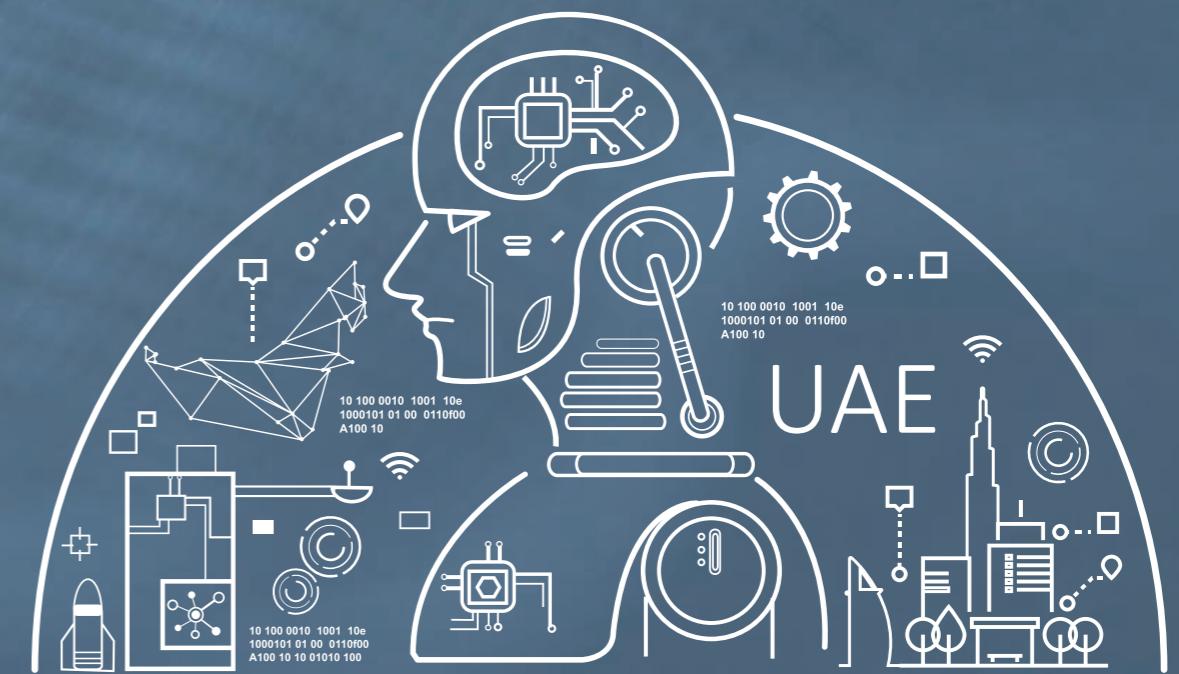




UAE
NATIONAL STRATEGY
FOR ARTIFICIAL INTELLIGENCE
2031



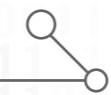


WE WILL TRANSFORM THE UAE INTO A
WORLD LEADER IN AI BY INVESTING IN
PEOPLE AND INDUSTRIES THAT ARE KEY
TO OUR SUCCESS.

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MINISTERIAL FORWARD



"WE WANT THE UAE TO BECOME THE WORLD'S MOST PREPARED COUNTRY FOR ARTIFICIAL INTELLIGENCE."

His Highness Sheikh Mohammed bin Rashid Al Maktoum

UAE Vice President and Prime Minister and Ruler of Dubai



Omar Sultan Al Olama

Minister of State for Artificial Intelligence

The role of any new minister is to set a direction for their tenure and orchestrate the vision set by the leadership.

The appointment as the UAE's Minister of State for Artificial Intelligence has brought the opportunity of a new remit without pre-existing boundaries and constraints.

The challenge in this role is balancing a global context that is changing rapidly with a stable direction for our nation. Technological and economic opportunities come thick and fast, as do other nations vying for global leadership in different aspects of AI.

Developing a roadmap for the UAE's role required us to contextualize global debates to the challenges and opportunities of the Middle East, particularly the unique situation of young and ambitious Arab countries. We also benefited from conversations with companies, politicians and leading experts on AI from around the world: understanding what they look for when deciding whom to work with and where to work.

The UAE government knows its strength is in combining a strong vision with active involvement - investment, legislation and testbeds - for technological innovation. Therefore, for this nation, being the most prepared country means a lot more than developing legislation that responds to changes in the world. Instead, it means proactively changing the world first. A recent article summarizes this attitude: "Today's biggest tech companies, led

by Google and Amazon, want to put AI at the core of their businesses, and the UAE hopes to do the same for an entire nation¹." The UAE will build an AI economy, not wait for one.

The National AI Strategy - UAI - from AI ready to AI leader.

The UAE has a vision to become one of the leading nations in AI by 2031 in alignment with the UAE Centennial 2071, creating new economic, educational, and social opportunities for citizens, governments and businesses and generating up to AED 335 billion in extra growth. This report breaks down our approach to this goal.

At the annual World Government Summit Meeting in February 2018, the UAE announced key elements of its strategy - a welcoming destination for developing AI products, new education programs and championing good governance.

We have added more details on how the UAE could become a fast adopter of emerging AI technologies across Government, as well as attract top AI talent to experiment with new technologies and work in a sophisticated, secure ecosystem to solve complex problems.

With this foundation of talent, as well as better governance of AI, we will have the right conditions to develop new AI solutions here in the UAE in the coming decade and beyond. These novel technologies have huge economic potential, including licensing and export overseas.

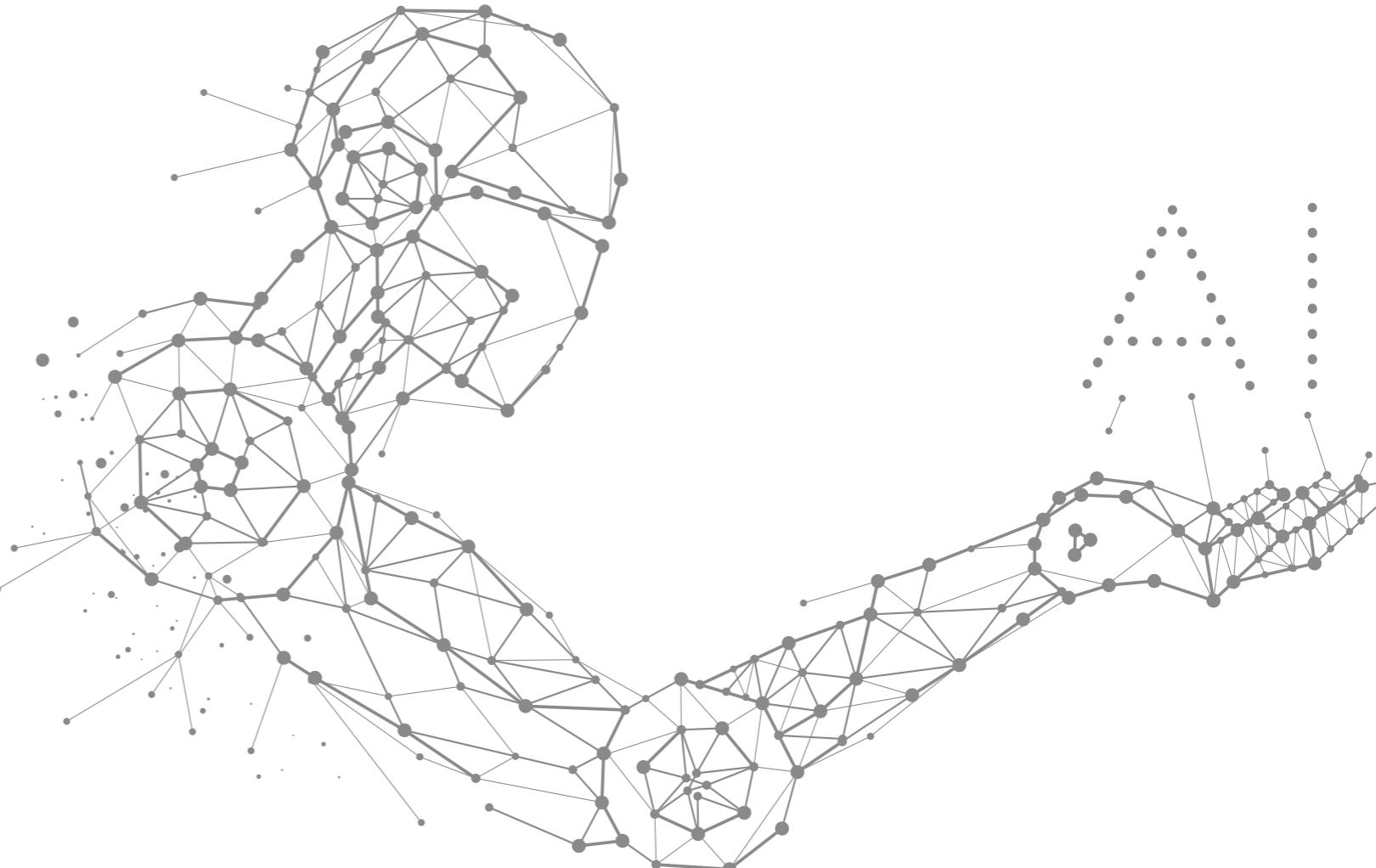
EXECUTIVE SUMMARY

The UAE sets a clear vision through its AI Strategy, to become the world leader in AI by 2031. Implementing this vision on the ground requires rigorous dedication and clear steps that outline the path for success. Hence, it is essential to set the foundation, the AI Strategy, with clear strategic objectives that outline the initiatives that are essential in achieving the milestones. It is notably worth mentioning that the AI Strategy aligns with the UAE Centennial 2071, to make the UAE the best country in the world by 2071. The AI Strategy will contribute significantly in education, economy, government development, and community happiness through various AI technologies implementations in different sectors to include energy, tourism, and education, to list few. The UAE AI and Blockchain Council will overlook the implementation of the AI Strategy throughout all emirates but ultimately, the implementation will be a multi-stakeholders effort and cooperation from different local and federal entities in the UAE.

