Developing an artificial intelligence strategy
National guide

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Key messages

1. Artificial intelligence (AI) has gained popularity after decades of trials. Broadly, artificial intelligence (AI) describes software that mimics human cognition or perception. AI is part of applications used in every daily life, including Google (search algorithms), Facebook (face recognition), Netflix (personalized movies), Siri and Alexa (virtual assistants), and chatbots.

2. More substantial applications supporting the Sustainable Development Goals (SDGs) can be found in personalized health-care treatments, education curriculums, smart cities, and judicial sentencing.

3. AI is the amalgamation of several fields and resources, and the result of a virtual ecosystem sustained by Government, the private sector and non-governmental organizations. AI should not be seen independently from the robotic process automation of repetitive tasks, where human involvement can be completely eliminated.

4. AI cannot be seen independently from security, data protection, privacy, safety, and data destruction, in addition to neuroscience and cloud and quantum computing. The ethical dimension of AI and related guidelines for responsible coding are vital to a national strategy.

5. National strategies need to address requirements and focus on multiple pillars across sectors and disciplines, covering a wide scope from legislation to human resources. Legislation should be innovation-friendly, and Government should be the enabler of innovation by prviding the required AI infrastructure.

6. AI will eliminate jobs but not work. Countries must therefore update school curriculums to include coding skills and skills that cannot be replicated by machines, such as critical thinking, cooperation and team-building, and social and emotional skills;

7. The AI industry is too broad to standardize, and related application sectors vary betweeen countries but are always based on national competitiveness and priorities.

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I. Best regional and international practices

A. Best practices from around the world

1. *China*

The Chinese Government has prioritized AI by promoting it in the thirteenth Five-Year Plan (2016-2020), Internet Plus and AI plans for the period 2016-2018, and a next generation AI plan. China aims to create a domestic AI market of 1 trillion renminbi ($150 billion), and to become the world's premier artificial intelligence innovation centre by 2030.[1]

The main pillars of the New Generation Artificial Intelligence Development Plan can be summarized as follows:

- Identify 17 areas of AI development, including intelligent and networked vehicles, identification systems, and service robots;
- Advance AI support frameworks, including intelligent sensors and neural system processing chips;
- Encourage intelligent manufacturing;
- Allocate resources for industry training, standard testing, and cybersecurity;
- Recruit the world's best AI talent, strengthen training of the domestic AI labour force, and lead the world in laws, regulations, and ethical norms.

A plan released by the Ministry of Science and Technology identifies a number of innovative AI platforms across the country to produce AI applications and services. These platforms will be built by enterprises and market mechanisms, local government, the AI industry, research institutions and universities, creating an open ecosystem. In principle, every subfield of AI research should have a State-level AI innovation platform.

The private sector is also actively pushing for AI. Three Chinese Internet giants, namely Alibaba, Baidu, and Tencent, as well as iFlytek (a voice recognition specialist) have joined a national team to develop AI in areas such as autonomous vehicles, smart cities, and medical imaging.

2. *Japan*

Japan has noted its strengths in advanced manufacturing practices where AI can be used effectively, and has recognized that Japanese scientific production in AI fields falls below counterparts in China and the United States. Consequently, the country enacted a policy in April 2016 to establish the Artificial Intelligence Technology Strategy Council, as part of the Public-Private Dialogue towards Investment for the Future, to manage five national research and development agencies and coordinate with three research centres specialized in neural networks and AI.[2]

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[1] The State Council of the People's Republic of China, Next Generation Artificial Intelligence Development Plan, July 2017.

[2] Artificial Intelligence Technology Strategy, Strategic Council for AI Technology, 21 March 2017

The Council developed a three-phase strategy with three objectives: productivity; health, medical care and welfare; and mobility.

- **Phase 1:** Utilization and application of data driven AI, developed in specific domains by 2020 (manufacturing, health care, agriculture, etc.);
- **Phase 2:** Public use of AI and data developed across various domains by 2030;
- **Phase 3:** An ecosystem built by connecting multiplying domains reaching a stage where the entire society contributes and benefits from AI.

The Japanese approach is an all-encompassing AI approach to society as a whole, with clear roles for and cooperation between industry, academia and the Government.

