

# Mapping Singapore's Journey and Approach to AI Governance

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# Key Takeaways

- AI's state of development and its double-edged potential for both benefit and harm continue to inform Singapore's fundamental approach to AI governance.
- This approach takes into consideration two major contextual factors: First, Singapore is likely to remain predominantly a deployer of AI solutions, rather than a developer. Second, Singapore will have to take a multi-stakeholder approach by ensuring that different players are able to act together to become more than the sum of its parts.
- Singapore's human-centric approach to AI governance is reflected in three inter-linked initiatives: the Model AI Governance Framework, the Advisory Council on the Ethical Use of AI and Data, and the Research Programme on the Governance of AI and Data Use.
- As a sector-agnostic document, the Model Framework is intended to operate above individual sectors, leaving room for individual sectors to define principles and values that are more relevant to them.
- Internationally, there is increasing governmental interest in AI regulation in specific applications, such as for autonomous vehicles, data privacy, and facial recognition.
- Amidst these developments, Singapore's regulatory approach may be described as pragmatic and lighter-touch. It has done so by taking a sector-specific approach guided by overarching guidelines, while studying potential longer-term issues.
- Going forward, there is a need to continue supporting and sustaining a trusted AI ecosystem. To that end, Singapore needs to continue to provide guidance in the use of AI, and to be responsive to industry realities, to sustain a trusted AI ecosystem.

# 1 Fundamental Approach to AI Governance

## 1.1 Introduction to AI's Potential

To some, it can appear as though artificial intelligence (“AI”) has finally achieved the full potential envisaged for it when the term was first coined in the 1950s. As a cognitive form of technology,<sup>1</sup> AI is said to have substantial implications across sectors such as science, education, industry and education, at the societal, national and supranational levels.<sup>2</sup>

The potential impact of AI on human society, however, is a double-edged one. AI has the potential to positively transform the future of humanity. It can help organisations and nations provide new goods and services, boost productivity, enhance competitiveness, improve economic growth and produce a better quality of life.<sup>3</sup> AI, however, also introduces new ethical, legal and governance challenges. These include the risks of unintended discrimination, unfair outcomes, worsening existing inequalities and divides, and issues relating to consumers’ knowledge about how AI is involved in making significant or sensitive decisions that affect them.<sup>4</sup>

- 1 “Preliminary Study on the Ethics of Artificial Intelligence.” UNESCO World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) (<https://unesdoc.unesco.org/ark:/48223/pf0000367823>).
- 2 It has perhaps become a truism to say that there is no widely accepted or authoritative definition of AI. Nevertheless, AI is defined (non-exhaustively) in the Model AI Governance Framework as a set of technologies that seek to simulate human traits such as knowledge, reasoning, problem solving, perception, learning and planning, and, depending on the AI model, produce an output or decision (such as a prediction, recommendation, and/or classification).
- 3 “Model Artificial Intelligence Governance Framework Second Edition.” Personal Data Protection Commission of Singapore (<https://www.pdpc.gov.sg/-/media/files/pdpc/pdf-files/resource-for-organisation/ai/sgmodelaigovframework2.pdf>).
- 4 “Model Artificial Intelligence Governance Framework Second Edition.” Personal Data Protection Commission of Singapore, (<https://www.pdpc.gov.sg/-/media/files/pdpc/pdf-files/resource-for-organisation/ai/sgmodelaigovframework2.pdf>). See also “Preliminary Study on the Technical and Legal Aspects Relating to the Desirability of a Standard-Setting Instrument on the Ethics of AI.” UNESCO COMEST (<https://unesdoc.unesco.org/ark:/48223/pf0000367422>).

## 1.2 Singapore's Fundamental Approach to AI Governance and Regulation

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AI's state of development and its double-edged potential up to the present moment continue to inform Singapore's fundamental approach to AI governance.<sup>5</sup> On one hand, there is a need to continue fostering innovation and the adoption of AI. On the other, AI's potential risks must be managed and addressed for society to trust AI technologies and adopt them. In fact, a more perceptive reader might notice the chicken-and-egg dimension of the situation: adoption requires society's trust, but for society to increasingly trust such systems, greater adoption is also required.

The innate connection between innovation and adoption, and trust and governance, is reflected in Singapore's high-level strategy for AI. The National AI Strategy ("NAIS"), which was publicly announced in November 2019 and overseen by the Smart Nation and Digital Government Office ("SNDGO"), calls for Singapore to be "at the forefront of development and deployment of scalable, impactful AI solutions" and "a global hub for developing, test-bedding, deploying, and scaling AI solutions".<sup>6</sup> To realise this vision, the NAIS envisages five "ecosystem enablers" to increase AI adoption in Singapore. Among these enablers is that of a "progressive and trusted environment", which is overseen by the Infocomm Media Development Authority ("IMDA"). In this regard, the NAIS notes that "Singapore's governance and regulatory regime must strike the right balance between fostering technology and business innovation, while safeguarding citizens' interests".<sup>7</sup>

The IMDA, a statutory board under the purview of Singapore's Ministry of Communications and Information (and also the public agency designated as Singapore's Personal Data Protection Commission ("PDPC")),<sup>8</sup> has endeavoured to achieve this "right balance" by adopting a risk-based, accountability-based, light-touch and voluntary governance approach.<sup>9</sup> At this juncture, it should be highlighted that this approach takes into consideration two major contextual factors. First, as a small country, Singapore is likely to remain predominantly a deployer of AI solutions, rather than a developer. While this may be apparent from Singapore's physical size, two statistics highlight this. One, a quick perusal of the list of top global AI enterprises with high growth shows a list dominated by companies from the US, China and India, with no Singaporean companies on the list.<sup>10</sup> Two, government R&D spending on AI is valued at \$1.2 billion, a far cry from China's \$59 billion, or even Japan's \$14 billion and South Korea's \$8.2 billion.<sup>11</sup> In fact, Oxford Insight's Government AI Readiness Index 2020 notes that Singapore's "lowest scoring dimension in any pillar is the Size dimension, reflecting the fact that the country does not have a technology sector on the scale of other global leaders

