



Innovate
UK

Innovate UK Global Expert Mission Report

Civil Security, Singapore

April 2024



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01. Executive Summary

Generative AI (GenAI) is a potential game-changer technology for the economy and society.¹ Governments worldwide are rushing to take a leadership role in both the development and deployment of the technology as well as the governance required to ensure that AI models are fair, equitable and free from inherent bias.

While GenAI and Large Language Models (LLMs) hold tremendous potential to drive progress, they have also significantly reduced the barrier for criminals, fraudsters, nation states and non-state actors to mass-produce illicit or fake content to undertake a multitude of undesirable activities. These activities range from the creation of hyper-realistic synthetic content (image, video, text, and audio), usually referred to as deepfake, to online information, misinformation and disinformation campaigns designed to influence, deceive or manipulate citizens, thereby eroding public trust and disrupting social cohesion.

Without the means to mitigate the use of GenAI to enable crime and misinformation campaigns and confidently identify material that has been artificially generated, GenAI-enabled criminality will have a profound impact on civil and national security efforts. Governments across the globe are grappling with these potential negative consequences of an otherwise groundbreaking technology, striving to balance innovation with the need for robust safeguards to protect society.

Singapore is taking an innovative approach to the development and adoption of AI across government and the public sector. Singapore's Home Team Science and Technology Agency, known as HTX, is a unique agency tasked with bringing together science and engineering capabilities across the Home Team Departments to transform the security landscape and enhance public safety. In parallel, HTX is driving AI adoption by funding global start-ups to deliver proof-of-concept projects aimed at addressing specific issues from challenge owners through its Hatch incubator. Singapore has also revamped its National AI Strategy and provided significant funding for initiatives such as the Digital Trust Centre, the Centre for Advanced Technologies in Online Safety (CATOS) and AI Singapore. The UK Home Office has an established relationship with HTX and both countries have ambitious plans to provide a leadership role in AI development and governance.

¹ How Generative AI Is Changing Creative Work (hbr.org)



In April 2024, a Global Expert Mission (GEM), comprising a delegation of six experts in the application of AI to security issues, disinformation and deepfake detection, travelled to Singapore to explore the country's civil security landscape, focussing on its endeavours to drive adoption of AI across the public sector and become a global leader in trustworthy AI systems. The delegation attended TechXSummit, HTX's international conference and exhibition on Homeland Security Science and Technology. The delegation met with both public and private organisations at the forefront of AI innovation, exploring leading developments and potential collaborations in the field.

The main findings of the Mission were:

- a nascent but growing ecosystem of start-ups nurtured by HTX to address security challenges,
- a readiness to deploy systems in the real world and a *'think AI first'* mindset when developing new solutions for government and the public sector,
- well-funded programmes to advance AI Governance and public trust in AI systems to complement investment in R&D and innovation,
- a commitment to ensuring that generative AI systems developed by Western technology multinationals, such as OpenAI, Google and Microsoft, are adapted to be relevant and applicable to the unique cultures, languages, and values of the Southeast Asia region,
- and an openness to collaborate with international partners.

The ambitions of the UK and Singapore in this sector are well-aligned and underpinned by a Strategy Partnership Agreement, a Memorandum of Understanding and a Digital Economy Agreement. Together with the connections formed during the Mission, existing relationships and common goals, the UK is well-placed to partner with Singapore to shape international AI governance and standards.

02. Acronyms

The following is a comprehensive list of acronyms used in this report, provided to help clarify the terminology and ensure a clear understanding of the content.

ASEAN	Association of Southeast Asian Nations (ASEAN)
A*STAR	Agency for Science, Technology and Research (Singapore)
B2B	Business to Business
B2C	Business to Consumer
CSA	Chief Scientific Advisor
DBT	Department for Business and Trade (UK)
DSIT	Department for Science, Innovation and Technology (UK)
DTC	Digital Trust Centre (Singapore)
FCDO	Foreign, Commonwealth and Development Office (UK)
GEM	Global Expert Mission
IMDA	Infocomm Media Development Authority (Singapore)
MAP	Milipol Asia Pacific
MCI	Ministry of Communications and Information
MTI	Ministry of Trade and Industry (Singapore)
NPCC	National Police Chiefs' Council (UK)
NRF	National Research Foundation (Singapore)
NTU	Nanyang Technological University, Singapore
NUS	National University of Singapore
SIN	Science and Innovation Network
TXS	TechXSummit
UKRI	UK Research and Innovation

03. Introduction

Innovate UK, Innovate UK Business Connect and the Global Expert Missions

Innovate UK supports business-led innovation and is part of UK Research and Innovation (UKRI).² UKRI convenes, catalyses and invests in close collaboration with others to build a thriving, inclusive research and innovation system. To this end, Innovate UK helps businesses to identify the commercial potential in new technologies and turn them into new products and services that will generate economic growth and increase productivity. With a strong business focus, Innovate UK drives growth by working with companies to de-risk, enable and support innovation. Innovate UK Business Connect exists to connect innovators with new partners and new opportunities beyond their existing thinking – accelerating ambitious ideas into real-world solutions. Innovate UK Business Connect is part of the Innovate UK group.

As innovation is increasingly a global endeavour and the ambition of UK businesses to become truly international enterprises is at its highest, Innovate UK established its Global Expert Mission (GEM)³ programme in 2017. Delivered by Innovate UK Business Connect, in partnership with the FCDO Science and Innovation Network (SIN)⁴, GEMs help further Innovate UK's global strategy by providing the evidence base for where it should invest and by providing opportunities for UK businesses to build partnerships and collaborations with key economies.

Mission Overview and Objectives

The primary goal of this Global Expert Mission (GEM) was to gather key insights into the innovation landscape in Civil Security in Singapore. Furthermore, the GEM explored potential opportunities to collaborate with relevant organisations in the civil security sector in Singapore.

The insights acquired during the Mission will be crucial in guiding Innovate UK on enhancing support for UK businesses looking to establish partnerships with organisations in Singapore.

The Mission focused on several areas key to assessing the appetite and opportunities for collaborative innovation. These areas include:

1. Providing an overview of crucial enabling technologies essential for addressing challenges in the Civil Security sector.
2. Conducting a comprehensive review of synergies in policy, security priorities, and strategy between the two countries.
3. Offering sector-specific intelligence and knowledge regarding Singapore's market for Civil Security products and services.
4. Enhancing the understanding of the innovation landscape in Singapore, along with analysis and mapping of key stakeholders in the Civil Security sector.



² <https://www.ukri.org>

³ <https://ktn-uk.org/programme/global-expert-missions/>

⁴ <https://www.gov.uk/world/organisations/uk-science-and-innovation-network>



Mission Scope

The Mission identified Generative Artificial Intelligence (GenAI), with a particular focus on deepfake⁵ identification as the technical theme. GenAI is developing at pace and is being utilised across a spectrum of illegal activity from the creation of abuse material to the spread of misinformation through deepfake audio and video.

Without the ability to mitigate the use of GenAI to enable crime, and confidently identify artificially generated material, GenAI-enabled criminality will have a profound impact on UK policing and Civil Security. Although evidence of GenAI-enabled crime is still relatively low, anticipation of its increased prevalence is fuelled by the remarkably low technical barrier that enables individuals with minimal expertise to engage in criminal activities. The adaptability of fine-tuned GenAI models poses an ongoing challenge, allowing offenders to tailor existing technologies for specific illicit purposes, demanding constant vigilance from law enforcement. The utilisation of both open-source and closed-source GenAI models complicates the landscape, with open-source models democratising advanced tools for a wider range of criminals.

The use of GenAI for criminal endeavours is a global issue for governments and law enforcement. The Mission focused on the opportunities for collaborative development of technical countermeasures to GenAI material between the UK and Singapore.