There are eight strategic objectives outlined in the AI Strategy, namely:

- Build a reputation as an AI destination.
- Increase the UAE competitive assets in priority sectors through deployment of AI.
- Develop a fertile ecosystem for AI.
- Adopt AI across customer services to improve lives and government.
- Attract and train talent for future jobs enabled by AI.
- Bring world-leading research capability to work with target industries.
- Provide the data and supporting infrastructure essential to become a test bed for AI.
- Ensure strong governance and effective regulation.

The UAE has a strong foundation consisting of cohesive and diversified multinational community that is a fast adapter to new and emerging technologies. Therefore, it acts as a magnet that attracts the best talents from the globe to conduct their experiments on AI solutions in the UAE and open the doors to practical implementations in different sectors.



WHERE THE UAE HAS OPPORTUNITIES TO LEAD

The UAE's vision to become a world leader in AI does not mean aiming for leadership across all technologies and sectors. The country will focus on domains where it can have world-leading assets and unique opportunities.

Therefore, the mission for this first Ministerial term is to transform the UAE into a world leader in AI by investing in the people and industries that are key to the UAE's success.

The UAE will begin through its existing strengths:

1. Industry Assets & Emerging Sectors
2. Smart Government

And also focus on opportunities where it can lead:

3. Data Sharing And Governance
4. New Generation Of Regional Talent

By 2031, the very best version of the UAE would package these strengths and opportunities together. For example, early Government adoption of AI will come with training for domestic talent. Governance frameworks will be evaluated by testing them in the UAE's industry pilots. The existence of a strong government and government-owned commercial sector in the UAE provides novel opportunities for trialing governance, education and product innovation in combination.

1. Industry Assets & Emerging Sectors

The UAE has set priority sectors - these will be the focus of initial activities. This does not mean that the UAE will stop working on AI solutions in other sectors where AI can deliver other benefits to society. It is also likely that these priorities will change over time, as the UAE economy matures and new opportunities arise.

But in the first instance, the UAE will leverage physical and digital assets in two of its strongest existing sectors as part of adopting and trialing AI. Support will also be given to developments in emerging sectors where the UAE has the strong potential economic gains and where there are pockets of opportunity to lead globally.

Therefore, the current priority sectors are:

Resources & Energy: from existing technology in the extraction industry to renewable energy and innovation in utilities.

Logistics & Transport: longstanding air and sea hubs in the UAE make it a valuable location for piloting new systems in the sector.

Tourism & Hospitality: opportunity for globally becoming first in customer-support AI, creating integrated and personalized services for tourists in the UAE.

Healthcare: a small sector with opportunity to be world leading in specific treatments, particularly in rare diseases.

Cybersecurity: a strategic imperative, given the rise of AI, the UAE will also concentrate on building robust systems for protection.

Economic Value of AI

Further details on these choices are in Objective 2. A core reason for choosing these sectors came down to the potential of AI deployment causing disruption as well as pure economics, for instance the potential of AED 136 billion gain in services and trade sectors played a significant role in choosing Tourism as a priority sector. AI in this growing consumer-facing sector could likely have spillovers into other service sectors. AED 91 billion in resources and utilities contributed to making energy a priority, as did the AED 19 billion in logistics.

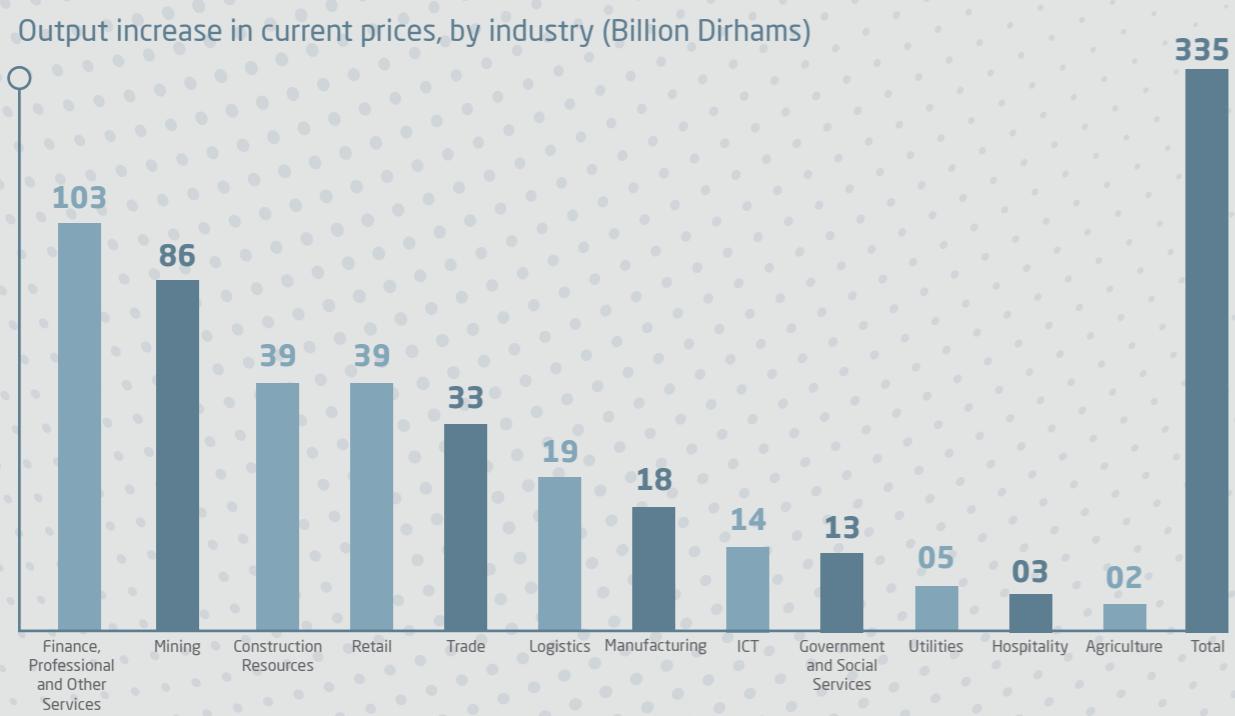
Estimates for global economic gains from automation technologies - 0.3% to 2.2 % growth in compound annual productivity - are impressive². Using this kind of modeling of year on year productivity gains, PwC estimated that AI will contribute AED 353 billion to GDP by 2030 (13.6% of GDP). Gains from increased performance outweigh those that come from replacing labor with machines in some sectors, which play a major role in the

young and resource-rich economies of the Middle East. For example, 85% of gains in oil and gas are likely to be in performance rather than labor substitution. This is similar in the redesign of the automotive industry or the large changes we are seeing to consumer marketing techniques.

Spending on AI is also a significant economic factor. International Data Corporation estimates annual spending on AI in the Middle East and Africa to reach AED 419.54 million by 2021, increasing 32% a year.

Using the UAE's national statistics, the absolute opportunity to increase economic output based on current technology capabilities rather than focusing on annual productivity growth was calculated³. Assuming automation happens to the full extent it can in each industry, there is a potential gain of AED 335 billion in increased economic output for the UAE. This is the equivalent to 26% increase.

Estimated increase in output due to application of AI in industries (AED billion in current prices)³



It is almost a coincidence that the PwC estimate for 2030 gain in GDP is similar to the overall increase in economic output that we estimated. The methods used to develop these estimates are different: the GDP estimate is based on data so far on average annual growth from automation, whereas we calculated the effects of specific technologies in different industries. Data from UAE FCSA National Accounts Estimates Tables 12, 13 and 15; Analyzed using the team's review of AI applications and desk research.

2. Smart Government

The UAE public sector is already a leader in smart public service delivery:

"We initiated electronic services 16 years ago and today we are launching a fresh stage relying on Artificial Intelligence... we are seeking to adopt all tools and methodologies related to Artificial Intelligence to expedite and ensure more efficiency for government services at all levels."

His Highness Sheikh Mohammed bin Rashid Al Maktoum
UAE Vice President, Prime Minister and Ruler of Dubai

The UAE is already taking steps to apply AI in innovative ways across government - dynamically adjusting transport timetables to respond to incidents, using AI sensors for smart traffic, deploying facial recognition to monitor driver fatigue and introducing chatbots to improve customer service.

Objective 4 explains how the UAE will take steps to increase the amount of government experimentation with AI to improve the lives of its citizens.

3. Data Sharing and Governance

It is part of the UAE's ethos to turn ambitious visions into deliverable projects. This connection between big ideas and practical implementation will, become an asset in AI policy discussions, that can fall easily into abstract or implausible science fiction. Combining hands-on experience with new technologies and global policy development is a strong way to develop a plausible, positive future for AI.

How will the UAE ensure AI is used for good?

Public debates about AI often focus on whether or not it could take over important human decisions: from whether we go to war, to who receives medication.



There continues to be a range of views about the prospects of AI, and many potential future scenarios for AI in the UAE societies. There is still time to change what this future will look like, making it one that more clearly reflects the UAE's values. The actions we take today are still very much under human control and can still reflect those values.

Responding to this opportunity, several of the initiatives in this strategy aim to develop a values-driven approach to AI:

The UAE Government will play a direct role in designing and enabling AI systems that create the most value for society (objective 4). This will also give the UAE practical experience of how these systems operate and allow the country to identify, ahead of time, any potential unintentional consequences.

These schemes and the national pilots in objective 2 will guide the approach to the governance of AI (objective 8). This approach to governance - embedded in worked examples - will help take the UAE beyond abstract statements to useable guidelines for values-driven AI.