- 5 Natarajan, Aishwarya. 2020. "KAS-Strathclyde Interview Series on AI, Global Governance and Ethics: Interview with Mr Zee Kin Yeong." KAS, 21 September. (<https://www.kas.de/en/interview/detail/-/content/kas-strathclyde-i...on-ai-global-governance-and-ethics-interview-with-mr-zee-kin-yeong>).
- 6 "National AI Strategy." Smart Nation and Digital Government Office ([https://www.smartnation.gov.sg/docs/default-source/default-document-library/national-ai-strategy.pdf?sfvrsn=2c3bd8e9\\_4](https://www.smartnation.gov.sg/docs/default-source/default-document-library/national-ai-strategy.pdf?sfvrsn=2c3bd8e9_4)). 7.
- 7 "National AI Strategy." Smart Nation and Digital Government Office ([https://www.smartnation.gov.sg/docs/default-source/default-document-library/national-ai-strategy.pdf?sfvrsn=2c3bd8e9\\_4](https://www.smartnation.gov.sg/docs/default-source/default-document-library/national-ai-strategy.pdf?sfvrsn=2c3bd8e9_4)). 64.
- 8 "Personal Data Protection Act 2012." Singapore Statutes Online. (<https://sso.agc.gov.sg/Act/PDPA2012>). 5(1).
- 9 Natarajan, Aishwarya. 2020. "KAS-Strathclyde Interview Series on AI, Global Governance and Ethics: Interview with Mr Zee Kin Yeong." KAS, 21 September. (<https://www.kas.de/en/interview/detail/-/content/kas-strathclyde-i...on-ai-global-governance-and-ethics-interview-with-mr-zee-kin-yeong>).
- 10 "Global artificial intelligence industry whitepaper." Deloitte China, 2019. (<https://www2.deloitte.com/cn/en/pages/technology-media-and-telecommunications/articles/global-ai-development-white-paper.html>).
- 11 "Government AI Readiness Index 2020." Oxford Insights. (<https://static1.squarespace.com/static/58b2e92c1e5b6c828058484e/t/5f7747f29ca3c20ecb598f7c/1601653137399/AI+Readiness+Report.pdf>). 107.

in AI readiness”.<sup>12</sup> Second, for Singapore to be able to punch above its weight, Singapore will have to take a multi-stakeholder approach by ensuring that different players are able to act together to become more than the sum of its parts.<sup>13</sup> These factors have shaped IMDA’s and PDPC’s priorities in developing Singapore’s “human-centric approach to AI governance”.<sup>14</sup>

This paper aims to situate Singapore’s “human-centric approach” amidst a range of regulatory approaches present internationally, with particular reference to the regulatory approaches of the US, the EU, and China. To this end, this paper will first elaborate on Singapore’s journey in AI governance so far, detailing the initiatives that it has taken, and how its approach dovetails with the context of specific industries. It will then scan the regulatory approaches, based on publicly available information, of the US, the EU and China, and will assess Singapore’s position vis-à-vis these three major international players in AI. The final section concludes with areas that Singapore may look into to further develop its approach to AI governance.



12 “Government AI Readiness Index 2020.” Oxford Insights.; That Singapore’s strengths lie in deployment, and not in development, was also reflected in comments made by Dr. Vivian Balakrishnan, Singapore’s Minister-in-Charge of the Smart Nation Initiative, in which he noted: “We will never have the oceans of data that China has, or the depth and unique ecosystem that Silicon Valley has. But I think we have a niche when it comes to deployment, especially in areas where we already have a competitive advantage, for instance, healthcare, education, logistics, Smart City, Urban Solutions and security”. See “Committee of Supply – Head U (Prime Minister’s Office).” Parliament of Singapore, 2020. (<https://sprs.parl.gov.sg/search/sprs3topic?reportid=budget-1297>).

13 See Oxford Insight’s Government AI Readiness Index 2020, which notes that “[s]upporting collaborations between academia, government and industry is also a key theme in Singapore’s policies supporting its AI sector.”

14 “Singapore’s Human-Centric Approach to AI Governance.” Paris Peace Forum, 17 June 2019. ([https://parispeaceforum.org/porteurs\\_projet/singapores-approach-to-human-centric-ai/](https://parispeaceforum.org/porteurs_projet/singapores-approach-to-human-centric-ai/)).

# 2 Singapore's Journey to AI Governance

## 2.1 Regulators' Roundtable and Model Framework

Singapore's human-centric approach to AI governance is reflected in three inter-linked initiatives: the Model AI Governance Framework ("**Model Framework**"), the Advisory Council on the Ethical Use of AI and Data ("**Advisory Council**"), and the Research Programme on the Governance of AI and Data Use ("**Research Programme**"). This section will set out in detail the formulation, objectives and present state of these initiatives, and how these initiatives sit alongside sector-specific initiatives and Singapore's involvement in the discourse on AI governance and regulation in the international arena.

**N** The Model Framework saw its beginnings take shape from the Regulators' Roundtable, a community of practitioners convened by the PDPC in 2017, comprising industry regulators and public agencies overseeing areas such as finance, law, healthcare, and transport (among other sectors). It was convened to allow public agencies in Singapore to align their approaches towards governing AI. Based on the views sought from the roundtable discussions, the PDPC published a Discussion Paper on AI and Personal Data ("**Discussion Paper**") in June 2018 as a precursor to the Model Framework.<sup>15</sup> The Discussion Paper set out preliminary views and positions on the human-centric, responsible and ethical use of AI, and set the groundwork for the recommendations eventually published in the Model Framework.