Built around UK business, policy and research representation, the GEM aims to:

- 1. Inform UK businesses and Government**
The findings and opinions of experts on the topic of the GEMs are made available to UK businesses and government departments. These inform UK businesses about potential opportunities for innovation in the country and the UK government on how it can help UK businesses make the most of those opportunities.
- 2. Building International Collaborations**
The expert insights will help inform how Innovate UK can best support UK businesses in finding and exploiting the opportunities for innovation partnerships. The GEM created connections with key organisations and people that will deepen and widen the collaboration with the partner country to benefit UK business.
- 3. Sharing UK Capabilities**
During the Mission, the delegation of experts will use the opportunity to promote and share the UK's innovation strengths.

⁵ Snapshot Paper - Deepfakes and Audiovisual Disinformation - GOV.UK (www.gov.uk)

04. Sector Overview

Geography and Economy

Singapore is an island country and city-state situated at the southern tip of the Malay Peninsula. It has a population of 5.9 million people. With a land area of less than half of Greater London, Singapore is one of the most densely populated countries in the world.

Singapore has an advanced market economy. Gross Domestic Product (GDP) was \$673 billion (£398 billion) at the end of 2023. In 2023, Singapore's economy grew by 2.2 per cent on a year-on-year basis and is forecast to continue to grow at 1 to 3 per cent in 2024.⁶

Singapore – UK Trade

As a former British colony, there are strong historic links between the UK and Singapore, both in direct trade and as an entry point to the wider Southeast Asia region. By 2030, Southeast Asia is forecast to be the fourth-largest economy in the world.⁷ The region has an estimated 310 million digital consumers, a digital population larger than the US, UK and Canada combined.⁸ An additional 30 million digital consumers are expected to be added between 2020 and 2025.

Singapore is the UK's 20th largest trading partner. Total trade between the UK and Singapore was £22.3 billion in 2023.⁹ Total exports to Singapore were worth £14.9 billion, with around 60% of exports resulting from services.¹⁰

The UK – Singapore Free Trade Agreement (UKSFTA) facilitates trade between the UK and Singapore. The trade agreement was launched in February 2021 and is the UK's first Free Trade Agreement with an ASEAN country.

Civil Security in Singapore

Singapore has a strong focus on civil (homeland) security. This encompasses physical security measures, cyber security, and digital threats. Singapore is ethnically and linguistically diverse. The three largest ethnic groups are Chinese, Malays and Indians. Singapore has four official languages: English, Mandarin Chinese, Malay and Tamil. Legislation such as the Maintenance of Religious Harmony Act (MRHA)¹¹ and the Protection from Online Falsehoods and Manipulation Act (POFMA)¹² are key mechanisms used to foster social cohesion between ethnic groups and prevent the communication of misinformation online.

⁶ Economic Survey of Singapore 2023 (mti.gov.sg)

⁷ ASEAN Statistical Brief Vol. IV, January 2024

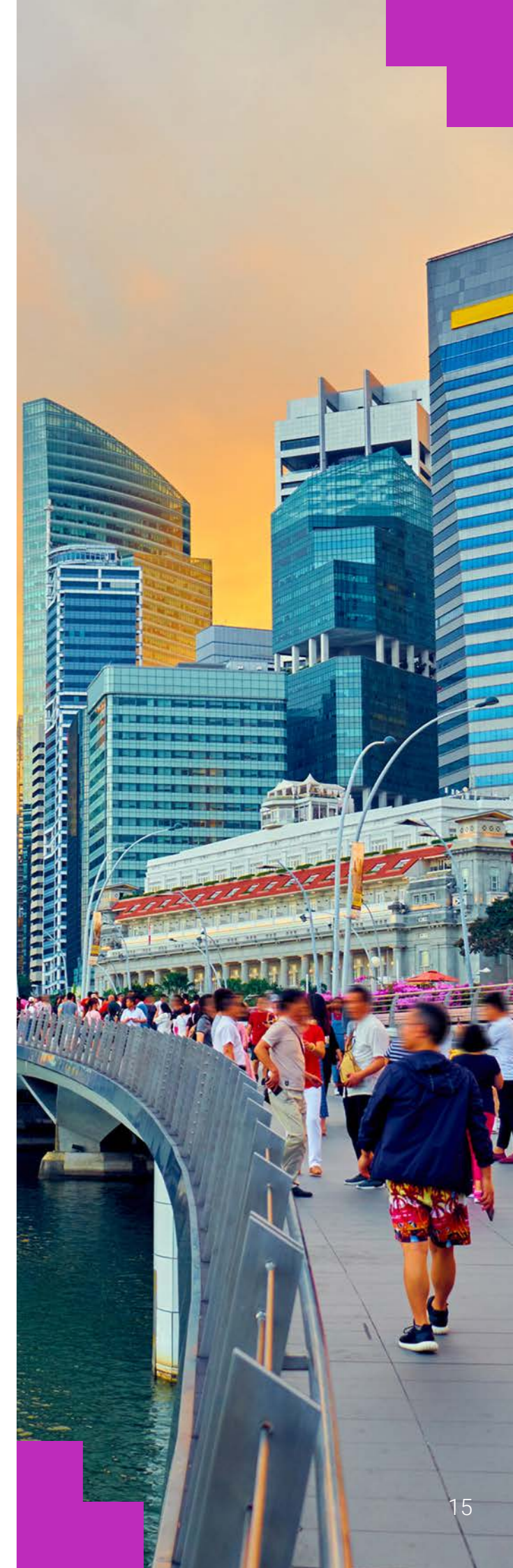
⁸ Report "Digital Consumers of Tomorrow, Here Today", Bain and Company

⁹ Trade and Investment Factsheet (publishing.service.gov.uk)

¹⁰ Figures accurate for the 4 quarters to the end of Q1 2024

¹¹ Maintaining Racial and Religious Harmony (mha.gov.sg)

¹² Protection from Online Falsehoods and Manipulation Act (pofmaoffice.gov.sg)





Singapore Digital Sector

Singapore's digital sector is valued at approximately £62.7 billion and has experienced significant growth, supported by government initiatives such as Smart Nation Singapore.¹³ Singapore's digital economy is comparable with that of the UK and the two countries have signed a Digital Economy Agreement (DEA).¹⁴ The DEA covers digitised trade in services and goods across the whole economy and, of relevance to this Mission, Artificial Intelligence and the responsible use of emerging technologies. The DEA highlights best practice and the development of governance and policy frameworks for the responsible development and use of AI as key focus areas for collaboration.

The digital sector spans several government departments. The Ministry of Home Affairs¹⁵ (MHA) is responsible for national security, public security, civil defence, border control and immigration in Singapore. The Ministry of Digital Development and Information¹⁶ (MDDI), formerly the Ministry of Communications and Information (MCI), is responsible for the development of information and communication (infocomm), cyber security and the media.

It is also responsible for the government's information and public communication policies. The Ministry's Infocomm Media Development Authority (IMDA)¹⁷ agency is at the forefront of initiatives and programmes aimed at preparing and protecting citizens and businesses for a digital future.

Enterprise Singapore (ESG)¹⁸ is Singapore's equivalent of Innovate UK. ESG supports companies to grow, innovate and internationalise. They also contribute to the growth of Singapore as a global hub for tech companies and start-ups.

In 2023, the UK signed a new strategic partnership with Singapore, the UK-Singapore Strategic Partnership.¹⁹ This partnership is aimed at enhancing economic cooperation and strengthening security cooperation, science and technology innovation, and research and development. Further to the Strategic Partnership, the UK has signed the UK-Singapore Digital Economy Agreement,²⁰ covering the digitised trade in services and goods across the whole economy.