The schemes will advocate these guidelines on a global stage, working with other countries and international technological groups (also objective 8). Finally, research that keeps to these ethical principles will be rewarded (objective 6).

4. New Generation of Regional Talent

A young and growing regional population is often described only in terms of unemployment. Youth unemployment in the Arab countries and Middle East was 30.6 % in 2016. It remains the highest of any region globally.

But the Middle East and North Africa has an unusual segment of the professional workforce. There is a high proportion of professionals already involved in operations, IT and engineering.

In fact there are giants in the field of AI who have come from some of the most fragile states in the Middle East. Iyad Rahwan and Oussama Khatib were both born in Aleppo, Syria. Iyad is now the director and principal investigator of the Scalable Cooperation group at MIT Media Lab. Oussama is a professor of computer science at Stanford University.

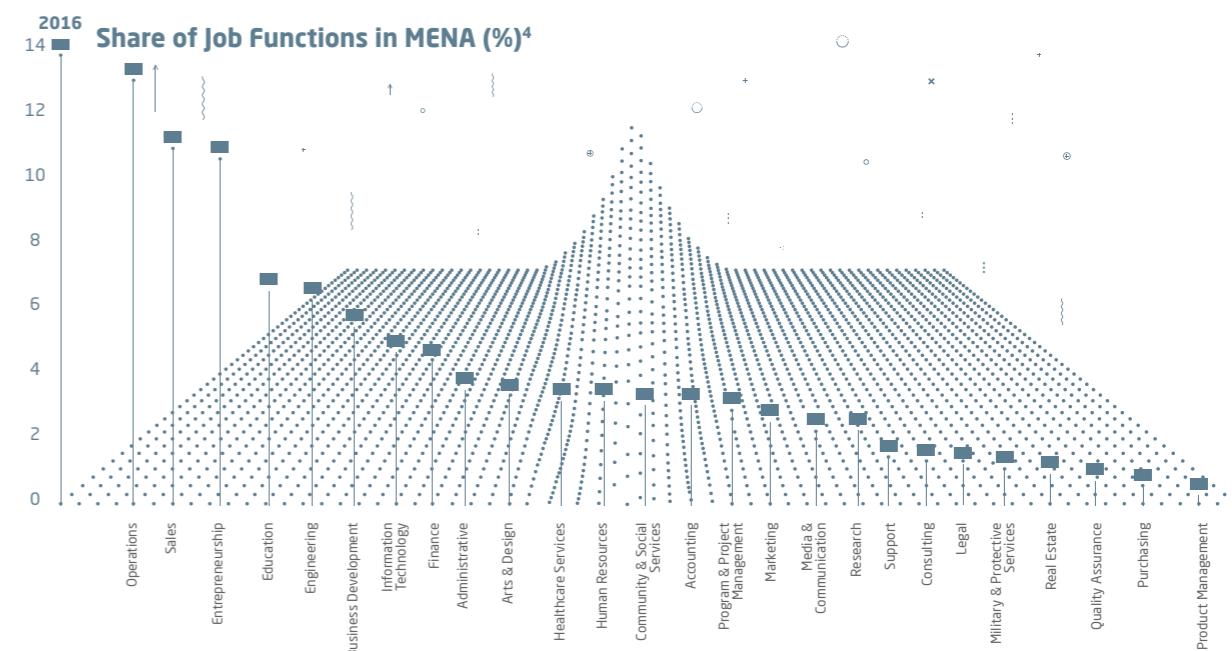
The UAE offers access to world-leading universities and a safe hub for highly skilled professionals to re-skill the most in-demand AI roles. The country needs to leverage on its geographic position, and this existing cohort of talent around it.

Out of the job functions reported on LinkedIn profiles, operations, information technology and engineering are ranked 1, 4 and 6 respectively³.

There is some evidence that there is a significant subset of these individuals already starting to combine technical skills and business operations. Data from jobseekers on the Middle East and South Asia jobs website, Bayt.com, shows that business analysts with technical skills often already have sophisticated, AI-relevant skills. 21% of the skills identified among this group were associated with business intelligence software like IBM Cognos, Microsoft Power BI or Qlik Sense. 20% were to do with data operations experience, for example with Hadoop or Apache Pig. 8% were Machine

Learning & Statistical Modeling tools like Neural Networks⁵.

The UAE is also globally competitive when it comes to the proportion of university graduates who study STEM subjects (22% compared to 16% in the US). These graduates already have the base foundational skills relevant to AI (computer science, programming literacy, and statistical analysis) and so can be rapidly upskilled to become AI-ready.

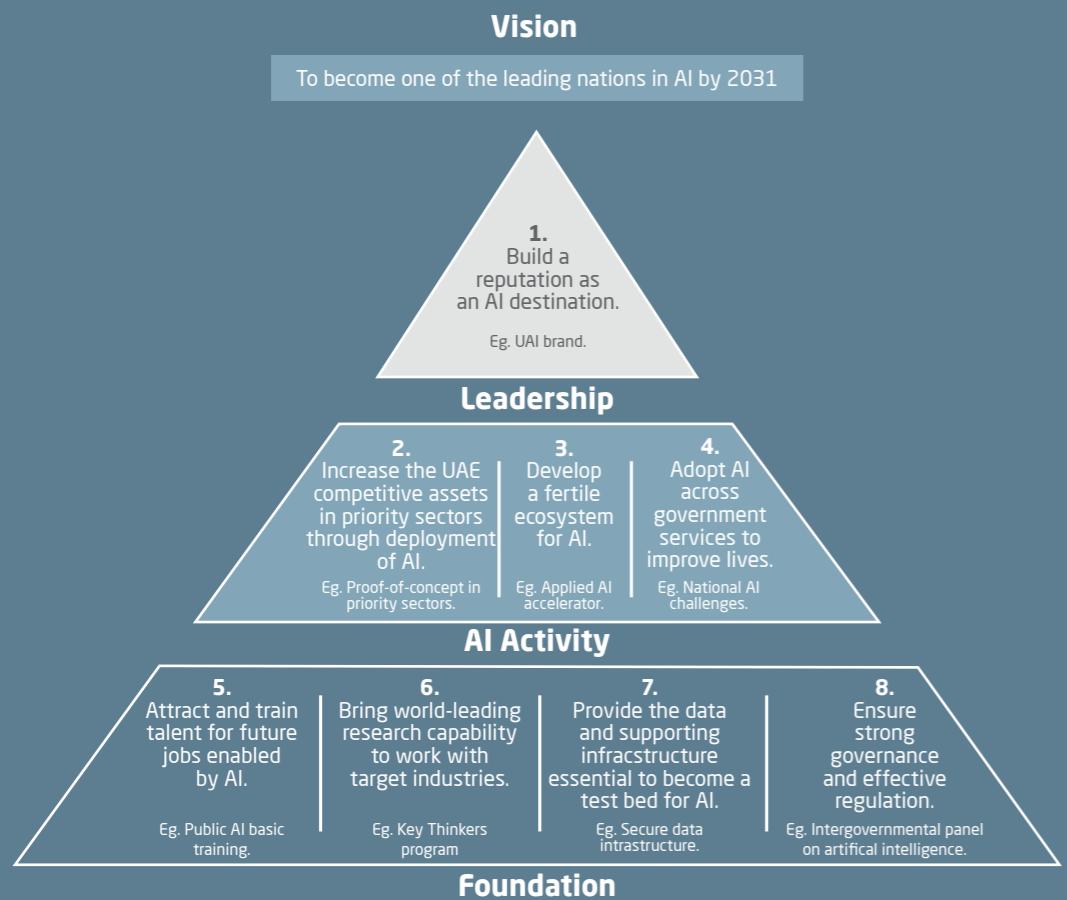


**Share of national graduates that are in
AI-relevant specializations
(statistics, mathematics, ICT technologies
and engineering) for selected countries.⁶**



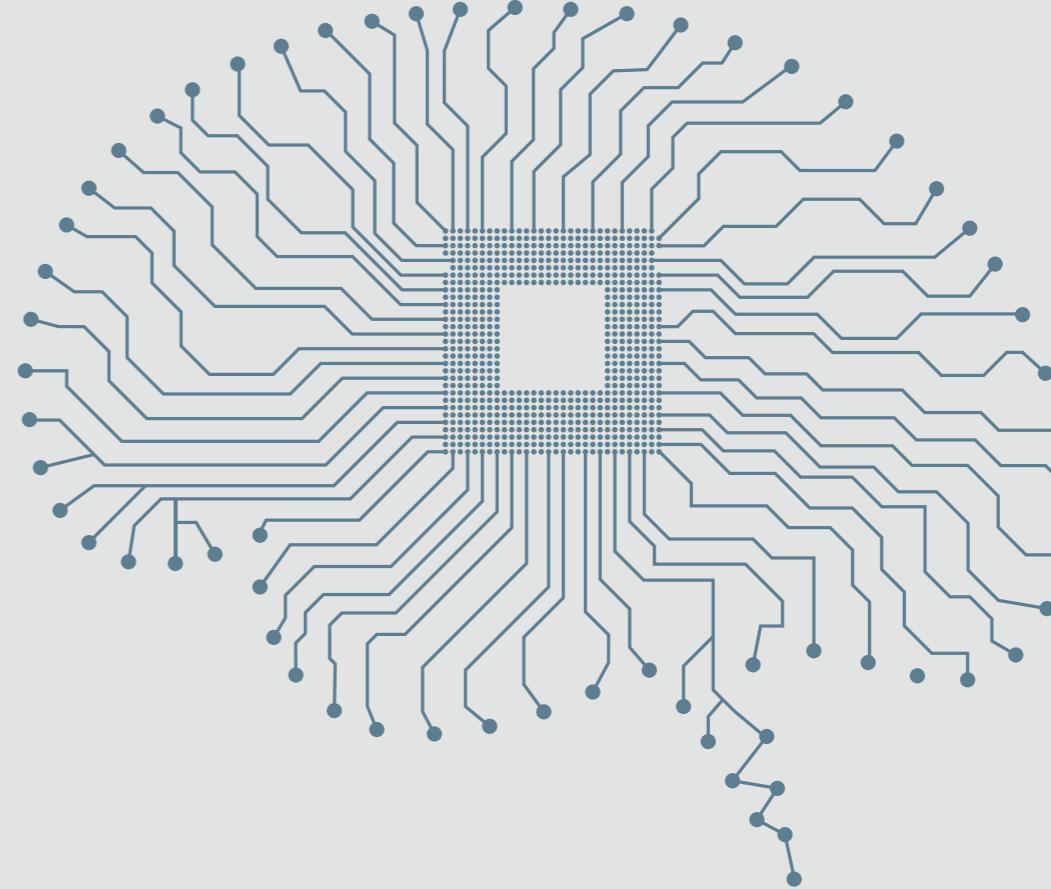
EIGHT STRATEGIC OBJECTIVES

Although priorities are set out above, there will need to be a complete system of support to move from a nation that adopts AI to one that is building and exporting it.



