151 Qatar's Law No. 13 of 2016 UAE's Federal Decree Law No. 45 of 2021 on Personal Data Protection Saudi Arabia's Personal Data Protection Law ^{255,256}	Planning	No plan	No plan	Planning	Planning
	Drive harmonisation of data governance laws across the region	Harmonising data governance regulation across the region could significantly help increase the transfer and cross-country flows of high-quality data used for developing products and services.	●	●	●	EU's GDPR APEC Privacy Framework ASEAN Framework on Personal Data Protection		No plan	No plan	No plan	No plan	No plan
	Invest in 5G and terrestrial internet infrastructure	As novel AI applications will require increasingly larger transfer of data, establishing modern infrastructure for data transfers as well as remote controlling of applications will be a prerequisite for AI readiness.	●	●	●	Singapore's Infocomm Media Development Authority (IMDA) US\$30m fund	UAE has already achieved almost 100% 5G penetration with the fastest 5G speed in the world 5G is a crucial element of Kuwait's Vision 2035 digital strategy	Planning	Implemented	Implemented	Implemented	Implemented

Infrastructure and data	Establish national compute resources for researchers without access to the needed level of compute	Governments should ensure that AI innovation is inclusive and researchers and academic communities can participate irrespective of the resources at their disposal. To achieve this, governments should create a national AI research resource, providing computational, data and training resources.	●	●	●	National AI Research Resource (NAIRR) is in development but has not yet been fully established		Not implemented	Not implemented	Not implemented	Not implemented	Not implemented
	Build/expand National Open Data Platforms allowing startups and researchers access to high-quality data	<p>This is especially the case for startups facing the “cold start problem”, in that they require data to produce an AI-driven product or service.</p> <p>Some countries in the region already provide such platforms, however, this is not the case for all, and even where countries provide them they lack high-quality data.</p>	●	●	●	<p>Denmark’s Datafordeler (Data Distributor)</p> <p>Canada’s Open Government Portal</p> <p>UK open data</p> <p>Austria’s Open Data Österreich</p> <p>Malaysia’s Portal Data Terbuka</p> <p>Data Commons, a platform aggregating data into a unified database</p>	All countries in our sample have a national open data portal, apart from Kuwait, which has a somewhat consolidated list of national datasets but links to different government departments for access - Egypt, Qatar, Saudi Arabia, UAE	Implemented	Implemented (partly)	Implemented	Implemented	Implemented
	Debate and explore establishment of industry-specific data trusts to facilitate data sharing	<p>Data trusts can provide a mechanism for the sharing of data with third parties, allowing to produce innovations while maintaining trust.</p> <p>This can be especially helpful in data rich industries (including health, energy, retail, government services, finance, transport), where data is kept in silos.</p>	●	●	●	UK’s Data trust initiative ,		No plan	No plan	No plan	No plan	No plan

Industry engagement	Incubators and accelerators focused specifically on AI start-ups		●	●	●	Tech Nation UK's Applied AI growth programme	UAE's Minister of State for Artificial Intelligence, Digital Economy, and Teleworking Applications, announced the establishment of an incubator environment focused on AI development. Dubai has also established the Dubai Smart City Accelerator to support startups with the potential to significantly impact cities. Saudi Data and Artificial Intelligence Authority (SDAIA) has launched the T5 Smart City Accelerator to support regional startups to grow their businesses and investments and to attract global talent. Qatar has established its Digital Incubation Center (DIC) , which has the IdeaCamp5 programme targeting startups in AI, advanced analytics and the IoT Egypt's National AI Strategy highlights that it aims to create AI-specific start-up incubators to “reduce the cost for starting a company and will channel the focus of the engineers and scientists towards the technical problem at hand”	Planning	Unknown	Implemented	Implemented	Planning
	Establish innovation fellowships to increase technological capacity in governments	Innovation fellowships offer the government the opportunity to have skilled tech talent to join the government for a specific period of time and work on a particular challenge or project. This allows governments to benefit from experienced developers while allowing tech talent to get involved in the workings of government.	●	●	●	US White House Innovation Fellowships UK No. 10 Fellowship		No plan	No plan	No plan	No plan	No plan
	Establish multi-stakeholder working groups and government to provide independent expert advice on policy priorities	Consult a wide range of relevant stakeholders across the AI community (e.g. private sector, academia, NGOs, civil society)) when refining existing and developing new laws and regulations related to the development, implementation and governance of AI (e.g. through workshops, feedback surveys)	●	●	●	UK AI Council Colombia Technical AI council Singapore multi-stakeholder advisory council on the ethical use of AI	UAE AI Council. However, it does not include stakeholders from civil society, academia and industry	No plan	No plan	No plan	No plan	No plan
	AI procurement legislation Conduct public consultation with businesses prior to enacting new laws	Create AI-specific procurement legislations to speed up buying of AI products and services, stimulate growth of SMEs and create AI procurement expertise within government.	●	●	●	UK's Guidelines for AI procurement	UAE	No plan	No plan	No plan	No plan	No plan