3. *United Kingdom*

A strategy entitled "Growing the artificial intelligence industry in the UK" was released in October 2017. It includes plans to supercharge the AI industry, potentially worth $814 billion to the British economy by 2035.[3]

The strategy includes 18 recommendations that describe how Government, industry and academia should work together to keep the United Kingdom among world leaders in AI. The recommendations are summarized as follows:

- Improve access to data;
- Improve the supply of skills;
- Maximize AI research by supporting the Alan Turing Institute of research;
- Support AI uptake.

The British approach concentrates on AI applications for the public good. The State encourages focusing on key social problems, such as the ageing population and the future of mobility. Two departments are responsible for the AI sector: the Department for Digital, Culture, Media and Sport; and the Department for Business, Energy and Industrial Strategy.

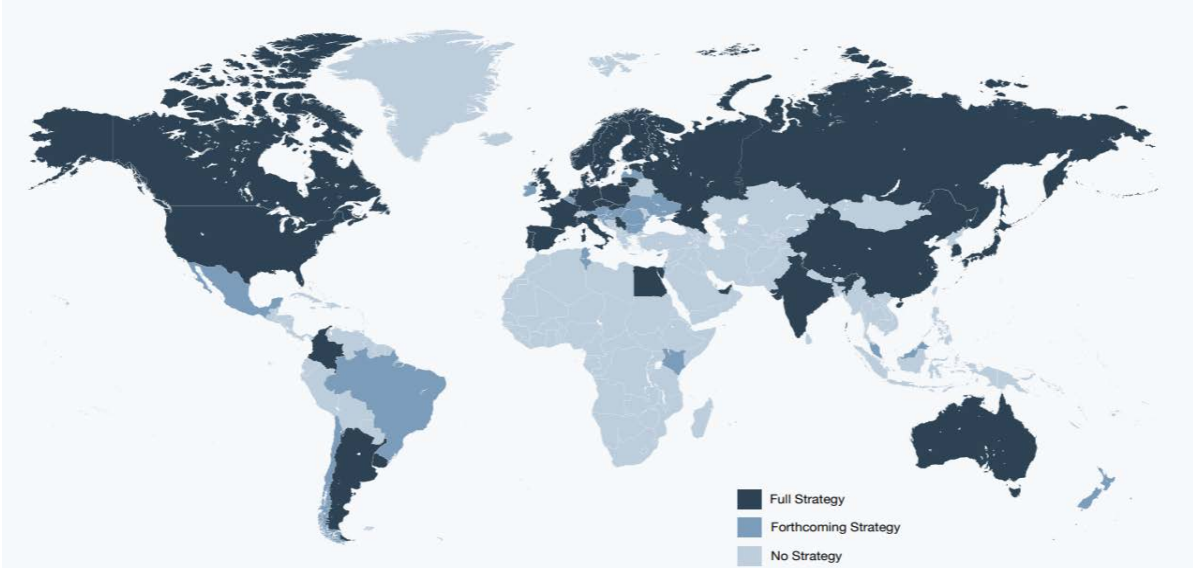
The Office for Artificial Intelligence has accomplished the following:

- Established the AI Council, which comprises independent experts and business leaders from business, academia and data privacy organizations;
- Established the Centre for Data Ethics and Innovation, which provides independent expert advice on the measures needed to ensure safe, ethical and innovative uses of AI and data-driven technologies;
- Announced 16 new centres for doctoral training at universities across the United Kingdom, delivering 1,000 new PhDs over the next five years;

[3] Professor Dame Wendy Hall and Jérôme Pesenti, Growing the artificial intelligence industry in the UK. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/652097/Growing_the_artificial_intelligence_industry_in_the_UK.pdf.

- Offered new AI fellowships to attract and retain top AI talent, led by the Alan Turing Institute;
- Confirmed the first wave of industry funding for new AI master degrees at leading United Kingdom universities;
- Established five new centres of excellence across the UK for digital pathology and imaging, including radiology and AI medical advances;
- Announced new research projects that consider how AI can be applied in the legal and accountancy sectors;
- Partnered with the Open Data Institute to explore the potential of data trusts, tackling illegal wildlife trade and reducing food waste, for example.