¹³ Smart Nation Singapore

¹⁴ UK-Singapore Digital Economy Agreement - GOV.UK (www.gov.uk)

¹⁵ Ministry of Home Affairs (MHA) | Singapore

¹⁶ Ministry of Digital Development and Information (mddi.gov.sg)

¹⁷ Architects of SG Digital Future | Businesses | IMDA

¹⁸ Enterprise Singapore (enterprisesg.gov.sg)

¹⁹ UK agrees new strategic partnership with Singapore - GOV.UK (www.gov.uk)

²⁰ UK-Singapore Digital Economy Agreement: final agreement explainer - GOV.UK (www.gov.uk)

05. The Innovation Landscape

Innovation Support

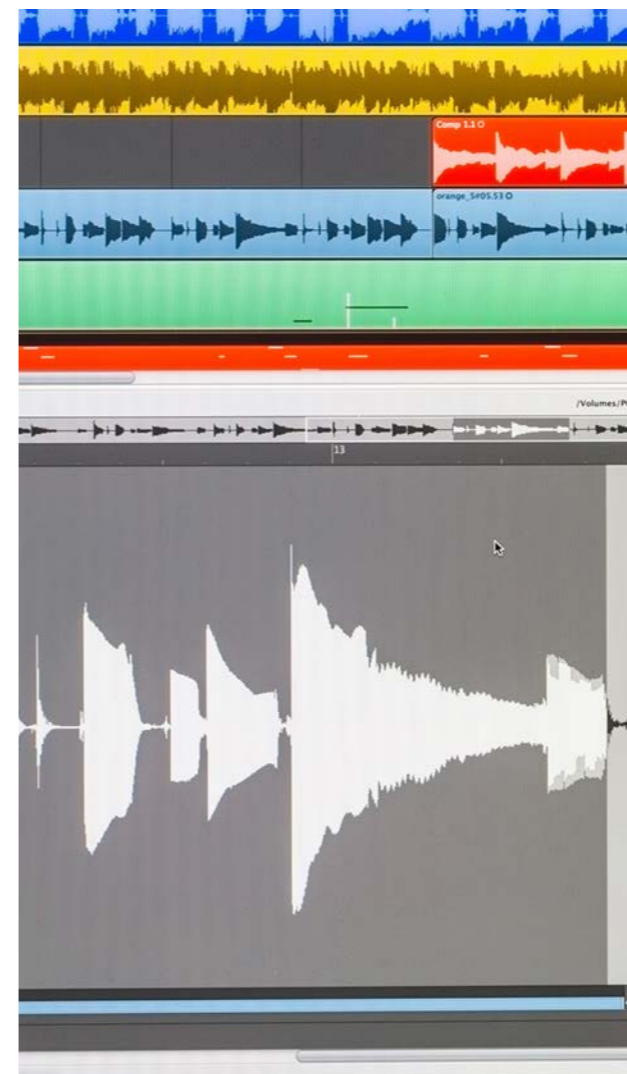
Singapore uses a variety of mechanisms, programmes and organisations to fund research and innovation. The landscape is complex with both centralised programmes, challenge-led competitions and decentralised entities fostering collaboration and supporting innovation. The delegation met with key stakeholders aligned to civil security and GenAI including HTX, A*STAR / CATOS, AI Singapore, The Digital Trust Centre, Hatch, KLASS Engineering and SGInnovate.

Home Team Science and Technology Agency (HTX)

The Home Team Science and Technology Agency (HTX) in Singapore is a statutory board of the Ministry of Home Affairs.²¹ The agency's Mission is to enhance homeland security through science and technology. Singapore's Home Team Departments include the Singapore Police Force, Singapore Civil Defence Force, Immigration and Checkpoints Authority, Singapore Prison Service and Central Narcotics Bureau.

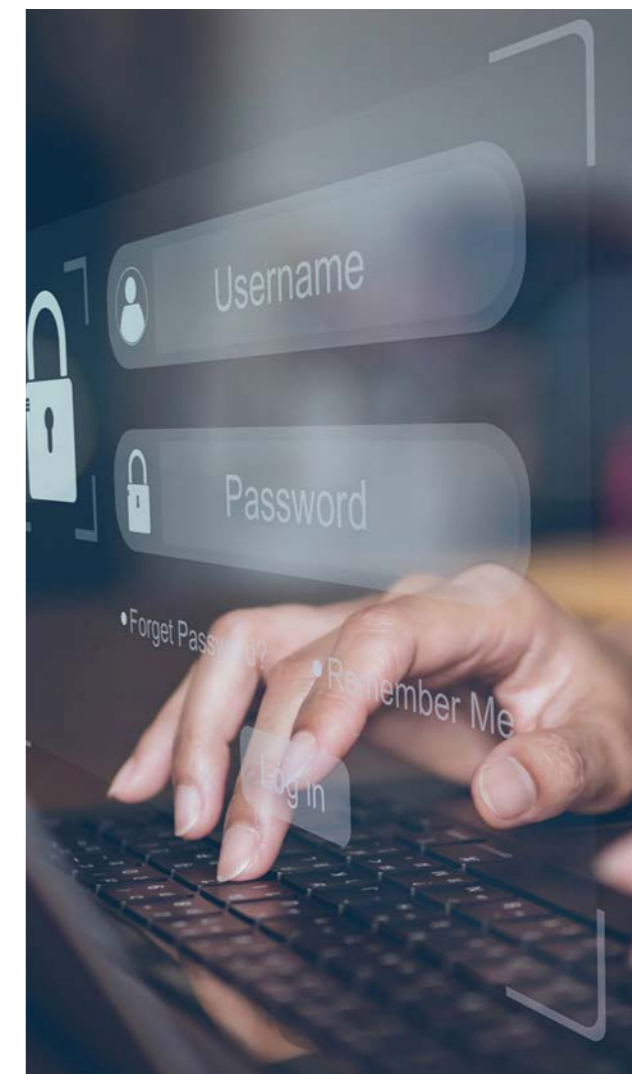
HTX capabilities are categorised into 15 specialisations, including Biometrics, Cybersecurity, Data Science and AI, Digital and Information Forensics, Marine Systems and Robotics.

The case studies highlighted in the boxes demonstrate HTX's technical capabilities in addressing the issues of deepfakes and scam websites.



Case Study

HTX's Sense-making and Surveillance Centre of Excellence has been directly involved in developing a tool for the identification of deepfakes. AlchemiX can be used to detect whether audio or media files have evidence of synthetic content. AlchemiX utilises state-of-the-art AI algorithms to identify subtle clues in deep-fake videos and audio.



Case Study

HTX's Q Team has developed the Online Cybersquat Hunter (OCH), an innovative tool that uses AI and image/text analysis to identify scam websites. OCH has been implemented in PhishMonSG, a phishing detection tool that proactively hunts for malicious sites posing as legitimate government websites.

²¹ <https://www.htx.gov.sg/techx/techxsummit>

HTX also operates the start-up accelerator, Hatch.²² Hatch is an innovation centre and accelerator established by HTX in collaboration with SOSA, an Israeli-based open innovation company. The Centre was launched in May 2023 and focuses on public safety and security innovations from companies across the globe.

Hatch delivers Dimension X, a challenge-led accelerator programme that validates innovative start-up technologies with the potential to solve public safety and security challenges devised by HTX. The Dimension X programme is open to start-ups from all sectors and countries with selected start-ups receiving a grant to undertake a proof-of-concept project in collaboration with HTX and potential end-users of the innovation. The incubator recently selected its second cohort of six start-ups, from 111 applications from 11 different countries.