The UAE's first steps will build a strong brand through AI activities that demonstrate the UAE as a testbed for AI technology. This will come through brokering agreements with international firms to base pilots in the UAE (under objective 2); it means coordinating access to domestic data systems applications (objective 3); and it will require government to take the lead in providing AI-enhanced services (objective 4).

There are also some early steps to be made in starting to build stronger foundations in talent, research, data and governance. Publicly accessible AI courses have already begun with large tech partners (objective 5); and international discussions on the positive use of AI provide an active platform for better governance of these technologies (objective 8).



Over time, AI activities will include more significant programs - from funding for proof-of-concepts to a domestic AI Accelerator. The foundation will also start to grow a new generation of AI-ready talent, complemented by regular presence from leading global AI researchers in the UAE and through playing a leading role in international governance initiatives.

Colleagues in the UAE Government, international bodies, educational institutions and global AI firms will play a significant role in achieving some of these objectives. The Office of the Minister of State for Artificial Intelligence (henceforth 'AI Office') will help broker new partnerships, particularly in education and governance. In particular, the AI Office aims to support other Ministries to make the most of world-leading AI technologies in their projects and policies, as well as train a generation of AI-ready talent in the UAE.

The second half of this report provides more detail of the direction under each objective. This includes detail of initiatives that are already running, ones that to start over the next 3 years, as well as examples of successful policies and projects from other nations that could provide templates for UAE policymakers.

OBJECTIVE 1: BUILD A REPUTATION AS AN AI DESTINATION

To become a global AI leader, the UAE needs to compete with destinations around the world that are also trying to attract scarce AI talent and grow AI investment. Boston, London, Beijing, Shenzhen, Toronto and many other places are all vying to be the 'next Silicon Valley' for AI.

Achieving this objective will require a brand that is built on what differentiates the UAE: its established reputation as a bold innovator.

This reputation already brings companies to the country. SparkCognition, the world-leading AI firm, recently announced their first international office outside the US to be based in Dubai.

This objective relies heavily on achieving the other seven. Those objectives are necessary but not sufficient to deliver the UAE as a destination for AI talent and investment.

There will also need to be a brand campaign that explains and illustrates the UAE AI offering in a compelling and authentic form. This brand will provide a practical means to communicate this to the rest of the world. This has been announced as 'UAI'.

UAI Brand

The UAE is developing a UAI brand and will use this to attract talent and business from across the globe to come to the UAE to test and develop AI.

This includes a UAI mark recognizing high quality, ethical AI companies. It would reward safe, efficient, verified AI technology with a 'UAI Seal of Approval'.

The UAI will consist of four levels of approval to include Public Sector Level, Private Sector Level, Institutional Level, and Product Level.

The certification system is based on the highest level of world-wide standards that will establish the core requirements in obtaining the UAE Seal of Approval. This robust, rigorous, and comprehensive certification methodology will ensure verifying the entities with the best AI technology in the region.

The UAE is aiming to host key international conferences and forums on AI making it a hub for global experts and entrepreneurs. With this, the UAE will become the center of AI startups in the region.

Singapore developed a successful brand campaign called 'Smart Nation'. It demonstrated the connection between digital innovation and national priorities, signaling that the digital revolution is at the center of Singapore's national strategy. A brand identity was backed up by regular⁵, substantive indicators of progress in the field.

OBJECTIVE 2: INCREASE THE UAE COMPETITIVE ASSETS IN PRIORITY SECTORS THROUGH DEPLOYMENT OF AI

AI has the potential to generate up to AED 335 billion in the UAE economy boosting this by supporting industry pilots in sectors where this kind of intervention will create the most economic or social value.

This objective details our initial priority sectors. This effort is complemented by support for government services in objective 4. In the medium to long term, these priority sectors could change.

Existing Assets

The largest economic gains from AI will come in significant and mature sectors, where the AI potential is also high - finance, resources, construction and retail trade.

Government has a role to play in supporting industry to achieve these gains - helping industries to develop AI where a competitive advantage exists, incentivizing global AI firms to locate in the UAE and local firms to connect globally, and finally by supporting business more generally with advice to become successful in an AI enabled world.

In three sectors, there are additional national assets or need for innovation that make them priorities:

a. Resources & Energy: The UAE is the 5th largest exporter of oil in the world. The existing extraction industry already uses modelling software and

algorithms to support its operations. As the UAE makes the transition to renewable energy supplies and more efficient water desalination, there is also an opportunity for AI systems to play a fundamental role in energy sector innovation. There is an opportunity to open up this sector to more companies, and provide support for proof-of-concept systems developed first in the UAE.

The UAE is planning a proof-of-concept to utilize AI systems in order to focus both internally, to make energy saving decisions, and globally to understand supply and demand for oil.

Energy supply and utilities is also an area of innovation. From smart grids to water recycling, there also needs to be support for small companies and utilities supplies to test and improve this infrastructure.

b. Logistics & Transport: The UAE is a globally competitive transit hub. 60 million people pass through Dubai Airport each year; 26 million pass through Abu Dhabi Airport. Jebel Ali port is the largest marine terminal in the Middle East and provides market access to over 2 billion people. Airport and port management companies from the UAE continue to expand their management of overseas facilities. The UAE's peninsular location between South Asia and East Africa provides an enduring advantage. There is an

opportunity to make the most of these assets - facilitating test beds for new technologies in these locations by deploying AI solutions for air traffic management, baggage handling, and airplane boarding.

Demonstrator projects that make the most of these physical and digital assets in logistics and transport will be funded.

c. Tourism & Hospitality: Tourism is a highly visible, successful export sector for the UAE. There is a particular opportunity to integrate services attracting tourists to the UAE and the packages that are offered once they are here, including business travelers and those on short stopovers.

The greatest opportunity in Tourism & Hospitality comes from innovations that have potential for spillover into other customer service sectors. AI can be utilized to predict tourist's needs and provide customized services.

Emerging Sectors

There are three other sectors, where the UAE has different kinds of advantage - these are not about existing scale but pockets of opportunity that are already visible. There are smaller, but valuable data assets; fast-growth and entrepreneurial activities or areas where government are taking a lead in the sector.

The opportunity in this sector is to create partnerships that can boost tourist numbers in the UAE, where those tourists have AI-driven schedules or use automated assistants during their stay.

a. Healthcare: Government does not own the healthcare industry in the UAE, but it plays a significant role in it. Dubai Health Authority's new Dubai Genomics program hopes to bring population-scale whole-genome sequencing to the Emirate. The aim is to use the diverse genetic community in the UAE as a resource for new scientific studies, which make it easier to predict risks associated with genetic-related illnesses. This kind of study, and similar uses of patient data from UAE hospitals, could lead to novel opportunities for digital health innovation based in the UAE.

The opportunities will most likely be low in number but some could be world-leading or have significant impact on the care of individuals with rare diseases. For example, testing diagnostics in a clinic that has access to the latest monitoring technology, detailed historical patient data and a diverse population could provide a rare asset for healthcare companies. There is also an opportunity to focus on diseases that are prevalent in the region, which receive relatively little attention from global pharmaceutical companies.

The AI Office is most interested in providing access for companies and researchers to hospital and national databases, where their work could develop specialist capability in diagnostics that use AI, particularly for common diseases in the region.

The AI Office has funded research into developing an AI algorithm for detecting Tuberculosis in patients via diagnosis of X-ray data and the pilot was launched at the United Nations World Data Forum 2018.

b. Cybersecurity: Historically, the UAE has attracted the regional hubs for large technology companies like SAP or Microsoft, which often locate to free zones within the city. More recently, the UAE has grown or attracted smaller cybersecurity firms.

There is significant potential benefit for government in developing better cybersecurity for their own services and for making the UAE a secure environment for business. There is also a strong entrepreneurial segment in cybersecurity, which the government wants to encourage.

There will be more than 7.5 billion Internet users by 2030 (90% of the projected world population of 8.5 billion). Like street crime, which historically grew in relation to population growth, similar evolution of cyber crime is being witnessed with projected damage costs to hit USD 6 trillion annually by 2021. Hence, cyber security is a big investment that requires a priority considering the global shift towards maintaining safety. Over the next five years, the global spending on cyber security will cumulatively exceed USD 1 trillion⁷.

