



International Institute
of Communications

Artificial Intelligence in the Asia-Pacific Region

Examining policies and strategies to
maximise AI readiness and adoption

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Introduction

The International Institute of Communications (IIC) has continually responded to the exponential growth in the communications and media sector, with digitally-driven disruption rife throughout the various layers that make up this grouping of hardware, networks, services, and content. It recognised too, the underpinning role of Artificial Intelligence (AI), driving convergence not only across our telecommunications, media and technology sectors, but blurring the boundaries between many industry sectors.

The IIC has always addressed policy issues head on, with our first dedicated meeting to the subject of AI in Mexico (2018). An overview of the issues raised by AI has been addressed in a briefing paper published in 2019 and during all subsequent IIC events, as well as in regular publications, such as its journal *Intermedia*.

This document is designed to enable stakeholders to consider different policy options as they address the issues raised by AI, so that they might build a framework that enables its development and use as a positive force in their countries, while mitigating risks and allaying concerns. Commissioned from the consultancy, TRPC, based in Singapore, it draws on personal interviews and desk research, examining current policies in the Asia-Pacific region, but also ventures farther afield and looks at the way in which emerging policies are developing.



Andrea Millwood Hargrave

Director General, International Institute of Communications



About the IIC

The IIC has operated at the intersection of business and regulation for over 50 years. By convening innovators and policy makers the IIC helps find regulatory frameworks to protect the interests of individuals, commercial organisations, economies and wider society. IIC members share a common belief that the impact of technological innovation on society should be evaluated and discussed and that policy and regulation should not hinder innovation and investment.

Learn more at www.iicom.org



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About TRPC

TRPC is a boutique consulting and research firm with over 25 years' experience in the telecommunications and ICT industries in the Asia-Pacific. We offer specialised advisory, research, and training services, with a focus on regulatory and strategic business issues, and possess an extensive network of industry experts and professionals throughout the region.

For more information, please visit www.trpc.biz



I.

Executive Summary

Creating and Seizing AI Opportunities



A fast-evolving technology that can serve multiple purposes, artificial intelligence (AI) does not have a single, universally accepted definition.

For the purposes of this report, “AI” designates all computer systems that can reason, learn, and act in response to what they sense and perceive. This encompasses everything from machine learning programmes and intelligent algorithms to predictive analytics, autonomous devices, and automated systems. Box 1 at the end of this section presents the different levels and types of AI currently in existence.

The different facets of AI present a range of economic opportunities while bringing complex regulatory challenges to the forefront. The scope and pace of technological advancements made by AI are pushing decision-makers and policy leaders in the Asia-Pacific (APAC) region – as elsewhere – to take a closer look at the way it is developed and implemented.

The following offers an overview of developments in AI and the way it is being implemented and promoted across APAC economies.

The Promise of AI

Though still in their infancy, AI products and services are being introduced across finance, healthcare, retail, transport, manufacturing, and agriculture – strategic industries that together drive the economic dynamism of both emerging and mature APAC economies.¹

For example, several major Asian insurers such as Prudential Singapore, Ping An, and Sompo Japan use machine learning – systems that learn and adjust their behaviour based on the information they receive – to automatically assess claims and manage fraud.² In China, Alibaba deployed its proprietary ET Agricultural Brain initiative, an AI-based project that uses visual recognition and real-time environmental monitoring to track the growth conditions of crops and livestock. Through machine learning algorithms, the data gathered helps farmers cut costs and increase yields.³

According to PwC estimates, the broad field of AI will contribute up to USD15.7 trillion to the global economy in 2030 – more than the current output of China and India combined. Of this, USD6.6 trillion are foreseen to come from increased productivity and USD9.1 trillion from consumption-side effects.⁴ In this context, AI is rapidly becoming central to public- and private-sector organisations' strategies across the region.

For businesses, AI provides immediate potential productivity gains – enabling the automation of tasks, the streamlining of processes, and the optimisation of resources – and can create long-term competitiveness by boosting overall investment and innovation. According to McKinsey estimates, for example, multinational corporations such as Alibaba, Amazon, Google, Baidu, and Facebook invested between USD20 billion and USD30 billion globally in AI in 2016.⁵ For governments, AI can help address a range of issues, including many of the United Nations' Sustainable Development Goals (SDGs). From poverty reduction to natural disaster mitigation, AI used as a full-fledged national priority and not just as a cost-cutting measure can be leveraged to tackle complex and longstanding challenges.⁶

To this end, the governments of China,⁷ Singapore,⁸ and South Korea⁹ are investing heavily in building AI ecosystems in which AI-driven companies and their innovative business models can grow and mature. In Indonesia,¹⁰ Malaysia,¹¹ and Thailand,¹² numerous public-private initiatives have begun taking shape to support experimental AI projects that go beyond for-profit uses of AI.

Other examples include the engineering student in the Philippines who has leveraged AI to communicate with patients suffering from locked-in syndrome – a severe paralysis due to traumatic brain injury, neural damage, or stroke that results in total loss of motor ability, including speech. The project involves a brain-computer typing interface that records brain signals and uses machine learning to turn them into basic shapes and letters.¹³

In India, Accenture is working with the National Association for the Blind to deploy an AI-powered system that uses image recognition, natural language processing, and natural language generation to inform visually challenged users on the number of people in a room, their ages, genders, and even emotions based on facial expressions. The system can also be used to identify and narrate text from books and documents, including currency notes, and identify obstructions.¹⁴



In this sense, policy-makers can determine the extent to which AI becomes a tool for societal good. From best practices to ethical principles, policy-makers can help prepare individuals, organisations, and communities to take advantage of the benefits of AI and its associated innovations, while mitigating any unintended or as-yet unidentified risks.



The Challenge of AI

The growth of AI across sectors, societies, and economies brings complex, inter-connected challenges to the forefront for national agenda-setting; and these need to be considered carefully – but promptly – as we move forward into an era of digital transformation.

The challenges can be bucketed together under four AI ‘topics’ that are at the forefront of APAC policy-makers’ discussions as they define and frame national approaches to AI:



Infrastructure

Strong infrastructural foundations that provide reliable, widespread, and affordable connectivity, are a fundamental prerequisite in allowing organisations (both commercial and non-commercial) and individuals to access digital platforms.

Even when a population understands AI and welcomes the changes that can be engendered, it does not necessarily translate into access, usage, and development if there is limited reach. This is especially true for rural and remote areas of the APAC region, where poor infrastructure and even poorer connectivity hinder populations’ ability to participate in the digital economy.¹⁵

According to the ITU, close to half of the world’s population still does not have access to the internet, with Asia and Africa having the lowest rates of access.¹⁶ Across APAC, close to 417 million people do not have access to basic internet services.¹⁷ At the same time, only 16% of the region’s SMEs use digital tools, with half citing price as a major obstacle.¹⁸



Access to data

Globalisation and digitalisation have led to greater connectivity, which in turn has rapidly increased the quantities of data flowing between devices, platforms, and networks. In this context, the ability to access and transfer data across boundaries and jurisdictions is increasingly crucial to the data-driven technologies that consumers, businesses, and governments use on a daily basis – including AI.

Yet many APAC economies have regulatory measures in place that limit or restrain the flow of data. Designed to keep data secure by confining it within a country's borders, data localisation measures can take many shapes; they can be explicitly required by law (within a cybersecurity regulation, for instance) or result from a combination of policies that makes it expensive, complicated, or unfeasible to transfer data transnationally. In some cases, such barriers target the protection of consumers' private information, limiting any form of unauthorised data transfer. In other cases, governments use them to ensure sensitive or strategic data cannot be accessed or compromised by foreign entities.

Whichever the reason, such measures can negatively impact the emergence and maturation of AI. AI needs vast amounts of data to effectively learn, grow, and expand, and blanket restrictions on data movements hinder its ability to access this vital resource. A key challenge for governments across the region is the design of policies and regulations that strike a balance between addressing valid privacy and security concerns and enabling the movement of data to keep their economies dynamic, competitive, and relevant in the digital age.



Skills and human capital

A key concern for citizens and governments alike is the extent to which workers and businesses are equipped with the skills, knowledge, and confidence to both use and benefit from AI systems.

But the pace and scope of AI's progress across sectors and industries can be difficult to follow from an institutional and organisational point of view. In many APAC countries, technological advances take place much faster than decision-makers can define approaches to fully harness or leverage them.

For businesses, this is embodied by the challenge of adapting workers, processes, and business models to radically reshaped competitive dynamics.¹⁹ For governments, the process can make it difficult to design policies that balance the need to support AI ecosystems (developing an AI-capable workforce) with the obligation to shield citizens from harmful unintended consequences (upholding workers' rights and interests).²⁰ This picture suggests the need for a new, more flexible and cooperative policy-framing approach.



Trust and partnerships

Developing data-driven innovations such as AI in a safe, ethical, and sustainable manner is necessary to enable consumers' trust and understanding, and to help get citizens' "buy-in" to the AI development trajectory. A complex and constantly evolving field, AI encompasses different types of systems (machine learning, deep learning, neural networks, autonomous vehicles, etc.) and can serve a range of purposes in a broad spectrum of sectors and industries. For example, the AI used by financial institutions is often not the same as the AI deployed in hospitals or factories.

This variety of hard-to-define technologies and systems can sometimes make it challenging to understand AI and where the respective systems will develop. Surveys show that despite AI awareness, citizens, consumers, business leaders, and even public-sector decision-makers do not necessarily understand the way AI technologies work – leading to a reluctance to trust and embrace them.²¹

Another contributing factor is the rising trend of businesses rebranding existing products and services as "AI" to attract capital and customers. From data analytics to predictive modelling, data-mining systems have long been used to process large amounts of data – only today many of them are referred to as "AI". This muddles the general understanding of AI and exacerbates both inflated expectations and misplaced suspicions. Providing clarity and developing signposts can serve to assure and allay many of the more challenging and far-reaching concerns, and contribute to a more constructive and coordinated approach to pursuing AI for the betterment of society.



Ecosystem and entrepreneurship

The emergence of a local AI industry – and a local AI start-up scene – is vital for economies aiming to become regional and global AI leaders.

At the national level, APAC governments are investing heavily in developing their own homegrown AI capabilities by financing research, development, and deployment efforts. Many, such as Australia, New Zealand, and South Korea, do so through coordinated local and national strategies, while others, such as Indonesia, Malaysia, and Thailand, adopt a more collaborative approach with private-sector players. Others still, such as China and Singapore, do both.

It is worth noting that China and Singapore are already looking further into the future, building strong foundations to become regional and global AI hubs. Indeed, their national AI strategies go one step further than creating dynamic and conducive environments in which innovative and competitive AI businesses can emerge; they explicitly aim to position their environments as attractive platforms for regional and global AI ecosystems to grow and mature.

In this review we show how these four topics are reflected in the policy and regulatory responses that can be observed around the APAC region, albeit with varying priorities and focus areas.

The Policy Response to AI

The AI policy landscape is both nascent and diverse in the seven APAC economies covered in this report. Nascent because there are few AI-specific policies driving AI adoption and readiness on a national level. Where there are AI policies in place, they are mostly sector-specific plans to upgrade strategic industries with AI or to prepare a sector's workforce to AI-intensive environments. Diverse because countries' approaches to AI vary greatly based on two distinct but inter-related elements: the different priorities that have been defined and the different resources that have been mobilised to harness the economic, social, ethical, and legal implications of AI advancement.

For example, **China** and **Singapore** have broad, overarching national policies specifically designed to drive AI readiness and to regulate its deployment, whereas **Malaysia** and **South Korea** have AI-related actions within broader digital transformation plans (though they both have announced forthcoming national frameworks aimed at consolidating the wide range of siloed initiatives in place).

Indonesia and **Thailand**, meanwhile, have launched targeted initiatives and programmes that facilitate the adoption of AI systems in strategic sectors and industries, focusing on public-private cooperation to drive adoption. Lastly, **Australia** has no formal AI policy in place, but has a variety of official guidelines, principles, and standards to help individuals, businesses, and institutions prepare for AI-driven disruption.

Alongside these national approaches are noteworthy multi-lateral strategies. The **OECD**, for instance, is putting AI at the top of members' policy agendas via its *Principles on Artificial Intelligence*, the first international standards agreed by governments for the responsible stewardship of trustworthy AI.²² It has also created the *OECD AI Policy Observatory*, an online hub providing resources on AI policies, initiatives, and metrics.²³

Likewise, the **G20** has formulated its own *AI Principles*, highlighting the importance of a human-centred approach to AI – using AI in a way that

respects human rights and inclusively shares the benefits and opportunities it creates.²⁴

These various approaches to AI policy-making have at least one element in common; they demonstrate that designing policies for AI requires much more than addressing technological or economic challenges.

This report examines the different AI policies and strategies governments in the region are beginning to introduce, the key issues they are looking at, and the specific challenges they are attempting to address. It also provides in-depth country studies for seven APAC economies, chosen for the variety of AI-specific strategies they are designing and adopting. The report highlights examples of public- and private-sector initiatives that are driving national AI readiness and adoption, and cites a number of AI insights collected from interviews with AI experts (researchers, academics, regulators, and industry players).



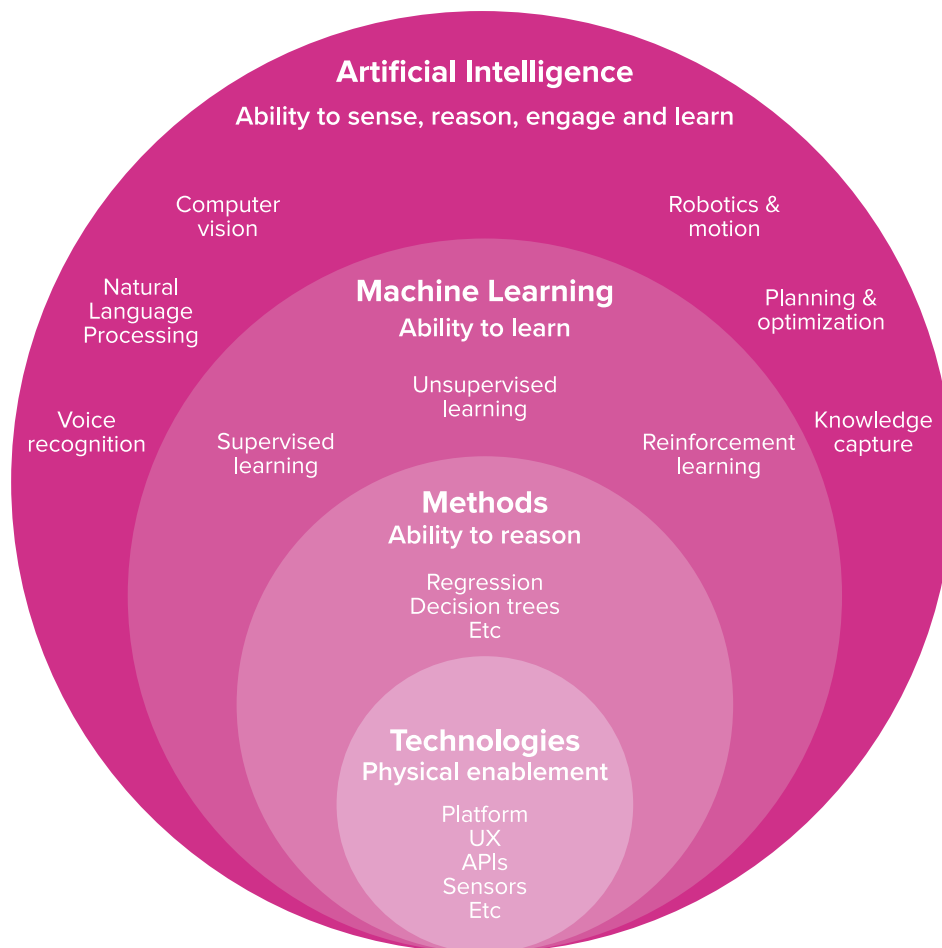
Box 1. Levels and Types of Artificial Intelligence

There is no single, universally accepted definition of AI. A complex and constantly evolving field, there are as many possible definitions as there are potential uses and applications.

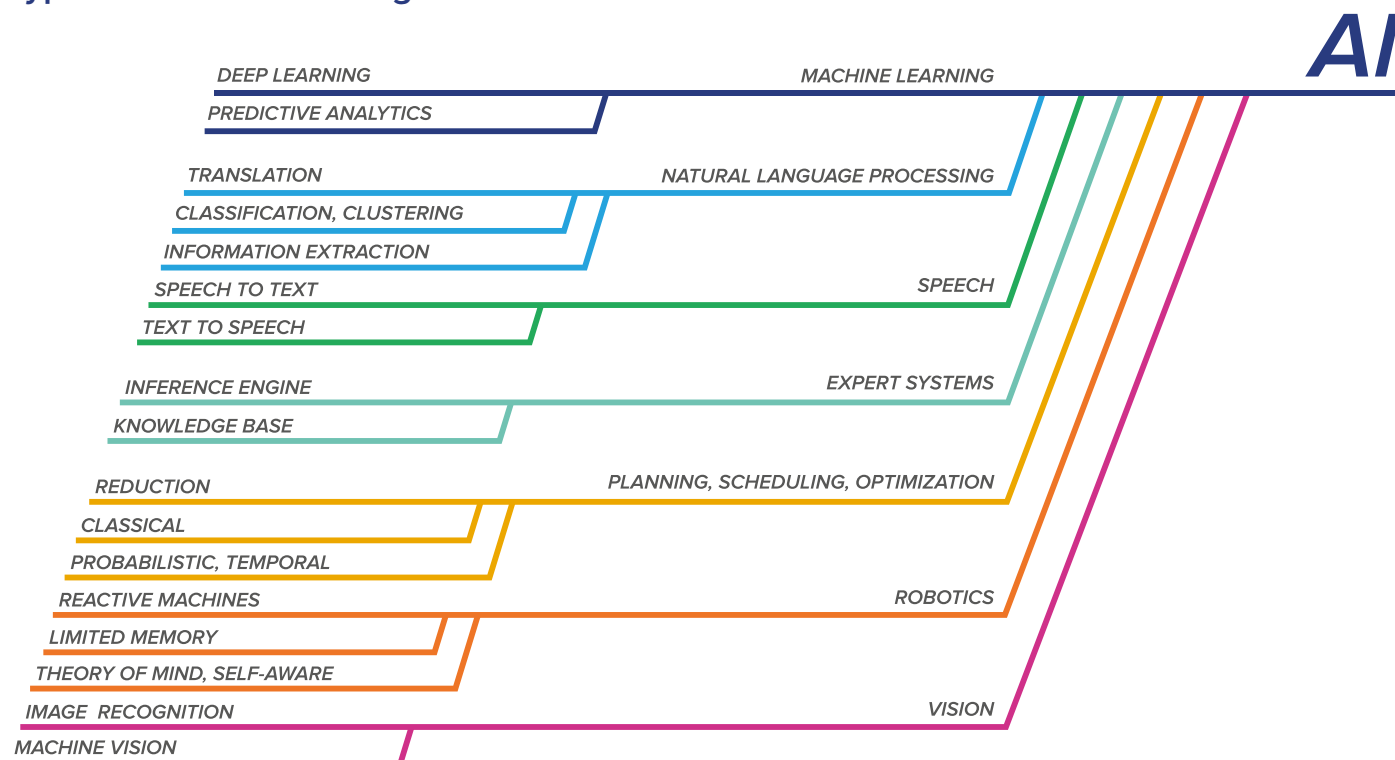
And this confusion will only grow as increasingly complex AI innovations come out of research laboratories and make their way into mainstream society, transforming the way humans and machines live and work together.

Despite this difficulty, it is possible to distinguish between several broad types and levels of AI. The figures below present some of the most common forms of AI, based on function, purpose, and complexity.

Levels Of Artificial Intelligence



Types of Artificial Intelligence



Source: Deloitte, www2.deloitte.com/fi/fi/pages/technology/articles/part1-artificial-intelligence-defined.html;

PwC, www.pwc.com/gx/en/issues/data-and-analytics/publications/artificial-intelligence-study.html;

Intellectyx, www.intellectyx.com/artificial-intelligence

II.

The Promise of AI

Solving Problems, Improving Lives



With its young, tech-savvy population and a marked appetite for innovation, the APAC region has what it needs to adopt and deploy increasingly smart, hyper-connected technologies that power digitally enabled societies.