**T**he Model Framework is a "voluntary" and "ready-to-use" tool that enables organisations deploying AI solutions at scale (be it to offer products and services, or to improve operational efficiency) to do so in a

<sup>15</sup> "Discussion Paper On Artificial Intelligence (AI) And Personal Data – Fostering Responsible Development And Adoption Of AI." Personal Data Protection Commission of Singapore, 2018. (<https://www.pdpc.gov.sg/-/media/Files/PDPC/PDF-Files/Resource-for-Organisation/AI/Discussion-Paper-on-AI-and-PD---050618.pdf>).

human-centric and responsible manner.<sup>16</sup> It is also billed as a “living” document,<sup>17</sup> which indicates the intention for the document to evolve through future editions alongside technological or societal developments. The Second Edition of the Model Framework was launched by Singapore’s Minister for Communications and Information, at the World Economic Forum Annual Meeting 2020.<sup>18</sup> This follows the launch of the First Edition at the World Economic Forum Annual Meeting 2019, where it was recognised as Asia’s first AI governance framework of its kind.<sup>19</sup>

As a guide and a soft regulatory tool, the Model Framework identifies ethical principles for the adoption of AI and (one could say with typical Singaporean pragmatism) helps readers translate these ethical principles into implementable practices. In particular, the Model Framework’s target readers are organisations and companies that are deploying AI technologies in the private sector.<sup>20</sup> To that end, the Model Framework aims to assist organisations to achieve the following objectives:

**B**uild consumer confidence in AI through these organisations’ human-centric and responsible use of such technologies in a way that mitigates the various risks in AI deployment;

**D**emonstrate reasonable efforts to align internal policies, structures and processes with relevant accountability-based practices in data management and protection (e.g., Singapore’s Personal Data Protection Act or the OECD’s Privacy Principles).

As regards its scope, the Model Framework is sector-, scale- and business model-agnostic.<sup>21</sup> It provides a baseline set of considerations and measures for organisations, regardless of their industry, size or business model, to adopt or adapt according to their requirements. As the Model Framework also does not focus on specific systems, softwares or technologies, nor on specific AI methodologies, it is also technology- and algorithm-agnostic.

Substantively, the Model Framework is guided by two fundamental guiding principles that aim to promote trust and understanding in AI. First, that organisations using AI in decision-making should ensure that the decision-making process is explainable, transparent and fair. Second, that AI systems should be human-centric.<sup>22</sup> In particular, the protection of human well-being and safety should be primary considerations in designing, developing and using AI.

These guiding principles are subsequently translated to implementable

<sup>16</sup> “Model Artificial Intelligence Governance Framework Second Edition.” Personal Data Protection Commission of Singapore, 2020. (<https://www.pdpc.gov.sg/-/media/files/pdpc/pdf-files/resource-for-organisation/ai/sgmodelaigovframework2.pdf>). Para 2.2.

<sup>17</sup> “Model Artificial Intelligence Governance Framework Second Edition.” Personal Data Protection Commission of Singapore, 2020. Para 2.2.

<sup>18</sup> “Singapore and World Economic Forum driving AI Adoption and Innovation.” Infocomm Media Development Authority of Singapore, 2020. (<https://www.imda.gov.sg/news-and-events/Media-Room/Media-Releases/2020/Singapore-and-World-Economic-Forum-driving-AI-Adoption-and-Innovation>).

<sup>19</sup> “Singapore Releases Asia’s First Model AI Governance Framework.” Infocomm Media Development Authority of Singapore, 2019. (<https://www.imda.gov.sg/news-and-events/Media-Room/Media-Releases/2019/singapore-releases-asias-first-model-ai-governance-framework>).

<sup>20</sup> “Model Artificial Intelligence Governance Framework Second Edition.” Personal Data Protection Commission of Singapore, 2020. (<https://www.pdpc.gov.sg/-/media/files/pdpc/pdf-files/resource-for-organisation/ai/sgmodelaigovframework2.pdf>). Para 2.2.

<sup>21</sup> “Model Artificial Intelligence Governance Framework Second Edition.” Personal Data Protection Commission of Singapore, 2020. Para 1.1.

<sup>22</sup> “Model Artificial Intelligence Governance Framework Second Edition.” Personal Data Protection Commission of Singapore, 2020. Para 2.7.

**R** practices in four key areas of an organisation's decision-making and technology-development processes:<sup>23</sup>

- a) Internal governance structures and measures;
- b) Determining the level of human involvement in AI-augmented decision-making;
- c) Operations management; and
- d) Stakeholder interaction and communication.

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<sup>23</sup> "Model Artificial Intelligence Governance Framework Second Edition." Personal Data Protection Commission of Singapore, 2020. Para 3.1.



The table prepared below shows a summary of some suggested considerations, practices and measures falling under each of these key areas.<sup>24</sup>

Internal governance structures & measures	Human involvement in AI-augmented decision-making	Operations management	Stakeholder interaction and communication
<b>Suggested considerations, practices &amp; measures</b>			
<p><b>Clear roles &amp; responsibilities</b></p> <ul style="list-style-type: none"> <li>■ Use existing or set up new corporate governance and oversight processes</li> <li>■ Ensure staff are appropriately trained and equipped</li> </ul>	<p><b>Appropriate level of human intervention</b></p> <ul style="list-style-type: none"> <li>■ Use probability-severity of harm matrix to determine level of human involvement</li> <li>■ Incorporate corporate values and society values in decision-making</li> </ul>	<p><b>Good data accountability practices</b></p> <ul style="list-style-type: none"> <li>■ Lineage, quality, accuracy, completeness, veracity, relevance, integrity, etc.</li> </ul>	<p><b>General disclosure</b></p> <ul style="list-style-type: none"> <li>■ Information on whether AI is used in products and services</li> <li>■ Use simple language, with communication appropriate to audience, purpose and context</li> </ul>
<p><b>Internal Controls</b></p> <ul style="list-style-type: none"> <li>■ Monitoring and reporting system to ensure awareness at appropriate level of management</li> <li>■ Manage personnel risk</li> <li>■ Periodic review</li> </ul>		<p><b>Minimise bias in data and model</b></p> <ul style="list-style-type: none"> <li>■ Heterogeneous datasets</li> <li>■ Separate training, testing, validation datasets</li> <li>■ Repeatability assessments, counterfactual fairness testing, exception handling, etc.</li> <li>■ Audit trail, black box recorder</li> <li>■ Regular review and tuning</li> </ul>	<p><b>Increased transparency</b></p> <ul style="list-style-type: none"> <li>■ Information on how AI decision may affect individuals</li> </ul>
			<p><b>Feedback Channels</b></p> <ul style="list-style-type: none"> <li>■ Avenues for feedback, review of decisions</li> </ul>

<sup>24</sup> "Model Artificial Intelligence Governance Framework Second Edition." Personal Data Protection Commission of Singapore, 2020.