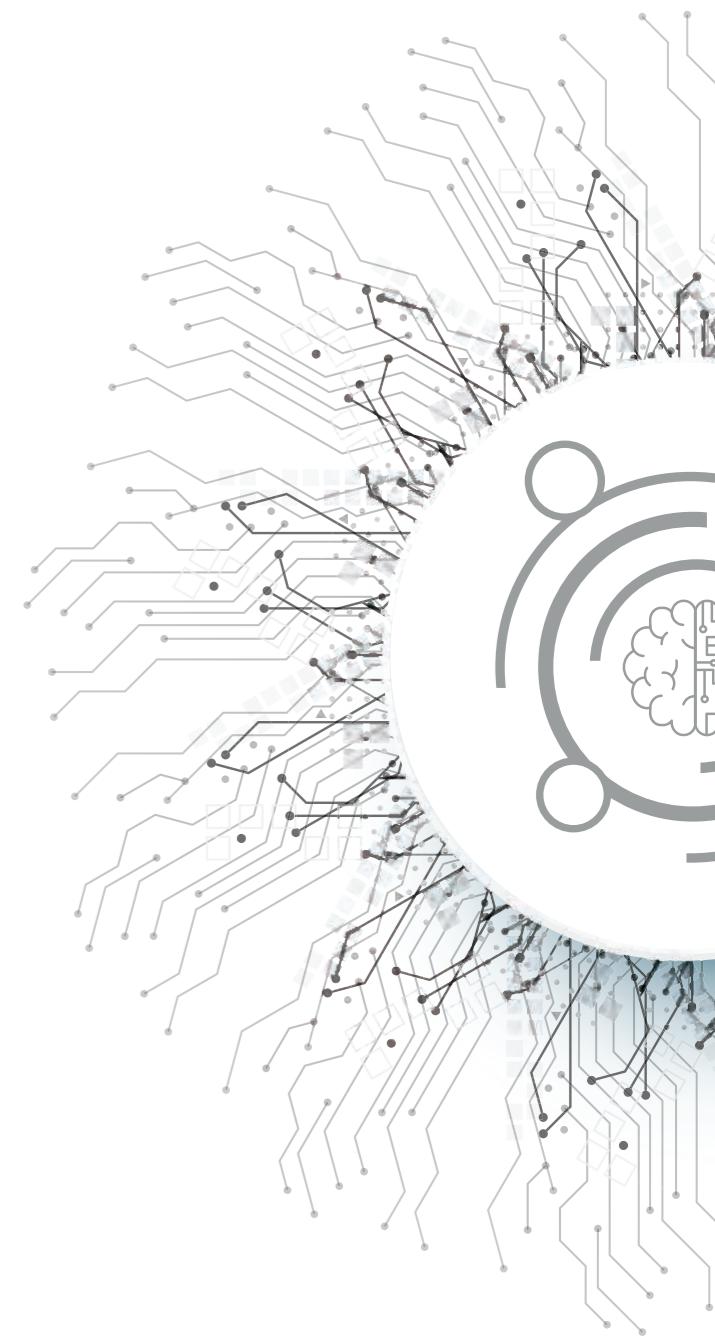
Supporting pilots that demonstrate new cybersecurity approaches in the UAE first. There is also interest in community-building and skills-building programs for SMEs and local talent that focus specifically on AI as a risk or opportunity for cybersecurity.

Proof-of-Concept Support in Priority Sectors

Within these five priority sectors, the UAE government will fund or broker pilot projects. These proofs-of-concepts could be designed by public sector, private sector or consortia. Funding will depend on how well proposed pilots map onto the reasoning for each priority sector as detailed above. For example, the AI Office is working with various private sector companies to develop pilots that use quantum computing to support health diagnostics and global energy supply management.

Developing AI technology in the UAE will help the UAE diversify its economy, enhance productivity and find new sources of growth. It will also firmly

establish UAE's credentials as a world leader in AI and act as a catalyst to attract further talent and investment. Focusing efforts in industries with an obvious potential for AI development, commercialization and export exists will maximize the likelihood of success and the return on investment.



OBJECTIVE 3: DEVELOP A FERTILE ECOSYSTEM FOR AI

A combination of funding, knowledge, and strategic support will be needed to develop a domestic AI ecosystem. This starts with better access to local data infrastructure and funding for projects that make the most of this which will lead to opportunities for building new companies. Once these elements are in place, there needs to be incentives for world-leading products and services to be developed in the UAE.

There are difficulties and uncertainties in developing algorithmic services. AI systems often require coordination across several locations, firms or industries. They also require trusted partners in order to automate products and services.

Governments can play an important coordinating role, providing access to networks, data and finance that can help overcome these barriers.

AI Network

In order to encourage more research, collaboration and commercialization local expertise will be aggregated through the establishment of a network of researchers, industry experts and policy experts from across the UAE. Funding for AI research and companies could be provided according to priorities identified by the group, backed by evidence from a survey of regional AI activities.

The Mohammed bin Rashid Innovation Fund has AED 2 billion to support local innovators. Collaboration between the

fund and the UAE Artificial Intelligence and Blockchain Council (see objective 4) could support companies that need access to government data or partnerships with Government.

The AI market is estimated to grow to USD 60 billion by 2021, with China alone aiming to create a USD 150 billion market by 2030⁸. The UAE will need to accelerate domestic AI commercialization in order to capture its share of this growing market. There are currently an estimated 2,600 AI-focused startups globally, but the vast majority of them are in America and China, along with economies like the UK and Japan⁹.

The UAE has an opportunity to become a competitive regional hub for AI entrepreneurs through providing a supportive ecosystem. A developed ecosystem of local startups will ensure that AI solutions are catering to the market needs of the UAE economy, rather than being reliant on adapting imported ideas and products.

Applied AI Accelerator

The AI Office will support the development of a domestic AI startup and product development ecosystem through incubator funds, mentoring, and publication of shared knowledge.

Zeroth AI, a Hong Kong based AI accelerator, provides USD 120,000 in seed capital to companies in the program for exchange for 10% equity stake. They also provide mentoring and support to get a long-term visa in Hong Kong. Another example, this time of a government supporting industry development, is in AI Singapore's 100 Experiments project. The project funds researchers and academics with up to USD 250,000 to work on industry specific problems for which AI technologies may be quickly built, but without the need for time and resource-consuming research.

AI Incentive Scheme for Overseas Companies

Greater FDI by foreign firms will be a key enabler of industry development, bringing technology and skills to the UAE. The scope for greater FDI is real. 70% of global executives believe technological change will lead to an increase in global FDI¹⁰. While the UAE is seen as a promising source of FDI, it is not seen as a top destination for FDI investment. Planned relaxation of foreign investment laws and improving reputation for ease of doing business should facilitate greater FDI¹¹.

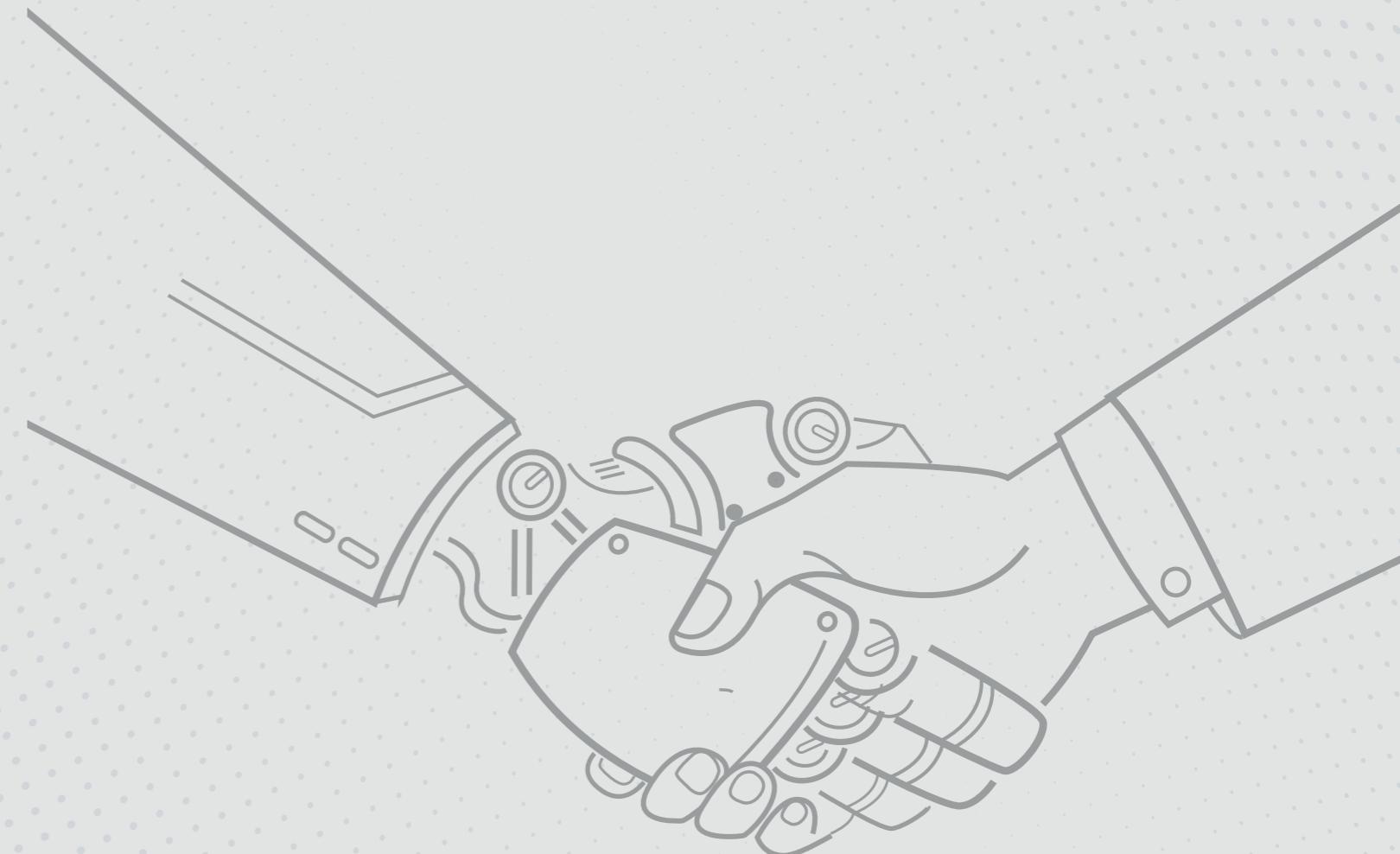
Incentives will be developed to encourage UAE firms to partner with global AI technology firms to foster greater links into global value chains and enable technology transfer from international firms. The incentives will also motivate international companies to set up regional offices in the UAE or relocate here. For example, a new cyber research center in Stuttgart and Tübingen, Germany (the Max Planck Society's Institute for Intelligence Systems) attracted foreign investment from Amazon leading to an estimated 100 jobs over the next five years and providing EUR 420,000 per year to fund research students. Foreign investors were driven by locating near this known center of talent, which previously had not engaged with industry partners. Although the UAE does not have this kind of strong AI talent hub, it is building attractors that will grow the technical community here quickly.