This is also true for AI, which, as the *AI for Good Global Summit* notes, can be used to address some of the greatest challenges facing humanity.²⁵

In APAC countries, many initiatives are already leveraging AI to fulfil a number of the United Nations' Sustainable Development Goals (SDGs) – hunger, poverty, inequality, discrimination. And just as many experimental projects are working on mitigating the impact of more complex issues – climate change, water security, air quality, to name but a few.



What AI Already Solves

The widespread digitisation of human activity generates the kind of massive data sets necessary for AI applications and systems to perform highly complex functions. Many such systems are already used to automate and optimise tasks that would require a less efficient use of manpower and resources to complete. And they are doing so in a wide range of areas that goes well beyond the most common industrial applications of AI. Some examples follow:



AI tracks mosquito populations to reduce the spread of dengue (Singapore)

Project Wolbachia – a joint project between the National Environment Agency (NEA) and Verily (formerly Google Life Sciences) – is a multi-year project that aims to curb the dengue virus-carrying *Aedes aegypti* mosquitoes. The idea is to inject male mosquitoes with the Wolbachia bacteria, which is transmitted to females during mating and prevents the hatching of mosquito eggs. Using an AI-based sex-sorting technology to accurately separate the males from the females, the NEA ensures the sorting is less laborious and more accurate than a more manual approach.²⁶



AI-powered microscope automatically spots Malaria parasites (China)

The EasyScan GO is an AI-enabled microscope developed to assist clinicians in identifying malaria parasites in blood smears. Created by Chinese microscope manufacturer Motic China Group, EasyScan GO accurately detects severe and drug-resistant cases of malaria, bypassing the need for blood-smear analysis by a World Health Organisation (WHO)-certified expert microscopist. This automated process provides results faster than with a manual examination, and alleviates the shortfall of trained personnel in under-resourced countries.²⁷



AI programme automatically screens for diabetic eye disease (Thailand)

Google is working with the state-run Rajavithi Hospital to launch an AI programme that analyses patients' eye-screen results to assess if they are at a risk of diabetic eye disease. The programme analyses patients' eye screening results to assess if they are at a risk of partial or complete vision loss, prompting the provision of vital pre-emptive treatment. The system has an accuracy rate of 95% when it comes to disease detection, compared with 74% from opticians or eye doctors.²⁸



AI system allows the visually impaired to live more autonomously (India)

Accenture is working with the National Association for the Blind in India to deploy Drishti, an AI-powered system that uses image recognition, natural language processing, and natural language generation to provide contextual information via users' smartphones. The system can describe the number of people in a room, their ages, genders, and even emotions based on facial expressions. It can also be used to identify and narrate text from books and documents, including currency notes, and identify obstructions like glass doors.³²



AI enhances security in urban centres (Malaysia)

Since 2017, MIMOS, Malaysia's national research and development centre for ICT, has been working with Huawei to develop AI-based security and surveillance solutions, including advanced video analytics and facial recognition systems. The solutions help cities automate everything from crime-detection mechanisms to emergency-response processes, making public services faster and more efficient.³³



AI module customises students' learning experiences (Vietnam)

Vietnamese tech giant FPT developed VioEdu, an AI-powered online e-learning system that allows students to personalise their learning experiences. The module examines students' behaviours during training courses to model their individual learning patterns. Once established, the patterns are synthesised and analysed by the system, allowing it to provide contents and delivery methods in a tailored manner. It can also identify potential knowledge gaps to propose suitable learning pathways.²⁹

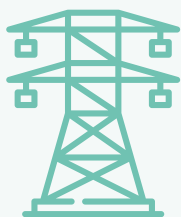


AI improves customer service and enhances e-commerce (Indonesia)

Kata.ai, Indonesia's most popular conversational AI platform, works with Unilever and Telkomsel to streamline and automate millions of customer interactions – up to 96% of customer queries – with minimum human interaction.³⁰ Tokopedia, Indonesia's biggest internet marketplace and one of the country's five unicorns, launched an AI research centre in conjunction with the University of Indonesia (UI) to develop AI-based solutions for the e-commerce sector (demand prediction, smart warehouses, and smart logistics).³¹

What AI Will Improve

Whether directly or indirectly, it is increasingly clear that no sector or industry will go unaffected by AI. PwC notes that one area in which AI can have the most visible – and meaningful – impact is in helping mitigate environmental damages and risks.³⁴ From the creation of distributed “off-grid” water and energy resources to improved natural disaster resilience planning, there is a wide range of areas in which AI can effectively combat the unintended effects of industrial activities:



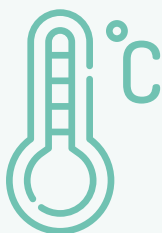
Distributed energy grids

AI can enhance the predictability of demand and supply for renewable energy sources across distributed grids, improving energy storage and efficiency. It can also support load management, assist in the integration and reliability of renewables, and enable dynamic pricing and trading.



Smart agriculture and food systems

AI-augmented agriculture involves automated data collection and data-based decision-making to allow corrective measures to be made automatically and in real-time. Whether it is the detection of crop diseases or the nutrition levels of livestock, AI can help increase resource efficiencies across the agriculture industry, lowering the use of water, fertilisers, and pesticides.



Weather and climate science and forecasting

A field that was once limited by its requirement of high-performance, energy-intensive computing power, climate informatics now benefits from deep-learning networks that can calculate millions of variables simultaneously and faster than ever before.



Smart disaster response

AI can analyse simulations and real-time data to predict weather events and disasters, allowing citizens and relevant authorities to take action in a timely and proactive manner. Deep-learning capabilities can also enhance disaster simulations to determine optimal response strategies, similar to the way AI is currently being used to identify the best moves in games like Go.



AI designed intelligent, connected, and liveable cities

AI could also be used to simulate and automate the generation of zoning laws, building ordinances, and floodplains. Combined with augmented and virtual reality (AR and VR) modules, AI can provide real-time city-wide data on energy, water consumption, traffic flow, people's movements, and weather hazards – all of which could optimise urban sustainability plans.



A transparent, digital Earth

A real-time, open-architecture, AI-infused digital geospatial dashboard for the planet would enable the monitoring, modelling, and management of environmental systems at a scale and speed never before possible – from identifying illegal deforestation and water extraction to tackling biodiversity loss and air pollution. The AI technologies exist, but what is missing is collaboration for open source data and APIs on a global scale.

III.

The Challenge of AI

Key Topics to Address



AI can become a truly positive force for societies, communities, and economies in APAC. Five key topics are at the heart of APAC policy-makers' discussions as they design frameworks to harness the power of AI, mitigate any potential risks, and allay concerns:

1. — **Infrastructure** – Strong infrastructural foundations provide reliable and widespread connectivity, allowing individuals and organisations to access digital platforms. It is much more difficult for a dynamic and innovative digital economy to emerge if only part of the population can contribute to it.
2. — **Access to data** – Data and information are the key drivers of digital products and services. From collection to processing and transfer, data that flows freely and securely across platforms, borders, and jurisdictions can help data-driven AI technologies learn, grow, and expand.
3. — **Skills and human capital** – Workers and businesses who are equipped with computer science skills and knowledge can both contribute and benefit from the digital economy. In the case of AI, being able to use AI systems will ensure no one is left behind as workplaces and business models turn to automation.
4. — **Trust and partnerships** – Developing AI in a safe, ethical, and sustainable manner can increase citizens' and consumers' trust and understanding, which in turn improves the pace and scope of AI adoption. Multi-stakeholder collaboration, meanwhile breaks down traditional silos that may hinder the development and spread of AI.
5. — **Ecosystem and entrepreneurship** – For economies to remain relevant and competitive in the age of AI, it is important for a local AI industry – and a local AI start-up scene – to emerge and mature. The right enabling regulatory and policy frameworks can support the growth of a national AI value chain, thereby creating a strong and sustainable AI ecosystem.

Key Topic 1: Infrastructure

Strong infrastructural foundations provide the reliable and widespread connectivity that AI – and many other digital technologies – require to be effective and useful. This includes a reliable national broadband telecommunications network, a comprehensively regulated telecommunications sector, investments in improved and widespread connectivity (especially in rural or remote areas), and secure and reliable access to cloud computing systems.



Infrastructure for affordable internet access

Affordable and reliable connectivity to regional and global telecommunications networks is indispensable for the growth and development of AI.

Some 370 million Southeast Asians had access to the internet in 2018, thanks largely to the rapid expansion and the continued improvement of both broadband and mobile infrastructure.³⁵ Smartphones account for more than 90% of Southeast Asian internet users, a trend that could accelerate intra-regional trade and growth, enabling a collective GDP uplift of USD1 trillion by 2025.³⁶

But despite these encouraging trends, poor infrastructure and even poorer connectivity remain major issues for rural and remote areas.³⁷ Close to 417 million people – most of them in Cambodia, Laos, Myanmar, and Vietnam – do not have access to basic internet services.³⁸ At the same time, only

16% of the region's SMEs actually use digital tools, and half of them cite price as a major obstacle.³⁹

Affordability is indeed a major barrier: the price of mobile data has generally declined, but the fact that applications use much more data than before makes internet use much too expensive for a large part of the region's population.⁴⁰ Data from countries holding 4G spectrum auctions between 2008 to 2016 shows that profit-oriented spectrum pricing may negatively impact consumers' purchasing power as well as hinder foreign investment inflows.⁴¹

In this context, the regulation of the telecommunications sector plays a role in improving connectivity throughout the region.

Infrastructure for inclusive internet access

The APAC region is particularly impacted by a widening digital divide. A region fraught with deep socio-economic inequalities, these are reflected in an uneven and fragmented access to digital technologies.

The penetration of digital communications is at an all-time high in the region. According to the GSMA, 2.8 billion people in APAC subscribed to mobile services in 2018, and the region has been the biggest contributor to global subscriber growth in recent years, with 466 million new subscribers added since 2014.⁴²

And yet the digital divide persists. According to the World Bank, the share of the APAC population living in extreme poverty (living with USD1.90 or less per day) has fallen below 3%, but that still leaves some 47 million people in extreme poverty.⁴³ These are 47 million people for whom e-commerce, e-payments, and even smartphone ownership are far from being day-to-day priorities.

Even within rapidly digitalising markets, connectivity is not evenly distributed across urban and rural populations. In Indonesia, only about 42-48% of people in rural communities have access to smartphones and the internet, compared to 71-72% of people in urban cities.⁴⁴

The digital divide is further exacerbated by the region's unequal vulnerability to natural and man-made catastrophes. Some regions experience disasters much more frequently and intensely than others, leading to the disruption of infrastructure that may not have been designed to withstand extreme conditions. Earthquakes, for instance, frequently damage submarine cables and interrupt internet access in densely populated coastal areas and cities.⁴⁵

Dr Shamshad Akhtar, Executive Secretary of UN-ESCAP, offers some insights into internet disparity in the APAC region. In an article published by *The Diplomat*, she points out that “high income countries [are] experiencing a higher growth rate of broadband penetration relative to other countries.” In short, more mature economies can devote more resources to building and maintaining internet infrastructure.⁴⁶

In this sense, the growth of AI as a driving economic force hinges on the region's ability to overcome the inequalities that block its overall digital enablement. To realise the benefits of AI while navigating their own specific economic challenges, APAC countries will need to promote an inclusive digital economy and society, where none are left behind.

Cloud computing to bridge the divides

A recent Oxford Economics report notes that cloud can help bridge infrastructure and connectivity gaps by putting sophisticated technologies within reach of smaller companies and emerging economies.⁴⁷

Flexible and distributed cloud platforms give companies of all sizes access to cutting-edge data tools, limitless storage, sophisticated software, and the ability to scale up or down quickly according to market factors – all without forcing them to invest in expensive servers or computers. This makes it easier for companies to experiment with new services, expand their global reach, and build solid foundations for the next generation of technologies that will drive business growth, including AI.

Cloud platforms also shift the economics of IT in favour of emerging economies. Cloud technology standardises and pools IT resources and automates

many of the tasks done manually. The underlying architecture facilitates elastic consumption, self-service, and pay-as-you-go pricing, thereby providing substantial economies of scale.⁴⁸ This makes it possible to bypass complex or rigid technological requirements, making it easier and more affordable to provide advanced digital products and services.

Cited in a report, Michael Zielenziger, Managing Editor of *Oxford Economics*, sees cloud computing as “(...) the ultimate ‘leapfrog’ technology. It allows economies and even small companies – in, say, Indonesia, Thailand, Myanmar, or elsewhere – to connect to the rest of the globe and compete. It can change the world and it will help shape the future.”⁴⁹

Despite the major opportunities it represents, cloud computing is not yet sufficiently implemented across the APAC region to effectively mitigate the region's infrastructure and connectivity disparities. The Asia Cloud Computing Association (ACCA) finds that while cloud infrastructure and expertise have become central components of many APAC economies' wider national digital transformation agendas, a cloud computing divide does exist – and persist – between emerging and mature markets.⁵⁰

For the ACCA, the key differentiator will be countries' adoption of ‘Cloud First’ policies – frameworks designed to push organisations and institutions to consider cloud computing solutions as a primary part of their IT architecture. Such policies not only drive countries' cloud adoption, they also contribute to their ability to harness the broader technological advancements that cloud computing enables.

As Jarom Britton, ACCA Chair for Public Sector Special Interest Group, notes in an online interview: “We always hear people talk about AI (artificial intelligence), blockchain, IoT (Internet of Things). Well you don't have AI if you don't have cloud. You don't have IoT if you don't have cloud. You don't have e-commerce if you don't have cloud... None of those things can happen unless cloud computing is facilitated.”⁵¹

Key Topic 2: Access to Data

The free and secure flow of data across borders and jurisdictions is crucial for the growth and expansion of AI. This could include providing publicly available data, establishing data trusts, promoting data portability, and facilitating cross-border data flows. It is also important that legal and regulatory measures designed today can evolve along with the AI innovations of tomorrow.

Data classification frameworks in which certain types of data may not be easy to design and implement, but they do constitute a proven and implementable way forward. And, as Prime Minister Shinzo Abe declared at the 2019 World Economic Forum, it is in everyone's best interest to put structured and nuanced cross-border data sharing at the top of governments' economic agendas.⁵²



Cross-border data flows enable digital innovations

Cross-border data flows are an enabling force for businesses around the world. From manufacturing and services to agriculture and retail, all sectors increasingly rely on data – and on its global flow – to plug into global value chains and contribute to the global economy.

SMEs, especially, benefit from the flow of data across borders; it helps reduce transaction costs and mitigate the constraints of geographic distance, increasing overall efficiencies as well as opportunities. Small businesses, like large ones, are able to reach global markets and leverage data-driven services to meet consumers' fast-evolving needs and expectations.

The public sector also benefits from cross-border data flows. Organisations in the healthcare sector, for instance, increasingly rely on access to data sets to improve research and provide faster, better health services. Data sharing has proven critical in saving lives as well as preserving economic and social stability in the event of epidemics, such as the Ebola and the Zika outbreaks.⁵³

Across the board, the free flow of data accelerates the spread of ideas, research, and technologies, leading to the emergence of new, innovative business models and opportunities that propel economies forward. But for a number of APAC governments, transnational data movements are closely tied to rising privacy and security concerns; namely, the perceived loss of control over where data is held and where it can be transferred, as well as the lack of visibility on who controls global data flows and who is to be held liable and/or responsible for any potential misuse.

There are also mounting concerns over the way AI systems use the large amounts of available data to make decisions autonomously – raising important questions in terms of trust, responsibility, and accountability that governments do not necessarily feel equipped to address. To ensure they remain in control, many governments enact measures that restrict the cross-border movements of data, inadvertently hampering digital businesses' access to global opportunities, and even negating the benefits brought about by global connectivity.

Data localisation requirements are a barrier to AI

Despite the significant benefits of cross-border data flows to companies, consumers, and national economies, many countries in the APAC region have measures in place that limit or restrain the flow of data across borders.

China has a number of regulatory measures restricting routine cross-border transfers of information. The *Cybersecurity Law* requires many international data transfers to be subject to a security assessment by the relevant industry regulator. It also states that personal information and important data must be stored locally, especially

when companies operate in “critical information infrastructure sectors”.⁵⁴

Indonesia, meanwhile, has a number of regulations that indirectly restrict the movement of data across platforms and jurisdictions. Its data localisation requirements compel providers of certain electronic services to use or establish data centres within Indonesia.⁵⁵ Other regulations require certain personal and financial data to be stored and processed locally. Another regulation requires providers of “over the top” (OTT) services – essentially every service provided via the internet – to register with the government, identify permanent local representatives, and open bank accounts in Indonesia.⁵⁶

In South Korea, the *Personal Information Protection Act* requires companies to obtain consent from “data subjects” (i.e., the individuals associated with particular data sets) prior to exporting that data. The Act also requires “data subjects” to be informed of who receives their data, the recipient’s purpose for having that information, the period that information will be retained, and the specific personal information to be provided.⁵⁷ This can constitute a substantial burden on companies trying to send data across borders.

According to the Information Technology & Innovation Foundation (ITIF), countries that enact barriers to data flows make it harder and more expensive for domestic companies to gain exposure and to benefit from the ideas, research, technologies, and best practices that accompany data flows – including AI-enabled innovations.⁵⁸

Data classification to balance security with data-driven innovation

Governments do not have to choose between enabling the flow of data across borders and upholding privacy and security principles. Indeed, several of the highest-ranking economies have implemented – or are looking to implement – regulations that structure cross-border data flows in a more balanced, nuanced, and targeted manner.

Data classification frameworks allow governments to bring specific solutions to specific problems, without adding unnecessary risks, costs, or burdens. Organising data by specific criteria – level of sensitivity, degree of strategic value, or extent of exposure to threats – makes it possible to determine which data can flow without limit (business-enabling data, for example), and which data may be clearly identified as vital or sensitive such that it needs to be restricted in movement (data related to national security, for instance).

By classifying information based on risk, an organisation can focus its security efforts more efficiently, mobilising the right resources to protect the right information. This leads to better security, as restrictions are put exactly how and where they are needed, without limiting businesses’ access to data in the process. Box 2 shows Australia’s approach to data classification.

Box 2. Australia's Model Data Classification Framework

Data classification is a risk-based approach to the management of data, and is a key component of any comprehensive security policy. It involves classifying data into categories based on sensitivity levels and risk profiles, and then aligning security controls needed for each level to manage risks appropriately.

Typically, classification of information is based on the potential impact to the national interest, organisations, or individuals, that would arise if the information's confidentiality, integrity, or availability are compromised.⁵⁹

The fewer the levels of classification, and the clearer the distinctions between levels, the more effective the classification system will be in ensuring the most sensitive information is properly secured.

Governments often employ a three-tiered classification scheme, with the majority of public sector data classified in the two lowest tiers.

The Australian Government uses categorisation model to assess the sensitivity or security classification of information by considering the potential impact that could arise from compromise of the information's confidentiality, integrity, and availability.

The Australian Government uses three security classifications:⁶⁰

Top secret: Most valuable, important and sensitive information. Compromise of information would be expected to cause exceptionally grave damage to the national interest, organisations, or individuals.

Secret: Very valuable, important and sensitive information. Compromise of information would be expected to cause serious damage to national interest, organisations, or individuals.

Protected: Valuable, important and sensitive information. Compromise of information would be expected to cause damage to the national interest, organisations, or individuals.

Other official information that does not warrant a security classification, is classified according to its sensitivity:⁶¹

Official: Sensitive: Sensitive information is that which would result in limited damage to an individual, organisation or government if compromised.

Official: Other information from routine business operations and services, the compromise of which would have a low impact.

Unofficial: Information which does not form part of official duty.

The majority of information that is created or processed by the Australian Government is considered 'official' information.

Source: TRPC Research

Key Topic 3: Skills and Human Capital

In the digital economy, workers and businesses looking to use and benefit from AI systems need computer science skills and knowledge. Equipping populations with AI skills is key to solving two interconnected barriers to the potential benefits of AI: the (real or perceived) risk of widespread job losses due to AI, and the rising talent gap that businesses face as their processes increasingly rely on AI-based systems.

Preparing students for the workplace of the future

According to recent estimates, about 15% of work activities are likely to be displaced by 2030. The proportion varies widely across countries; automation may negatively impact mature markets – reflecting higher wage rates and thus stronger economic incentives to automate – while it may create unique leapfrogging opportunities for emerging markets.⁶²

A report on the advantages of automation finds that, if harnessed properly, mature economies such as Australia stand to boost their economy by up to USD1.5 trillion (AUD2.2 trillion) by 2030.⁶³ At the same time, however, economies that are less equipped to transition into an AI-driven society face a number of difficulties and drawbacks, including the possibility of massive job displacements and the risk of heightened socio-economic inequalities.