Two other key documents complementary to the Model Framework were also released by IMDA and PDPC at the World Economic Forum Annual Meeting 2020. First, the Implementation and Self-Assessment Guide for Organisations (“ISAGO”). Second, the Compendium of Use Cases (“Compendium”).<sup>25</sup>

ISAGO is billed as a “companion” to the Model Framework.<sup>26</sup> Developed in collaboration with the World Economic Forum’s Centre for the Fourth Industrial Revolution,<sup>27</sup> it aims to help organisations assess the alignment of their AI governance processes with the Model Framework, and identify and address potential gaps in their existing processes. Like the Model Framework, it is also a “living” document intended to evolve in tandem with technological and societal developments. ISAGO sets out a list of questions based on and organised according to the four key areas in the Model Framework. It also provides references and examples on how organisations may implement the considerations and practices set out in the Model Framework. These references and examples include publications and advisories by the PDPC, industry use cases and international AI standards. In using ISAGO, organisations are asked to consider only implementing practices and considerations which are relevant to their context (e.g., business needs, resource constraints, and regulatory requirements), as well as to take a risk-based approach by adopting measures commensurate with the potential risks of the AI solution deployed.

The Compendium serves to provide industry “proof-points” for the Model Framework.<sup>28</sup> It sets out examples where organisations across sectors, sizes and borders have implemented or aligned AI governance practices with all sections of the Model Framework. Its aim is three-fold: (a) provide referential examples of how organisations have put in place accountable AI governance practices; (b) demonstrate how organisations have benefited from the use of AI in their business; and (c) demonstrate how organisations can build a competitive advantage by building trust with their customers and stakeholders.

## 2.2 Advisory Council on the Ethical Use of AI and Data

The Advisory Council brings together a diverse group of international thought leaders and industry stewards for the purposes of:

- a) Advising the Government on legal, ethical, policy and governance issues arising from the use of data-driven technologies in the private sector; and
- b) Providing guidance to businesses to minimise legal, ethical and sustainability risks, and to mitigate any adverse impacts on consumers from the use of data-driven technologies.

<sup>25</sup> “Model AI Governance Framework.” Personal Data Protection Commission of Singapore, 2020. (<https://www.pdpc.gov.sg/Help-and-Resources/2020/01/Model-AI-Governance-Framework>).

<sup>26</sup> “Model AI Governance Framework.” Personal Data Protection Commission of Singapore, 2020.

<sup>27</sup> The collaboration between IMDA and the World Economic Forum first began in 2019. While there are no primary sources regarding this collaboration, reference may be made to the following press release, available at [https://www.sgpc.gov.sg/sgpcmedia/media\\_releases/imda/press\\_release/P-20200122-2/attachment/Singapore%20and%20World%20Economic%20Forum%20Driving%20AI%20Adoption%20and%20Innovation.pdf](https://www.sgpc.gov.sg/sgpcmedia/media_releases/imda/press_release/P-20200122-2/attachment/Singapore%20and%20World%20Economic%20Forum%20Driving%20AI%20Adoption%20and%20Innovation.pdf).

<sup>28</sup> On 16 October 2020, IMDA announced a second volume of the Compendium, which contains new use cases on how AI Singapore, the City of Darwin, Google, Microsoft and Taiger implemented or aligned their practices with the Model Framework. The second volume is available at <https://file.go.gov.sg/ai-gov-use-cases-2.pdf>.

The composition of the Advisory Council reflects the need for strong private-public partnerships and globally diverse views. On this basis, members of the Advisory Council comprise a balanced mix of key representatives from: (a) international leaders in AI such as Google, Microsoft and Alibaba; (b) advocates of social and consumer interests; and (c) leaders of local companies that are keen users of AI.<sup>29</sup>

On 30 November 2018, the Advisory Council convened for its inaugural meeting.<sup>30</sup> Members of the Council came together for a robust discussion on the ethical use of AI and data, including on the Discussion Paper, and on improvements to the Model Framework (that was being drafted at the time). Since then, the Advisory Council has sat for three other times. In February 2020, Minister for Communications and Information S Iswaran noted that the Advisory Council had “made a good start in helping organisations improve their AI governance practices”.<sup>31</sup> Among other things, the Advisory Council obtained industry views and advised the Government on the development of the Model Framework and ISAGO. It also engaged the community and industry on AI and data developments, encouraged the adoption of the Model Framework, and provided guidance on the direction of AI governance research.<sup>32</sup> In so doing, the Advisory Council plays a key role in facilitating and enabling the multi-stakeholder approach to AI governance that, as mentioned above, is a key theme in Singapore’s AI governance approach.

## 2.3 Research Programme on Governance of AI and Data Use

To develop cutting-edge thinking in the governance of AI, the Research Programme was set up in the Singapore Management University’s School of Law (“**SMU SOL**”) in 2018. Achieved through a competitive grant process, the Research Programme is buttressed by a sum of S\$4.5 million over the course of five years.

To host the Research Programme, the SMU SOL launched the Centre for AI and Data Governance (“**CAIDG**”) in September 2018. The CAIDG has been conducting industry-relevant research on areas of AI and data use, as well as organising engagement forums such as conferences, roundtables and seminars on policy and regulatory issues. Moving forward, the CAIDG will publish and present research papers to develop the frontiers of thought leadership on AI and data. In the meantime, the PDPC and IMDA continue to support CAIDG and the Research Programme by engaging local and international stakeholders to partner CAIDG in achieving its objectives.

The three initiatives above encapsulate Singapore’s human-centric approach to AI – one that aims to balance the twin needs of fostering innovation and safeguarding public confidence in the use of AI, by placing human users and adopters at the centre of policy-making and accountability. Overall,

<sup>29</sup> The composition of the Advisory Council, accurate as at the Advisory Council’s inaugural meeting in December 2018, is available at <https://www.imda.gov.sg/-/media/imda/Files/About/Media-Releases/2018/Annex-A---Council-Members-of-the-Advisory-Council-on-the-Ethical-use-of-AI-and-Data.pdf?la=en>.