TechXSummit (TXS)²³ is a biennial international conference and technology exhibition on Civil Security organised by HTX. It brings together government officials, industry leaders and academics to discuss the latest challenges in civil security and how technology and innovation can be harnessed to meet those challenges. In 2024, TXS and the Milipol Asia-Pacific (MAP) security exhibition were brought together as a joint event. The event attracted 11,613 visitors including 465 official VIP delegates from 75 countries. The exhibition featured 307 exhibitors. The theme of this year's joint event was *Powering Innovation: A Safe & Secure Future*. Keynote speeches and panel discussions discussed the evolution and future of artificial intelligence and its application to civil security.



In September 2024, Singapore's ST Engineering (www.stengg.com) launched its Einstein.AI deepfake detection tool for enterprises at the annual InnoTech conference. Aimed at financial institutions, investment platforms and media companies, the tool exploits inconsistencies in video and audio frequencies to flag potential computer generated content.

²² HTX | Hatch (<https://www.htx.gov.sg/what-we-do/hatch>)

²³ <https://www.htx.gov.sg/techx/techxsummit>

The National Research Foundation

The National Research Foundation (NRF) sets the top-down priorities and direction for research and development in Singapore. Established in 2006 as part of the Prime Minister's Office, the NRF develops policies, plans and strategies for research, innovation and enterprise.²⁴

Singapore's current Research, Innovation and Enterprise strategy, RIE2025, continues the country's journey towards a knowledge-based, innovation-driven economy and society.²⁵ Through this strategy Singapore will commit \$25 billion, or about 1% of Singapore GDP, to RIE between 2021 and 2025.

Of relevance to the civil security agenda, Singapore's Smart Nation and Digital Economy domain will be further developed within RIE2025. Artificial Intelligence remains a key tenet of the Smart Nation and Digital Economy domain. Aligned with Singapore's National AI Strategy, RIE2025 will continue to invest in both fundamental research in areas such as explainable AI and accelerate market adoption through technology transition labs.

Agency for Science, Technology and Research (A*STAR)

The Agency for Science, Technology and Research (A*STAR) is Singapore's agency for mission-driven research and innovation.²⁶ Its role is to bridge the gap between academia and industry. This is achieved by developing capabilities within research institutes and engaging researchers and other public sector agencies with industry to deliver impact, economic growth and societal benefits. A key example of mission-driven research and innovation in the civil security space has been the establishment of the Centre for Advanced Technology in Online Safety (CATOS).²⁷

CATOS hosts the Online Trust and Safety (OTS) Research Programme, which is funded by the Ministry of Communications and Information (MCI). Its aim is to deepen Singapore's expertise in detecting and preventing the negative impacts and harm resulting from deepfakes, misinformation and other malicious content. To achieve this ambition, the Centre will build a community of research partners, companies and practitioners in online trust and safety. With a dedicated investment of \$50 million, CATOS will lead the charge in developing innovative solutions that prevent, detect and mitigate online harms within their local and regional contexts.

²⁴ National Research Foundation, Singapore (NRF) (<https://www.nrf.gov.sg/>)

²⁵ RIE2025 Handbook (nrf.gov.sg) (<https://www.nrf.gov.sg/rie-ecosystem/rie2025handbook/>)

²⁶ Agency for Science, Technology and Research (A*STAR) ([a-star.edu.sg](https://www.a-star.edu.sg/))

²⁷ CATOS | Centre for Advanced Technologies in Online Safety (<https://www.catos.sg/>)



Case Study

Large Language Models (LLMs) are a type of artificial intelligence model designed to understand and generate human language. Existing LLMs display a strong bias towards western attitudes and culture. AI Singapore have developed SEA-LION, a family of LLMs specifically pre-trained and instruct-tuned for the Southeast Asian region.

AI Singapore - National University of Singapore

The National University of Singapore began in 1905 as a small medical school and has now established itself as a Singapore's most prestigious university.²⁸ Across three campuses NUS is home to over 40,000 students and 12,000 staff. It oversees world-class institutes and Centres including the Centre for Quantum Technologies, the Yong Loo Lin School of Medicine and the Asia Research Institute.

Located at NUS, AI Singapore²⁹ is Singapore's national programme in AI. The programme brings together research institutions, start-ups and established companies with the shared goal of enhancing Singapore's capabilities in artificial intelligence.

The programme is a cross-government initiative involving the National Research Foundation (NRF), the Smart Nation and Digital Government Office (SMART), the Economic Development Board (EDB), IMDA, SGInnovate and Integrated Health Information Systems. The NRF funds the programme through an investment of up to \$150M over five years. AI Singapore runs programmes that cover fundamental research, AI governance, challenge and industry-focused innovation, product development, and skills training.

AI Singapore's key research topics include Fairness, Transparency / Explainability, Safety & Security, Accountability and Ethics & Human-Centricity.

²⁸ NUS - National University of Singapore (<https://nus.edu.sg/>)

²⁹ <https://aisingapore.org/>

Digital Trust Centre – Nanyang Technical University

Nanyang Technological University (NTU) in Singapore is a research-intensive institution known for its strengths in engineering, technology, and interdisciplinary research.³⁰ Established in 1991, NTU is one of the two largest public universities in Singapore. Its international outreach is broad and includes more than 570 academic and research partnerships with institutions in the U.S., Europe and Asia-Pacific.

The Digital Trust Centre (DTC)³¹ is a national centre for research in trust technology at NTU. Founded in 2023, DTC focuses on developing trust technologies to ensure the use of technology in Singapore. It is funded by the Singapore Government’s IMDA and NRF. It received S\$100M (£58.6M) for five years from October 2022.

On privacy, DTC is working with several companies to develop and demonstrate privacy technologies in particular sectors. Examples included collaboration with Mastercard in financial services, with Meta on privacy in digital marketing, and with blockchain partners (unnamed) in asset tracking.

Enterprise Singapore

Enterprise Singapore is a government agency under the Ministry of Trade and Industry (MTI) in Singapore, dedicated to supporting the growth and development of Singaporean businesses.³² Its Mission is to promote economic growth, support the creation of jobs and attract inward investment. Enterprise Singapore is the equivalent of Innovate UK and the two organisations work closely together through a strategic partnership which includes the support for a number of activities such as bilateral collaborative R&D competitions.

Infocomm Media Development Authority

The Infocomm Media Development Authority (IMDA) is a statutory board of the Singapore government tasked with the development and regulation of the infocomm and media sectors.³³ Its remit is to create a dynamic, holistic and exciting ecosystem filled with growth opportunities through talent, research, innovation and enterprise. Further, IMDA plays a key role in funding initiatives such as the Digital Trust Centre and the AI Verify Foundation.

³⁰ NTUatAGlance2023

³¹ <https://www.ntu.edu.sg/dtc>

³² Enterprise Singapore (enterprisesg.gov.sg)

³³ Architects of SG Digital Future | Businesses | IMDA



06. White Papers & Policies

Smart Nation & Digital Economy

Singapore's Smart Nation Initiative is a concerted government effort aimed at leveraging technology to improve the quality of life for its citizens, enhance economic opportunities, and build a sustainable future.³⁴ By integrating digital solutions into various aspects of urban living, such as healthcare, transportation, and governance, the initiative seeks to create a seamless, efficient, and inclusive society.

The Smart Nation Initiative goes beyond the adoption of digital solutions and sets the ambition to be at the forefront of the global drive to develop new technologies and solutions, including AI.

National AI Strategy

In 2019, Singapore published its first National AI Strategy. In 2023, the Singapore National AI Strategy 2.0 (NAIS 2.0) was launched to capitalise on the progress made through early investment in the technology.³⁵ The latest strategy reaffirms Singapore's commitment to realising the positive benefits of AI while recognising the need for governance, risk management and the safe and resilient development and deployment of AI models.