In 2015, computer science professor and artificial intelligence pioneer Stuart Russell wrote an open letter calling for researchers to maximise AI's social impact as it is made more capable and powerful: "The potential benefits [*of AI research*] are huge, since everything that civilization has to offer is a product of human intelligence; we cannot predict what we might achieve when this intelligence is magnified by the tools AI may provide, but the eradication of disease and poverty are not unfathomable. Because of the great potential of AI, it is important to research how to reap its benefits while avoiding potential pitfalls."⁶⁴

Curriculum reform and lifelong learning are key facets of education policy that can effectively address both worker displacement and talent

gap. Yet few APAC countries have begun to address the impact of automation through educational policy. Intelligent automation is expected to boost the importance of both education related to STEM (science, technology, engineering, and mathematics) and of so-called soft skills, which allow workers to trade on their uniquely human capabilities.

However, in all but the highest-scoring countries, little has been done to prepare future workers through school curricula or, just as importantly, teacher training. At the same time, some experts warn that a focus on soft skills would be a distraction in countries where even basic education remains a challenge.⁶⁵

In Singapore, AI skills are considered one of the four core abilities that will help the country strengthen its digital readiness,⁶⁶ which is why the government has introduced experimental coding classes for all upper primary pupils. Conducted by the Education Ministry and the IMDA, the 10-hour enrichment programme aims to develop an appreciation of core computational thinking and coding concepts in pupils, and will be rolled out to all primary schools by 2020.⁶⁷ Singapore is also experimenting with funding "individual learning accounts", which adults can use to support training courses throughout their lives.

In South Korea, the MSIT announced a dynamic talent development system to nurture 10,000 AI-ready talents. A KRW180.6 billion (USD149 million) investment into an Innovative Academy will train technical capabilities of 2,500 students, provide overseas postgraduate training for 2,250 students, set up AI departments in graduate schools to train 860 talents, and provide industry-specific training to 7,000 talents for 'quick entry' into the economy.⁶⁸

In Malaysia, AI, computer programming, and robotics will be introduced as a compulsory subject to Year Four students in 2020.⁶⁹ Coding was introduced in secondary schools in 2017, via Basics in Computer Science (Asas Sains Komputer) and Computer Science (Sains Komputer). These subjects expose students to simple coding methods using Microsoft Visual Basic, JAVA, HTML, Javascript, Microsoft Access, MySQL, XAMPP, and Notepad. The Ministry of Education is also working with MDEC to train lecturers at the Institutes of Teacher Education (IPG), as well as to provide coding skills to about 500 teachers.⁷⁰

Helping workers navigate new labour dynamics

The challenge for government and industry, with the help of educational institutions, is to ensure that workers are provided ample opportunity to gain the skills needed to operate effectively in the future workplace and take advantage of opportunities brought about by automation. Labour market policies to enable greater worker mobility and flexibility – for example, through relaxed licencing requirements for certain occupations or more portable workplace benefits – can help countries meet this challenge.

According to the *EIU Automation Readiness Index*, the countries where such policies and programmes are closest to being in place are the same that are the most supportive of AI and robotics innovation, and are beginning to address the associated educational challenges. In the APAC region, Singapore, South Korea, and Japan all rank highly in this regard, demonstrating labour markets that are both strong enough to protect workers from severe disruptions and flexible enough to prepare them for the inevitable changes ahead.⁷¹

Upskilling and retraining to mitigate the AI talent gap

Fears of widespread job losses due to AI are only one side of the coin. Businesses where robotics and automation are being actively deployed report major gaps in AI-capable talent, making it difficult to benefit from the transformative benefits of AI.⁷² This is also the case in the APAC region, where only 1 in every 1,000 candidates is qualified to use, develop, or run an AI system.⁷³

According to a study conducted by Chinese tech giant Tencent, there are just over 300,000 AI researchers and practitioners worldwide, when several millions are needed to adequately meet market demand.⁷⁴ In China alone, demand for AI professionals may surge to 5 million in a few years, with researchers in machine learning, smart chips, and algorithms being the most sought-after.⁷⁵ One way Chinese companies are addressing the talent gap is to launch overseas labs to attract foreign researchers and Chinese nationals living abroad. Tencent opened its own AI lab in Seattle,

Washington state, while Alibaba is planning on opening seven labs worldwide aimed at beating similar research facilities built by IBM, Microsoft, and Intel.⁷⁶

Another way is to reinforce training initiatives aimed at equipping existing technology workers with more advanced AI skills and knowledge. In Singapore, government agency AI Singapore launched a three-year programme, comprising workshops and apprenticeship schemes, to equip 12,200 Singaporean professionals and engineers with marketable AI knowledge.⁷⁷

Private companies are also creating re-skilling and re-training opportunities. In Japan, multinational electronics manufacturer Daikin launched an internal programme aimed at turning 1,000 employees with no background in AI into skilled AI professionals. Following specialised courses at Osaka University for six months, the selected employees are then assigned special data-based roles within the company to hone their newly acquired skills.⁷⁸

Universities are also playing a role in ensuring workers across the APAC region are not left behind. According to Dr Norisma Idris, Associate Professor at the Department of Artificial Intelligence (University of Malaya), the Malaysian government is “initiating industry partnerships with universities, as well as creating collaboration opportunities between researchers and government agencies. It is also launching and promoting new AI and Data Science programmes, as well as introducing AI-related courses within other programmes. All this is to increase the number of students registering in AI-related programmes.”⁷⁹

In China, more than 70 Chinese universities and colleges have introduced AI-related majors, and 283 universities are licensed to offer data science programmes.⁸⁰ In India too, AI-related courses and programmes are in high demand – so much so that some states are finding it difficult to keep up with the rising demand.⁸¹

Ralph Haupter, President of Microsoft Asia, notes in a blog post, “In the AI era, everyone – at all levels, in all roles, and especially from all cultures and walks of life – needs to be equipped with tools and skills to be future-ready.”⁸²

Key Topic 4: Trust and Partnerships

Data-driven technologies such as AI need to be developed in a safe, ethical, and sustainable manner for citizens and consumers to understand and trust them. This is especially true for a growing number of digital devices and services – including data-intensive AI systems – that rely on personal data to function. This means developing frameworks that ensure AI systems are fair, transparent, and inclusive, and rooting these frameworks in local, regional, and international collaboration schemes that enable best practices, standards, and principles to be shared globally.



Trust as a defining concept of data-driven societies

According to a recent Salesforce report, APAC consumers do not necessarily understand the way AI technologies work, despite being acutely aware of them. This translates into an observable reluctance to trust AI technologies, even knowing full well that they can potentially improve different aspects of their daily lives.⁸³

A key issue is that the more data-intensive digital platforms and devices become – and the more that data is entrusted to automated, algorithmic decision-makers – the more difficult it becomes for citizens to know whether their data is used for the purposes and in the manner for which it was collected (i.e. that their data is responsibly and ethically used).

For example, Airbnb leverages TensorFlow, Google's open-source library that supports machine learning, to identify and predict users' accommodation preferences.⁸⁴ Singapore's OCBC bank developed AI solutions that learn from customer data – purchasing behaviour as well as interactions with relationship managers – to offer targeted and

tailored products and services.⁸⁵ CCTV systems in China,⁸⁶ Malaysia,⁸⁷ and Singapore⁸⁸ are increasingly equipped with AI-based voice, facial, and even gait recognition capabilities.⁸⁹

While all these systems are primarily designed to improve citizens' and consumers' lives, they do create massively detailed datasets that could be used for criminal activities if they were to fall in the wrong hands. The problem is that most trust and privacy regulations – where they exist – were enacted before the use of the Internet of Things (IoT), big data, and AI were a consideration, and when consent provisions were defined more simply than they are today. That is why it is preferable for AI systems to clearly demonstrate that they comply with data protection and privacy laws that regulate how the data of individuals and organisations is collected, stored, used, and disseminated.

This is an emerging topic all around the region, and one that is yet to come to concrete conclusions. APAC economies are in varying stages of development when it comes to their respective data protection and privacy regimes. Malaysia, Singapore, and the Philippines have clear and thorough data protection laws in place, equipping both businesses and governments to face data-related challenges in the digital age.

In Singapore, the Personal Data Protection Commission (PDPC) released a discussion paper titled “Artificial Intelligence (AI) and Personal Data – Fostering Responsible Development and Adoption of AI”, which proposes an accountability-based framework on consumer protection issues related to AI. The proposed governance framework put forth by the PDPC seeks to strike a balance between maximising the benefits of AI without compromising privacy and accountability.

In Thailand, the National Legislative Assembly approved the *Personal Data Protection Act, B.E. 2562 (2019)* (“PDPA”).⁹⁰ As the country's first consolidated law on data protection, it frames the collection, use, and disclosure of personal data, drawing key concepts and principles from the *EU General Data Protection Regulation (GDPR)* – though it is yet unclear if the law has specific provisions for data used by AI systems.

Ethics as a driving principle of AI-based systems

Beyond regulatory measures to instil trust, driving AI readiness and adoption also requires accountability. For instance, when an AI application is in charge of deciding who qualifies for a loan, it is important for the bank to be able to explain the algorithm's decision, as well as take full responsibility in case of errors or oversights.⁹¹ This entails designing AI systems that are fair, reliable, and safe, as well as secure, inclusive, transparent, and accountable.

So far, there are no specific laws governing the ethical use of AI in the region, but efforts are underway to better understand and address legal, moral, and ethical issues raised by the spread of AI systems and services across economic sectors.⁹²

In Japan, the Ministry of Economy, Trade, and Industry (METI) formulated the “Contract Guidance on Utilisation of AI and Data” to help organisations navigate the complexities of drafting a contract that involves AI- and data-based systems.⁹³ METI also announced more in-depth guidelines this year to address issues such as legal liability and user rights. China, meanwhile, released the Beijing AI Principles, a code of ethics for AI that aims to guide AI scientists and engineers as they research, develop, use, and plan AI-based systems.⁹⁴

In Australia, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) launched a landmark discussion paper on a proposed Ethics Framework.⁹⁵ The paper highlights eight core principles to guide AI deployment in the Australian economy: generating net-benefits, doing no harm, complying with regulatory and legal requirements, appropriately upholding privacy, boosting fairness, being transparent and easily explained, containing provisions for contesting a decision made by a machine, and including an accountability trail.

In Singapore, the Ministry of Transport set up a Committee on Autonomous Road Transport, which will look into regulating the use of driverless cars in the near future.⁹⁶ In 2018, the Monetary Authority of Singapore (MAS) released the “Principles to Promote Fairness, Ethics, Accountability and Transparency (FEAT) in the Use of Artificial Intelligence and Data

Analytics in Singapore's Financial Sector”.⁹⁷ The government also convened an Advisory Council on the Ethical Use of AI and Data, comprising experts in AI and big data from local and international companies, as well as academia and consumer advocates.⁹⁸

While not necessarily going to the same lengths as Singapore, most other governments with AI strategies are also employing the language of ethics to foster the responsible use of AI. Singapore's lead in grappling with issues of explainable, transparent, and fair algorithms, as well as in practically incorporating considerations for competition, privacy, and ethics into its policy and regulatory frameworks, will be a useful resource for other governments as they formulate their own AI strategies.

The difficulty lies in two different, but related, facets of AI. First, the fact that the more data is created and fed into AI systems, the more difficult it is to guarantee that it will be strictly used in the manner or for the purpose for which it was collected. In this sense, moral principles and ethical guidelines must be instilled into the AI systems themselves, as well as into the regulations that frame them. Box 3 presents Singapore's approach to making AI both ethical and trustworthy. Second, the fact that a full and unequivocal comprehension of human decision-making, including heuristics, biases, group dynamics, creativity, and imagination must first be attained before attempting to use them to improve computer forecasting models, predictive analytics, or robotic systems.

Box 3. Singapore's Model AI Governance Framework

The Personal Data Protection Commission (PDPC), Infocomm Media Development Authority (IMDA), with the advice from the Advisory Council on the Ethical Use of AI and Data recently published the Proposed Model AI Governance Framework (Model Framework).

The Model Framework translates ethical principles into practical measures that can be implemented by organisations deploying AI solutions at scale. One of its aims is to promote AI adoption while building consumer confidence and trust in providing their personal data for AI-focused purposes.

The Model Framework is based on two high-level guiding principles that promote trust in AI and understanding of the use of AI technologies:

1. Decisions made by or with the assistance of AI should be explainable, transparent, and fair so that affected individuals will have trust and confidence in these decisions.
 - Explainable: Automated algorithmic decisions and the data that drives such decisions must be understandable by end-users and other stakeholders in non-technical terms.
 - Transparent: AI developers, data scientists, application builders, and companies should be accountable for the AI algorithms, systems, applications, and resultant decisions respectively in order to build trust in the entire AI ecosystem.
 - Fair: AI algorithms and models embedded in decision-making systems should incorporate fairness at their core to avoid unintentional biases or discriminatory practices.
2. AI systems, robots, and decisions made using AI should be human-centric, i.e. put users front-and-centre of all and any AI deployment.
 - Decisions should strive to help individuals and avoid causing foreseeable harm.
 - Tangible benefits to individuals should be identified and communicated to build consumer understanding and confidence.
 - AI systems and robots should be designed to avoid causing bodily harm or affecting the safety of individuals.

Source: Personal Data Protection Commission (PDPC), www.pdpc.gov.sg/-/media/Files/PDPC/PDF-Files/Resource-for-Organisation/AI/A-Proposed-Model-AI-Governance-Framework-January-2019.pdf

Key Topic 5: Ecosystem and Entrepreneurship

Building digital economies and digital societies is key to competitiveness in the digital age. Across the APAC region, digital economy initiatives encompass a wide range of AI-enabling efforts; from investments in AI start-ups to matching business problem statements with AI research talent, governments across the region are developing a broad base of AI expertise to strengthen and consolidate homegrown AI ecosystems.

Investing in innovation

Across the board, private- and public-sector investments are driving countries' ability to research, develop, and apply AI technologies. IDC estimates that global spending on cognitive and AI systems will reach USD77.6 billion in 2022, more than three times the USD24 billion forecast for 2018 – a compound annual growth rate (CAGR) of 37.3%.⁹⁹ The same estimates see software as both the largest and fastest growing technology category, representing around 40% of all cognitive/AI spending with a five-year CAGR of 43.1%. Two areas of focus for these investments are conversational AI applications (e.g., personal assistants and chatbots) and deep learning and machine learning applications (employed in a wide range of use cases).¹⁰⁰

Big tech and other venture capital firms are also focusing their investments on AI. Pitchbook, an investment analyst firm, estimates that in 2017, USD6 billion was invested across 643 venture capital deals in AI.¹⁰¹ According to McKinsey estimates, multinational corporations such as Alibaba, Amazon, Google, Baidu, and Facebook invested between USD20 billion and USD30 billion globally in AI in 2016.¹⁰² From 2011 through February 2017, these companies were behind 29 of 55 major merger & acquisition deals in the United States and nine of ten major deals in China – an investment strategy that is helping these companies acquire pivotal talent, technology, and data sets, potentially raising barriers for slower-moving competitors.¹⁰³

Governments, meanwhile, are also doing their part. Since 2017, at least 20 countries have released

well-funded national AI strategies with the clear objective of maximising the potential benefits of AI.¹⁰⁴ From USD21.6 million in Australia (*Australian Technology and Science Growth Plan*) and USD91.5 million in Singapore (*AI Singapore*) to USD1.95 billion in South Korea (*Artificial Intelligence R&D Strategy*), governments are clearly focusing their resources on ramping AI capabilities.

China stands out in this regard. Determined to become a global AI powerhouse by 2030, the Chinese government is said to have invested USD12 billion in AI in 2017 – and is likely to invest at least USD70 billion by 2020.¹⁰⁵ These funds are used to develop AI projects for the government, but also to support the rapid growth of domestic AI companies. Other initiatives include the announcement of a USD2.1 billion-blueprint to build an AI industrial park in the suburbs of Beijing,¹⁰⁶ and the Ministry of Education's launch of a five-year AI talent training programme.¹⁰⁷

China's race to the top via generous investments seems to be paying off. According to the Allen Institute for Artificial Intelligence, China's output of influential AI research papers is close to overtaking that of the United States, the world's current number one in AI research. Measuring not just the number of papers, but how often they are cited – a good shorthand measure for influence in the wider scientific community – the Allen Institute finds that China is poised to overtake the United States in the 1% of most-cited papers by 2025.¹⁰⁸

Building conducive environments

In addition to investment, policies, laws, and regulations play an essential role in enabling the many AI initiatives that start-ups, entrepreneurs, research laboratories, and academics prepare and launch every year.

As mentioned earlier in this report, cybersecurity and privacy protection frameworks are key elements of a conducive regulatory environment. But there are many other items at play. Namely, all the measures that allow experimental AI projects to become marketable products and services, with real-life applications as well as sustainable business models. Speaking at an MIT conference on AI policy, Regina

Barzilay, MIT professor at the *Computer Science and Artificial Intelligence Laboratory* (CSAIL), cites the example of AI in healthcare. Her research uses machine learning to analyse mammogram results for better early detection of breast cancer, but the limited access to data and to large testing populations makes it challenging to refine automated detection tools.¹⁰⁹ R. David Edelman, Director of the Project on Technology, the Economy, and National Security (TENS) at the MIT Internet Policy Research Initiative (IPRI), notes during the same event that this is an area that public policy could and should address, as governments are best positioned to bridge discussions between citizens, policy-makers, and artificial intelligence technical communities.¹¹⁰

This propensity to build networks and promote collaboration is a natural strength for Singapore, one of APAC's most prominent AI-enabled economies. A historical hub for regional and global flows of capital, people, technology, and ideas, it has built strong organisational and institutional capabilities, allowing it to craft a conducive environment for AI-focused innovation to grow and mature. Singapore's thriving AI sector is thus the product of a range of converging factors: a prime location at the crossroads of Asia's biggest markets, low taxes on businesses, a well-developed IT infrastructure, strong investment opportunities, and a robust regulatory regime.

Through the Infocomm Media Development Authority (IMDA), Singapore has coordinated various AI efforts undertaken by ministries, agencies, academia, and a growing collection of homegrown and multinational AI firms. This includes sector-specific initiatives launched by the National Research Foundation (industry-driven AI applications),¹¹¹ the Economic Development Board (productivity-focused programmes),¹¹² and the Monetary Authority of Singapore (fair and ethical AI in the financial sector).¹¹³

Interviewed in a MIT Technology Review report, Zee Kin Yeong, Assistant Chief Executive, Data Innovation and Protection at IMDA, says that the overarching goal for Singapore "is to see how Singapore-based AI research can filter into products and into the hands of companies and

consumers. One key feature is matching research talent in research institutions with specific industry problems."¹¹⁴

Writing in *Ethos*, Ng Chee Khern, Permanent Secretary for Smart Nation and Digital Government, echoes this sentiment: "We are witnessing a paradigm shift where [*government*] agencies are beginning to see technology not just as an expense, but also as an investment in new strategic capability: that it is about how technology can help agencies reach top-line growth (faster time-to-market for services, improved service delivery) in achieving mission objectives."¹¹⁵

In this context, several coordinated programmes are in place to ensure AI effectively addresses as many socio-economic challenges as possible. *AI Singapore*, the national programme for developing artificial intelligence capabilities, has the Grand Challenge initiative – a five-year, USD109 million investment fund for developing AI solutions to solve the nation's most pressing issues in healthcare, finance, and urban mobility. There is also the *100 Experiments* programme, a business-focused initiative that helps companies use AI to solve day-to-day issues, including operational efficiency, product design, and customer engagement.¹¹⁶

Building a vibrant core of AI developers and companies is another goal of IMDA's strategy. Four key initiatives can be highlighted: a nine-month *AI Apprenticeship Programme* for recent graduates; a three-month *AI for Industry* programme for IT professionals and software developers; *AI for Students*, an online learning programme for schools; and *AI for Everyone*, a short course that will give 10,000 non-technical Singaporean workers basic familiarity with how AI can apply to their jobs and lives.¹¹⁷

Building an AI ecosystem in such a comprehensive, consistent, and coordinated manner may not yet be within reach of all APAC governments. The example set by Singapore may serve as a guide for governments looking to holistically and sustainably strengthen their AI capabilities.

IV.