Other relevant cases are Australia, Canada, India and the European Union.



Source: International Development Research Centre, Government AI Readiness Index, 2020.

B. Best practices from Arab countries

Arab countries can be divided into three groups according to their level of digital readiness:[4]

Level 1: Countries with low to medium digital readiness: Algeria, the Comoros, Djibouti, Iraq, Libya, Mauritania, the State of Palestine, Somalia, the Sudan and Syrian Arab Republic.

Level 2: Countries with digital potential: Egypt, Jordan, Lebanon, Morocco and Tunisia.

Level 3: Digital leaders: Gulf Cooperation Council (GCC) countries, namely Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates.

[4] الاتحاد العربي للاقتصاد الرقمي، الإستراتيجية العربية للاقتصاد الرقمي نحو مستقبل رقمي مستدام، شامل، آمن، 2018، ص 51.

1. *United Arab Emirates*

In October 2017, the country established the AI Council and the Ministry of Artificial Intelligence. The United Arab Emirates has crafted a national AI strategy focused on expanding the role of AI in nine sectors: transport, health, space, renewable energy, water, technology, education, environment, and traffic. In Dubai, the Government is creating a huge demand for AI applications, so it is attracting startups and investments. The list of government bodies requiring new AI applications includes the Ministry of Health and Prevention, the Smart Dubai Department, Dubai Electricity and Water Authority (DEWA), and the Dubai Police.

2. *Saudi Arabia*

The country does not have a national AI strategy, but went down in history as the first State to gran citizenship to a robot named Sophia. Its flagship National Transformation Programme notes the need for AI-driven tools. In October 2017, the vision for a new city, Neom, was revealed. Neom will be a huge connected city built in the desert, where everything is linked to AI.5 Saudi Arabia will therefore be creating demand to attract AI apps suppliers.

Challenges in the Arab region revolve around the fact that Government is alone in promoting new technologies. To ensure success, the private sector should also be a partner. Consequently, Saudi Arabia and the United Arab Emirates remain in the early stages of AI investment and policymaking.[6]

3. *Egypt*

The Egyptian AI strategy was launched in 2018, and is expected to be implemented in three to five years. The aim is to develop businesses related to AI and digital transformation projects, which represent a great opportunity for the country. The strategy covers the following focus areas: training and capacity-building, producing and exporting AI solutions, and investing in young people, and training professional cadres. The strategy's objectives are to create an enabling environment for the growth of AI startups, offer AI startups the opportunity to participate in projects with various State agencies, support youth capabilities in the field of data science and AI, and encourage the private sector to invest in AI.

4. *Tunisia*

The Tunisian AI policy was launched in 2018.[7] The aim is to facilitate the development of an AI environment to effectively contribute to equitable and sustainable development and job creation. The strategy was initiated in a workshop hosted by UNESCO on science, technology and innovation policy,

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[5] Alaa Shahine and others, Saudi Arabia just announced plans to build a mega city that will cost $500 billion, Bloomberg, 24 October 2017. Available at www.bloomberg.com/news/articles/2017-10-24/saudi-arabia-to-build-new-mega-city-on-country-s-north-coast.

[6] The Economist Intelligence Unit, Scaling Up The Potential Economic Impact of Artificial Intelligence in the UAE and Saudi Arabia, May 2019.

[7] National Agency for the Promotion of Scientific Research (ANPR), National Artificial Intelligence Strategy. Available at www.anpr.tn/national-ai-strategy-unlocking-tunisias-capabilities-potential/.

in partnership with the National Agency for the Promotion of Scientific Research. A task force was formed to identify priority areas and policies to be included in the strategy.

5. *Qatar*

The Ministry of Transport and Communication, in partnership with the Qatar Computing Research Institute, launched the national AI strategy in 2019.[8] The aim is to make AI ubiquitous in all aspects of Qatari life, business and governance, making Qatar a role model for the AI+X nation. The strategy has six pillars: education, data access, employment, business, research, and ethics. It envisions two roles for Qatar. Firstly, Qatar must develop the capacity to produce world class AI applications in areas of national interest, and create a business environment enabling the use of AI as a driver for innovation. Secondly, Qatar must be an efficient consumer of AI, with a properly educated citizenry, sound laws, and ethical guidelines.