The strategy comprises three systems, working through 10 Enablers (see figure 1). The three systems are:

- **System 1:** Activity Drivers (Enablers: Industry, Government, Research)
- **System 2:** People and Communities (Enablers: Talent, Capabilities, Placemaking)
- **System 3:** Infrastructure & Environment (Enablers: Compute, Data, Trusted Environment, Leader in Thought and Action)

International collaboration is a key part of NAIS 2.0 in terms of R&D, AI governance and deployment. Action 15 of the strategy, for example, sets the goal to establish Singapore as an ambitious and pragmatic international partner on AI Innovation and Governance.

³⁴ Smart Nation Singapore (<https://www.smartnation.gov.sg/>)

³⁵ National AI Strategy (smartnation.gov.sg) (<https://www.smartnation.gov.sg/nais/>)

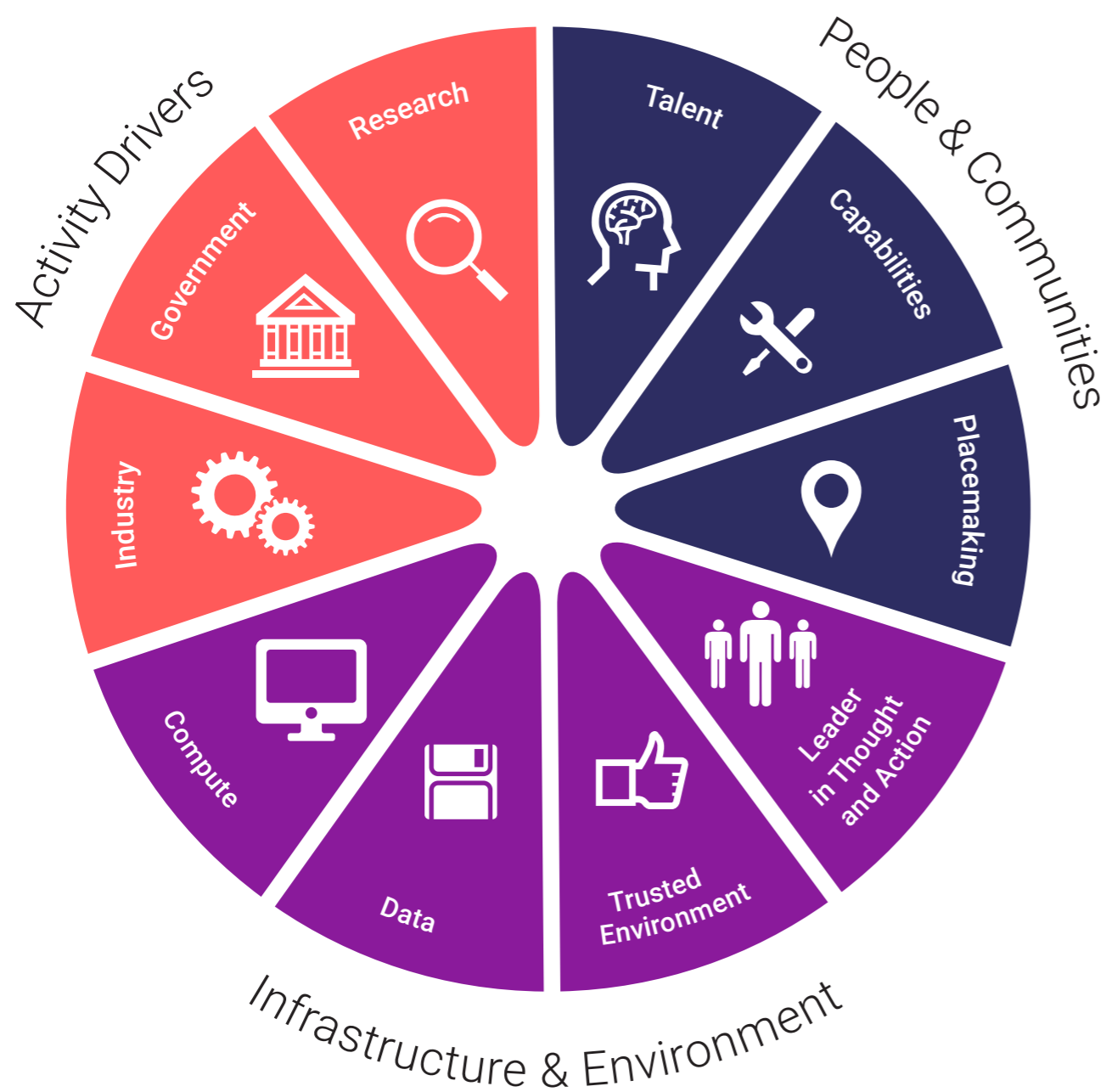


Figure 1 Schematic representing Singapore's strategy for AI

AI Singapore

AI Singapore is a national programme launched in 2017 to enhance AI capabilities and drive adoption in various sectors. Its remit covers the breadth of AI capabilities from research and innovation to governance, deployment and training.

Singapore has committed S\$500 million through AI Singapore under its Research, Innovation and Enterprise 2020 and 2025 plans.

To address global competition for AI talent, a new AI Accelerated Masters Programme will be rolled out to build a pipeline of research talent and students with the skills to pursue careers in AI research and commercialisation. IMDA's Digital Scholarship will support Singaporean students across undergraduate and postgraduate courses in AI. The TechSkills Accelerator will reskill 18,000 tech professionals in AI and Analytics with an emphasis on GenAI, Software Engineering, Cloud and Mobility.



07. Bilateral Cooperation

The UK and Singapore have a longstanding history of collaboration in research and innovation. The UK Science and Innovation Network (SIN) country Summary on Singapore highlights partnerships and key collaborations between the UK and Singapore.³⁶

Some specific collaborations relevant to Civil Security, GenAI and AI governance include:

- In June 2023, Singapore and the UK signed a Memorandum of Understanding (MoU) on Emerging Technologies, including AI, and Data Cooperation.³⁷
- Enterprise Singapore and Innovate UK signed an MoU in 2021 to strengthen cooperation in innovation and joint R&D.³⁸ This was extended in October 2024 for a further 3 years.

During the 2023 G20 Summit in India, the UK and Singaporean Prime Ministers signed the UK-Singapore Strategic Partnership.³⁹ In addition to strengthening economic ties, the new Strategic Partnership will deepen security cooperation, science and technology innovation, and research and development. This includes collaboration to counter new and emerging threats in domains like cyber and AI through a first-of-its-kind partnership between Singapore's new Digital and Intelligence Service and the UK.

Imperial College London and Nanyang Technological University (NTU) have established joint research centres and programmes in the areas of engineering, technology and medicine.⁴⁰

The University of Glasgow Singapore (UGS)⁴¹ launched in 2011 as the Scottish University's first overseas subsidiary. In partnership with the Singapore Institute of Technology (SIT), the University of Glasgow provides BEng and BSc Honours degree programmes delivered in-country to qualified graduates.

The Cambridge Centre for Advanced Research and Education in Singapore (CARES)⁴² is the University of Cambridge's first overseas research centre. Cambridge CARES brings together researchers from around the world to work on new scientific advances and technologies that will benefit Singapore and the international community.

The Singapore Institute of Management is a leading private education institution with partnerships with four UK institutions, namely the University of Warwick, University of Birmingham, University of London and the University of Stirling.

³⁶ [20240419_Singapore_Country_Snapshot.pdf \(publishing.service.gov.uk\)](#)

³⁷ [UK-Singapore data and tech agreements to boost trade and security - GOV.UK \(www.gov.uk\)](#)

³⁸ [Singapore and the UK strengthen enterprise, co-innovation and R&D – UKRI](#)

³⁹ [UK agrees new strategic partnership with Singapore - GOV.UK \(www.gov.uk\)](#)

⁴⁰ [Collaboration Mechanisms | Research groups | Imperial College London](#)

⁴¹ [University of Glasgow - Study - Singapore](#)

⁴² [Cambridge CARES | Cambridge CARES](#)

08. Stakeholder Engagement

HTX

The GEM team met with HTX in London prior to the GEM delegation traveling to Singapore. The HTX delegation presented the work of the agency highlighting its areas of expertise and case studies across different areas. Alignment between HTX priorities and the priorities of the UK Home Office were discussed together with potential areas of collaboration.