The Policy Response to AI

Overview of AI Strategies



While AI is an emerging, fast-evolving technology, some governments are making major strides in the way they are designing frameworks around it.

From overarching national AI strategies to sector-specific guidelines for AI implementation, APAC governments are embracing and leveraging AI at their own pace and in their own manner.

The AI frameworks described in this section cover a selected range of AI-specific initiatives that are being developed and implemented globally, as well as across the APAC region.¹¹⁸

Global AI Policy Strategies

European Commission

The European approach to AI emphasises three key areas: collaboration across European Union (EU) members, the promotion of shared values, and the development of ethical guidelines and best practices.

In April 2018, 25 European countries signed a *Declaration of Cooperation on Artificial Intelligence*

to emphasise the importance of working together to ensure AI is developed according to their shared values.¹¹⁹

Although some EU countries have their own national AI initiatives, the *Declaration* reinforces the need to work together to enhance research and deployment while dealing collectively with social, economic, ethical, and legal questions.

At the same time, the European Commission (EC) adopted the *Communication on Artificial Intelligence*, a 20-page policy document that lays out its approach to AI.¹²⁰ Through this, the EC aims to:

1. Increase the EU's technological and industrial capacity and AI uptake by the public and private sectors;
2. Prepare Europeans for the socioeconomic changes brought about by AI; and
3. Ensure that an appropriate ethical and legal framework is in place.

Key initiatives include:

Investment: A commitment to increase the EU's investment in AI from EUR500 million in 2017 to EUR1.5 billion by the end of 2020;

Cooperation: The creation of the European AI Alliance and the High-Level Group on Artificial Intelligence;

Principles: The development of AI ethics guidelines for member states to address issues such as fairness, safety, and transparency;

In April 2019, the High-Level Group on Artificial Intelligence published the final **Ethics Guidelines for Trustworthy Artificial Intelligence**, which lists **seven key requirements** that AI systems should meet in order to be considered trustworthy by European standards.¹²¹

- 1. Human agency and oversight:** AI systems should support human autonomy and decision-making, as prescribed by the principle of respect for human autonomy.
- 2. Technical robustness and safety:** AI systems must be developed with a preventative approach to risks and in a manner such that they reliably behave as intended while preventing unintentional, unexpected, and unacceptable harm.
- 3. Privacy and data governance:** AI systems necessitate adequate data governance that covers the quality and integrity of the data used, its relevance in light of the domain in which the AI systems will be deployed, its access protocols, and the capability to process data in a manner that protects privacy.
- 4. Transparency:** AI systems must ensure that all elements – the system itself, the data it uses, and the business models it works towards – work in accordance with the principles of transparency, traceability, and explainability.
- 5. Diversity, non-discrimination, and fairness:** AI systems must enable inclusion and diversity throughout their life cycles, ensuring equal access through inclusive design processes as well as equal treatment of all stakeholders.
- 6. Societal and environmental well-being:** AI systems must consider the broader society, other sentient beings, and the environment as stakeholders throughout their life cycle.
- 7. Accountability:** AI systems must be designed in a way that ensures responsibility and accountability for the systems and their outcomes, both before and after their development, deployment, and use.

In June 2019, during the first AI Alliance Assembly, the High-Level Expert Group on Artificial Intelligence (AI HLEG) presented its *Policy and Investment Recommendations for Trustworthy Artificial Intelligence*.¹²²

The report lists 11 key recommendations aimed at helping EU members go beyond national AI strategies and work towards a concerted, human-centric approach to AI:

- Empower and protect humans and society
- Take up a tailored approach to the AI landscape
- Secure a Single European Market for Trustworthy AI
- Enable AI ecosystems through Sectoral Multi-Stakeholder Alliances
- Foster the European data economy
- Exploit the multi-faceted role of the public sector
- Strengthen and unite Europe's research capabilities
- Nurture education to the Fourth Power
- Adopt a risk-based governance approach to AI and an ensure an appropriate regulatory framework
- Stimulate an open and lucrative investment environment
- Embrace a holistic way of working, combining a 10-year vision with a rolling action plan



G20

In June 2019, the G20 – of which Australia, China, India, Indonesia, Japan, and South Korea are members – adopted a set of non-binding *AI Principles* to ensure AI is developed in a human-centric manner.¹²³

Overall, the G20 guidelines call for users and developers to ensure AI is fair and accountable, with transparent decision-making processes and that respects the rule of law and values including privacy, equality, diversity, and internationally recognised labour rights. The principles also urge governments to ensure no citizen is left behind as AI advances, providing a fair transition for workers through training programmes and access to new job opportunities.

Based on the OECD's own *OECD Principles on AI*, the G20 principles underline the need for:

- Inclusive growth;
- Sustainable development and well-being;
- Human-centred values and fairness;
- Transparency and explainability;
- Robustness;
- Security and safety; and
- Accountability.

A number of guidelines are also provided for G20 policy-makers to facilitate international cooperation, capacity building, and research and investment in the field of AI.

Discussions are also ongoing on the launch of an International Panel on Artificial Intelligence (IPAI). Primarily championed by Canada and France, the IPAI will bring together global AI experts to facilitate and foster international collaboration and coordination on AI policy developments.¹²⁴

OECD

In May 2019, the OECD – of which Australia, Japan, New Zealand, and South Korea are members – adopted the *OECD Principles on AI* to help member economies formulate consistent and concerted public policies and strategies on AI.¹²⁵

The responsible stewardship of trustworthy AI is guided through five main complementary, values-based principles:

- AI should benefit people and the planet by driving inclusive growth, sustainable development, and well-being.
- AI systems should be designed in a way that respects the rule of law, human rights, democratic values, and diversity, and they should include appropriate safeguards – for example, enabling human intervention where necessary – to ensure a fair and just society.
- There should be transparency and responsible disclosure around AI systems to ensure that people understand AI-based outcomes and can challenge them.
- AI systems must function in a robust, secure, and safe way throughout their life cycles and potential risks should be continually assessed and managed.
- Organisations and individuals developing, deploying, or operating AI systems should be held accountable for their proper functioning in line with the above principles.

In line with these value-based principles, the OECD also provides five non-binding recommendations to governments:

- Facilitate public and private investment in research & development to spur innovation in trustworthy AI.
- Foster accessible AI ecosystems with digital infrastructure and technologies and mechanisms to share data and knowledge.
- Ensure a policy environment that will open the way to deployment of trustworthy AI systems.
- Empower people with the skills for AI and support workers for a fair transition.
- Co-operate across borders and sectors to progress on responsible stewardship of trustworthy AI.¹²⁶

The OECD is also planning on launching an AI Policy Observatory to facilitate dialogue and share best practices on AI policies. A multi-disciplinary organisation, the AI Policy Observatory will help, among other missions, develop metrics to measure AI research, development, and deployment, as well as gather evidence to assess members' progress as they implement the AI principles and recommendations.¹²⁷



Japan

Japan was among the first countries to develop a national AI strategy. Largely focused on making AI useful to both society and economy, Japan's approach aims to strengthen AI R&D capabilities, develop AI systems with industrial applications, and prepare workers for the transformations of the labour market.

In April 2016, the *Strategic Council for AI Technology* was established to develop a roadmap for the industrialisation of artificial intelligence.¹²⁸ The 11-member council included representatives from academia, industry, and government, as well as the President of Japan's Society for the Promotion of Science, the President of the University of Tokyo, and the Chairman of Toyota.

In March 2017, the *Artificial Intelligence Technology Strategy* was released along with an *Industrialisation Roadmap*, which organises the development of AI into three phases:¹²⁹

1. The utilisation and application of data-driven AI developed in various domains;
2. The public use of AI and data developed across various domains; and
3. The creation of ecosystems built by connecting multiplying domains

The strategy applies this framework to three priority areas of Japan's *Society 5.0* initiative¹³⁰ – productivity, health, and mobility – and outlines key policies related to R&D, talent, public data, and start-ups.

In July 2017, Japan published the *Draft AI R&D Guidelines for International Discussions* in preparation for the Conference toward AI Network Society.¹³¹ The document is not intended to be a regulation, but a set of non-binding AI R&D principles and guidelines promoting the benefits and reducing the risks of AI.

The document includes the following Basic Philosophies:

- Human-centred society
- Share guidelines as non-binding soft law with stakeholders internationally
- Ensure balance of benefits and risks
- Avoid hindering technologies or imposing excessive burdens on developers
- Review the Guidelines constantly and renew them as necessary

Japan's self-identified weakness in AI is its lack of AI-enabled talent. The 2017 *White Paper on International Economy and Trade* noted that there is a talent shortage of approximately 50,000 in the technology field, including AI.¹³² In June 2019, Prime Minister Shinzo Abe unveiled a plan to train 250,000 people in AI skills annually by 2025, but the plan has been criticised as unrealistic due to a shortage of AI-capable teachers.¹³³



United States

In February 2019, President Donald Trump issued the *Executive Order on Maintaining American Leadership in Artificial Intelligence*, effectively launching the *American AI Initiative*.¹³⁴

The Executive Order emphasises the central role that the Federal Government plays in facilitating AI R&D, training workers for a changing world, promoting trust in AI, and using AI to protect national interests, security, and values.¹³⁵

And while the Executive Order emphasises American leadership in AI, it is stressed that this requires enhancing collaboration with foreign partners and allies.

The *American AI Initiative* is guided by five principles:

1. Driving technological breakthroughs;
2. Driving the development of appropriate technical standards;
3. Training workers with the skills to develop and apply AI technologies;

4. Protecting American values including civil liberties and privacy and fostering public trust and confidence in AI technologies; and
5. Protecting US technological advantage in AI, while promoting an international environment that supports innovation.

The Executive Order calls on the National Science and Technology Council (NSTC) Select Committee on Artificial Intelligence to coordinate the *American AI Initiative*.

All executive departments and agencies that are developing or deploying AI, providing educational grants, or regulating or guiding AI are required to adhere to six strategic objectives:

- Promoting sustained investment in AI R&D;
- Enhancing access to Federal data, models, and computing resources;
- Reducing barriers to the use of AI technologies;
- Ensuring that technical standards minimise vulnerability to attacks from malicious actors;
- Training American AI researchers; and
- Implementing an action plan to protect US economic and national security interests.

APAC AI Policy Strategies

The seven APAC economies covered in this report are approaching AI in three distinct – but not incompatible – ways:

- **National / overarching AI strategies:** Clear, coherent, and comprehensive policies are essential to support economically strategic areas. This is also true for AI. A complex, multi-faceted technology, accelerating its adoption at the national level requires whole-of-government plans aimed at guiding and accelerating concerted efforts, coordinated initiatives, and sustained collaboration across both existing institutions and newly formed government bodies.
- **Sector-Specific / Industry-Driven AI Strategies:** The absence of a national AI policy does not mean that nothing is being done to advance AI. In fact, most governments across the region have programmes to both upgrade existing industries with AI and foster a domestic AI market. These include programmes to both upgrade existing

industries with AI and foster a domestic AI market. These initiatives can be part of wider national technology plans, but they can also address the specific needs and priorities of a given sector.

- **Foundational Guidelines, Principles, and Standards on AI:** Another approach is to focus less on the pace and scope of AI growth and more on fostering a conducive environment for a dynamic and sustainable AI ecosystem to emerge. Beyond the mobilisation of resources, this entails ensuring that infrastructural, institutional, and organisational capabilities are in place, as well as defining the values, best practices, and technical standards that will allow AI to prosper sustainably.

It is worth noting that the categorisation within these three major groupings is neither clear-cut nor definitive. Indeed, many of the APAC countries examined have initiatives and plans that run parallel to one another or that complement each other by addressing different specific needs simultaneously.

National / Overarching AI Strategies

Country	National AI Strategy
Australia	None
China	Next Generation Artificial Intelligence Development Plan
Indonesia	None
Malaysia	National AI Framework (forthcoming, announced in 2018)
Singapore	AI Singapore, National AI Strategy
South Korea	Mid-to Long-term Master Plan in Preparation for the Intelligent Information Society (forthcoming, announced in 2016)
Thailand	None

Only China and Singapore have broad, overarching national policies specifically designed to drive AI adoption and to promote its deployment across public and private organisations. In both cases, the government is launching multi-faceted initiatives aimed at raising AI investment, supporting AI-based start-ups, enabling AI-capable manpower, and improving security frameworks.

The major difference between the two strategies is that Singapore is working closely with AI researchers and academics to ensure these activities are conducted in an ethical, transparent, and accountable manner,¹³⁶ while China is adopting a more permissive, business-first approach with little to no oversight on the way AI ventures – data mining, location tracking, facial recognition – are developed or deployed.¹³⁷

Malaysia and South Korea have national AI policies in the making, though in both cases there is little information on how existing capabilities will be consolidated under an actionable, nationwide AI agenda. Based on their current approaches to AI, cooperation and coordination are expected to play a major role in their plans, albeit in very different manners.

Malaysia has so far prioritised cooperation with the private sector, multiplying the number of joint experimental projects that draw on the expertise – and funds – of global AI players.¹³⁸ South Korea, meanwhile, emphasises cooperation with academia and research organisations, highlighting the importance of skills, training, and knowledge in the maturation of its AI ecosystem.¹³⁹

Sector-Specific / Industry-Driven AI Strategies

Country	Sector-Specific AI Initiatives
Australia	Australian Technology and Science Growth Plan, Cooperative Research Centres (CRC) programme, ¹⁴⁰ AI PhD scholarships
China	China Artificial Intelligence Industry Innovation Alliance (CAIIA), Three-Year Action Plan for Promoting Development of a New Generation Artificial Intelligence Industry (2018–2020), AI Innovation Action Plan for Colleges and Universities
Indonesia	Making Indonesia 4.0, Tokopedia AI Research Centre, NVIDIA AI R&D Centre
Malaysia	Industry Digitalisation Transformation Fund (2019 budget), Malaysia City Brain project, Data Free Trade Zone (DFTZ), National Policy on Industry 4.0 (Industry4WRD)
Singapore	Digital Economy Framework for Action, Autonomous Vehicle Rules, Principles to Promote Fairness, Ethics, Accountability and Transparency (FEAT) in the Use of Artificial Intelligence and Data Analytics in Singapore's Financial Sector, Veritas framework
South Korea	Artificial Intelligence Information Industry Development Strategy, I-Korea 4.0 (2018-2022), AI R&D Strategy, Data and AI Economy Revitalisation Plan (2019-2023)
Thailand	Thailand 4.0, Digital Park Thailand, Thai People Map and Analytic Platform (TPMAP),

The approaches of Indonesia and Thailand stand out in that they are both focused on industry-driven AI. In both cases, AI policies are being launched to drive the AI readiness and adoption of key economic sectors (factories, farms, services, e-commerce), with special focus on preparing small and medium enterprises (SMEs) to capitalise on the opportunities brought about by the “4.0 revolution”.¹⁴¹

A key challenge for both markets is ensuring their institutional complexities do not get in the way of regulatory clarity and consistency.¹⁴² The fact that AI cuts across many strategic verticals may make it easier to coordinate laws, policies, plans, agencies, and bodies at all levels of government, avoiding overlap and providing clarity to investors, business leaders, and government stakeholders alike.



Foundational Guidelines, Principles, and Standards on AI

Country	Foundational AI Plans and Programmes
Australia	AI Ethics Framework, AI Standardisation Roadmap, AI Technology Roadmap, Humanising Machine Intelligence (HMI) project
China	Beijing AI Principles
Indonesia	Indonesia AI Forum on Data Privacy and Protection, Data Protection Bill (draft) ¹⁴³
Malaysia	Ministerial Value Innovative Centres (VICs, proposed), ¹⁴⁴ National Digital Identity (forthcoming)
Singapore	Advisory Council on the Ethical Use of AI and Data, five-year Research Programme on the Governance of AI and Data Use, Proposed Model AI Governance Framework ¹⁴⁵
South Korea	KAIST Taming Artificial Intelligence: Engineering, Ethics, and Policy forum ¹⁴⁶
Thailand	Thailand Personal Data Protection Act, Thailand Cybersecurity Act, Ethical Guidelines for AI (draft)

Australia has several federal and local plans that prioritise both theoretical and applied research to enable the advancement of fair, inclusive, and socially responsible technologies. Australia’s Chief Scientist, Dr Alan Finkel, has for example proposed an AI certification scheme to ensure AI companies meet relevant ethical standards and independent auditing requirements.¹⁴⁷

The private sector, meanwhile, strongly acknowledges the importance of AI in elevating the country’s economic competitiveness. A Deloitte survey finds that 50% of Australian executives see AI currently being used to “catch up” with competition rather than to establish a distinct advantage,¹⁴⁸ a situation that has pushed industry leaders to call for greater AI spending and investment.¹⁴⁹

Australia



National AI Strategy	No
National Agency	Department of Industry, Innovation, and Science; Commonwealth Scientific and Industrial Research Organisation (CSIRO)
Key AI Organisations	Data61, Credit Clear, Oovvuu, Hyper Anna, iCetana
Key Industry/Sector	Agriculture, Human/Social Services, Healthcare, Defence, Financial Services, Mining, Oil and Gas
Key AI Technology	Machine Learning, Advanced/Predictive Analytics, Image/Pattern Recognition, Moral Machine Intelligence (MMI)
Rank in EIU's Automation Readiness Index ¹⁵⁰	10 / 25
Rank in Oxford Insights' Government AI Readiness Index ¹⁵¹	11 / 194

Key Policy	Key Agency	Key Sector	Key Objective
Australian Technology and Science Growth Program (2018)	Department of Industry, Innovation, and Science	Key projects include: <ul style="list-style-type: none"> • Upgrade supercomputers, • Support the Medical Industry Growth Plan, • Increase women's participation in STEM, • Establish a National Space Agency, • Upgrade satellite imagery and GPS systems, • Modernise patents management system, • Strengthen AI and machine learning capabilities. 	The government will allocate AUD2.4 billion (USD1.63 billion) to technology and science over the next 12 years.
Digital Economy Strategy (2017)	Department of Industry, Innovation, and Science	Key areas of focus: <ul style="list-style-type: none"> • People: Develop digital skills • Services: Government to deliver better digital services • Digital assets: Build infrastructure and provide secure access to high quality data • Enabling environment: Maintain cybersecurity and review regulatory systems to ensure they are fit for purpose and technology neutral 	A roadmap for the government, the private sector, and the community to develop world-leading digital business, address the skills gap, and equip workforces with the necessary digital skills to support growth and job creation.
National Innovation and Science Agenda (2015)	Innovation and Science Australia	Four pillars: <ul style="list-style-type: none"> • Culture and capital; • Collaboration; • Talent and skills; and • Government as an exemplar. 	Promote and foster science and innovation to generate insights and ideas, create jobs, and drive long term economic growth.



“Machine learning requires a lot of curated data, and bigger, more established companies typically do not have their data warehouses set up in such a way that it is easy to amalgamate all of the necessary data... In contrast, start-ups develop their business models with data acquisition and curation in mind...”

Dr Zygmunt Szpak, Senior Research Associate, Australian Institute for Machine Learning (AIML)

Country Overview

Australia does not yet have a broad, nationwide policy on AI, but the Department for Industry is reportedly developing a national AI policy.¹⁵²

For now, however, government-led AI initiatives are primarily public consultations that facilitate and open discussions on AI, aiming to enable the development of official guidelines, principles, and standards to help public and private organisations brace for AI-driven disruption. Australia does, however, have several all-encompassing national technology plans that recognise the economic importance of AI and other advanced technologies, but none of these constitute an AI-specific framework.