<sup>30</sup> “Inaugural meeting of the Advisory Council on the Ethical Use of Artificial Intelligence and Data.” Infocomm Media Development Authority of Singapore, 2018. (<https://www.imda.gov.sg/about/newsroom/media-releases/2018/inaugural-meeting-of-the-advisory-council-on-the-ethical-use-of-artificial-intelligence-and-data>).

<sup>31</sup> “MCI’s response to PQ on the work of the Advisory Council on the Ethical Use of AI and Data.” Ministry of Communications and Information, 2020. (<https://www.mci.gov.sg/pressroom/news-and-stories/pressroom/2020/2/mci-response-to-pq-on-the-work-of-the-advisory-council-on-the-ethical-use-of-ai-and-data>).

<sup>32</sup> “MCI’s response to PQ on the work of the Advisory Council on the Ethical Use of AI and Data.” Ministry of Communications and Information, 2020.

## 2.4 Application to Specific Sectors

the regulatory model may be described as “light-touch”, with a preference for shaping behaviour and practices through soft regulatory tools such as guides and advisories, rather than the sanctioning power of laws and regulations. More will be described below on why it is found that this regulatory approach is presently the most appropriate for Singapore’s circumstances.

The financial sector has in recent years been characterised by fast-moving technological and regulatory developments. The rise of the “fintech” (or financial technology) industry, in particular, has seen the application of emerging technologies such as AI and blockchain in the financial sector, with regulators also having had to adjust their regulatory positions quickly to respond to these developments.

For this reason, it comes perhaps as no surprise that the financial sector has also seen developments in the space of AI governance. Perhaps in a telling sign of AI’s influence on the sector and vice versa, it was at the Singapore Fintech Festival 2019 where the NAIS was launched.<sup>33</sup> More critically, AI governance has arguably seen its greatest sector-specific developments in Singapore’s financial sector. This may be best seen from the launch of the Principles to Promote Fairness, Ethics, Accountability and Transparency in the Use of Artificial Intelligence and Data Analytics in Singapore’s Financial Sector (“**FEAT Principles**”) in November 2018.<sup>34</sup> Launched by the Monetary Authority of Singapore (“**MAS**”), the FEAT Principles provides guidance to firms that use AI and data analytics to offer financial products and services. In particular, the document sets out foundational principles for the use of AI and data analytics in the provision of financial products and services, and assists firms in contextualising and operationalising the governance of AI and data analytics tools in their business models and structures. In a further recognition of the growing importance of AI governance in the financial sector, the MAS also announced the Veritas framework in November 2019, which provides financial institutions “with a verifiable way to incorporate the FEAT principles into their AIDA solutions”, and will, in particular, “comprise open source tools that can be applied to different business lines, such as retail banking and corporate finance, and in different markets”.<sup>35</sup>

How does this complement or interact with the human-centric approach to AI governance shaped by IMDA and PDPC, especially the Model Framework? As a sector-agnostic document, the Model Framework is intended to operate above individual sectors, leaving room for individual sectors to define the principles and values that are more relevant to them. In particular, as the Model Framework states, “ethical considerations can be introduced as corporate values and managed through ethics review boards or similar structures”.<sup>36</sup> This flexibility for other ethical considerations to be prioritised as organisational values thus leaves room for

<sup>33</sup> “Speech by Deputy Prime Minister and Minister for Finance Heng Swee Keat at the Singapore Fintech Festival X Singapore Week of Innovation and Technology 2019 on 13 November 2019.” Prime Minister’s Office, 2019. (<https://www.pmo.gov.sg/Newsroom/DPM-Heng-Swee-Keat-at-SFF-X-SWITCH-2019>).

<sup>34</sup> “Principles to Promote Fairness, Ethics, Accountability and Transparency (FEAT) in the Use of Artificial Intelligence and Data Analytics in Singapore’s Financial Sector.” Monetary Authority of Singapore, 2018. (<https://www.mas.gov.sg/~media/MAS/News%20and%20Publications/Monographs%20and%20Information%20Papers/FEAT%20Principles%20Final.pdf>).

<sup>35</sup> “MAS Partners Financial Industry to Create Framework for Responsible Use of AI.” Monetary Authority of Singapore, 2019. (<https://www.mas.gov.sg/news/media-releases/2019/mas-partners-financial-industry-to-create-framework-for-responsible-use-of-ai>).

<sup>36</sup> “Model AI Governance Framework.” Personal Data Protection Commission of Singapore, 2020.

sectors to specify ethical considerations that are most relevant or important to them. In any case, the principles of “ethics” and “accountability” in the FEAT Principles may also be interpreted as a reflection of the recommendations set out in the section on internal governance structures and measures in the Model Framework.

Another local sector that has seen some regulatory developments is the transport sector, specifically in relation to autonomous vehicles (“AVs”). Transport regulators in Singapore, notably the Ministry of Transport and the Land Transport Authority, have been early players in respect of AI-related regulation. For instance, the Road Traffic (Autonomous Motor Vehicles) Rules 2017 (the “AV Rules”) were published in August 2017,<sup>37</sup> even before the publication of the Model Framework and its related documents. In January 2019, provisional national standards were also published to guide the industry in the development and deployment of AVs. These steps bolster Singapore’s ambitious roadmap to be a first-mover in deploying AVs in Singapore.<sup>38</sup>

The AV Rules, in particular, set out requirements to be complied with for the testing of AVs in Singapore. These requirements stipulate, for instance, that a person cannot use or undertake any trials of automated vehicle technology on any road unless properly authorised and with liability insurance in place, that any such authorised person must ensure that the vehicle is installed with a data recorder capable of storing information when the vehicle is used; and that the vehicle must have a failure alert system that allows the driver to take immediate manual control of the vehicle when a failure of the autonomous system or other emergency is detected.<sup>39</sup>

It should be borne in mind that these legal requirements, insofar as they facilitate the safe testing of AVs, do not provide direct answers to liability-related issues, and do not apply to mainstream use. Hence, it remains to be seen exactly how regulations pertaining to consumer use of AVs will gel with the recommendations set out in the Model Framework. Indeed, stepping back, it has been noted in a report issued by the Singapore Academy of Law’s Law Reform Commission that “it is clear that there is no ‘one size fits all’ regulatory solution, not least given the diversity of AI systems ... and the contexts in which they may be deployed”.<sup>40</sup> It remains a long journey towards a coherent application of the Model Framework to the many sectors which AI is set to transform.