[8] Hukoomi, Qatar's National Artificial Intelligence Strategy Launched, 30 October 2019. Available at https://portal.www.gov.qa/wps/portal/media-center/news/news-details/qatarsnationalartificialintelligencestrategylaunched.

II. Pre-requisites for artificial intelligence

A. Ubiquitous, open and secure Internet

While AI is not an Internet technology, the Internet is the core infrastructure of the ecosystem in which AI thrives. According to an ESCWA study,[9] fixed broadband in the Arab region is generally costly and slow, with caps on traffic volume:

- The cost of international capacity is tenfold that of North America and Western Europe;
- Latency is high because 90 per cent of Internet traffic passes over international connections owing to the lack of viable internet exchange points in the region;
- Fixed broadband deployment is slow and overburdened by regulatory restrictions;
- The telecom industry, owned and/or operated by Governments through their regulatory authorities, weakens competition and stifles innovation in the provision of ubiquitous access and services, such as open access, community networks, and liberalized spectrums.

B. Healthy and vibrant startup ecosystem

According to AI Index 2018 of Stanford University,[10] in the United States, active AI startups increased by 113 per cent, while all active startups increased by 28 per cent. A successful startup ecosystem has five pillars: risk capital; strong software industry; Government willingness to invest; strong universities producing breakthrough ideas and technologies; and an educated population that generates entrepreneurs.

C. Digital competencies

Different types of digital competencies are needed for the twenty-first century. Several organizations and initiatives are calling for an overhaul of curriculums, and encourage a shift away from educating for specific jobs towards acquiring skills that allow graduates to adapt to evolving tasks arising from technological change.[11] UNCTAD classifies the digital skills needed in four levels.[12] The first two levels relate to all people, and the last two levels are for ICT professionals:

- Adoption of technologies: learning basic digital literacy skills and awareness in primary school;
- Basic use of technology: learning coding in intermediate schools (before age 12), and basic knowledge of ICTs for all citizens to solve everyday problems and to engage in community activities, including programming skills, data analysis, processing and modelling;

[9] ESCWA, Arab Horizon 2030: Digital Technologies for Development, 2017, p. 37.

[10] Yoav Shoham and others, The AI Index 2018 Annual Report, December 2018.

[11] World Economic Forum, The Future of Jobs: Employment, Skills, Workforce Strategy for the Fourth Industrial Revolution, 2016.

[12] UNCTAD, Building Digital Competencies to Benefit from Frontier Technologies, 2019.

- Creative use of technology with adaptation: includes fresh graduates employed in the ICT and other digitally related industries;
- Creation of new technologies: learning engineering and sophisticated programming skills, and using complex algorithms such as ML.

There is increasing demand for strengthening uniquely human skills that cannot be easily replaced by machines, by developing the following skills in schools and training the entire population: complex problem solving, critical thinking, creativity and design, sense making, collaboration and team-building, social intelligence, cross-cultural competencies including gender awareness, transdisciplinary thinking, communication and new media, and virtual tools for work and collaboration.

When companies in Arab countries were surveyed, they frequently cited the following skills as being in high demand by 2022:[13]

- Analytical thinking and innovation;
- Active learning;
- Creativity, originality and initiative;
- Technology design and programming;
- Critical thinking and analysis;
- Complex problem-solving;
- Leadership and social influence;
- Emotional intelligence;
- Reasoning, problem-solving and ideation;
- Systems analysis and evaluation.

In summary, to ensure that the next generation of workers and policymakers is tech savvy, it is necessary to put in place long-term educational strategies, such as providing children access to coding and computer science courses starting in primary school.

D. Data policies and regulations

1. *Availability of data and big data*

The algorithms that power AI run on data, and today's world is deluged with it. Since the onset of the digital era, the actions of people and machines all over the world, mediated by smartphones, sensors and other devices, are continuously recorded and stored in electronic databases as large sets of unorganized data called big data. According to Domo's 2018 Data Never Sleeps bulletin[14], the Internet receives 3,138,420 GB of data every minute. This huge collection of diverse data provides the raw material for training algorithms.