The *National Innovation and Science Agenda (NISA)*, for instance, is an all-encompassing national technology plan that puts emerging technologies such as cloud and AI at the heart of its agenda. Among its main objectives are building world-class national research infrastructure, fostering international research collaboration, incentivising investment in innovative start-ups, and attracting and nurturing talent.¹⁵³ In a similar vein, the *Digital Economy Strategy* focuses on how the country can leverage the economic benefits brought about by the digital economy.¹⁵⁴ The strategy does not specifically target AI, but it includes measures that strengthen the country’s data analytics capabilities,

and establishes the National Data Advisory Council, a government agency overseeing the ethical use of data.¹⁵⁵

Meanwhile, the 2018 Australian Technology and Science Growth Program specifically earmarks AUD29.9 million (USD21.6 million) over four years to strengthen the country’s AI capabilities. Of this amount, AUD25 million will be used to support industry-led Cooperative Research Centre (CRC) Projects that focus on machine learning.¹⁵⁶ The rest of the budget will be devoted to post-graduate scholarships, the development of a Technology Roadmap, a national AI Ethics Framework, and an AI Standards Framework.¹⁵⁷

In terms of adoption, Dr Zygmunt Szpak, Senior Research Associate at the Australian Institute for Machine Learning (AIML), sees “Most of the private sector activity is happening in relatively new companies or start-ups. Machine learning requires a lot of curated data, and bigger, more established companies typically do not have their data warehouses set up in such a way that it is easy to amalgamate all of the necessary data. It is quite a bureaucratic undertaking for them to get on top of what data they have, and understand its quality. In contrast, start-ups develop their business models with data acquisition and curation in mind and hence, it is easier for them to explore machine-learning solutions.”¹⁵⁸

Dr Zygmunt Szpak adds that government adoption is just as strong in Australia. “Many government departments are exploring, adopting, or actively using AI technologies. For example, machine learning is being used to audit tax returns and predict congestion on traffic networks. Government is also promoting the adoption of machine learning technologies by funding free workshops for various industry bodies. There seems to be a genuine interest in machine-learning technology from diverse public-sector organisations. The Department of Defence is also investing heavily in adopting the latest AI techniques.”¹⁵⁹

Despite these initiatives, Deloitte’s *State of AI in the Enterprise* survey finds that Australian businesses are mainly using AI to “catch up” to competitors rather than to “leapfrog ahead”.¹⁶⁰ According to the survey, 41% of Australian executives reported that their company either completely lacks an AI strategy or has only disparate departmental strategies, compared to 30% of executives globally. Likewise, a recent BCG survey found that Australians are generally supportive of AI, but their level of support varies significantly by use case.¹⁶¹ For example, there is overwhelming support for AI in areas such as transport optimisation, predictive maintenance of public infrastructure, and customer services. Conversely, 56% of people do not approve of using AI to determine innocence or guilt in a criminal trial, and 53% disagree with its use for making parole decisions.

In this context, the lack of an overarching national AI strategy may hinder the growth of Australia’s AI ecosystem. Indeed, many of the government’s AI initiatives may be too dispersed – and conceptual – to help organisations make sense of the new dynamics created by AI technologies. The Australian Institute for Machine Learning (AIML) called for the creation of a National Centre of Excellence in Machine Learning, an innovation hub that would bring together Australia’s AI research groups and industry to meet the opportunities and challenges of AI technologies.¹⁶²

Strengths

The Australian government is focused on promoting social and inclusive growth and having the right

standards and ethics framework in place to support the responsible development of AI, as well as ensuring that the benefits of AI technologies outweigh the impact on society. To this extent, the Australian government launched various public consultations to facilitate and open discussions on AI. Though unable to compete with the likes of China and the United States when it comes to sheer AI investment, Australia *can* make a significant contribution to the global advancement of AI. It can, for instance, continue to develop the ethical principles, standards, and guidelines that will help worldwide AI initiatives keep AI ethical and transparent.

Cross-sectoral research collaboration between government, academia, and industry

In spite of not having a dedicated national AI strategy there have been a number of organisations and individual experts engaging in AI research that stand to provide insights and deliver inputs into a national framework (if and when the federal government decides to develop one). Major universities, as well as some corporations, a handful of start-ups, and state agencies are funding research and supporting AI pilots, in particular the government-supported CSIRO and Data61.

Data61 and Monash University have, for example, developed a ‘data airlock’ solution which uses AI to analyse potentially harmful data and disturbing images while protecting investigators from exposure to confronting images so they can carry out analysis in a safe and secure manner.¹⁶³ It is used by the Australian Federal Police (AFP) and the Department of Home Affairs to ethically research the use of machine learning and data analytics in advancing law enforcement.

Some state governments, such as Queensland¹⁶⁴ and South Australia,¹⁶⁵ have also declared their intention to develop AI capabilities, often within innovation precincts. This is an area in which there could be significant growth over the coming years, although it could also be undermined as state capitals compete for AI talent. Government efforts have been relatively small thus far,¹⁶⁶ but Australia already has a number of centres of AI

research, including Data61 and the 3A Institute (at the Australian National University), along with noted global experts in particular areas. The Westmead Applied Research Centre at the University of Sydney won the Google.org AI Impact Challenge to develop an AI programme that helps prevent heart attacks by using data from smartphones and wearables.¹⁶⁷

Several Australian institutions are sharing AUD50 million (USD35million) from the Microsoft AI for Earth programme to conduct research on water, agriculture, biodiversity, and climate change.¹⁶⁸ The Federal Court developed a Proof of Concept using the Watson platform with IBM partner Carrington Associates for splitting assets after a relationship breakdown.¹⁶⁹ And National Australia Bank (NAB) set up a Data Guild to educate bank employees in the value of good data governance, data quality and ethics, working with AWS, Azure, and Google.¹⁷⁰

A budding legal and ethical framework for AI

Since the beginning of 2019, Australia has multiplied the number of initiatives designed to ensure that AI innovation is done in an ethical and responsible manner. In January 2019, the Australian Human Rights Commission shared the findings of a study on the way AI governance and leadership can impact human rights.¹⁷¹ Conducted in conjunction with the World Economic Forum (WEF), the project highlighted the fact that most AI discussions focus on the right to privacy (who owns, controls, and exploits personal data), but there are many other areas in which AI can profoundly impact socio-political realities (employment, policy-making, socio-economic equality, etc.).

In April 2019, the Department of Industry, Innovation and Science kicked off a national conversation on how the country should develop and use AI by first identifying key governance principles and measures, with the well-being of Australians as the top priority. The discussion resulted in the “*Artificial Intelligence: Australia’s Ethics Framework*” paper, released on what should be the core AI principles and values and whether they resonated with the Australian public.¹⁷² In June 2019, Standards Australia began a consultation process with key stakeholders across industry, government, civil society, and academia on standards for AI applications which could give the

country a competitive advantage. Titled “*Developing Standards for Artificial Intelligence: Hearing Australia’s Voice*”, the resulting paper notes that standards developed and applied specifically to AI can not only guarantee AI is used for social good in Australia, they can also help other countries adopt a like-minded human-centric approach to AI design and deployment.¹⁷³

In July 2019, the Australian Council of Learned Academies (ACOLA) launched “*The Effective and Ethical Development of Artificial Intelligence – An Opportunity to Improve our Well-being*”, a paper that calls on the government to lead efforts to make Australia a global example for the responsible adoption of AI.¹⁷⁴ ACOLA concludes that the best way to ensure AI contributes to Australians’ well-being is to establish an independent policy and regulatory body dedicated to the sole advancement of AI. In August 2019, the Australian National University (ANU) launched the AUD1.5 million (USD1 million) *Humanising Machine Intelligence (HMI)* project to build a framework for moral machine intelligence (MMI) and develop an “AI with moral values”.¹⁷⁵ The initiative gathers some of the country’s foremost AI specialists from all levels and branches of the AI spectrum, an achievement in and of itself.

For Sassoon Grigorian, Senior Director of Government Affairs & Public Policy at Salesforce, all these initiatives are important for Australia to catch up – and keep up – with AI development in other countries. He notes in a blog post that these efforts could culminate in the creation of a National Advisory Council on ethics and AI, with “members representing a mix of sectors including business, not-for-profit, academia, and government, and a diverse range of backgrounds that reflect community diversity. It should also not be limited to technologists, including human rights advocates, ethicists, economists, and community members.”¹⁷⁶

Challenges

Lack of a dedicated national AI strategy

While the government has devised a range of initiatives conducive to the development of AI under the broad policy agenda of digital economy and innovation strategy, they remain fragmented across various agencies and initiative champions. As Australia has already discovered through the development of its digital transformation journey, it will be beneficial for the government to develop a comprehensive framework with strong strategic focuses for AI and coordinate the execution of the national strategy to collaborate across different agencies to implement the action plans.¹⁷⁷

Gaps in AI talent and skill development

While venture capital is beginning to make itself available, and AI experts continue to call for increased government spending (so as to keep up with other countries), the underlying challenge lies in developing the necessary human capital and overcoming the skills gaps that currently abound in both public and private sectors. This requires a long-term commitment that has been slow to emerge – partly due to a climate of fear over automation, the ‘future of work’ and a dismantling of privacy rights. Half of all Australian respondents to a Deloitte survey expressed major or extreme concern with existing AI risks.¹⁷⁸

Low business and consumer adoption

According to the *Salesforce AI Readiness Index*, Australia scores well in terms of government readiness, but far less well in terms of business and consumer readiness.¹⁷⁹ This discrepancy between government effort and wider adoption risks turning Australia into what Tufts University calls a “stall out” economy: one that has attained digital maturity in key areas, but whose overall pace of innovation is slowing down. If consumer and business readiness do not improve, Australia will be overtaken by nimbler, more dynamic economies that are eager to keep up with the rapidly growing and evolving AI sector. Catching up will become harder the more advanced, complex, and widespread AI technologies become.

China



National AI Strategy	Yes
National Agency	Ministry of Science and Technology (MOST); AI Plan Promotion Office
Key AI Organisations	Baidu, Alibaba, Tencent, iFlytek, SenseTime, Ubtech Robotics, Cambricon
Key Industry/Sector	E-commerce, Manufacturing, Smart City, Vehicles, Surveillance/Police, Finance ¹⁸⁰
Key AI Technology	Facial Recognition, Language/Voice Recognition, Robotics, Neural Networks, Computer Vision
Rank in EIU's Automation Readiness Index ¹⁸¹	12 / 25
Rank in Oxford Insights' Government AI Readiness Index ¹⁸²	20 / 194

Key Policy	Key Agency	Key Sector	Key Objective
Three-Year Action Plan to Promote the Development of a New-Generation Artificial Intelligence Industry (2018-2020) (December 2017)	Ministry of Industry and Information Technology (MIIT)	<ul style="list-style-type: none"> Intelligent and networked products including connected vehicles, service robots, video image identification systems Support systems including sensors and neural network processing chips Intelligent manufacturing 	The Action plan lays out strategies to achieve the first milestone in the Next Generation AI Development Plan
Internet Plus Artificial Intelligence Plan (2016-2018)	National Development and Reform Commission (NDRC), the Ministry of Science and Technology (MOST), the Ministry of Industry and Information Technology (MIIT), and the Cyberspace Administration of China (CAC)	<ul style="list-style-type: none"> Smart home and intelligent appliances Intelligent unmanned systems Smart automobiles Robots Intelligent wearable devices 	AI is identified as one of the 11 priority areas to help accelerate the use of ICT in conventional industries. It targeted to build platforms for fundamental AI innovation and make breakthroughs on basic core technology by 2018.
Next Generation Artificial Intelligence Development Plan (July 2017)	MOST together with the AI Development Plan Promotion Office leads and engage with 15 ministries and departments including the NDRC, MIIT to implement and coordinate key AI projects	<ul style="list-style-type: none"> Autonomous vehicles Smart cities Computer vision in medical diagnosis such as medical imaging Voice intelligence 	The Development Plan comprehensively outlines China's strategies and initiatives to accelerate economic and social development through advancing AI technologies.



Country Overview

China has a national AI policy that clearly outlines its strategy to become the world's leading AI power by 2030. Launched in July 2017, the *Next Generation Artificial Intelligence Development Plan* includes initiatives and goals for R&D, industrialisation, talent development, education and skills acquisition, standard setting and regulations, ethical norms, and security.¹⁸³

Before the *Next Generation Plan*, China had specific AI-related provisions within its broader national plans. The *Made in China 2025 Blueprint*¹⁸⁴ and the *Three-Year Guidance for Internet Plus Artificial Intelligence Plan (2016-2018)*,¹⁸⁵ for instance, outline the expansion of the robotics, autonomous vehicles, and smart homes industries. But the *Next Generation Plan* marks a turning point, as it made AI a clear national priority backed by central government guidance and public-sector funding.

Since the release of the *Next Generation Plan*, the government has published the *Three-Year Action Plan to Promote the Development of New-Generation Artificial Intelligence Industry*,¹⁸⁶ which advances four major tasks ahead of the 2020 targets:

- Develop intelligent and networked products such as vehicles, service robots, and identification systems;
- Enable AI support systems, including intelligent sensors and neural network chips;
- Support the growth of intelligent manufacturing systems and mechanisms; and

- Create a conducive environment by investing in industry training resources, standard testing, and cybersecurity.

The top down approach adopted by the Chinese government in driving R&D and commercialisation of AI technologies has ensured IT companies and start-ups have access to stable funding and financial support. As of June 2018, there were more than 1,000 AI companies (start-ups and bigger organisations combined) in China, as compared to half that many in the United States.¹⁸⁷ In 2018, 27 out of the top 50 Chinese AI companies were backed by either government-associated funds or the leading tech giants of Baidu, Alibaba, and Tencent.¹⁸⁸

In addition to government funding, Chinese AI start-ups have been very successful in attracting venture capital, securing 48% of total global investment in 2017.¹⁸⁹ Central government guidance funds are established and channelled into technology development zones and science parks. Provincial and city governments are also following suit to mobilise resources and funding to bolster AI development, promote collaborations among government, industry, and academia with supporting policies.

There is also the fact that Chinese citizens seem to be embracing AI with enthusiasm, using AI face recognition for everything from credit applications to payment authentication. Unlike other economies, China's citizens are more willing to adopt technology first, rather than wait for related regulations.¹⁹⁰ This unparalleled access to large quantities of consumer data generated from a huge population actively using mobile devices and digital platforms has given Chinese AI companies a distinct comparative advantage in research and development which involves the testing of algorithms and machine learning.

Cited in a report, Dr Kai-Fu Lee, Chairman and CEO of Sinovation Ventures and President of Sinovation Venture's Artificial Intelligence Institute, notes that "the Chinese entrepreneurial system is an advantage for China. AI companies are moving very quickly into new spaces. A third big factor is the government support. At a local level, cities give subsidies to AI companies that move there, they have venture capitalists that invest in AI, and they have smart

people move to these cities, including overseas-returning experts.”¹⁹¹ China has already emerged as a credible AI global leader, accelerated by a powerful technology industry, a ‘mobile first’ society, and an open approach to data collection. Chinese AI companies have a clear advantage in terms of both funding and government support, with public and private sectors working in tandem to achieve clear and identified, albeit ambitious, goals.

Strengths

Whole-of-government endeavour with strong funding support

China’s AI industry is booming: in 2017, it was valued at CNY23.7 billion (USD3.5 billion) growing by 67% that same year. China has consistently surpassed the United States in terms of patents and research papers since 2006,¹⁹² with 25% of AI papers on Scopus in 2017 originating from China as compared to 17% from the United States.¹⁹³ Extensive venture capital and government funding have contributed to the proliferation of both AI research and AI companies: as of June 2018, there were more than 1,000 AI companies (start-ups and bigger organisations combined) in China, as compared to perhaps half that many in the United States. A majority of these companies are located in Beijing, Shanghai, Shenzhen, and Hangzhou, specialising in areas such as voice recognition, computer vision, and natural language processing.

Central government guidance funds are established and channelled into technology development zones, robotics, and science parks. Provincial and city governments are also following suit to mobilise resources and funding to bolster AI development, promote collaborations among government, industry, and academia with supporting policies. Shanghai alone will set up investment funds of no less than CNY100 billion (USD15.1 billion)¹⁹⁴ and the Tianjin government has contributed to establishing a CNY100-billion industrial fund.¹⁹⁵ Beijing and Shanghai set up pilot zones for AI in February and May 2019 respectively after an earlier commitment to build an AI-centric development park in the capital city that could host 400 enterprises. While the Beijing pilot zone will focus on AI-related

regulations, data sharing and the development of ethical standards, Shanghai will concentrate their efforts on AI applications in healthcare, smart cities, intelligent transport.

Leveraging cross-sector and global collaborations

AI companies in China are highly innovative and a number of them have successfully teamed up with internationally renowned research institutes and global players, to acquire and advance the latest AI know-how. For example, Baidu further strengthened its ties with Intel to enhance the neural network processor and optimise its various AI platforms including deep-learning, voice assistance and autonomous driving.¹⁹⁶ Tencent’s Medical AI Lab, currently focused on the diagnosis of Parkinson’s disease, is partnering with UK-based digital health tech start-up Medopad and specialists in King’s College London to assess and track patients’ movement using video analysis and motion capture technologies.¹⁹⁷

International collaborations and research networks play a pivotal role in advancing AI technologies and will continue to drive breakthroughs in AI applications. In Shanghai, an AI Industry Alliance was established to enhance resources matchmaking among the participating enterprises to accelerate the development of AI applications in different sectors.¹⁹⁸ The 22-member bloc includes BAT, DeepBlue, and UCloud, along with the Microsoft Asia Research Centre, and ABB, a Swiss conglomerate specialising in robotics and automation technology.

Nascent AI principles and regulatory frameworks

A coalition, comprising the Beijing Academy of Artificial Intelligence (BAAI), Peking University, Tsinghua University, Institute of Automation and Institute of Computing Technology within the Chinese Academy of Sciences, and the BAT, released the *Beijing AI principles* in May 2019 to provide guidance on AI R&D, implementation, governance and long term planning.¹⁹⁹ These principles stress the importance of respecting people’s privacy, freedom, dignity, rights and autonomy and are largely in line with those adopted by the OECD and the EU.

This formulation of AI principles is one step closer to the establishment of comprehensive ethical and regulatory frameworks, and policies which the country targets to achieve by 2030. In view of the rapid development in AI, the Chinese government

can be expected to accelerate the development of standards and legal frameworks governing issues such as the use of robotic systems, computer vision, human-machine interaction, AI security, and accountability in cases of AI-related accidents.

Challenges

Domestic talent shortage

With AI high on the agenda of many economies, competition for AI talent is rife and there is a global shortage of AI researchers. Although China had the world's second largest AI talent pool next to the United States in 2017, accounting for 8.9% of the world's total, only 5% are top-rated AI specialists with many years of research experience.²⁰⁰ Municipal governments, research institutes and IT companies alike have been relying on short term strategies such as scholarships and competitive remuneration packages to attract talent from overseas and retain local talent.²⁰¹

To bridge the talent gap, the government needs to devote more resources to universities to boost the number of undergraduate and graduate students taking not only core STEM subjects, but various creatively challenging subjects that will be necessary for holistic and advance AI development, as well as further nurturing AI talent through exchange and training programmes. As industry plays a critical role in cultivating talent, industry–university collaboration can expect to be fostered where industries can assist in setting the curriculum and provide students with internships and the opportunities to work in AI innovation labs.

Putting business interests ahead of research

AI Investment from China's tech giants including Baidu, Alibaba, Tencent (BAT) have been skewed towards the development of applications in a comparatively small number of select sectors such as healthcare, finance, and connected vehicles. Contrastingly, relatively fewer resources have been devoted to AI research (as well as the core technologies that underpin the development of AI).

This over-emphasis in developing profit-driven AI applications not only intensifies competition among start-ups, but also risks leading to over-investment and duplication of resources. Research can be strengthened through an integration of industry and academic R&D to strike a balance between applications development and fundamental research. Home-grown core technologies may become critical competitive enablers moving forward, particularly if various trade disputes and global value chain fragmentation continues.

Indonesia



National AI Strategy	No
National Agency	Ministry of Communication and Information Technology (Kominfo)
Key AI Organisations	Tokopedia, Snapcart, Bukalapak, Nodeflux, Kata.ai, Bahasa.ai, Dattabot, Prosai.ai, Eureka.ai
Key Industry/Sector	E-commerce, Manufacturing, Smart City, Vehicles, Education, Advertising/Customer Experience, Cybersecurity ²⁰²
Key AI Technology	Language/Vocal Recognition, Machine Learning, Recommendation Engines, Chatbots, Intelligent Teaching Modules
Rank in EIU's Automation Readiness Index ²⁰³	25 / 25
Rank in Oxford Insights' Government AI Readiness Index ²⁰⁴	57 / 194

Key Policy	Key Agency	Key Sector	Key Objective
Government Regulation No 71 of 2019 (GR 71/2019) on Electronic Systems and Electronic Transactions ²⁰⁵	Government-wide	Cross-sectoral	GR 71/2019 was introduced in October 2019 to replace GR82/2012. It redefines key concepts such as "Personal Data", introduces new differentiators such as private and public categories for electronic system organisers ("ESOs"), and widens the scope of government action when governing electronic systems and platforms.
Making Indonesia 4.0 (2018)	Ministry of Industry	Five key technological advances: <ul style="list-style-type: none"> • internet of things (IoT), • AI, • Human-machine interface, • Robot and sensor technology, • 3D printing. 	Revitalise the manufacturing sectors in a bid to increase the contribution of to GDP growth and elevate Indonesia to a global top 10 economy by 2030 through expanding net exports, and enhancing productivity and innovation capabilities.