Business Support for UAE AI Firms

Once local systems and companies are in place, the next step is to form more ambitious UAE presence in global markets.

Creating global markets often requires investments that are speculative (e.g. international trips, marketing campaigns) or require coordination (e.g. trade missions, joint ventures). This can often be difficult for individual businesses to undertake. Similarly, investments in new products require large-scale investments, which can carry too much risk for any one investor.

Governments can help business solve this problem by offering guidance, financial support, and by acting as a coordinator. Providing support and guidance will overcome knowledge barriers to developing AI solutions and strengthen connections into international markets, increasing exports and growth.



OBJECTIVE 4: ADOPT AI ACROSS CUSTOMER SERVICES TO IMPROVE LIVES AND GOVERNMENT

Government can play a strong role in making sure AI delivers the greatest public value, by making citizens safer, healthier and happier.

The UAE also faces significant social and economic challenges, where the outcomes for the population are poor compared to other countries. For example, high rates of obesity and heart disease, high rates of traffic fatalities, poor air quality and poor education outcomes. Using AI to better respond to these challenges has huge potential benefits. There is a role for Government in supercharging this - providing the focus, resources and drive to solve these challenges.

National AI Challenges

A single program could be set up to support the best ideas from across government, universities and the private sector, which solve the UAE's most pressing challenges using AI. In Australia, the government recently launched a National Missions Program, beginning with making the nation the healthiest in the world. This included a step-change increase in investment in national genomics and personalized medicine capability and its integration into medical research and healthcare systems.

In similar fashion, a nationwide program to tackle the UAE's distinctive challenges will be launched. The best

ideas will receive funding, mentoring and access to data. Importantly, the program will have the potential to demonstrate the benefit of AI to the UAE population and inspire the nation to embrace AI to make lives better.

UAE Artificial Intelligence and Blockchain Council

AI can also be used to improve the experience and cost of government transactions and services. There will be fewer time-consuming administrative processes, fewer errors, and more convenient services.

Building on a successful generation of digital government initiatives, the UAE has an opportunity for global leadership. But government entities need support from political leaders to move key services - such as tax filings, applications, regulatory compliance checks, payment of fines - to interoperable digital platforms, with high-quality, complete and accessible data.

The UAE Artificial Intelligence and Blockchain Council includes representatives from all emirates on both federal and local levels. The Council's main objective is to identify how and where AI can be incorporated in government and what supporting infrastructure it requires.

OBJECTIVE 5: ATTRACT AND TRAIN TALENT FOR FUTURE JOBS ENABLED BY AI

A recent study commissioned for the 2018 World Government Summit in Dubai argued that for six Middle East countries, 45% of the existing work activities in the labor market are automatable today based on current technologies. This average is slightly below the global average of 50%¹². The same study shows that this risk is higher in sectors where employees perform routine tasks like in manufacturing and transportation. In the arts, education and healthcare, where human interaction or creativity is more important, the risk is much lower.

For the UAE, around 43% of existing work activities have the potential to be automated across key sectors such as administration, government, manufacturing and construction. With around 70% of Emiratis employed in the public sector, retraining of government workers is particularly critical. It has been estimated that almost 300,000 jobs in the UAE in the Administrative and Support and Government sector may be impacted by automation, with around 125,000 of these jobs held by UAE nationals¹³. This will have a major impact on the public sector workforce and needs to be carefully managed, with a 2016 survey of Emirati workers finding the ideal future role for 54%

was one in administration i.e. a role that may not exist in the future.

These predictions could prove inaccurate. Working practices in the UAE are often different to US job descriptions, which are the ones used to estimate how work can be automated. At the same time, the growing youth population in the region and dominance of job-related visas in the UAE could have the greatest effects on the underlying dynamics of the workforce.

Given this, there is a significant low-skilled population whose job can easily be changed by automation, but who currently have few skills to make the most of these changes.

40% of the UAE workforce has good digital skills¹⁴. This is less than the 56% of people with good digital skills in the UK, the top rated-nation in the AI-Readiness Index¹⁵.

For most of the population, developing better digital skills and basic understanding of AI will help them make better decisions in an economy where automation technologies enter the workplace.

Digital Skills in the UAE and UK



Public AI Training

Free courses are being run for UAE residents to raise awareness and understanding of AI technologies. The UAE AI Summer Camp took place in the summer of 2018 and it supports the efforts of future knowledge transfer and building a generation capable of adopting advanced technologies in developing solutions for various future challenges. Over 5000 UAE residents received specialized training on the fundamentals of AI with hands-on experience.

Upskilling Students

There is a similar opportunity in the student population. The UAE has a small student population, but a high percentage (22%) are in core STEM areas: ICT, engineering and natural sciences. Upskilling STEM graduates with specialist courses will provide the fastest short-term solution to increasing the number of AI experts. This upskilling will also provide a stronger pipeline of students able to undertake post-graduate training in AI to develop the pool of UAE talent able to build AI systems.

The United Kingdom has recently stated an aggressive target of having at least 1,000 government supported

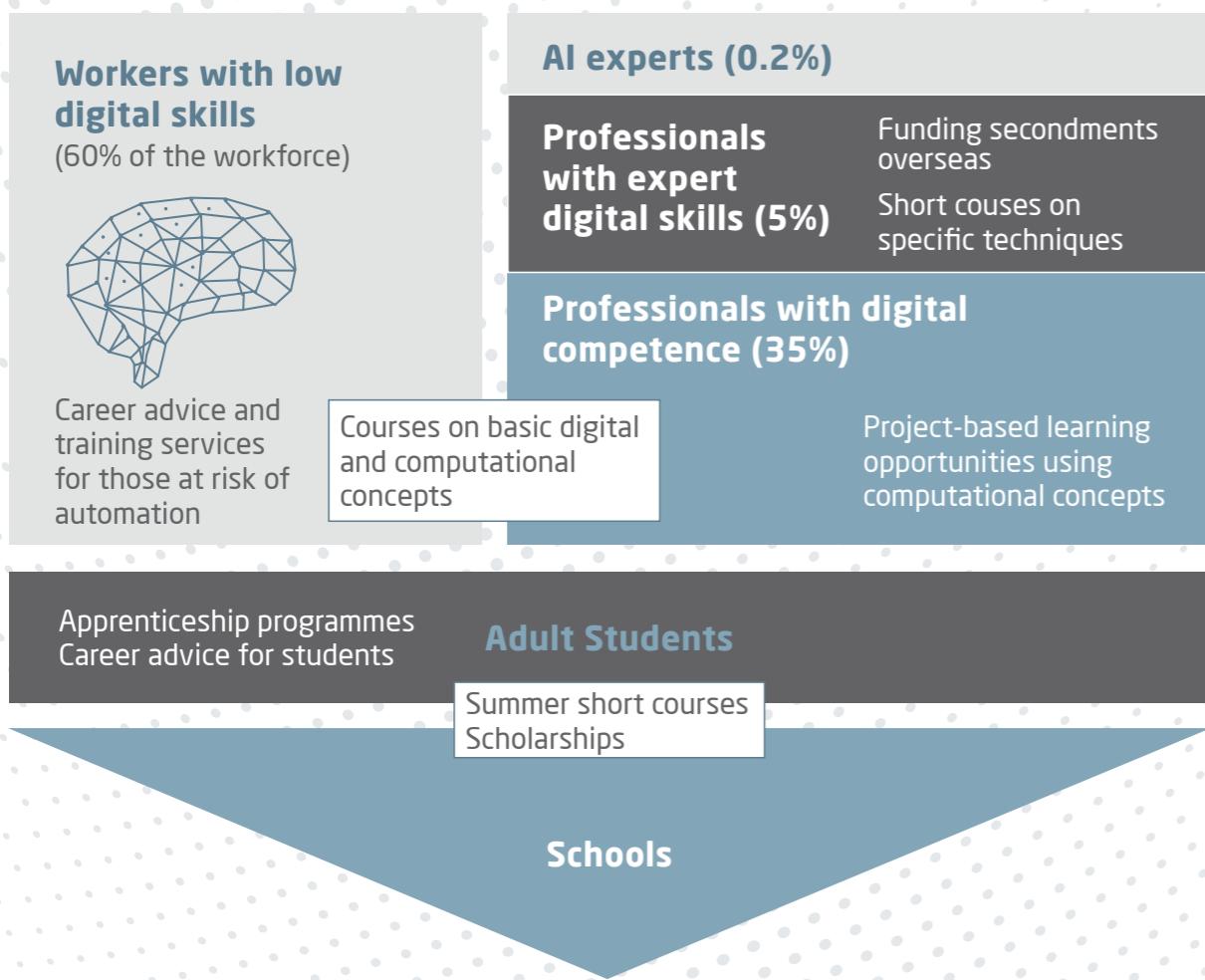
PhD places at any one time in AI and related disciplines, by 2025. In order to compete technically on a global scale the UAE must also be ambitious in its targets, to that effect, at the February 2018 World Government Summit, the Minister of State for Artificial Intelligence announced that the UAE has the intention to produce world-class AI talent. This will be done through upskilling 1/3 of the UAE's STEM graduates per year (2000 students).