To a certain extent, AI is only as good as the data behind it. Hence, the first question to be asked when developing an AI strategy is "what data do we have?". According to a survey conducted in 2017

[13] ESCWA, Impact of the Fourth Industrial Revolution on Development in the Arab region, 2019.

[14] www.domo.com/blog/data-never-sleeps-6/.

by the Mohammed Bin Rashed School of Government,[15] 98 per cent of smart phone owners use social media apps on their mobile phones, followed by 55 per cent for multi-media, gaming and news, among other things.

According to ESCWA,[16] the Arab region is seeing an increased growth in big data infrastructure and applications, with more data centres being established and with the market size in this area to reach $3.2 billion by 2020. Best examples are the C5 Accelerator in Bahrain, helping regional startups scale through cloud computing; and Geomatic in Morocco that conducts big data analysis and visualization.

The second source of data is automation systems. For example, big agricultural giants like Monsanto, John Deere and DuPont Pioneer have a wealth of data on agriculture in the United States. According to ESCWA, the largest investors in automation in the region have been Governments (20.4 per cent), the financial sector (19.2 per cent), and telecommunication companies (13.3 per cent).[17]

The third source of big data is from Internet of Things (IoT) devices. For example, in the United States, Taser sells police body cameras that can search a crowd for outstanding warrants using real-time face recognition. The data that was used to train the Taser software comes from surveillance cameras scattered across streets. Examples of connected devices used in IoT include sensor-based devices that monitor daily activities such as eating and sleeping; home appliances; and sensor devices for improving agricultural productivity. These devices provide data sets of measurements: temperature, soil fertility, noise level, traffic jam locations, rubbish bin capacity, sleeping patterns, and other types of data that can subsequently be used to train ML software.

The Arab region is still in the early deployment phases of IoT applications, except in GCC countries where the IoT solution market is expected to reach $11 billion within the next decade, with the largest sectors comprising utilities, public administration, retail and wholesale, housing and construction, and transport and logistics.[18]

There is no evidence of large big data collections in the Arab region. There are some but, in most cases, the collected data is stored outside the region. While there are no strong applications to gather big data through IoT and other local apps, there is opportunity not only in 'Arabization' of content technology, but also in 'localizing' technologies addressing unique problems and challenges that consider the local cultural and political, social and legal contexts.

Open data can also be a great source for data sets that can be used in AI applications. When e-government systems are in place, data sets can be generated from various databases and made available to the public through a national open data portal, such as data.gov.uk which hosts over 50,000 data sets today. The United Kingdom ranks joint-first with Canada in the World Wide Web Foundation's global rankings for public access to official data.[19] Open data can drive startups, innovators and AI coders, who can use it to develop new services, applications, and train the machine for AI applications.

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[15] www.mbrsg.ae/home/publications/research-report-research-paper-white-paper/the-arab-world-online-2017.aspx.

[16] ESCWA, Impact of the Fourth Industrial Revolution on Development in the Arab region, 2019.

[17] Ibid.

[18] Ibid.

[19] www.computerworld.com/article/3427838/what-is-the-uk-government-s-open-data-strategy.html.

AI requires computers with high computational and processing power, because of the need to manipulate large data sets and scan all possibilities for every decision. While computational power is rising exponentially (a mobile handset in 2019 had more computational power than a NASA computer in 1969), AI needs cheap computational power such as those available in large data centres. These super-computers need to be available to programmers, along with affordable hosting in data centres and cloud strategies.

2. *Legal framework for data*

Laws are need to ensure data privacy and security. The European Union established an international legal framework when it published the General Data Protection Regulation in 2016, which sets the guidelines for the collection and processing of personal information for citizens and residents.

The international community is still debating the legal framework for the ownership of data, since most data gathered on people worldwide is owned by a handful of companies. Governments are aware that data has become the hot asset of the twenty-first century, and are looking for solutions to ensure privacy and security, as well as the availability of unbiased data sets to feed ML algorithms. Some Arab countries have already developed laws on access to information and protection of personal data, including Jordan, Lebanon, Morocco and Tunisia.

III. Components of successful AI strategies

A. Innovation-friendly legislation

Effective regulation should address transparency, understandability, predictability, accountability of AI algorithms, risk management, data protection, and safety.