<p>Presidential Regulation No 95 of 2018 (GR 92/2018)</p>	<p>Government-wide</p>	<p>Cross-sectoral</p>	<p>GR 95/2018 was introduced in 2018, and governs the Sistem Pemerintahan Berbasis Elektronik (SPBE), which is the government administration that utilises information and communication technology to provide services.</p> <p>This includes aspects of the country's government cloud, including the SPBE infrastructure, defined as hardware, software, and facilities that become the main support for running the systems, applications, data communications, data storage and processing, integration/connecting devices, and other electronic devices, and also the country's National Data Centre.</p>
<p>1,000 Start-Up Digital National Movement Programme (2016)</p>	<p>Ministry of Communications and Information</p>	<p>Priority sectors:</p> <ul style="list-style-type: none"> • Agriculture • Education • Health • Tourism • Logistics • Energy 	<p>Produce high-quality digital technology start-ups valued at USD10 billion, through incubation and cooperation between academia and start-ups.</p> <p>It will be launched in 10 cities including Jakarta, Bandung, Surabaya, Yogyakarta, Semarang, Malang, Medan, Bali, Makassar, and Pontianak.</p>



Country Overview

Indonesia is very open to AI, but it does not have a comprehensive national AI strategy to effectively frame this openness. It does have several nationwide plans that aim to turn the country into the largest digital economy in Southeast Asia by 2030, but none of them target AI specifically.

In April 2018, President Joko “Jokowi” Widodo launched the *Making Indonesia 4.0* programme to help the country better compete in the digital era.²⁰⁶ A comprehensive roadmap to digitisation, the programme contains ten steps that the government needs to implement, including: empowering SMEs through digital technology, improving digital

infrastructure, attracting foreign investors, changing educational curricula, and providing incentives for businesses based on digital technology. Most importantly, the programme explicitly mentions five key technologies that Indonesia must prioritise in the years to come: Internet of Things (IoT), AI, Human Machine Interfaces (HMI), Robotics and sensor technologies, and 3D-Printing technologies.

Indonesia's start-up ecosystem is growing rapidly, as evidenced by the number of success stories coming out of the country. Ride-hailing firm Go-Jek, web forum Kaskus, e-commerce platform Tokopedia, and most Fintech players, are very successful in their respective fields, and are actively adopting AI solutions to further consolidate their competitive advantages. A key differentiator for these companies is the trove of data they are accumulating to build targeted AI models and applications. With a population size of over 267 million, Indonesia (like China) can stand to leverage large amounts of user data that will power the sustainable advancement and spread of AI.²⁰⁷

The Indonesian government is also driving the country's AI readiness. According to Dr Nyoman Adhiarna, IT Governance for Electronic Systems and Digital Economy, Ministry of Communication and Information Technology (Kominfo), key government agencies are proactively launching AI-driven initiatives in a range of sectors: "The Central Bank and the Tax Department are using AI to analyse their own data and improve their policy-making decisions. The Ministry of Health is looking into AI to transform patient services as well as administrative processes. The Agency for Climatology, Meteorology, and Geophysics (BMKG), meanwhile, is preparing to leverage the weather and earthquake data it owns, though for now data ownership is fragmented across multiple agencies."²⁰⁸

On paper, then, Indonesia is particularly open to AI.²⁰⁹ An IDC survey found that at least a quarter of Indonesian technology companies are adopting AI, with the country leading the region in this regard.²¹⁰ But, it is argued, many of them may be adopting AI solutions that are not necessarily relevant or useful to actual business needs. Edwin Sugianto, COO of Asuransi Axa Indonesia, is quoted as seeing

the Indonesian market "influenced by trends in the global market and flooded by a wave of new technologies that might not be truly relevant or viable to be implemented straight away. Listening to customers prior to introducing a new product, service, or technology is always recommended as the best practice."²¹¹

Together, these trends demonstrate that Indonesia is still in the initial stages of AI development, especially in comparison to neighbouring countries. And this is despite the recognition among key enterprises and certain government agencies of the importance of leveraging the opportunities offered by advanced AI technologies such as automation, robotics, and autonomous vehicles.²¹²

Dr Nyoman Adhiarna notes that turning Indonesia's openness to AI into effective, sustainable adoption will require a consistent and concerted approach: "From a regulatory perspective, there is no specific law related to AI. There are *the Electronic Information and Transaction Law*, the *GR82* [now *GR71*] regulation in relation to data protection (principles of transparency and accountability), and the future *Personal Data Protection Law* (currently being drafted) – but nothing to guide institutions and organisations on the unique ins and outs of AI. Likewise, putting a specific government agency in charge of AI initiatives could help consolidate current and future AI efforts. Kominfo could, for instance, supervise and coordinate the AI initiatives launched across different economic sectors."²¹³

Strengths

A young and dynamic start-up ecosystem

A number of AI companies have emerged in Jakarta in the last few years with the potential to thrive and to drive the focus on, and development of, AI. For example, Nodeflux, a Jakarta-based AI start-up backed by Telekom Indonesia and venture capital East Ventures, developed expertise in facial recognition technology, computer vision and video analytics that can be employed in people counting, crowd and traffic management, and monitoring of illegal parking. The company also partnered with the provincial government in Jakarta to detect

water levels in dams, sewers and waterways and promptly issues warnings and alerts when flooding is anticipated. Nodeflux plans to further solicit government support to build an AI community in Indonesia.

Other AI start-ups such as BJtech, Halosis and Kata.ai, which partnered with mobile network operator Telkomsel, have been successful in building conversational AI platforms using natural language processing technologies. Together with the country's two major e-commerce platforms, Tokopedia and Bukalapak, these AI start-ups have accumulated a trove of data that can be used to further build AI models and applications. With a population size of over 267 million, of which some 106 million are tech-savvy mobile Internet users, Indonesia (like China) stands able to leverage large amounts of user data that is of paramount importance in fuelling the development of AI.²¹⁴

A strong potential for AI adoption among enterprises and SMEs

A survey conducted with businesses engaged in the retail, IT/telecom, financial services and insurance industries across eight APAC markets by Appier found that Indonesian companies top the list in AI implementation with 65% adopting or expanding the use of AI to improve operational efficiency and develop innovative products and solutions that better meet customers' needs. The results suggest a high level of willingness to explore and utilise AI.²¹⁵ In this regard, helping SMEs acquire a broad base of AI awareness and acceptance can further enhance adoption, allowing them to take advantage of these emerging technologies and encourage both greater usage and further innovation from AI start-ups.

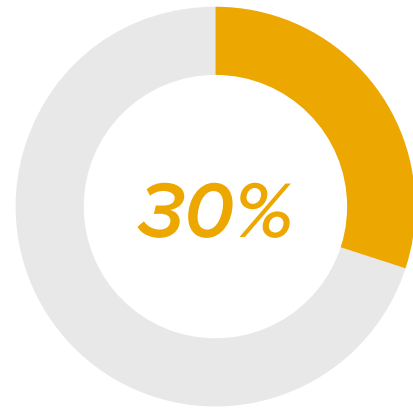
Innovative public-private partnerships

In February 2019, e-commerce platform Bukalapak partnered with the Bandung Institute of Technology to inaugurate the country's first AI and cloud computing innovation centre. 200 engineers from Bukalapak are to engage in knowledge exchange with researchers and students. More importantly, the company will contribute big data to facilitate research on natural language processing, computer vision and deep learning.²¹⁶ In March 2019, the

other e-commerce giant Tokopedia partnered with Universitas Indonesia to create the country's first AI Centre of Excellence with support from Nvidia. Leveraging Nvidia's deep learning supercomputer technology, researchers can develop and test a wide range of AI solutions tailored for different industries such as logistics, transport, and financial services, in addition to solving societal issues.²¹⁷

Challenges

By 2021, more than 30% of consumers in Indonesia are expected to interact with AI-enabled bots and one-fifth of commercial enterprise applications are set to be powered by AI.²¹⁸ However, compared to neighbouring countries, Indonesia is still in the initial stages of AI development, despite the recognition among key enterprises and certain government agencies of the importance of moving from labour-intensive to knowledge-intensive growth models and leveraging the opportunities offered by advanced AI technologies such as automation, robotic systems, autonomous vehicles.²¹⁹



of consumers in Indonesia are expected to interact with AI-enabled bots

“It is increasingly difficult to find Indonesian talent that has the experience to take [AI] to the next level.”

Aswin Tanu Utomo, Vice President of Engineering at Tokopedia



Lack of a national AI strategic plan

Although AI and robotic sensor technologies are key focus areas within the Making Indonesia 4.0 roadmap, there are no specific strategies and action plans to shape the direction and development of AI – even though it is expected to be one of the key enablers for Industry 4.0. The government will need to formulate a national plan with coordinated strategies across relevant agencies if it is to accelerate research, innovation and adoption to capitalise on the envisioned AI opportunities. A dedicated government agency could be set up to identify key sectors to be focused on, examine the policy and ethical implications of AI deployment, determine the roles of different ministries and departments, and coordinate work among them.

A small pool of AI talent

Currently there is a very limited AI talent pool for Indonesian companies to tap into, and the country has a relatively small proportion of students studying STEM subjects in top-rated universities. Cited in an online article, Aswin Tanu Utomo, Vice President of Engineering at Tokopedia, believes in Indonesian talent, but he also recognises that “It is increasingly difficult to find Indonesian talent that has the experience to take [AI] to the next level.”²²¹ The government has proposed to increase the overall education budget to IDR505.8 trillion (USD35.5 billion) in 2020, with part of that sum devoted to developing domestic AI capabilities via college scholarships and AI skills-training (coding, data analytics, etc.).²²²

Infrastructure often does not enable continuous/sustainable connectivity

In Indonesia, cloud infrastructure and data centre facilities are limited, and telecommunication infrastructures are still underdeveloped. For example, fixed and mobile broadband speeds in Indonesia are one of the lowest in ASEAN behind Laos, Philippines, and Vietnam²²⁰ and many rural parts of the country are still deprived of high-speed mobile networks. There is also the fact that many rural/remote parts of the country are both susceptible and vulnerable to major natural catastrophes, jeopardising what little connectivity these areas may have. Mobile network and fibre infrastructure will go a long way in connecting remote areas and islands, improving internet accessibility and broadband speeds. Developing a national data centre and a cloud network may also help overcome this obstacle.

Malaysia



National AI Strategy	Yes (forthcoming, announced in 2018)
National Agency	Malaysia Digital Economy Corporation (MDEC)
Key AI Organisations	G3 Global, NEUON, Avanade, Glueck Technologies, Wonderland Technologies
Key Industry/Sector	E-commerce, Manufacturing, Agriculture, Smart City, Surveillance/Police, Financial Services
Key AI Technology	Facial Recognition, Robotics/Robo-Advisors, Machine Learning, Sentiment Analysis, Chatbots
Rank in EIU's Automation Readiness Index ²²³	14 / 25
Rank in Oxford Insights' Government AI Readiness Index ²²⁴	22 / 194

Key Policy	Key Agency	Key Sector	Key Objective
Budget 2020 (2019) ²²⁵	Government-wide (led by the Ministry of Finance)	Cross-sectoral	In October 2019, Budget 2020 was announced, with a clear intention to drive the digital transformation of society and institutions alike. A number of measures were announced to support start-ups, prepare 5G deployment, train the workforce, and accelerate the adoption rate of next-generation technologies (including AI).
National AI Framework (forthcoming, announced in 2018) ²²⁶	Malaysia Digital Economy Corporation (MDEC)	Cross-sectoral	Drive Malaysia's AI ecosystem, by leveraging AI and machine learning for digital transformation
National Policy on Industry 4.0 (Industry4WRD) (2018) ²²⁷	Ministry of International Trade and Industry	Cross-sectoral, with emphasis on industry	Aims to drive the country towards becoming an Industry 4.0 hub for Southeast Asia, using new technologies such as IoT, AI, Robotics, and Additive Manufacturing to increase productivity and competitiveness across industries.
National Big Data Analytics Framework (2015) ²²⁸	MDEC	Cross-sectoral	Drive big data analytics (BDA) demand in all sectors and activate adoption & usage of BDA in the public sector.



“[Malaysia’s National AI Framework] will develop strategies and action plans specifically for AI. Its main objective will be to enable a dynamic AI ecosystem and to leverage the social and economic benefits that AI technologies can potentially deliver.”

Eric Ho, Investment Research & Advisory at MDEC

Country Overview

The Malaysian government is finalising a *National AI Framework*, expected to be completed by the end of 2019. It will be led by the Malaysia Digital Economy Corporation (MDEC) through a newly formed AI unit,²²⁹ which will comprise both local and international experts to ensure that Malaysia is on the right track to develop a robust AI ecosystem.²³⁰

According to Eric Ho, Investment Research & Advisory at MDEC, the *National AI Framework* will “develop strategies and action plans specifically for AI. Its main objective will be to enable a dynamic AI ecosystem and to leverage the social and economic benefits that AI technologies can potentially deliver.”²³¹ In the meantime, Malaysia’s AI strategy is strongly based on fostering enhanced cooperation mechanisms between government, academia, and industry, as demonstrated by several strategic partnerships launched in the smart city and e-commerce sectors:

- The Malaysia City Brain project: A partnership between MDEC, Kuala Lumpur City Hall, and Alibaba, the initiative combines 5G, IoT, and AI technologies to optimise traffic, parking, and energy management.²³²
- The digital free trade zone (DFTZ): Alibaba also worked with MDEC to set up the DFTZ – an eFulfillment and eServices hub designed to facilitate cross-border trade and enable local online businesses to export their goods.²³³

- Security and surveillance: Since 2017, MIMOS, Malaysia’s national research and development centre for ICT, is working with Huawei to develop AI-based security and surveillance solutions, including advanced video analytics and facial recognition systems.²³⁴

For Dr Norisma Idris, Associate Professor at the Department of Artificial Intelligence (University of Malaya), “It is important that the government, industry, and universities continue to work together to support the national AI agenda. In many countries, these partnerships enable the development and commercialisation of innovative AI products and services, and Malaysia has everything it needs to foster a dynamic, homegrown AI ecosystem.”²³⁵

In the last few years, Malaysia’s start-up and technology ecosystem has indeed undergone a massive transformation. The start-up community has attracted investments to the tune of USD1.45 billion in 2016,²³⁶ and incubated a number of deep-learning start-ups that are using AI for e-commerce activities, human sentiment analysis, and automated customer support, among others.

For Dr Norisma Idris, sentiment analysis – the use of natural language processing, text analysis, computational linguistics, and biometrics to identify, extract, quantify, and study affective states and

subjective information – has become a key differentiator for businesses in Malaysia: “Sentiment analysis is the main AI trend in Malaysia. Most industries and many government agencies perform sentiment analysis for specific purposes. This includes feedback from customers (for industry), and the prediction of positive/negative perceptions on key policy issues (for government).”²³⁷

Broadly speaking, the private sector has been very active in developing innovative uses of AI. Primarily led by international organisations, these initiatives are being developed in various sectors, including transport, logistics, and energy. Dr Norisma Idris notes that “Just a few years ago, the medical industry was driving AI the fastest, as advanced image-processing solutions were being developed for all types of medical devices. Today, however, language-driven applications such as chatbots, sentiment analysis, and text normalisation systems dominate in most industries.”²³⁸

Despite these factors, businesses and organisations in Malaysia remain unprepared to adopt AI; organisations have yet to develop or articulate a clear AI roadmap. According to an IDC survey, only 26% of Malaysian organisations have embarked on their AI journeys. As it stands, the country’s adoption rate (8.1%) lags significantly behind other APAC markets,²³⁹ highlighting the urgent need for a consolidated AI strategy that is both driven and owned by Malaysia. As Eric Ho of MDEC puts it, “AI development and adoption can be accelerated in Malaysia by focusing on constructing comprehensive policies and regulations for better direction and vision.”²⁴⁰

Strengths

Robust private sector development and international collaborations

In the absence of a national AI strategy, the private sector has been developing innovative uses of AI. Primarily led by international organisations, these initiatives have been developed in various sectors. For example in health, Prudential Malaysia launched “Pulse”, an all-in-one application that offers AI-powered health information which

contains an array of personal health management options including a dengue alert feature called Artificial Intelligence in Medical Epidemiology (AIME), which utilises big data and AI to predict whether a certain locality will face a dengue epidemic within the next 30 days, with an accuracy of 80%.²⁴¹

Likewise, Plus, Malaysia’s largest highway concessionaries company, is partnering with Microsoft Malaysia to integrate the Microsoft Azure cloud system into its highway toll network to transform and modernise the country’s highway experience. This partnership would make it the first in the country to leverage AI, big data analytics and cloud computing to improve its highway network by better predicting traffic congestion and monitoring the safety of its highways.²⁴² Alibaba Cloud, aside from supporting the government’s digital agenda in Kuala Lumpur through the City Brain initiative to monitor and collect data on traffic movement to improve mobility and alleviate congestion,²⁴³ is also working with Bank Muamalat to use big data and AI to better understand and develop tailored products and services for different customer segments.²⁴⁴

This openness with working with international experts with greater expertise and experience in various sectors not only enables technology transfers and knowledge sharing, but also helps to build awareness and encourage other organisations to follow-suit.

AI park to foster R&D and grooming local talent

The Malaysian company G3 Global has inked a USD 1 billion-agreement with two Chinese firms to develop its first AI park, focused on building AI applications that take advantage of computer vision, speech recognition and natural language processing. The park will also serve as a platform to groom local AI talent, and support efforts to build a commercial AI ecosystem and advance AI research in Malaysia. This park is expected to have a huge impact on government agencies, as well as banking, manufacturing and healthcare industries by centralising R&D akin to a mini ‘Silicon Valley’ for AI in Malaysia.²⁴⁵ Further, this would also help to retain local AI talent by developing an active hub for innovation and development to realise opportunities.



In the last few years, Malaysia's start-up and technology ecosystem has undergone a massive transformation, with the start-up community attracting investments to the tune of USD1.45 billion in 2016, according to a report by Pagan Research. The Malaysian start-up ecosystem has also incubated a number of deep tech start-ups that are using AI for detecting fraudulent behaviour in e-commerce activities, human emotion analysis

and automated customer support among other things.²⁴⁶ Concurrently, AI centres of excellence and consultancies such as Avanade²⁴⁷ and Crayon²⁴⁸ are offering a range of services to assist companies in effectively implementing AI in their business operations. However, this continues to be an area the government can do more in to simulate domestic talent development, especially given the gap in local human resources.

Challenges

Lack of open discussions with stakeholders

Where the National AI Framework was first announced by the previous Najib-government, there were question marks on the continuity of the Framework. This was put to rest and the new government has announced a target of end-2019 for the National AI Framework. However aside from couple of media announcements that it is being developed, there is little detail released. Alongside the National AI Framework, the "Cloud First" Strategy meant to guide public sector on how to adopt cloud computing technologies has yet to be released, while the Digital Trusted Zone has also seen little progress.

Without a transparent process involving multi-stakeholders including local industry players, it is unlikely that the National AI Framework will have incorporated the ambitions or concerns from local stakeholders which may lead to an implementation gap.