Given the public sector is a major employer and potential user of AI in the UAE, The AI Office has also started specific training for government employees.

Government Training

The AI Office is offering more advanced courses for Government employees starting Q4 2018, focused on skills needed to work with them being the AI Experts (ambassadors) in their entities. These require participants to complete a capstone project related to their current job. The aim is to ensure that 100% of senior leadership in government - Director-General, Ministerial and Senior-Ministerial levels - are trained and versed in AI, with more junior government employees being trained on a more ad hoc basis.

This illustration summarizes how skills training could fit together across different segments of the labor market.



Professional Upskilling

There is also an opportunity to take professionals with expert digital and analytic skills and provide them with the training needed to become specialists in AI. In the New Generation of Regional Talent section of this AI Strategy, the strong segment of professionals in the region with operational and analytical skills was highlighted. It is the AI Office's aim to help upskill these individuals. Upskilling existing professional workers in the UAE could include specialist-training, secondments and study tours overseas.

Employment Transition Support

Skills training for 60% of the workforce with low digital skills would benefit from more robust data on current skills in the labor force and current job openings. The AI Office supports the Minister of State for Higher Education and Advanced Skills in their efforts to improve this data collection, and champions efforts to develop a series of career advice tools and services to help current and future workers make more informed choices.



OBJECTIVE 6: BRING WORLD-LEADING RESEARCH CAPABILITY TO WORK WITH TARGET INDUSTRIES

This objective is concerned with building the wider knowledge production in the UAE, including university and commercial R&D. This will need to include increasing investment in research and encouraging world-class academics to work in the UAE.

Investing in AI R&D capability is a necessary first step. The US, France, UK and China have embraced strategic national plans to boost AI's share of its R&D investments. The UAE is ranked 35th in the world for overall R&D investments.

There are researchers in UAE institutions developing or modifying algorithmic or automated technologies. To provide a targeted boost to R&D in AI, the focus will be on supporting and expanding the research of this small community.

The UK's national institute for data science and artificial intelligence was created as a partnership between centers of excellence at existing universities. Five founding universities - Cambridge, Edinburgh, Oxford, UCL and Warwick - and the UK Engineering and Physical Sciences Research Council created The Alan Turing Institute in 2017. It provides coordination and support for the research community,

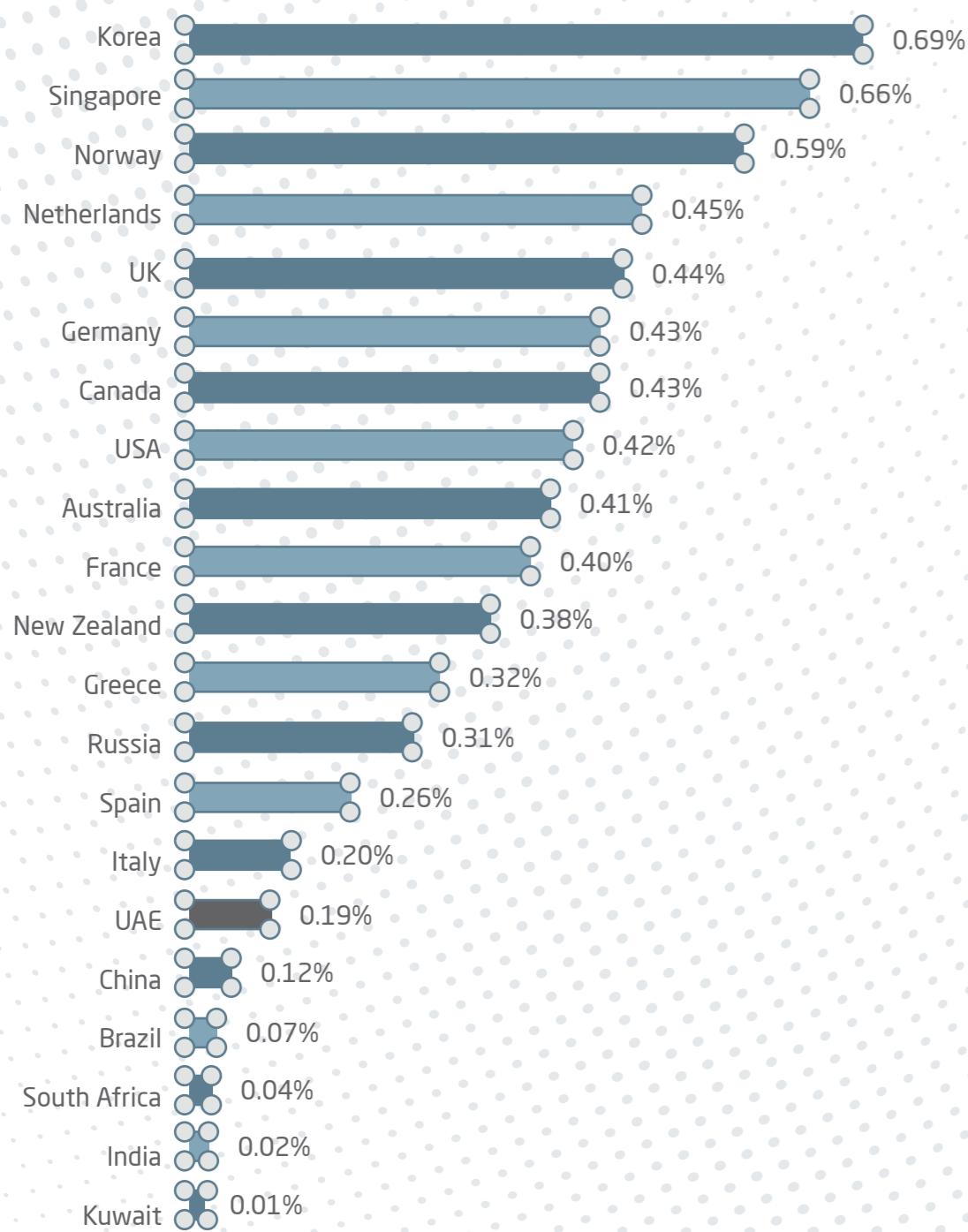
without the overheads of establishing a new university-scale institution. The AI Network in Objective 3 will help support similar coordination.

Even in countries with a well-established research base, AI experts are in short supply and highly attractive to industry. For example, 65% of Google DeepMind research hires came from academia¹⁶. AI ideas are still emerging and new technologies are still finding their way to industry. Governments are investing heavily in AI, to supplement but by no means match significant investment by private companies.

The US and China are world-leaders in developing domestic research capacity. This dominance is visible in AI research output, where the countries also produce the most number of original research papers on AI¹⁷.

Countries with fewer researchers are still able to have research impact by building capacity in strategic areas. Countries like Canada and Spain have already developed hubs in AI-related research.

Percentage of population working as full time researchers in science, technology, and innovation¹⁸.



The UAE is a young country that has not yet established a strong academic tradition to provide a pipeline of world class researchers. It will need to look for other ways to access research talent. With more than half the world's population just a five hour flight away, the UAE is in a prime position to attract global research talent to visit the UAE to help build capacity and share their AI knowledge.

Short-term opportunities for leading AI professors to work and experience the potential in the UAE may also support the UAE to attract leading professors in the medium to longer term, and develop UAE university capacity. Saudi Arabia's Center for Complex Engineering Systems is a partnership between the Saudi Government and MIT, creating a flow of expert academics to Saudi Arabia.

National Virtual AI Institute

To ensure this increase in investment is well targeted, the AI Office will survey current local R&D capacity. This will help identify options for what is required and how best to boost R&D that can be directly applied to industry, providing a medium-longer term solution to addressing the UAE's R&D gap. Following the survey, the UAE will launch a National Virtual AI Institute with stakeholder partners to aggregate the best local and global expertise in the region, and to encourage more R&D activity, collaboration and commercialisation. The AI Network in

Objective 3 will provide the platform for this R&D network.

Key Thinkers Program

A program to attract key AI thinkers to visit the UAE will be initiated. These key AI thinkers will participate in workshops and lectures with local universities and businesses. Key Thinkers will also be provided with incentives to run research projects in partnership with these local bodies.

In line with objective 4, improving lives, and objective 8, good governance of AI, The AI Office will also want to recognize and reward AI research with the greatest value to society. An award for programs with outstanding governance frameworks or the greatest social impact would be a helpful incentive.

AI Library

The research gap can be closed if the benefit of research can be shared with those who have an interest in AI. In order to boost further innovation, the AI Office will work on creating an open-access digital library of research and papers in both English and Arabic. This will be a first-of-a-kind initiative to boost the research sector in the region. The UAE will also endeavor to create accessible summaries of UAE government funded AI research and programs in order to help encourage the development of AI solutions. The AI Library will be a joint collaboration between academia, industry and government.

OBJECTIVE 7: PROVIDE THE DATA AND SUPPORTING INFRASTRUCTURE ESSENTIAL TO BECOME A TEST BED FOR AI

Governments around the world are increasingly recognizing the value of the vast data sets they collate. Machine learning models need access to training data sets, and open data can also be used to test and improve AI systems' performance.

The UAE has taken steps towards opening data to improve transparency, but still significantly lags behind other countries in the number of open data sets it releases. 537 datasets are currently available, whereas Turkey has shared 1,280 and Canada has over 10,000.