Good regulation can take many different forms, and appropriate regulatory responses are context dependent. There is no one-size-fits-all for AI regulation, but it is important that such regulation is developed through an approach that is based on human rights and has human wellbeing as a key goal.[20]

B. Government as an enabler of innovation

Government should be an enabler of innovation, and a patron that enhances the entire innovation ecosystem. Government policies can include forming research councils, establishing research centres and public universities, soliciting foreign direct investment (FDI), and lowering the cost of doing business.

A concept that has been instrumental in building the Internet is 'permission-less innovation'.[21] The following is a 10-point checklist that policymakers can follow to achieve that goal:

- Make permission-less innovation the default policy;
- Remove barriers to entry and innovation;
- Protect freedom of speech and expression;
- Retain and expand immunities for intermediaries from liability associated with third-party uses;
- Rely on existing legal solutions and the common law to solve problems;
- Wait for insurance markets and competitive responses to develop;
- Push for industry self-regulation and best practices;
- Promote education and empowerment solutions;
- Adopt targeted, limited legal measures for truly hard problems;
- Evaluate and re-evaluate decisions based on benefit-cost analysis.

C. Government as a driver of demand for AI

When the innovation ecosystem is weak, the Government can generate demand for AI by becoming the customer 'anchor tenant'. This in turn forces companies and startups to fulfil the demand, thus providing Government with a key role in jump-starting the pickup of AI companies.

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[20] IEEE, Ethically Aligned Design – Version II, 2017.

[21] https://permissionlessinnovation.org/what-is-permissionless-innovation/.

D. Science engagement, research and development, and technology facilitation

The following countries lead in spending on research and development as a percentage of GDP:[22]

- Around 4 per cent: South Korea;
- Around 3 per cent: United States, most European Union countries, Japan;
- Around 2 per cent: China, Norway, Singapore, world average.

Arab countries' average is 0.53 per cent. Developing countries need specific policies for technology development, transfer and deployment. There is a need for technology facilitation programmes that build or strengthen the capacity to identify technology needs, to facilitate the preparation and implementation of technology projects and strategies that foster sustainable development; stimulate technology cooperation; support the design and establishment of country-tailored policies spurring technology transfer and enabling frameworks for transfer of technology; build capacity in public and private institutions to deliver technology transfer services; and facilitate regional and global peer learning, exchange and training programmes.

E. Attract and retain talent

There are three groups of talent that need to be strengthened for the development and adoption of AI:

- Researchers who drive fundamental advances in AI;
- Specialists in software engineering, data sciences and in the application area;
- The entire population who is familiar with AI technologies, so as to operate those applications reliably.

A report by the National Science and Technology Council of the Office of the President of the United States examines the diversity challenge in finding and retaining AI talent.23 AI training is inherently interdisciplinary, often requiring a strong background in computer science, statistics, mathematical logic, and information theory. Research has shown that diverse groups are more effective at problem solving than homogeneous groups, and policies that promote diversity and inclusion enhance the ability to draw from the broadest possible pool of talent, solve tough challenges, maximize employee engagement and innovation, and lead by example by setting a high standard for providing access to opportunity to all segments of society. In addition to ensuring that the national workforce has the necessary digital skills, some countries have policies for attracting and retaining international talent.

F. Job creation in the age of AI

Predicting future job growth is extremely difficult, as it depends on technologies that do not exist today and the multiple ways they may complement or substitute for existing human skills and jobs. In the case where AI technologies would complement human skills, there is a wider belief that employment requiring manual dexterity, creativity, social interactions and intelligence, and general knowledge will thrive. Hence, new jobs will be created to replace old ones, while increasing economic

[22] https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS.

[23] Executive Office of the President of the United States, Preparing for the Future of Artificial Intelligence, 2016.

growth and productivity. In cases where AI technologies would substitute human skills, future employment would be restricted to the below four categories:

- Engaging with AI technologies throughout the process of completing a task;
- Developing AI applications for practical use by highly skilled software developers, engineers, and data scientists, among others;
- All roles related to the monitoring, licensing, and repair of AI;
- Management of paradigm shifts created by AI technologies.