<sup>37</sup> “Road Traffic (Autonomous Motor Vehicles) Rules 2017.” Attorney-General’s Chambers, 2017. (<https://sso.agc.gov.sg/SL/RTA1961-S464-2017?DocDate=20170823>).

<sup>38</sup> The steps in this roadmap include expanding permitted test areas to cover all roads in western Singapore, having self-driving buses ply the Jurong Innovation District by 2022, and implementing automated cranes and AVs to boost productivity in its ports. See “Report on the Attribution of Civil Liability for Accidents Involving Autonomous Cars.” Singapore Academy of Law, 2020. ([https://www.sal.org.sg/sites/default/files/SAL-LawReform-Pdf/2020-09/2020\\_Report%20on%20the%20Attribution%20of%20Civil%20Liability%20for%20Accidents%20Involving%20Autonomous%20Cars.pdf](https://www.sal.org.sg/sites/default/files/SAL-LawReform-Pdf/2020-09/2020_Report%20on%20the%20Attribution%20of%20Civil%20Liability%20for%20Accidents%20Involving%20Autonomous%20Cars.pdf), at pp 8–9).

<sup>39</sup> “Report on the Attribution of Civil Liability for Accidents Involving Autonomous Cars.” Singapore Academy of Law, 2020.

<sup>40</sup> “Applying Ethical Principles for Artificial Intelligence in Regulatory Reform.” Singapore Academy of Law, 2020. ([https://www.sal.org.sg/sites/default/files/SAL-LawReform-Pdf/2020-09/2020%20Applying%20Ethical%20Principles%20for%20AI%20in%20Regulatory%20Reform\\_ebook.pdf](https://www.sal.org.sg/sites/default/files/SAL-LawReform-Pdf/2020-09/2020%20Applying%20Ethical%20Principles%20for%20AI%20in%20Regulatory%20Reform_ebook.pdf)). 1.

## 2.5 Involvement in the International Arena

Cognisant of its inability to act as a lone actor in the AI governance space given its position as an adopter and price-taker, Singapore has also actively involved itself in international forums and platforms on AI governance.

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As early as 2018, for instance, Singapore has been involved in the European Council's High-Level Expert Group on AI as an observer participant,<sup>41</sup> as well as in OECD's Expert Group on AI.<sup>42</sup> In 2019, Singapore's human-centric approach to AI was recognised internationally at two prestigious platforms: One, winning the first prize in the Ethical Dimensions of the Information Society category at the World Summit on the Information Society Forum 2019,<sup>43</sup> and two, being selected as the only project in Asia to be featured at the Paris Peace Forum 2019 under the theme of "new technologies".<sup>44</sup> In 2020, Singapore became involved in the OECD's ONE AI Network,<sup>45</sup> which was established in 2020 to provide expert input to OECD's analytical work on AI. More recently, it also became a founding member of the Global Partnership on AI in June 2020.<sup>46</sup>

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41 "Register of Commission Expert Groups." European Commission, 2018. (<https://ec.europa.eu/transparency/regexpert/index.cfm?do=groupDetail.groupDetail&groupID=3591>).

42 "List of participants in the OECD Expert Group on AI (AIGO)." OECD, 2020. (<https://www.oecd.org/going-digital/ai/oecd-aigo-membership-list.pdf>).

43 "Singapore wins top prize for AI initiatives at UN-level awards." CNA, 9 April 2019. (<https://www.channelnewsasia.com/news/singapore/singapore-wins-top-prize-for-ai-initiatives-at-un-level-awards-11426920>).

44 "Singapore's Human-Centric Approach to AI." Paris Peace Forum 2019. ([https://parispeaceforum.org/porteurs\\_projet/singapores-approach-to-human-centric-ai/](https://parispeaceforum.org/porteurs_projet/singapores-approach-to-human-centric-ai/)).

45 "OECD Network of Experts on AI (ONE AI)." OECD, 2020. (<https://oecd.ai/assets/files/one-ai-bio-book.pdf>).

46 "Launch of the Global Partnership on Artificial Intelligence." Government of France, 17 June 2020. (<https://www.gouvernement.fr/en/launch-of-the-global-partnership-on-artificial-intelligence>).

# 3 Observations from Overseas Approaches to AI Regulations

**T**his section takes a brief look at regulatory approaches to AI overseas – in particular, the US, the EU and China given their status as major global AI players – and identify pertinent observations on how Singapore’s regulatory approach compares to the approaches of these three jurisdictions.

**F**irst, at a broader level, the three most influential jurisdictions in AI have taken divergent approaches towards regulating AI based on their domestic priorities.

# S

The US federal government is taking a light-touch regulatory approach towards regulating AI, exemplified by the White House's recent release of a Memorandum titled "Guidance for Regulation of Artificial Intelligence Applications".<sup>47</sup> The Memorandum espouses a regulatory approach that encourages innovation and calls upon federal agencies to avoid needlessly hampering AI innovation and growth, and avoid taking a precautionary approach that holds AI systems to unnecessarily high standards, regulating only when necessary.

Nevertheless, notwithstanding the federal government's articulated approach, local governments have independently begun to regulate specific applications of AI. For instance, in May 2019, the San Francisco city government banned the purchase and use of facial recognition technology by public agencies.<sup>48</sup> The US court system is also hearing cases challenging the use of facial recognition software.<sup>49</sup> It remains to be seen how the trend of regulating specific AI uses in the US will develop after the release of the White House's Memorandum. This stands in contrast to the attitude towards facial recognition in Singapore: facial recognition technology has not been specifically regulated or restricted, although it is not entirely unregulated – existing laws like the Personal Data Protection Act would apply to the private sector's use of facial recognition technology where personal data is involved,<sup>50</sup> while government Instruction Manuals and the Public Sector (Governance) Act regulate public sector use of personal data.<sup>51</sup>

47 "Memorandum for the Heads of Executive Departments and Agencies." The White House, 2020. (<https://www.whitehouse.gov/wp-content/uploads/2020/01/Draft-OMB-Memo-on-Regulation-of-AI-1-7-19.pdf>).