Singapore



National AI Strategy	Yes
National Agency	AI Singapore, National AI Office, Infocomm Media Development Authority (IMDA)
Key AI Organisations	Trax, CXA, Rotimatic, Zhixin, Evie
Key Industry/Sector	E-commerce, Smart City, Vehicles, Surveillance, Financial Services, Healthcare, Education
Key AI Technology	Facial/Vocal Recognition, Robotics, Customer Experience, Chatbots, Robo-Advisors, Machine/Deep Learning, Predictive Analytics, Automated Algorithms
Rank in EIU's Automation Readiness Index ²⁴⁹	3 / 25
Rank in Oxford Insights' Government AI Readiness Index ²⁵⁰	1 / 194

Key Policy	Key Agency	Key Sector	Key Objective
National AI Strategy (2019) ²⁵¹	National AI Office	Cross-sectoral	Long-term national programme to accelerate the development and adoption of AI across Singapore society, starting with nine key sectors: Transport and Logistics, Smart Cities and Estates, Safety and Security, Healthcare, Education, Manufacturing, Finance, Cybersecurity, and Government.
Veritas (2019) ²⁵²	Monetary Authority of Singapore (MAS)	Financial services industry	In November 2019, the MAS announced Veritas, a framework for financial institutions to promote the responsible adoption of AI and data analytics.
Model Artificial Intelligence (AI) Governance Framework (2019) ²⁵³	Personal Data Protection Commission (PDPC)	Cross-sectoral	Provide an accountability-based framework with ethical principles for organisations to practically implement when deploying AI – ultimately promoting AI adoption and building consumer confidence and trust

Principles to Promote Fairness, Ethics, Accountability and Transparency (FEAT) in the Use of Artificial Intelligence and Data Analytics in Singapore's Financial Sector (2018) ²⁵⁴	MAS	Financial services industry	Outlining principles for the use of AI and data analytics (AIDA) in decision-making in the provision of financial products and services.
Digital Government Blueprint (2018) ²⁵⁵	Gov Tech	Public sector	To better uses data, connectivity and computing to re-engineer business processes, re-architect technology infrastructure and transform services for citizens, businesses and public officers; automates processes to better serve citizens
AI Singapore (2017) ²⁵⁶	Government-wide partnership – Infocomm Media Development Authority (IMDA), National Research Foundation (NRF), Smart Nation and Digital Government Office, Economic Development Board, SGInnovate and Integrated Health Information Systems	Cross-sectoral	Five-year, SGD150 million national programme to enhance Singapore's capabilities in AI based on three pillars of AI Research, AI Technology, and AI Innovation.



Country Overview

Singapore is one of a handful of APAC economies to have all the elements in place to effectively drive AI readiness and adoption.²⁵⁷ From data protection laws²⁵⁸ to nationwide cybersecurity strategies,²⁵⁹ Singapore has built strong regulatory foundations to maximise the impact of AI and other emerging digital technologies on its economy.²⁶⁰

Singapore's commitment to a progressive and conducive approach to AI is embodied by *AI Singapore*, a five-year national programme exclusively devoted to enhancing Singapore's AI capabilities through AI investment and AI adoption.²⁶¹ *AI Singapore* consists of four key pillars, all aiming to drive investments and broaden adoption:²⁶²

- **Fundamental AI Research:** Funds scientific research that will contribute to the other pillars of AI Singapore.
- **Grand Challenge:** Supports the work of multi-disciplinary teams that provide innovative solutions to major challenges Singapore and the world face (health, mobility, finance, etc.).
- **100 Experiments:** Funds scalable AI-based solutions to industry-identified problems.
- **AI Apprenticeship:** A nine-month structured programme to foster a new cohort of AI talent in Singapore.

Despite its small size, Singapore is home to 346 AI start-ups,²⁶³ compared to larger economies such as China with 910²⁶⁴ and Australia with 278.²⁶⁵ Additionally, nearly 10% of organisations in Singapore are already embracing AI in some capacity, as highlighted in a 2019 Enterprise Cognitive/AI survey.²⁶⁶

Singapore's government-wide efforts are largely focused on promoting a responsible and accountable use of AI. To this end, the government created the *Advisory Council on the Ethical Use of AI and Data*,²⁶⁷ published several documents on the ways responsible data collection and usage can drive AI adoption,²⁶⁸ and launched a *Model AI Governance Framework*.²⁶⁹ In addition, the Monetary Authority of Singapore (MAS) released a set of *fairness, ethics, accountability, and transparency (FEAT) principles* to promote the responsible use of AI and data analytics in finance.²⁷⁰

Apart from promoting industry AI adoption, the government is also driving more inclusive use of AI in the public sector. Published in 2018, the *Digital Government Blueprint (DGB)* was launched as a component of Singapore's *Smart Nation* initiative focused on digital transformation of the government. The DGB sets a number of milestones for 14 specific initiatives to be achieved by 2023, including the goal that all ministries and related government agencies should have at least one AI project by 2023.²⁷¹

In this context, policy-makers are keen to build the foundations for and drive the rapid take up of AI, given its presumed potential to strengthen Singapore's economy – adding up to USD215 billion in gross value across 11 industries by 2035²⁷² – and positioning Singapore as the data, algorithmic, and talent hub for the region.²⁷³

Strengths

A strategy focused on accountable and responsible development

Singapore is focusing on managing community concerns around AI by grappling with issues of transparency, fairness, competition, privacy and ethics in its policy and regulatory frameworks.

It is one of the few governments to create an AI Ethics Advisory Council as part of its AI strategy, as well as provide guidelines and a framework for organisations to develop and use AI in a responsible manner. Promoting trust and confidence is a key aspect of Singapore's AI approach, and will be a useful example for other governments to emulate as they formulate their own AI strategies.²⁷⁴

Apart from the Model AI Governance Framework, initiatives announced in 2018 include the setting up of an Advisory Council on the Ethical Use of AI and Data, and a research programme on the *Governance of AI and Data Use* in partnership with Singapore Management University.²⁷⁵ The Infocomm Media Development Authority (IMDA) is also setting up a *Digital Services Laboratory* (DSL) programme to bring together relevant parties to identify strategic areas benefiting from faster intermediation, and address digitalisation challenges. Technologies or solutions created by IMDA such as AI libraries, will be released by DSL as open source. Currently, the National Speech Corpus and the Intelligent Sensing Toolbox are available for download.²⁷⁶ The Artificial Intelligence Technical Committee (AITC), formed under the Information Technology Standards Committee (ITSC), will recommend the adoption of relevant international AI standards for Singapore, and further promote awareness of AI emerging standards.²⁷⁷

Human capacity development and private-public collaboration

In terms of human capacity and skills development, AI Singapore, launched in May 2017, is a five-year, SGD50 million (USD36 million) government-wide partnership to enhance Singapore's capabilities in AI.²⁷⁸ The programme consists of four key initiatives focused on AI research, innovative solutions, experiments and an AI apprenticeship programme.²⁷⁹ AI Singapore launched two capacity building programmes in 2018 – AI for Everyone (AI4E) and AI for Industry (AI4I) – aimed at equipping 12,000 Singaporeans over three years with AI knowledge.²⁸⁰

One key focus of AI development in Singapore is on autonomous vehicles (AV). A set of provisional national standards called Technical Reference 68

(TR 68) were introduced by Enterprise Singapore in January 2019 to promote the safe deployment of autonomous AV in Singapore.²⁸¹ Other initiatives to promote AV in Singapore include the National University of Singapore (NUS) and the Singapore-MIT Alliance for Research and Technology (SMART), the A*STAR's Institute for Infocomm Research (I²R),²⁸² and the Centre of Excellence for Testing and Research of Autonomous Vehicles (CETRAN) at Nanyang Technological University.²⁸³ In 2018, the Ministry of Transport announced that the Civil Aviation Authority of Singapore (CAAS) is launching an Aviation Transformation Programme (ATP) that will promote the use of new technologies such as AI to improve airport operations.²⁸⁴

Singapore also announced a collaboration with the World Economic Forum's (WEF) Centre for the Fourth Industrial Revolution (C4IR) to further drive AI and data innovation, including engaging organisations to discuss Singapore's Model AI Framework and facilitate its adoption. The C4IR and IMDA will also develop a measurement matrix for the Model Framework which regulators and certification bodies globally can adopt for assessing whether organisations are responsibly deploying AI. IMDA and the C4IR will also develop a discussion paper outlining policy options on the facilitation of cross-border data flows.²⁸⁵

Lack of soft skills and AI talent gap

Now, more than ever, soft skills, critical thinking, and knowledge of humanities (history, politics, philosophy, sociology) are needed to make high tech products and services useful to society. This is especially important in the case of AI, as citizens increasingly call for governments to put ethical principles and values at the heart of AI plans and initiatives. The PDPC and MAS' respective frameworks have begun looking at this, but are only scratching the surface where it still remains unclear how to implement and apply these frameworks in AI.

On the talent side, this means building pools of talent that can in turn build and sustain digital capabilities. Whether it is specialised technical talent (data scientists, cybersecurity experts, machine-learning programmers) or digital transformation specialists (user-interface designers, software engineers, business developers), it is important to be able to find the right people for the right jobs. Singapore's Smart Nation fellowship, for instance, was designed to attract and develop technical talent that can innovate for the public good.²⁸⁶

Major cybersecurity lapses

The cyber-attack on SingHealth in 2018 saw 1.5 million personal particulars stolen. Investigations revealed that SingHealth had not received the necessary security software updates for 14 months since the last update on the spread of the WannaCry ransomware. Following this, and despite the nationwide calls to tighten cybersecurity, another unauthorised access attempt was reported to have taken place involving about 70 HealthHub accounts. And while the government continues to ramp up resources to strengthen cybersecurity through its *Cyber Security Law* and the *Cyber Security Strategy*,²⁸⁷ it needs to start at the root of the problem and identify current gaps in its own infrastructure, be they technical, political, or operational.

South Korea



National AI Strategy	Yes (forthcoming, announced in 2016)
National Agency	Ministry of Science and ICT (MSIT)
Key AI Organisations	Samsung, LG, Naver, Hyundai
Key Industry/Sector	E-commerce, Smart City, Vehicles, Financial Services, Education, Healthcare
Key AI Technology	Facial/Vocal Recognition, Robotics, Chatbots, Robo-Advisors
Rank in EIU's Automation Readiness Index ²⁸⁸	1 / 25
Rank in Oxford Insights' Government AI Readiness Index ²⁸⁹	26 / 194

Key Policy	Key Agency	Key Sector	Key Objective
Act on Promotion of Information and Communications Network Utilisation and Information Protection ("Information and Communications Network Act") ²⁹⁰	Korea Communications Commission	Cross-sectoral	In March 2019, several amendments were introduced to strengthen data protection standards and to align them with key GDPR requirements (a way to gain access to the European market).
Mid- to Long-Term Master Plan in Preparation for the Intelligent Information Society (2017-2035) ²⁹¹	Ministry of Science and ICT (MSIT)	Cross-sectoral	This policy sets out the overarching vision of a human-centred intelligent information society, and proposes a three-prong, balanced policy regime which has influenced and informed the AI R&D Strategy.
I-Korea 4.0 (2018-2022) ²⁹²	MSIT	Cross-sectoral The policy seeks to promote intelligence, innovation, inclusiveness, and interaction in a wide range of sectors including Smart Cities, Healthcare, Transportation, Education, and Manufacturing.	A joint effort by 21 government departments, agencies and the Fourth Industrial Revolution Committee, the milestone policy is focused on three main pillars (D-N-A): Data, Network, and AI. Going into its second year, there have been several other policies and initiatives introduced, by individual ministries as well as collaborations between ministries, to achieve the I-Korea 4.0 goals. These policies include the AI R&D Strategy, the 6th National Informatisation Master Plan (2018-2022), and the Data and AI Economy Revitalisation Plan (2019-2023).

AI R&D Strategy ²⁹³	MSIT	Cross-sectoral	Geared at developing three areas of AI: technology, application to industry, and support systems such as education and employment.
6th National Informatisation Master Plan (2018-2022) ²⁹⁴	MSIT	Cross-sectoral Areas of focus: Smart Cities/ Villages/Factories, Healthcare, Disaster/ Environment Management, Transport, Manufacturing and Finance.	The policy articulates four goals that are aligned with previous policies released on intelligent technologies and informatisation. The four goals are: (1) an intelligent and responsible digital government, (2) economic growth through digital innovation, (3) a human-oriented digital society, and (4) a secure and intelligent network infrastructure.
Data and AI Economy Revitalisation Plan (2019-2023) ²⁹⁵	MSIT	Cross-sectoral Initiatives include: <ul style="list-style-type: none"> • Creating a convergence cluster of 10 AI unicorn firms • Training 10,000 data and AI talents 	The plan proposes nine policy tasks that promote data collection, distribution, and utilisation – ultimately raising the domestic data market to KRW30 trillion (USD24.7 billion); creating world-class AI innovative ecosystems; and promoting AI-data convergence.



Country Overview

South Korea is energetically developing its AI industry, seeking to become a top-four global AI market and close the gap with leading AI countries.²⁹⁶ With plans to finalise a national AI strategy by the end of 2019, the South Korean government is making considerable efforts to accelerate domestic investment, adoption, and innovation in AI.

In May 2018, as part of the national I-Korea 4.0 plan, the Ministry of Science and ICT (MSIT) announced a new AI R&D Strategy, bolstered by an investment of KRW2.2 trillion (USD1.81 billion).²⁹⁷

Comprising three main components, the strategy aims to:

- Secure AI talent: Establish six graduate schools devoted to AI by 2022, with the goal of training 5,000 AI specialists (1,400 AI researchers and 3,600 data management specialists);
- Develop AI technology: Fund large-scale projects in national defence, medicine, and public safety through an AI R&D challenge similar to DARPA in the United States;
- Support the development of AI start-ups and SMEs: Support emerging AI businesses by creating an AI-oriented start-up incubator.

More recently, the Ministry of Trade, Industry and Energy (MOTIE) indicated that it will introduce AI-based industrial intelligence across all manufacturing sectors, invest KRW8.4 trillion (USD6.91 billion) into the R&D of three key industries: non-memory chips, future mobility, and biotechnology, as well as build 2,000 AI-based factories and enact manufacturing innovation laws by 2030.²⁹⁸

Apart from channelling government budget, the government's emphasis on industry collaboration is also a strong factor in its AI development. Samsung is leading the charge, first establishing its AI research centre in 2017.²⁹⁹ Most recently, Samsung announced plans to invest USD22 billion into AI by 2020, and USD116 billion into non-memory chips to power AI-enabled devices through to 2030.³⁰⁰

Ethical AI is another major priority for the South Korean government. The *Mid to Long Term Master Plan in Preparation for the Intelligent Information Society* is anchored on the concept of a human-centred intelligent information society. This consideration of the human aspect of AI and other intelligent technologies is also re-emphasised in the *6th National Informatisation Master Plan (2018-2022)*. Moving forward, the government also seeks to create a Charter of Ethics for developers and users of intelligent technologies like AI, to reduce the misuse of technology.³⁰¹

As competitive as South Korea's strategy may be, it must also resolve long-standing institutional obstacles. It is, for instance, overcoming the

tendency for government agencies to work in silos. The MSIT is working with the MOTIE, the Ministry of Food and Drug Safety (MFDS), and the Ministry of Health and Welfare (MOHW) to invest KRW42 billion (USD34.6 million) over the next five years to accelerate the development of AI-powered medical devices and systems.³⁰² This pan-government initiative is indicative of the government's recognition of the need to coordinate scarce – and scattered – resources to compete with nimbler economies.

Strengths

Local talent development, early ethics discussions, industry collaboration

As outlined in I-Korea 4.0 and other related policies, the approach seeks not only to be comprehensive but sustainable as well. The foresight to not only focus government investment on the development of technologies but also on the talent and infrastructure needed to support and sustain development in the long-term is a clear strength.

In addition, the consideration and emphasis of ethics from the onset is commendable as it sets up the policy space to discuss a fundamental concern of society at large. For instance, the Mid to Long Term Master Plan in Preparation for the Intelligent Information Society is anchored on the concept of a human-centred intelligent information society. This consideration of the human aspect of AI and other intelligent technologies is also re-emphasised in the *6th National Informatisation Master Plan (2018-2022)*. Moving forward, the government also seeks to create a Charter of Ethics for developers and users of intelligent technologies like AI, to reduce the misuse of technology.³⁰³

Apart from channelling government budget, the government's emphasis on industry collaboration is also a strong factor in its AI development. In South Korea, the private sector plays an instrumental role in accelerating the AI industry. Samsung is leading the charge, first establishing its AI research centre in 2017.³⁰⁴ Most recently, Samsung announced plans to invest USD22 billion into AI by 2020, and USD116 billion into non-memory chips to power AI-enabled devices through to 2030.³⁰⁵

Lack of start-ups, domestic venture capital, and international collaboration

A large portion of the country's AI developments have been concentrated in the activities of industry incumbents and conglomerates, potentially hindering the innovation and growth of the AI start-ups and the tech industry at large. While there are signs of improvement, with the investment and engagement of smaller firms and start-ups—for example the AI Quantum Computing Information Technology Research Centre set up by KAIST and funded by the government, domestic telecommunication giant KT and three domestic SME tech firms—more can be done on this front to engage smaller players in the market.³⁰⁶ This is compounded by the fact that the domestic venture capital ecosystem is relatively underdeveloped in South Korea, resulting in a small number of AI-focused start-ups to begin with.³⁰⁷ To alleviate this, the government could consider regulatory changes that would encourage the development of venture capitalism in South Korea.

In addition, addressing the lack of experienced and competent AI talent will take time. Nurturing domestic AI talent could also benefit from greater facilitation of international collaboration and information exchange. Whilst many domestic universities and research institutes like the Korea Advanced Institute of Science and Technology (KAIST), National Institute for Science and Technology in Ulsan (UNIST), Pohang University of Science and Technology (POSTECH) and Electronics and Telecommunications Research Institute (ETRI) have increasingly focused on AI and machine learning, their scientific publications have had minimal exposure and influence outside South Korea, and there is little international collaboration that promotes innovation and growth.³⁰⁸ This is one area that the government could work on in conjunction with the training of AI talents.

Thailand



National AI Strategy	No
National Agency	Ministry of Information and Communication Technology, Ministry of Digital Economy and Society (MDES)
Key AI Organisations	AI Technologies, OxygenAI, Jitta
Key Industry/Sector	E-commerce, Manufacturing, Agriculture, Smart City, Vehicles, Financial Services, Healthcare, Education
Key AI Technology	Facial/Vocal Recognition, Robotics, Machine Learning, Video Analytics, Chatbots, Algorithms
Rank in EIU's Automation Readiness Index ³⁰⁹	n/a
Rank in Oxford Insights' Government AI Readiness Index ³¹⁰	56 / 194

Key Policy	Key Agency	Key Sector	Key Objective
Draft Ethical Guidelines for AI (2019) ³¹¹	Ministry of Digital Economy and Society (MDES)	Cross-sectoral	Six key AI principles are outlined in the draft: AI must contribute to competitiveness and sustainable development; it must comply with law and international standards; it must be developed with accountability and responsibility; it must uphold security and privacy; it must promote equality, diversity, inclusion, and fairness; and it must be made reliable.
The Twelfth National Economic and Social Development Plan (2017-2021) ³¹²	Office of the National Economic and Social Development Board (NESDB)	Cross-sectoral	Use advanced technologies such as AI, IoT, smart devices and robotics to strengthen existing production and services.
Thailand 4.0 (2016) ³¹³	Ministry of Digital Economy and Society (MDES)	Cross-sectoral	To develop Thailand into a smart and technology-driven economy. This policy also encourages AI adoption in its Smart Cities initiative.
Digital Park Thailand (2018) ³¹⁴	Digital Economy Promotion Agency (DEPA)	Cross-sectoral	Serve as the digital and innovation hub of the ASEAN sub-region.
Digital Government Plan (2017-2021) ³¹⁵	Digital Government Agency (DGA)	Public Sector	Transform the Thai government into a digital government and digitise all sectors including agriculture, tourism, education, health and medicine, investment, disaster prevention, and public administration.