Innovate UK's role in developing international collaborations and the concept of the Global Expert Mission was communicated to the HTX delegation. The HTX delegation was introduced to the GEM delegation and the GEM's itinerary in Singapore was discussed.

TechXSummit

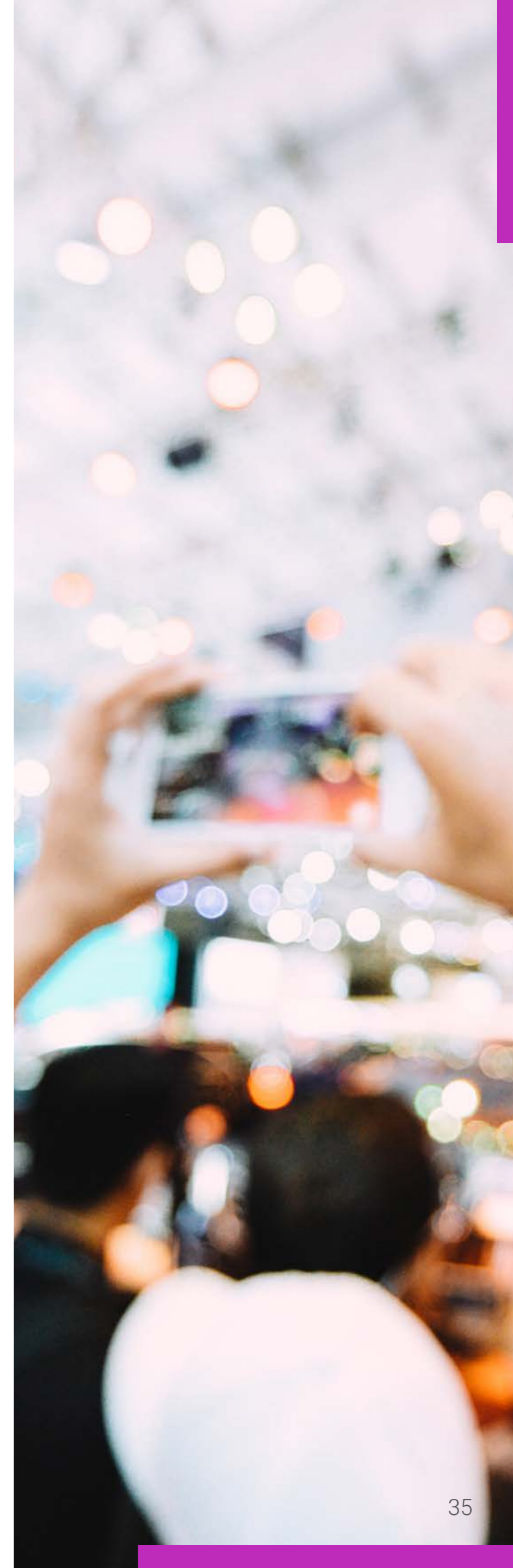
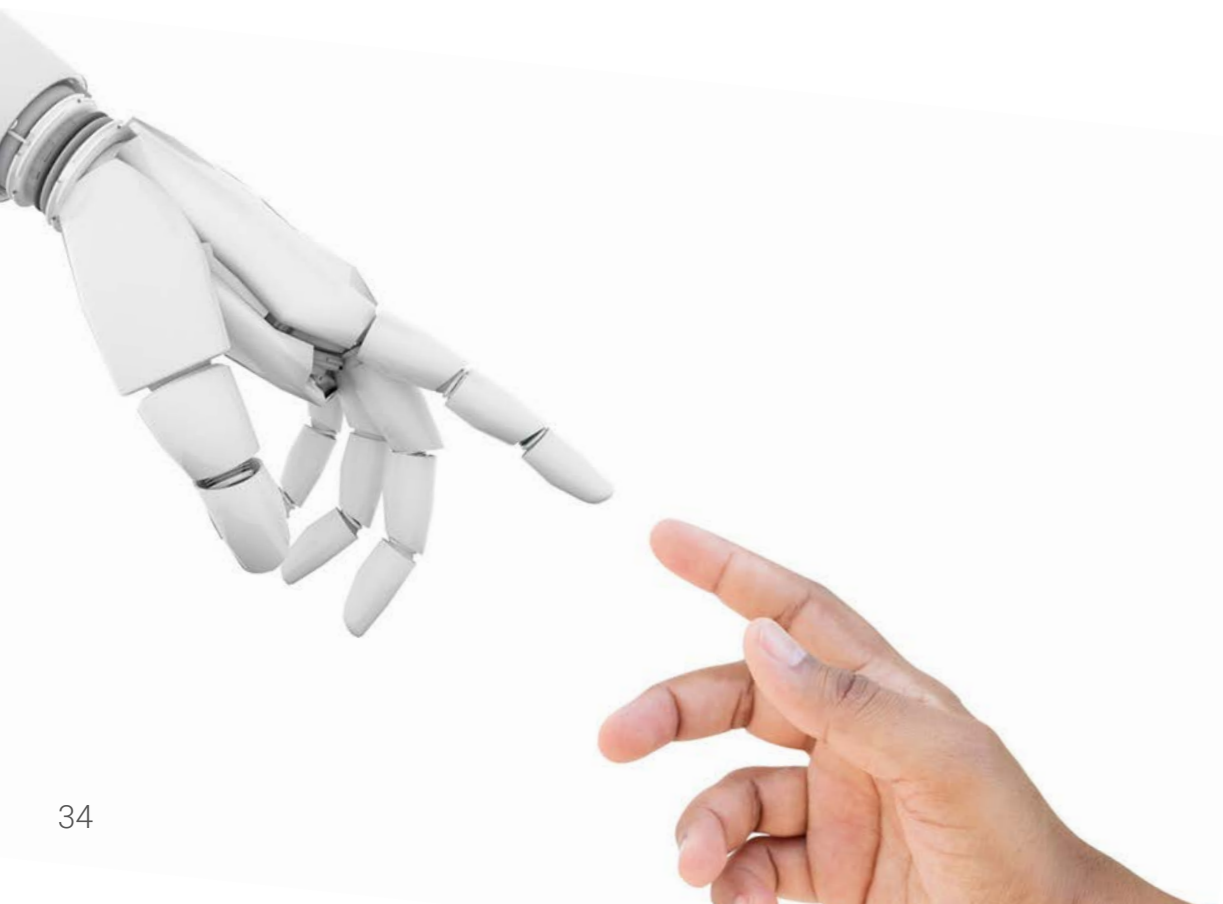
The delegation attended the TechXSummit, HTX's international conference and exhibition on Homeland Security Science and Technology.

Several useful insights emerged from the delegation's participation in during the TechXSummit, particularly on the wider Singapore context and ambition.

HTX and the Singapore government are acutely aware of the security threats around AI, including deliberate mis-use, deepfakes and data poisoning. Through the many programmes and initiatives around AI and online trust, there is a clear ambition for Singapore to become a leader in both AI development and deployment and in the governance of AI systems.

Hatch

The GEM delegation attended Hatch's Dimension X Cohort Two Demo Day. An overview of Hatch was provided by the Centre Director and Senior Open Innovation Manager. In addition to the overview and discussion, the delegation was given a tour of the second cohort of Dimension X start-ups. The start-ups presented and demonstrated their technologies and discussed their experience of collaborating with HTX. The start-ups who presented their technologies to the delegates were Speechmatics (UK), Abax (Singapore), Epic Blue (Belgium), GaitMetrics (Singapore), M-CADOR (France), Opsis – Emotion AI (Singapore).