ESCWA has estimated the future of jobs in the Arab region following the fourth industrial revolution:[24] there will be a shift in demand as some occupations will be eliminated and others will be transformed into new jobs. This means that technological advancements 'eliminate jobs, not work'.

Agriculture and industry are more susceptible to automation than services. Given that the manufacturing sector's contribution to most Arab economies has been stagnant at an average of 10 per cent over the past 10 years, on average 46.5 per cent of jobs in Arab countries are at higher risk of partial automation because they fall under the services or agriculture sectors.

The region must also prepare for an increase in demand for health care and social services, owing to a projected shift in demographics. In this context, there is an obligation to protect the most vulnerable countries and the most vulnerable within society, and prepare all population segments (older persons, women, refugees) for the shift already taking place, in line with SDGs 8 and 10.

G. Ethical dimension of AI

Several ethical questions are related to AI applications:

- What if the data set is biased?
- How does the machine decide right from wrong?
- Who is responsible when the decision is taken by a machine rather than by a law-abiding person?
- How to audit an AI system to know that it is aligned with societal values?

Some ML systems iterate and evolve over time, and may even change their own behaviour in unforeseen ways.

Several international organizations, including the United Nations, have convened conferences on the urgent issue of ethics in AI. Companies have established their own codes of AI ethics, and joined forces in creating broad initiatives such as the Partnership on AI and Open AI. Others such as the European Union, the Institute of Electrical and Electronics Engineers (IEEE), and the Future for Life Institute have started researching and reporting on the ethical use of AI. The European Group on Ethics in Science and New Technologies published an ethical framework which proposes a set of fundamental

[24] ESCWA, Impact of the Fourth Industrial Revolution on Development in the Arab region, 2019.

ethical and democratic principles that AI jeopardizes,[25] and assesses whether new governance and regulatory instruments are required to deal with the following issues:

- Human dignity;
- Autonomy;
- Responsibility;
- Justice, equity, and solidarity;
- Democracy;
- Rule of law and accountability;
- Security, safety, bodily and mental integrity;
- Data protection and privacy;
- Sustainability.

H. Awareness

Public understanding related to the development of AI technology is necessary at a societal level, because human adaptability to technological change is not keeping pace with the speed of scientific and technological innovation.[26] People are:

- Worried about the negative impact, especially loss of traditional jobs;
- Not sure how to use their capabilities to the fullest extent to become digital citizens;
- Not sure whether AI can make human society a better place;
- Not sure whether AI technology brings benefits to the economy and industries;
- Not sure whether AI should have, or could develop, any sense of ethical behaviour.

Technology awareness and understanding of social, cultural, and ethical issues of AI are the new literacy skills society must embrace if AI applications are to be accepted and trusted as an integral part of modern living, transforming society for the better.

Furthermore, special awareness programmes must target policymakers, because governing AI and related technologies requires a dutiful level of technical expertise that most government officials currently do not possess. The general levels of technical understanding and expertise, policies and regulations may fail to support innovation, adhere to national principles, and protect public safety.

I. Standardization of AI

Adoption of standards brings credibility to technology advancements, and facilitates an expanded interoperable marketplace.[27]

The International Telecommunication Union (ITU), IEEE and the International Telecommunication Union (NIST) are leading in this area. Such standards and benchmarks would be

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[25] European Group on Ethics in Science and New Technologies, Statement on Artificial Intelligence, Robotics and 'Autonomous' Systems, 2018.

[26] www.vox.com/recode/2019/6/11/18651010/mary-meeker-internet-trends-report-slides-2019?fbclid=IwAR17AVlT4tRzZ0rVYGy0V_sgpLOS_mZblQSiZwRdDZX_VbPonEda71d9mYM, slide 156/333.

[27] https://www.nitrd.gov/PUBS/national_ai_rd_strategic_plan.pdf.

useful for the certification of systems involving AI. Standards, guidelines and benchmarks for AI could be developed by engaging the AI community.

J. Meeting the SDGs

The United Nations issues an annual report on how agencies are using AI, and which SDGs are impacted by their AI projects.[28] Big data and the Internet of Things can contribute to achieving the SDGs when applied to agriculture, health, water distribution, and reducing energy consumption for sustainability using smart meters and smart grids.[29]

Furthermore, many countries have included AI applications in their strategies that meet the SDGs, including the United States (AI for the Public Good), the United Kingdom (strategy for ageing society and the future of mobility), and Japan (healthier society).