Country Overview

Thailand has yet to formulate an overarching national AI policy. For now, says Dr Passakon Prathombutr, Executive Vice President of the Digital Economy Promotion Agency (DEPA), “Thailand is focusing on capacity building, re-skilling, and up-skilling its manpower to prepare society for the wide impact of AI. This is an essential step to become a regional and global hub for AI.”³¹⁶

In this context, most of Thailand’s AI initiatives are embedded within policies and strategies developed by different ministries and agencies to bolster the development of AI-related technologies, including the *Twelfth National Economic and Social Development Plan (2017-2021)*,³¹⁷ the *Thailand 4.0 policy*,³¹⁸ and *Digital Park Thailand*.³¹⁹

Thailand 4.0, for example, emphasises the growth and spread of advanced technologies such as AI, IoT, smart devices, and robotics to transform existing production and services into smart, value-added production and services³²⁰ – thus diversifying the economy and helping escape the “middle income trap”. The *Twelfth National Economic and Social Development Plan (2017-2021)*, meanwhile, is partly centred around the use of advanced technologies such as AI, IoT, smart devices, and robotics to transform existing production and services into smart, value-added production and services.³²¹

Thailand has indeed seen tremendous growth in its technology sector in recent years, and could very soon lead Southeast Asia in terms of industrial AI adoption. According to statistics from the Thailand Board of Investment (BOI), shipments of industrial robots increased by 133% to 7,500 units between 2013 and 2018, mainly driven by the automotive and electronics and electrical appliance industries. 50% of manufacturers in Thailand are considering adopting automation systems within the next three years.³²²

At the same time, however, AI start-ups are relatively new in Thailand and are still in the initial stage of their AI journey.³²³ Dr Passakon Prathombutr notes, “The main AI trend in Thailand is in the area of natural language processing, which includes sentiment analysis and machine translation. There is also the field of video content analysis, which focuses on facial recognition and license plate recognition (LPR).”³²⁴ In 2018, around 20 Thai enterprises – ranging from conglomerates to banks, telecom operators and retailers – adopted some type of AI solution, driven by a need to differentiate their products and services.³²⁵ It is estimated that some 100 enterprises in Thailand will embrace AI in 2019.³²⁶

Strengths

Innovation and development across multiple sectors

AI is being adopted across various industry verticals in Thailand. The healthcare sector, already a major economic asset for Thailand, is set to benefit from greater automation. The Thai Ministry of Public Health has started leveraging machine learning and computer visualisation systems to help its affiliated government agencies identify public health risks and disease hotspots and mitigate the risk of epidemics.³²⁷ The Khon Kaen smart city initiative, meanwhile, is undertaking a Smart Health Project encompassing smart ambulances and preventive healthcare services in a joint effort between local healthcare providers, academics, and the Thai Government.³²⁸

AI is also used to predict babies' health and development based on their parents' profile to reduce medical costs for the government. To this extent, the Ministry of Digital Economy and Society (MDES) is setting up a "big data sandbox" – an experimental regulatory 'safe space' that allows organisations to test digital products and services without putting data or systems at risk – for other ministries to run similar experiments with their own datasets.³²⁹

The banking sector plans to move to facial recognition for electronic know-your-customer regulations, as well as blockchain and machine learning for fraud detection. For Dr Passakon Prathombutr, "AI is shaping the future of the financial services industry in Thailand, with more local and foreign Fintech companies implementing AI in their processes and operations."³³⁰ The oil and gas industry is also implementing AI to detect dangerous conditions for personnel, while retail businesses use AI for customer experience and loyalty programmes.³³¹

Public-private partnerships to boost local talent and development

To further facilitate and enable AI use and development, the Thai government has engaged in public-private partnerships to improve the skillset of its economy to meet its AI ambitions. For instance, Thailand's National Science, Technology and Innovation (STI) Policy Office is working with Google and the United Nations Economic and Social Commission for Asia and the Pacific (UN-ESCAP) on a joint *AI for Social Good* initiative, bringing together researchers, policy makers, NGOs, and the private sector from across the APAC region to discuss the uses of AI for sustainable development.³³²

Likewise, the Ministry of Education is working with the British Council and Chulalongkorn University's Computer Engineering Department to develop an AI enabled system capable of evaluating students' speaking and writing abilities.³³³ The Office Vocational Education Commission (OVEC) is partnering with private sector entities to boost STEM skills and spearhead the use of new technologies like AI, automation and robotics.³³⁴ And Google, Microsoft, Cisco, and Huawei are collaborating

with the Digital Economy Promotion Agency (DEPA) to create a learning curriculum that will produce 40,000 digital and high-tech workers by 2022.³³⁵ The DEPA is also working with Kasetsart University to open the Digital Academy Thailand, aimed at educating and developing digital skills in AI and Data Science.

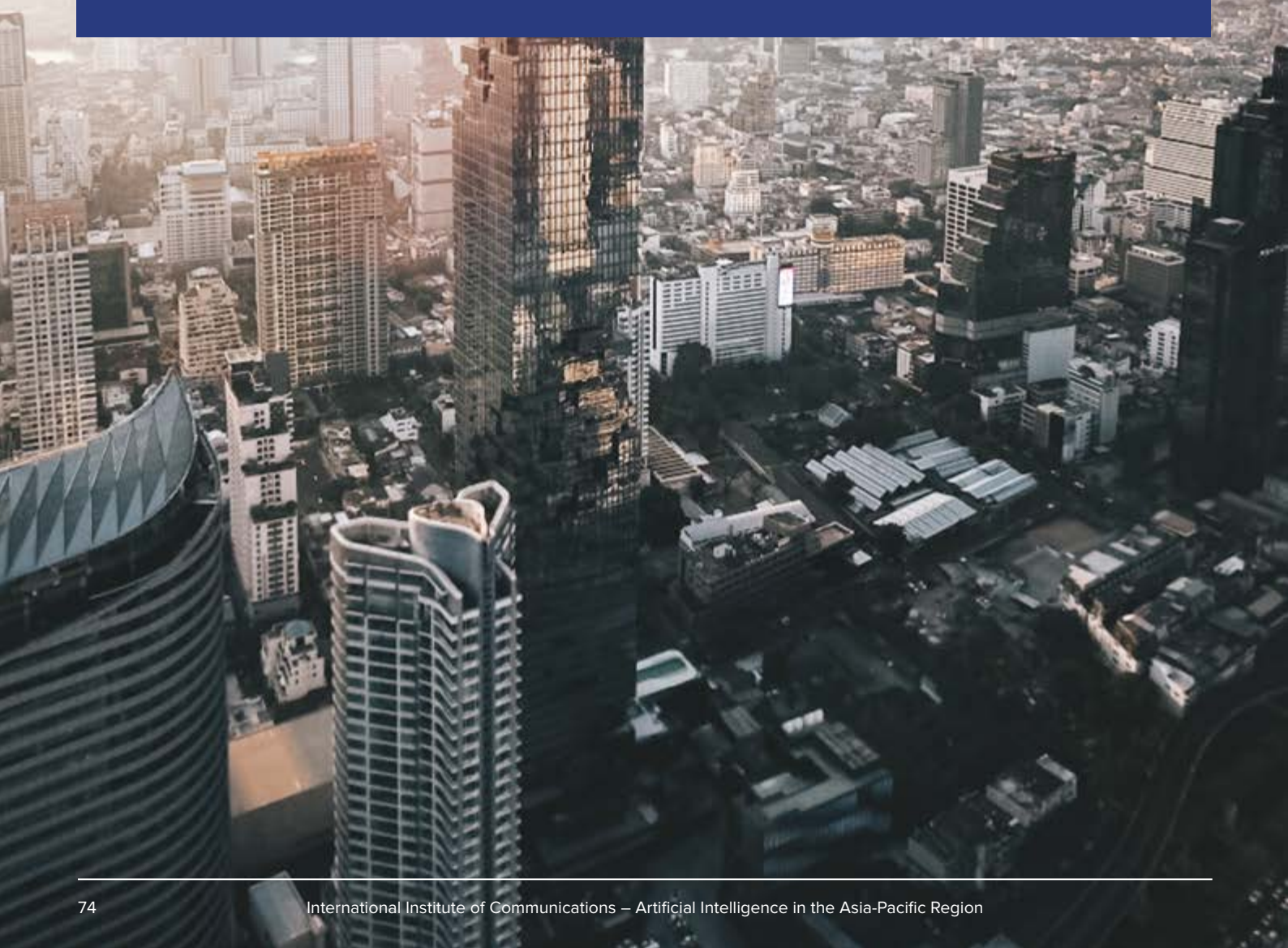
DEPA also spearheaded the Digital Park Thailand, which is expected to serve as the digital and innovation hub of the ASEAN sub-region. A flagship project of the Eastern Economic Corridor (ECC), it aims to create a favourable ecosystem to enable the development of innovative solutions, for which USD160 million has been earmarked. An IoT Institute will be located inside the park's Digital Valley, that will use IoT and AI as key technologies for development.³³⁶ Likewise, the *Thai People Map and Analytic Platform (TPMAP)* developed by the National Electronics and Computer Technology Centre (NECTEC) applies AI to reduce poverty in the country. NECTEC plans to initiate its own R&D projects, such as National Language Processing to enable the business sector to develop its own AI usage model.³³⁷

Lack of clear government guidelines

Although the Thai government aims to make better use of AI and prioritise the development and adoption of AI, it has yet to develop clear strategies and guidelines at the national level. Additionally, there is limited strategic coordination between the country's existing national plans to promote AI, as well as limited success metrics to evaluate and assess where gaps still exist and need to be addressed.

Lack of AI-capable talent and R&D initiatives

Thailand currently lacks sufficient talent and R&D in AI technology. To address this gap, Thailand is examining the possibility of adding AI to high school curricula to promote AI among the youth.³³⁸ Another challenge for Thailand is the fact that most workers are low- or mid-level employees, meaning several of them may be replaced by automation, especially in the sectors of healthcare, banking, and retail. As for high-level employees and senior management, new jobs can be found in the field of data analysis, but preparing them to take on these new skillsets will take time.³³⁹



v.

Conclusion

Design Principles for Effective AI Policies

Policy-makers have an important role to play in ensuring that AI becomes a tool for societal good and does not simply exacerbate or aggravate current socio-economic challenges in APAC. From best practices to ethical guidelines, policy-makers can help individuals, organisations, and communities take advantage of the benefits of AI and its associated innovations, while mitigating any unintended or as-yet unidentified risks.

This examination of countries' specific policy approaches to AI suggests a number of design principles that APAC policy-makers are looking into when shaping ecosystems, preparing talent, and building trust.



Design Principle 1: Shaping AI Ecosystems

From investment and procurement schemes to labour policies and open data mechanisms, the public sector stands to play a significant role in the expansion and adoption of AI technologies. Governments that design sound, *coherent* national plans around AI and allow their institutions to execute these plans are one step ahead of governments debating the nature or value of AI systems.

Enable innovation by reducing red tape and boosting entrepreneurship

Across APAC, red tape remains a major obstacle for technology entrepreneurs. In most cases, this is not due to governments being against the emergence of innovative businesses, but a natural consequence of having outdated policies and/or slow-moving bureaucracies. China recently overcame this constraint by progressively testing and rolling out pro-innovation reform measures.

First piloted in eight Chinese cities and regions, the approach allowed the authorities to monitor and evaluate the effectiveness of the reforms before implementing them on a wider scale.³⁴⁰ In case of security or compliance concerns, regulatory sandboxes – special regulatory provisions that allow businesses to test innovative technologies in a controlled environment while giving governments room to make regulatory experiments – can be set up, as Singapore has done to encourage Fintech innovation.³⁴¹

Make data open and available

AI technologies require a steady diet of reliable, actionable, and secure data to learn and function. But many industries across the region struggle to track, capture, store, and aggregate operational data in a way that informs AI systems. In many organisations, data sits in silos with fragmented ownership. In others, vast quantities are collected but never analysed. Governments can help organisations institute effective data governance protocols – including data anonymisation processes – so that AI systems can better access them and learn from them. Governments can also bridge data gaps by opening their own data; making government data freely available for everyone to access, use, and republish without restrictions from copyright, patents, or other mechanisms of control can help AI technologies advance in the interest of citizens and consumers alike. In this regard, South Korea is the top performing country in the APAC region. Both the Open Data Barometer³⁴² and the OECD³⁴³ note its willingness to make government data available on national portals as well as useful to the delivery of government services and benefits.

Facilitate cross-border flows and regional cooperation

Cross-border data flows are imperative to drive AI growth.³⁴⁴ In the age of hyper-connected people, devices, and platforms, data flows across multiple locations and jurisdictions are very difficult to contain within physical and virtual borders. Facilitating the movement of data requires effective and consistent cooperation between governments that share a common goal. Initiatives such as the APEC Cross-Border Privacy Rules (CBPR) system can ensure cross-border flows of data and personal information are as useful to AI technologies as they are secure for users. In this regard, Japan stands out as both a regional and global leader. According to the Salesforce Cross-Border Data Flows Index (CBDFI), Japan has the least restrictive and the most consistent approach to cross-border data flows.³⁴⁵ Japan has indeed ramped up efforts to create a regulatory environment that both enables and protects the free flow of data across boundaries – ensuring that the movement of data across borders

is not hindered by the regulatory safeguards designed to keep it secure.

Strengthen multi-lateral/regional cooperation

APAC has copious AI ‘assets’, such as well-funded centres of research, populous and data-generating consumer markets, and government expertise in coordinating value networks. Working together, governments, entrepreneurs, technology firms, and research institutes operating in APAC can build a collaborative ecosystem that addresses common development challenges.

Design clear, comprehensive government plans

AI, like all other digital technologies able to transform entire economic sectors, is most effective when guided by sound, coherent policies. The digital age is the domain of innovative tech companies but driving the adoption of disruptive products and services requires the support of governments with both vision and capability. Overall, it seems that public spending is poised to become as important as governments’ planning and implementation mechanisms. In Australia, a number of AI professionals have called for more public spending in AI.³⁴⁶

Address inequalities that prevent wider AI adoption/deployment

The Salesforce AI Readiness Index shows marked differences between mature and emerging economies, suggesting that the digital divide that has long characterised the region can and may already be carrying over to the AI sector.³⁴⁷ According to the World Bank, the prolongation of the digital divide is to be expected, as the spread of digital technologies has yet to equate to the spread of digital dividends.³⁴⁸ For the ITU, this divide is more of a temporary phenomenon that will naturally taper off as AI technologies gain in maturity and are used for social good.³⁴⁹



Design Principle 2: Preparing AI Talent

AI technologies require advanced skills and workers who can develop and maintain complex AI systems and applications. But recent estimates find that there are only 300,000 AI engineers, researchers, and practitioners worldwide, when several millions of them will be needed over the next two decades.³⁵⁰ Across the board, companies report that finding the right talent is the biggest hurdle they face in trying to integrate AI into their existing operations. And the shortage is even more acute in the APAC region.³⁵¹

Adapt educational institutions and what they teach

Curriculum reform of both compulsory and post-compulsory education is gaining traction in most of the countries in the Index. In Singapore, coding has been introduced to primary and secondary school curricula, as well as STEM coursework in secondary and vocational training programmes.³⁵² Such initiatives could be used to introduce students to the more abstract facets of AI, including the role of ethics in computer science, the influence of biases in society and in databases, and the importance of data quality when using data-driven technologies.

Use AI to make education better

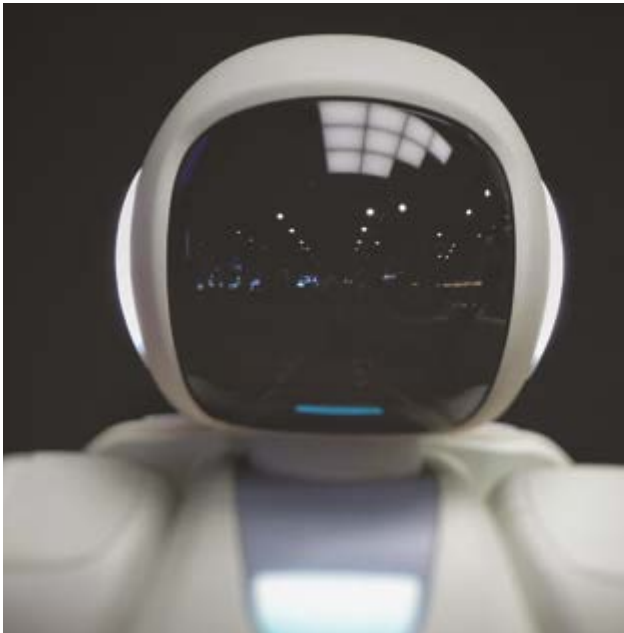
Big data and analytics can be used to improve both learning and teaching experiences. Capturing data on student demographics, school attributes, and individual trajectories can help decision-makers optimise the way they allocate resources or adjust policies. AI-based Intelligent Tutor Systems (ITS), for example, can deliver precise support to students. Universities in Singapore and Malaysia are experimenting with predictive software that detects the likelihood of students dropping out of a class.³⁵³ AI systems can also help teachers improve their workflows, by relieving them of some of the more routine, time-consuming tasks of teaching, including grading and record-keeping.

Support upskilling and lifelong learning schemes

According to some estimates, AI will push as many as 375 million workers globally – or 14% of the global workforce – to reskill or make a transition to new occupational categories.³⁵⁴ Lifelong learning and upskilling schemes are already helping workers upgrade and diversify their skills. Such programmes could be expanded to include AI-specific skills such as applied statistics, computational thinking, graphical modelling, robotics, programming languages, and cognitive science theory.

Prepare workers to the challenges of tomorrow

A recent study shows that some 60% of occupations have at least 30% of constituent work activities that could be automated, suggesting that many workers will be impacted by the rise of automation technologies.³⁵⁵ But even with automation, the demand for skilled and specialised workers will keep on growing, as productivity gains move the labour market towards a new class of “smart”, knowledge-intensive jobs. To meet the needs, expectations, and demands of a fast-evolving labour market, workers will have to learn to work with machines instead of against them.



Design Principle 3: Building Trust in AI

Privacy and security are central to the development and deployment of AI technologies. As AI grows increasingly complex and widespread, it will become inescapable for AI-driven organisations to comply with laws that regulate the way individuals' and organisations' data is collected, stored, used, and protected. In this context, trust will be crucial for the rise of AI in day-to-day functions. Not only must algorithms be understandable, transparent, reliable, and trustworthy, the organisation using it must be accountable in case it leads to errors or misuses.

Enforce privacy principles and practices

“Privacy by Design” comprises a number of technical and organisational measures at each stage of the data collection and processing chain. It pushes organisations to consider the privacy and security requirements of their data-dependent products, systems, and operations every step of the way. It also includes security measures such as access controls, audit logs, encryption, and data segregation to keep personal data separate from other forms of data. Conducting regular privacy impact assessments (PIA) can also help identify and mitigate privacy risks before the actual processing of personal data. While AI systems may involve innovative, complex, and sometimes unexpected/unintended uses of personal data, the use of PIAs help organisations better assess the risks and impacts involved in the processing of personal data.

Make transparency a key feature of AI products and services

Increasingly complex digital products and services require increasingly complex uses of data. Recent scandals involving the lack of consent to use personal data for decision-making have driven individuals to demand more transparency on what personal data is processed and who the data is given to.³⁵⁶ As the number of self-managing, hyper-connected devices grows across homes, offices, and even public spaces, it is crucial for AI

systems to be transparent; not only how, but also why a decision or an action was reached. Making AI explainable in this manner allows consumers to better understand how AI systems work and affect them.

Control the way data is collected and used

There are many ways to ensure personal data is used in the way it is meant to be used. Data anonymisation – deleting or encrypting personally identifiable information to make the data irreversibly untraceable and unreproducible – allows AI systems to use data without using or divulging any personal or private information, mitigating the risks of data breaches and accidental disclosures. Data limitation policies, meanwhile, force organisations to limit the use of personal data for the purpose for which it was originally collected, and for which consent was provided. Finally, data minimisation reduces the amount of data collected and processed by establishing at the onset what data is relevant and necessary for a given purpose.

Enable ethical, unbiased AI

For AI to grow and deliver on its promises, it must be designed and deployed in a manner that earns and keeps the trust of individuals, organisations, and governments alike. Making AI trustworthy entails embedding ethical principles into AI systems, ensuring they act in a fair, inclusive, and humane

manner.³⁵⁷ One way of ensuring AI technologies positively impact the world around them is to identify and minimise the risk of bias, especially when AI systems are in a position to influence recommendations and predictions.

AI algorithms are only as good as the data they are fed to learn, which means it is up to humans to manually take fairness and diversity into account as datasets are built.

Use AI to strengthen cybersecurity

Researchers in the United States and China have successfully used commercially available AI systems to dial phones and open websites without the knowledge of the AI systems' users, a short step to more malicious intents, such as unlocking doors and withdrawing funds.³⁵⁸ Compromised AI systems are a real risk, especially when the absence of human intervention can allow it to go undetected. But AI can be used to patch its own weaknesses; AI can improve existing detection and response capabilities, as well as create new preventative defence protocols. Companies can use AI platforms to streamline complex, manual, or time-consuming inspection processes, allowing specialists to devote their attention to more immediate threats.

Use AI for good and teach AI to do good

Collaborating with private-sector organisations, governments can share AI tools and resources, datasets, and supporting knowledge and expertise to address pressing sustainability challenges and help vulnerable populations. Governments can also drive and support efforts aimed at better understanding and addressing the legal and ethical issues that AI technologies create. The recent work of the IIC with the UN-ESCAP – Artificial Intelligence for Economic Growth and Social Good – demonstrates the importance of looking at the way in which policy makers might understand and address the issues raised by the increasing use of AI as both an economic and societal enabler.³⁵⁹



VI.

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