Digital Trust Centre

The Digital Trust Centre, hosted by Nanyang Technological University (NTU) in Singapore, is a leading research institution focused on advancing digital trust technologies and promoting cybersecurity innovation to build a secure and trustworthy digital environment.

The founding principles of the DTC are to: 1) deliver strong local talent and indigenous capabilities in trust technology; 2) provide research support to co-develop solutions with early adopter companies, and 3) build and contribute to global standards in digital trust through international partnerships and exchanges.

The DTC is focused on enabling trust. It has developed a comprehensive taxonomy of AI safety and is looking at 'decentralisation' technologies (such as blockchain) to assure trust. It is focused on a range of issues including robustness and integrity, bias/fairness, explainability, privacy and transparency.

The DTC described GenAI-specific safety concerns as 'AI Safety' and refers to most other safety components as 'Responsible AI'. For DTC, 'AI Safety', includes testing for real/fake content, detecting harmful content, and developing evaluations and metrics to measure safety of deployments and models.

KLASS Engineering

KLASS Engineering⁴³ is an applied Research and Development company specialising in the development of digital solutions for public safety. The company was founded in 2015 and operates in the homeland security space. Its core capabilities include Data Analytics, Video Analytics, Speech Analytics, Robotics & Autonomous Systems and Internet-of-Things. KLASS has a team of over 50 engineers.



⁴³ KLASS Engineering and Solutions - KLASS (klases.com.sg)



A*STAR / Centre for Advanced Technologies in Online Safety (CATOS)

The Centre for Advanced Technologies in Online Safety (CATOS) was established in 2024 and still under development during the GEM delegation visit. The Centre's key strategic pillars for the OTS Research Programme are:

- **Deep Tech Research:** focusing on evaluating and funding low-TRL research with high competitive advantages and potential to move to mid-TRL.

- **Systems Engineering:** focusing on mid-to-high TRL technology evaluation, integration and translation of technology outputs into needle-moving use cases.
- **Programme Coordination:** Focusing on engaging research and practitioner communities through workshops, forums, and collaborative networks.

The technologies covered by CATOS include sentiment analysis, deepfake and misinformation detection, and an emphasis on hate speech and localised online harms specific to Singapore.



AI Singapore, National University of Singapore

AI Singapore is a national programme aimed at driving the adoption of AI in Singapore.

An overview of AISG's objectives and three pillars were presented to the GEM delegation. AISG's three key pillars are:

1. **AI Research:** build deep AI research capabilities in Singapore, invent the next generation of AI techniques/algorithms and position Singapore as a key player on the global stage
2. **AI Technology:** create significant economic and social impact by tackling national or global challenges using AI.
3. **AI Innovation:** focuses on accelerating industry's adoption of AI technology through projects and talent development. This is achieved through its programmes such as the 100 Experiments Programme⁴⁴ and the AI Apprentice Programme.⁴⁵

⁴⁴ 100Experiments - AI Singapore

⁴⁵ AI Apprenticeship Programme (AIAP)[®] - AI Singapore

⁴⁶ SEA-LION - AI Singapore

The presentation was followed by an in-depth discussion on AI Singapore's priorities, particularly the SEA-LION⁴⁶ (Southeast Asian Language In One Network) project and regional collaboration.

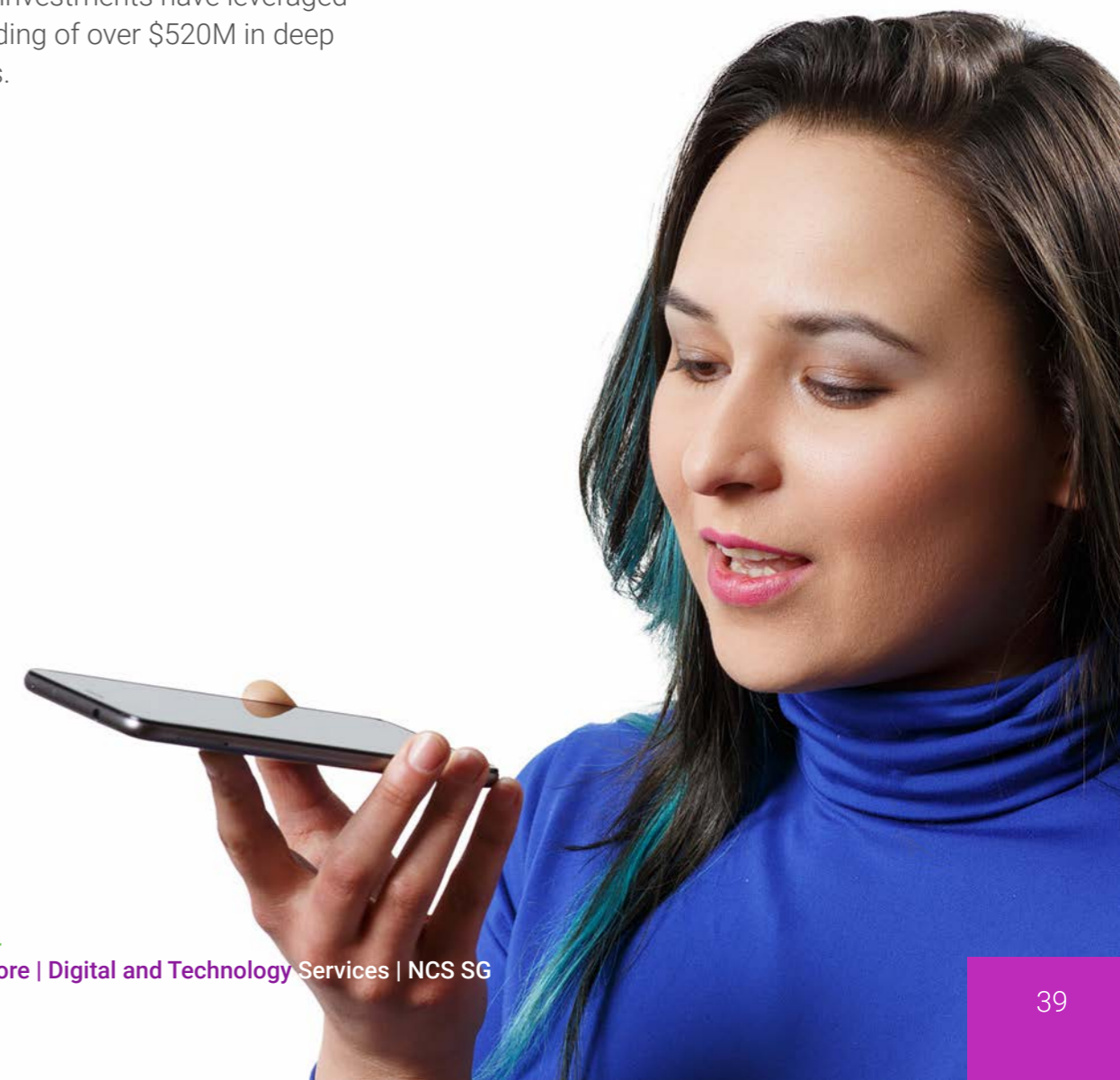
Singapore AI is also at the forefront of developing and growing Singapore's AI talent pipeline. Its AI Apprenticeship Programme (AIAP) gives individuals with intermediate AI skills the opportunity to obtain real-world development experience including building an end-to-end Machine Learning solution. To date the AIAP has helped train 300 Singaporean AI engineers.