<p>Industry engagement</p>	<p>Create AI challenges by inviting startups to bid for solving particular local challenges through AI products</p>	<p>Public challenges are a highly effective vehicle allowing SMEs to develop AI-driven solutions for public challenges, stimulating private-sector growth and benefiting citizens.</p>	<p>●</p>	<p>●</p>	<p>●</p>	<p>Singapore's AI Grand Challenge UK's Turing AI scientist grand challenge India's National Informatics Centre's Artificial Intelligence Challenge in 2020</p>	<p>Egypt's Ministry of Communications and Information Technology (MCIT) sponsors the Egypt Internet of Things (IoT) and Artificial Intelligence (AI) Challenge Qatar University College of Engineering (QU-CENG), Hamad bin Khalifa University (HBKU), the Qatar Computing Research Institute (QCRI), and Huawei Qatar have launched the Artificial Intelligence National Competition Saudi Data and Artificial Intelligence Authority (SDAIA) has announced launching the "NEOM Challenge" focused on AI solutions UAE's Telecommunications and Digital Government Regulatory Authority sponsors the UAE IoT & AI challenge</p>	<p>Implemented</p>	<p>Unknown</p>	<p>Implemented</p>	<p>Implemented</p>	<p>Implemented</p>
<p>Refining AI policies</p>	<p>Develop, revise and monitor national AI strategies</p>	<p>Some of the region's governments have designed national AI strategies while some are still in the process of doing so. Governments that have not developed AI policy documents should do so. Governments that have already developed these policies should ensure that they are regularly refined to align with their set timeline, and simultaneously monitor that over time they are aligned with the county's vision.</p>	<p>●</p>	<p>●</p>	<p>●</p>	<p>Finland's ongoing publication of documents supplementing its National AI strategy</p>	<p>Egypt National AI Strategy National Artificial Intelligence Strategy for Qatar Saudi Arabia's National Strategy for Data & AI UAE National Strategy for AI</p>	<p>Implemented</p>	<p>No plan</p>	<p>Implemented</p>	<p>Implemented</p>	<p>Implemented</p>
	<p>Build dedicated offices within government empowered to co-ordinate cross-governmental policies for investment, public-sector applications and responsible AI practices.</p>	<p>Lessons from the UK and the rest of the world have shown that establishing AI-specific offices with its own budget and mandate can foster policy innovation and develop real expertise within government. Countries that haven't established them should create them, whereas those which already have them should strengthen their role.</p>	<p>●</p>	<p>●</p>	<p>●</p>	<p>UK Office for Artificial Intelligence Colombia's AI Task Force</p>	<p>Egypt's National Council for Artificial Intelligence Qatar's Cabinet approved a draft decision establishing an artificial intelligence committee in 2021 UAE's Artificial Intelligence Office Saudi Data and AI Authority (SDAIA)</p>	<p>No plan</p>	<p>No plan</p>	<p>Planning</p>	<p>Implemented</p>	<p>Implemented</p>

Refining AI policies	Create AI learning tracks for government officials	AI expertise within government remains a major issue across the region and the world more broadly, affecting the quality of strategic policymaking and procurement of AI-related product and services. A learning track for officials could provide a pathway for governments to build that expertise. These learning tracks should include: -basis of AI technology (including machine learning, natural language processing and computer vision) - AI ethics and responsible use - integration of AI into the provision of public services	●	●	●	Argentina's Design Academy (LABGobAr)	Huawei has <u>partnered</u> with Kuwait's Central Agency for Information Technology (CAIT) to support IT talents in government sectors UAE's AI Office has been offering more advanced courses for government employees since 2018, focused on the skills needed to work with them to be the AI experts in their entities	Unknown	Implemented	Unknown	Unknown	Implemented
	Establish AI working group with policymakers from across the region to align policies	A regional working group of policymakers could help countries across the regions align policy priorities and orchestrate areas of investment attention to ensure mutual growth. Examples from across the world, such as the EU, the OECD or LATAM, show that regional co-operation can help foster an environment where AI development can flourish.	●	●	●	EU's High-level expert group on artificial intelligence OECD Global Partnership on AI FairLAC , established by the IDB		No plan	No plan	No plan	No plan	No plan

Endnotes

Endnotes

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- 256 For Egypt and the UAE, government agencies responsible for overseeing the application of these laws still need to be created.

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LONDON

20 Cabot Square
London, E14 4QW
United Kingdom
Tel: (44.20) 7576 8000
Fax: (44.20) 7576 8500
Email: london@economist.com

NEW YORK

750 Third Avenue
5th Floor
New York, NY 10017
United States
Tel: (1.212) 554 0600
Fax: (1.212) 586 1181/2
Email: americas@economist.com

HONG KONG

1301
12 Taikoo Wan Road
Taikoo Shing
Hong Kong
Tel: (852) 2585 3888
Fax: (852) 2802 7638
Email: asia@economist.com

GENEVA

Rue de l'Athénée 32
1206 Geneva
Switzerland
Tel: (41) 22 566 2470
Fax: (41) 22 346 93 47
Email: geneva@economist.com

DUBAI

Office 1301a
Aurora Tower
Dubai Media City
Dubai
Tel: (971) 4 433 4202
Fax: (971) 4 438 0224
Email: dubai@economist.com

SINGAPORE

8 Cross Street
#23-01 Manulife Tower
Singapore
048424
Tel: (65) 6534 5177
Fax: (65) 6534 5077
Email: asia@economist.com