K. AI key sectors

According to McKinsey Research, AI adoption by industry and its functions occurs by order of industries: telecom, high tech, automotive and assembly, financial services, resources management of power and natural gas, health care, retail, education, professional services, travel and logistics, and pharmaceutical.[30] The functions needing AI are: service/operations, product/service development, marketing and sales, manufacturing, supply-chain management, and risk management.

For the Arab region, the sectors most prone to AI adoption are utilities, public administration, retail and wholesale, housing and construction, and transport and logistics.[31]

National AI strategies recommend application in sectors based on:

- The competitive advantage of sectors;
- Societal needs such as ageing, power consumption, health and education;
- Alignment with the SDGs, especially in countries going through the development phase.

This said, higher automation levels in a sector implies more readiness for AI adoption.

L. Investment in AI

Bold investments are needed to facilitate marketing of AI products produced locally; support emerging national businesses working in the AI domain; and encourage startups to adopt AI-based solutions, build capacities and competencies, and participate in relevant workshops and seminars. Sympathetic tax incentives and relaxed regulations can help AI innovators and entrepreneurs establish their own businesses, especially in the registration phase.

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[28] ITU, United Nations Activities on Artificial Intelligence, 2019.

[29] UNCTAD, Foresight for Digital Development, 2016.

[30] McKenzie, Artificial intelligence: the next digital frontier?, 2017. Available at www.mckinsey.com/~/media/McKinsey/Industries/Advanced%20Electronics/Our%20Insights/How%20artificial%20intelligence%20can%20deliver%20real%20value%20to%20companies/MGI-Artificial-Intelligence-Discussion-paper.ashx.

[31] ESCWA, Impact of the Fourth Industrial Revolution on Development in the Arab region, 2019.

M. Public-private partnerships

Possible frameworks:

- Businesses contribute to the implementation of AI-based government initiatives and services, provided that these initiatives and services are based on profit sharing between the public and private sectors;
- Government collaborates with external expertise to develop AI-based public services to improve public services and to encourage the local private sector to be part of this collaboration;
- Government advised to establish special facilities for AI investors, especially in the government services sector, to increase private sector opportunities to participate in such projects.

N. SWOT analysis

To determine the main focus areas in an AI strategy, a SWOT analysis of the current national AI situation and its uses and applications in the country should be conducted. For this purpose, relevant national documents and plans need to be consulted. A number of bilateral meetings could also be convened with various national authorities. A table that summarizes key strengths, weaknesses, opportunities and threats facing the implementation of the AI strategy could then be developed and included in the strategy document.

O. Monitoring and evaluation

To ensure the proper implementation of an AI strategy at the national level, specific monitoring and evaluation mechanisms are required. Several indicators that can track the implementation of the policy can be proposed. Examples of indicators include the following:

- Proportion of FDI in artificial intelligence development and applications;
- Number of AI-related projects/initiatives implemented locally/regionally;
- Related cooperation between research and industry;
- Increases in profits, effectiveness and institutional performance;
- Customer satisfaction with the provided services;
- Prevalence of public awareness of AI.

In addition, a monitoring and evaluation plan could use AI tools, such as the AI Index,[32] to estimate the progress and impact achieved by the AI strategy.

P. Governance

There is a need to specify and dedicate an administrative unit responsible for implementing the initiatives mentioned in the AI strategy. It could be a unit related to a ministry of technology or digital

[32] Stanford University, The 2019 AI Index Report, 2019. Available at https://hai.stanford.edu/research/ai-index-2019.

economy, or it could be established specifically for this task. The structure and mandate of this unit and its reporting mechanisms need to be clarified in its establishment decision.

In addition, an advisory body that includes the private sector, civil society, and academic and research entities can be appointed to provide the necessary technical advice to this unit and help fulfil its mandate.

Q. Risk management plan

The AI strategy, like other strategies, may face challenges and obstacles that hinder its implementation. Therefore, it is advisable to include in the strategy a plan highlighting potential risks and the actions needed to mitigate their impact.

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