Data Sharing

The UAE has an opportunity to become a leader in available open data for training and developing AI systems. The greatest advantage that the UAE has is in its diversified culture, with more than 200 nationalities residing in the UAE. Given the unique mixture of cultures in the UAE, the data sets that the country holds is impeccable. This data in combination with machine learning can aid in accurately diagnosing diseases such as Tuberculosis (TB) using Artificial Intelligence. The UAE realizes that the oil of the future is data and will

invest into creating a robust data infrastructure. The UAE's ambition is to create a data-sharing program, providing shared open and standardized AI-ready data, collected through a consistent data standard.

The X-Road platform in Estonia supports access and combination of government and private databases, setting the stage for the application of machine learning tools. The data solution saves citizens over 800 years of working time per annum.

Secure Data Infrastructure

A secure data infrastructure will be necessary to facilitate data sharing, and manage privacy concerns. Investing in a single AI data infrastructure makes it easier to do this efficiently, and makes it simpler to access data relevant to research or developing new products and services.

Some countries have already experimented with virtual data libraries. Australia's SURE (Secure User Research Environment) allows researchers to access data in hospitals,

general practice and cancer registries. While designed to handle health data, it is now being used by other agencies with sensitive data, e.g. the Australian Taxation Office and the Australian Department of Social Services. SURE offers a data repository service, where a user can purchase secure, hosted space for multiple datasets and projects and set their own data governance framework, if approved by SURE. SURE also offers single project workspaces where SURE manages both the data governance and technical aspects of hosting. In these cases, a user must seek research ethics committee approval for the research before a workspace will be granted.

Beyond national datasets, there is also a need for data protection and authentication as part of good corporate practice in the UAE. As the consultative group under objective 8 develops, they will begin to address these issues. Europe's General Data Protection Regulation includes new rights for consumers; it provides an opportunity to re-consider how consumer data is handled, even for customers who are not European citizens.

OBJECTIVE 8: ENSURE STRONG GOVERNANCE AND EFFECTIVE REGULATION

The speed of developments in AI is a challenge for governance. With vast research efforts around the globe, it is difficult to ensure this technology is developed in a safe and ethical environment.

As Governments and leading AI thinkers around the world grapple with this challenge, there is an opportunity for the UAE to learn from the best and collaborate with others to ensure effective governance and regulation of AI, both domestically and internationally.

The UAE has the ambition to take a leading role in the development of responsible AI and advancing the regulation of AI. For example, the UAE has an important contribution to make to this global discussion by connecting abstract discussions to pilots run by, or in partnership with government.

This will also mean working to make sure the UAE has the legal environment to support innovation in general and the adoption of AI in particular. Innovations in AI technology often require rapid changes in regulatory settings and can create risks to society. The adoption of interconnected data systems and the growing dependence of major industries on software also makes an economy more vulnerable to

digital disruption. Cyberwarfare capability will continue to grow, meaning that cybersecurity will become increasingly important. In the absence of a coherent national strategy, cybersecurity would be developed on an ad hoc basis. This is inefficient and risks leaving gaps. This will be addressed through the governance review.

National Governance Review

The UAE Artificial Intelligence and Blockchain Council will add to its remit to review national approaches to issues such as data management, ethics and cybersecurity. They will also review the latest international best practices in legislation and global risks from AI. Furthermore, the Council will ultimately oversee the implementation of the AI Strategy in the UAE.

Other countries have developed advisory structures that combine expertise in technical fields and regulation. The 2016 White House Artificial Intelligence Strategy formed a standing committee consisted of regulators and industry experts. California's Little Hoover Commission is currently studying the impact of AI on regulatory settings through a committee of experts. France has created a national AI ethics committee,

as well as ethics-by-design training for tech developers to build ethical considerations into their projects.

Globally, the UAE has begun work on a number of initiatives to help develop responsible AI.

During the World Government Summit in February 2018, over 100 leading experts at the inaugural Global Governance of Artificial Intelligence Roundtable were hosted. This collection of AI experts debated how governments could best navigate the challenges posed by the rapid rise of AI.

Second Global Governance of Artificial Intelligence Roundtable

For the 2019 World Government Summit, The AI Office is working with UNESCO, OECD, IEEE and the Council on Extended Intelligence in identifying the foremost experts and themes to explore. All of these working groups will then present their outcomes at a High Level Ministerial Panel composed of the world's foremost Minister's of Digital, Technology and ICT who are responsible for the development and use of AI in their countries.

Intergovernmental Panel on Artificial Intelligence

A natural evolution of the Roundtable is in the formulation of an intergovernmental body, dedicated to providing a mechanism for governments and private companies to better understand AI and its impact on societies in order to help give a solid framework for future regulation, in a more tangible and enforceable manner. In March 2018, President Macron, at the launch of the French Artificial Intelligence Strategy, announced a desire to establish an "IPCC for Artificial Intelligence" - referring to the Intergovernmental Panel on Climate Change. The UAE has expressed a desire to work with France and other governments in creating the foundations for such a body. The AI Office is actively working toward making this happen.

CONCLUSION

"We, in the UAE, have no such word as "impossible"; it does not exist in our lexicon. Such a word is used by the lazy and the weak, who fear challenges and progress. When one doubts his potential and capabilities as well as his confidence, he will lose the compass that leads him to success and excellence, thus failing to achieve his goal."

His Highness Sheikh Mohammed bin Rashid Al Maktoum
UAE Vice President, Prime Minister and Ruler of Dubai

The UAE is unlike any other country in its diversified population, comprising of unique talents - we aim to give this human potential the best opportunities to nourish and flourish. Given this human potential, the UAE has always aimed at not just being better, but to become the best.

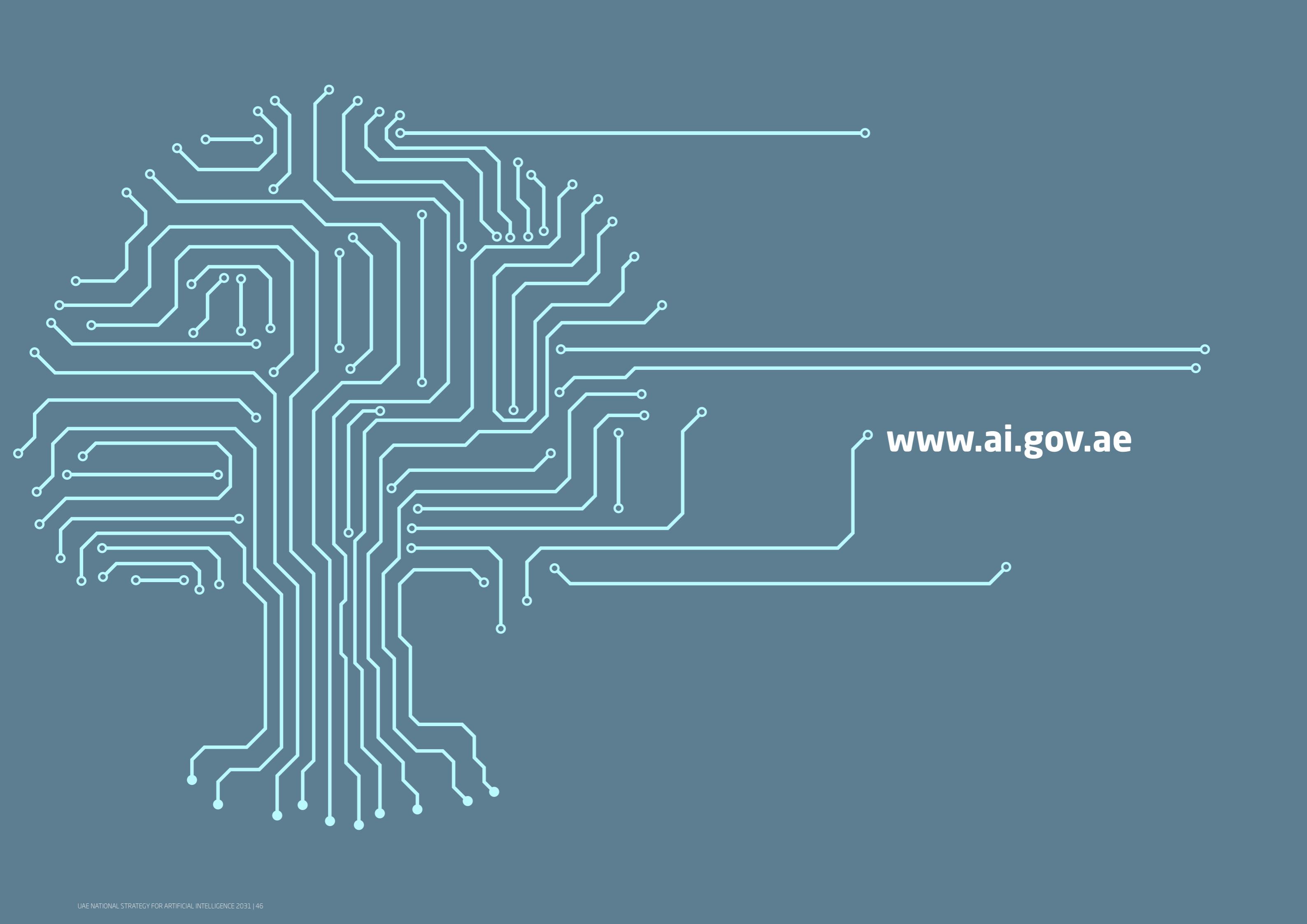
The AI National Strategy is a cornerstone of the UAE Centennial 2071 and is a major variable in the overall equation. It will bring transformation to a new level by 2031 and set the foundations for future generations in the UAE to become the best.

As one of the first movers in paving the path for AI nationally, a plethora of challenges is certain to arise, but we are true believers in that nothing is impossible in the UAE. We are a country that is known for tackling challenges head on, creating new opportunities, and deploying innovative solutions.

As Minister of State for Artificial Intelligence, I aim to catalyze the responsible development of AI within our country, in order to help us reach the UAE Centennial 2071 - and to act as an inspiration for other nations to harness this technology for the betterment of humankind.

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