48 Lee, Dave. 2019. "San Francisco is first US city to ban facial recognition." BBC, 15 May. (<https://www.bbc.com/news/technology-48276660>). To this end, as far as this author is aware, facial recognition technology has not been specifically regulated or restricted in Singapore, although it should be noted that it is not entirely unregulated – existing laws like the Personal Data Protection Act would apply to the private sector's use of facial recognition technology where personal data is involved, while internal Instruction Manuals and the Public Sector (Governance) Act regulates public sector use of personal data. Indeed, Singapore is expanding on the use of facial recognition applications. Earlier this year, the Singapore Government announced that Singaporeans could begin to use facial verification services to access digital government services under the National Digital Identity Programme. See for e.g., <https://www.businesswire.com/news/home/20200921005898/en/Singapore-Government-Extends-National-Digital-Identity-Programme-With-Face-Verification-Solution-From-iProov-and-Toppa-Ecquaria>.

49 Howard, Ayanna. 2019. "The Regulation of AI – Should Organizations Be Worried?" MIT Sloan Management Review. ([https://sloanreview.mit.edu/article/the-regulation-of-ai-should-organizations-be-worried/?gclid=CjwKCAjwg6b0BRBMEi-wANd1\\_SjZisEN-CqXXO/www0D5P9zJ3Xfs8wvJfs-gHTI7FtmlQYWqQL9VJDxoC3M4QAvD\\_BwE](https://sloanreview.mit.edu/article/the-regulation-of-ai-should-organizations-be-worried/?gclid=CjwKCAjwg6b0BRBMEi-wANd1_SjZisEN-CqXXO/www0D5P9zJ3Xfs8wvJfs-gHTI7FtmlQYWqQL9VJDxoC3M4QAvD_BwE)).

50 "Speech by Dr Janil Puthuchear, Senior Minister of State, Ministry of Communications and Information, at the MCI Committee of Supply Debate 2020 on 3 March 2020." Ministry of Communications and Information, 2020. (<https://www.mci.gov.sg/pressroom/news-and-stories/pressroom/2020/3/speech-by-dr-janil-puthuchear-at-the-mci-committee-of-supply-debate-2020-on-3-mar-2020>).

51 Choo, Felicia. 2019. "Parliament: Public agencies not governed by PDPA because of fundamental differences in how they operate." The Straits Times, 1 April. (<https://www.straitstimes.com/politics/parliament-public-agencies-not-governed-by-pdpa-because-of-fundamental-differences-in-how>).

52 "White Paper on Artificial Intelligence – A European approach to excellence and trust." European Commission ([https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020\\_en.pdf](https://ec.europa.eu/info/sites/info/files/commission-white-paper-artificial-intelligence-feb2020_en.pdf)).

# R

The EU appears to prefer a more robust regulatory approach, anchored by human rights. This is exemplified by the European Commission's White Paper issued on 19 February 2020,<sup>52</sup> which sets out key elements of a future regulatory framework that ensures compliance with EU rules protecting fundamental rights and consumers.

The EU White Paper posits that there is a need for a horizontal European regulatory framework for trustworthy AI that should build trust among consumers and businesses; ensure regulatory consistency across Europe; ensure socially, environmentally and economically optimal outcomes,



and create a frictionless internal market while protecting consumers in respect of fundamental rights and safety. The central idea of the proposed regulatory framework is to introduce regulatory intervention for “high-risk” AI applications to ensure that regulatory intervention is proportionate. In this regard, if an AI application is considered high-risk, key requirements must be complied with. For example, regulated parties will need to keep accurate records of training datasets, and provide citizens clear information about the AI system’s capabilities and limitations. The output of the AI system must also be first reviewed and validated by humans. Further, all high-risk AI systems must go through “priority conformity assessments” before use. Conversely, a voluntary labelling scheme will be established for non-high-risk applications to allow businesses to signal the trustworthiness of their AI-enabled products and services.

**C**hina intends to be a global leader in regulating AI as it sees this as an opportunity to take the lead through introducing new international standards, for instance, in domains such as AI security.

**I**n July 2017, China’s State Council issued “a Next Generation Artificial Intelligence Development Plan”, which aimed to establish AI laws and regulations, and AI security assessment and control capabilities by 2025.<sup>53</sup> In November 2017, the China Academy of Information and Communications Technology and Tencent Research produced a book titled “A National Strategic Initiative for Artificial Intelligence”, which set an aim for China to actively construct AI ethical guidelines, and to be a leader in AI legislation and regulation, education and personnel training.<sup>54</sup>

**T**o further these policies, China established a national AI standardisation group and a national AI expert advisory group in January 2018, whilst releasing a White Paper on AI Standardisation calling for the promotion and formulation of a set of universal regulatory principles and standards to ensure the safety of AI technology.<sup>55</sup> This was further developed on by a White Paper on Standardisation of AI Security on 27 December 2019, which analysed the status of laws, regulations and standardisation of AI security (i.e., the ability of AI systems to withstand adversarial attacks and other threats that affect the functioning and performance of AI systems) and provided a framework for AI security standardisation systems. It also pushed for China to increase its influence on international standards in AI security by strengthening research and having its experts participate at and serve in international platforms.<sup>56</sup>

**I**n contrast to these three influential jurisdictions, most other governments are adopting a “wait-and-see” approach to AI regulation. However, there is generally increasing governmental interest in AI regulation in specific applications, such as for autonomous vehicles, data privacy, and facial recognition.<sup>57</sup>

<sup>53</sup> Available in English translation from the New America Institute by Roger Creemers et al. “A Next Generation Artificial Intelligence Development Plan.” China State Council, 2017. (<https://na-production.s3.amazonaws.com/documents/translation-full-text-8.1.17.pdf>).

<sup>54</sup> Ding, Jeffrey. 2018. “Deciphering China’s AI Dream.” In *Governance of AI Program*, Future of Humanity Institute. Oxford: Future of Humanity Institute. ([https://www.fhi.ox.ac.uk/wp-content/uploads/Deciphering\\_Chinas\\_AI-Dream.pdf](https://www.fhi.ox.ac.uk/wp-content/uploads/Deciphering_Chinas_AI-Dream.pdf)).

<sup>55</sup> “White Paper on Standardization in AI.” National Standardisation Management Committee, Second Ministry of Industry, 2018. (<http://www.cesi.cn/images/editor/20180124/20180124135528742.pdf>).

<sup>56</sup> “Excerpts from AI Security Standardization White Paper.” ChinAI Newsletter, 2020. (<https://chinai.substack.com/p/chinai-83-ai-security-standardization>).

<sup>57</sup> Walch, Kathleen. 2020. “AI Laws are Coming.” Medium, 20 February. (<https://www.forbes.com/sites/cognitiveworld/2020/02/20/ai-laws-are-coming/#50ba4c74a2b4>).

Second, industry reactions to current global AI regulatory trends appear to be somewhat positive, with the largest indications coming from the large technology firms. For instance, Google, Facebook, Amazon, Microsoft and SenseTime have called for AI to be regulated, and have thus far shown initial interest in engaging governments in discussions. Nevertheless, it remains to be seen how the industry is likely to react as governmental regulatory action becomes more concrete.<sup>58</sup> After all, most of the largest technology players have, while articulating the desire for AI to be regulated, also seen fit to produce their independent ethical values of AI, many of which are expressed at the level of broad principles.

Amidst these developments, Singapore's regulatory approach may be described as pragmatic and lighter-touch (but not entirely *laissez-faire*). While not taking a horizontally hard regulatory approach (as the EU appears to be heading towards) or a hands-off regulatory approach (as the US is leaning towards), Singapore has attempted to strike a balance between encouraging adoption and preserving public trust by taking a sector-specific approach guided by overarching guidelines (i.e., the Model Framework), while studying potential longer-term issues (e.g., through the Research Programme and the Advisory Council). This is informed by a perspective that premature regulation of AI technologies could impede its development and deployment, increase compliance costs, and discourage adoption for early industry use cases, and girded by the understanding that Singapore cannot expect to influence global technological or regulatory developments alone.<sup>59</sup> It should also be remembered that the use of AI in Singapore is not entirely de-regulated – existing laws, such as the Personal Data Protection Act 2012 (“PDPA”), which regulates the collection, use and disclosure of personal data by private sector organisations, continue to apply where AI systems are deployed.

<sup>58</sup> A recent article on Wired highlighted how corporate calls for regulation can be used in self-serving ways, such as shifting the regulatory spotlight onto specific technologies and away from the nature of the technology's development and use, or to be involved in discussions with governments to shape regulatory outcomes to their benefit. See Sherman, Justin. 2020. “Oh Sure, Big Tech Wants Regulation – on Its Own Terms.” *Wired*, 28 January. (<https://www.wired.com/story/opinion-oh-sure-big-tech-wants-regulation-on-its-own-terms/>).

<sup>59</sup> Natarajan, Aishwarya. 2020. “KAS-Strathclyde Interview Series on AI, Global Governance and Ethics: Interview with Mr Zee Kin Yeong.” *KAS*, 21 September. (<https://www.kas.de/en/interview/detail/-/content/kas-strathclyde-i...on-ai-global-governance-and-ethics-interview-with-mr-zee-kin-yeong>).

# 4 Next Phase and Conclusion

**O** Having released the three key initiatives underpinning Singapore's human-centric approach to AI governance, there is a need to continue supporting and sustaining a trusted AI ecosystem. To that end, Singapore needs to continue to be proactive in providing guidance in the use of AI, and to be responsive to industry realities, to sustain a trusted AI ecosystem. Given the nascency of AI development and deployment, industry support can be an effective means to formulate industry standards and build communities. The collation of real world examples and use cases in the Model Framework, ISAGO and Compendium could be seen as incipient efforts in this direction.

**M** In addition, the Singapore Computer Society, with the support of the IMDA, has also launched the AI Ethics and Governance Body of Knowledge, a document that forms the basis of future AI ethics and governance training and certification for professionals implementing AI products or projects on responsible AI deployment based on the Model Framework.<sup>60</sup> In turn, this helps facilitate the creation of an expert panel comprising trained and certified professionals to help organisations implement the Model Framework. Looking forward, as AI becomes more pervasive and influences how we work, live, and play, AI governance in Singapore is expected to focus particularly on the impact of AI on individuals, such as consumers and employees, as organisations increasingly adopt AI. There is also a need to prepare for the future of work, and advance a human-centric approach to AI.<sup>61</sup>

**L** It would not be possible to, in these pages, capture exhaustively all local and global developments in AI and AI governance over the last few years – of which there have been many. Instead, the aim has been to set out the path to Singapore's

<sup>60</sup> Iswaran, S. 2020. "Prologue." AI Ethics and Governance Body of Knowledge. (<https://ai-ethics-bok.scs.org.sg/document/26>).

<sup>61</sup> Natarajan, Aishwarya. 2020. "KAS-Strathclyde Interview Series on AI, Global Governance and Ethics: Interview with Mr Zee Kin Yeong." KAS, 21 September. (<https://www.kas.de/en/interview/detail/-/content/kas-strathclyde-i...on-ai-global-governance-and-ethics-interview-with-mr-zee-kin-yeong>).

existing regulatory approach to AI, and to juxtapose this against key international developments. It is hoped that the reader will realise that AI regulation, as with many other forms of technological regulation, is highly context- and country-dependent. Each country will have their own priorities in respect of AI and these will shape their corresponding regulatory approach. The previous decade for AI regulation has been an exciting one. 2020 has shown that it is hard to imagine what the next decade might bring. But it will, without a doubt, be more exciting than the last.

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