SGInnovate

SGInnovate is the venture capital arm of Singapore's IMDA. Its Mission is to support entrepreneurial scientists to build Deep Tech start-ups. SGInnovate has invested in over 80 deep tech start-ups across its priority themes of Artificial Intelligence, Quantum Computing, Cybersecurity, Health & Biomedical Sciences, Advanced Manufacturing, Agrifood, Sustainability and Transportation. SGInnovate's investments across its portfolio companies exceeds \$74M. These investments have leveraged follow-on funding of over \$520M in deep tech start-ups.

NCS

NCS⁴⁷ is owned by Singapore Telecom (SingTel) and have been providing IT operational services for over 40 years. They have around 12,000 staff with 10,000 staff being sited in Singapore itself and 1500 in the Netherlands and the rest in their India and China sites.



⁴⁷ NCS Singapore | Digital and Technology Services | NCS SG

09. Collaboration Opportunities

Singapore is taking a leading role in developing and deploying AI systems across various sectors including civil security. Singapore's approach is multifaceted combining an overarching National AI Strategy with specific programmes and initiatives aimed at AI governance, trust and mitigating mis- and dis-information, and deepfakes. Further, Singapore's distinctive Home Team (HTX) approach is driving the adoption of advanced technologies including AI across government. The approach being taken is sensitive to regional requirements, multi-culturalism & diversity aspects and is aligned to a zero-tolerance policy towards activities that spread or promote discrimination or racial intolerance.

The ambition, breadth and openness of Singapore's approach will create a multitude of opportunities for collaboration. These opportunities are detailed below.



Opportunities for UK Organisations

The economic and social impact of deepfake technology and content is a rapidly growing challenge and concern for both Singapore and the UK. Priority areas for Singapore include **deepfake detection capabilities, enhanced online trust and safety, content provenance and mis/dis-information source attribution**. These priorities mirror those in the UK and offer UK businesses the opportunity to develop or adapt solutions for markets in two countries with ambitions to be global leaders in this area. The established relationships between innovation and civil security organisations in the UK and Singapore enhances opportunities for collaborative development, deployment and procurement.

Singapore has robust university funding mechanisms for both research and innovation and knowledge exchange initiatives supported by public sector investment. Examples identified through the Mission were Hatch, the Digital Trust Centre, CATOS and AI Singapore. The research themes and priorities of these organisations, together with the challenge-led approach of Hatch, create opportunities for Innovate UK to explore joint funding opportunities with these organisations.

The HTX Hatch accelerator programme is well aligned to the core scope of the GEM and there are clear synergies between the programme being developed by CATOS and UK organisations such as the Alan Turing Institute.⁴⁸ HTX's incubator Hatch is a potential partner for a Global Incubator Programme (GIP) to Singapore. It's focus on real-world challenges, rapid deployment and testing, and deep connections to Singapore's start-up community creates a unique environment for UK start-ups and SMEs explore collaboration and business opportunities in Singapore.

Hatch's programmes are open to start-ups and SMEs in the UK and include a Hatch & Match scouting programme to attract companies with innovations in civil security to Singapore and an Open Innovation Challenge to crowdsource and demonstrate innovate technologies to solve specific security challenges.



Case Study

ScamShield (www.scamshield.gov.sg), was developed by Open Government Products in collaboration with the Singapore Police Force and the National Crime Prevention Council. Comprising of an app, website and helpline, ScamShield can check suspicious calls, websites and messages for known scams and block communication to protect individuals from harm.

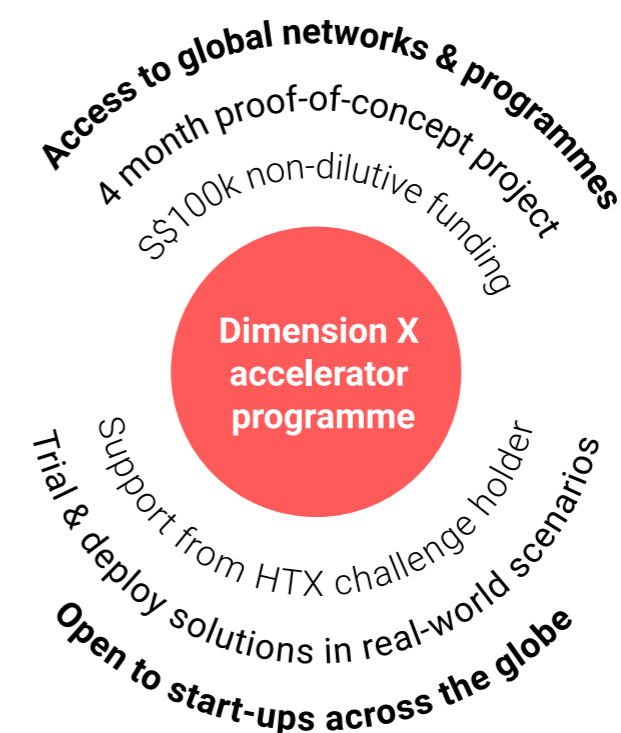


Figure 2 Hatch's challenge-led Dimension X accelerator programme

⁴⁸ Home | The Alan Turing Institute

Innovation Challenges & Partnerships

Singapore's programmes such as Hatch and AI Singapore take a top-down, challenge-led approach similar to Innovate UK's Contracts for Innovation⁴⁹ (formerly the Small Business Research Initiative (SBRI)). Funding for proof-of-concept studies and the development of Minimum Viable Products (MVP) together with the government acting as the first customer, is a powerful approach to targeting innovation at public sector issues.

Synergies between the approaches adopted by Singapore and the UK for challenge-led innovation would aid collaboration and the co-development of challenges for shared problems and concerns, such as the detection of deepfake content. Potential market access to both Singapore and the UK would also act as an incentive and drive technical differentiation.

SGInnovate, the venture capital arm of IMDA, expressed a willingness to collaborate with the UK, facilitate knowledge exchange and promote B2B engagement. SGInnovate also work with international organisations through its Global Network.⁵⁰

⁴⁹ Innovate UK Contracts for Innovation – UKRI

⁵⁰ Our Partners | SGInnovate (<https://www.sginnovate.com/our-partners>)





Talent Exchange & Skills Development

Access to talent was a common challenge highlighted in several meetings with organisations in Singapore. The GEM visit identified clear opportunities to explore exchange mechanisms, for example through a Fellowship scheme, and exchanged best practice for the development and upskilling of workers. The benefits of such a scheme include:

- Building the capability of host departments to access and use scientific knowledge relevant to their policy priorities
- Strengthening engagement between government and academia, supporting the development of lasting and trusted connections

A UK programme similar to AI Singapore's AI Apprenticeship Programme for up-skilling engineers with AI skills should be considered as this has been successful in Singapore.

Regulation and Standards

The UK and Singapore are committed to the safe and ethical adoption of AI as detailed in their respective AI Strategies. Further, both countries have signed up to the Bletchley Declaration on the global governance of AI. Singapore aligns with the UK on regulations for some industries, such as food, finance, and health, but further lessons could be learned from regulatory frameworks in collaboration with the UK.

Organisations such as the Digital Trust Centre and AI Singapore are leading Singapore's efforts in research in AI governance, ethics and transparency and are key partners to explore regulatory alignment and the development of common standards between the UK and Singapore to facilitate international collaboration and trade.

10. Potential Barriers to Collaboration

Generative AI is a nascent technology. It is difficult to predict how the technology and industry will evolve both in terms of applications and solutions and what regulation or legislation will be required to mitigate its nefarious use.

Singapore is actively engaged in international collaborations, with significant partnerships already established with China and the U.S. in Artificial Intelligence.

Additionally, Singapore has signed a Digital Partnership with the EU (EUSDP), which includes bilateral cooperation on AI, focusing on interoperability in governance, standards, and testing frameworks. In this competitive landscape, the UK will need to clearly demonstrate the unique benefits and added value it can offer in specific areas, particularly where Singapore already has existing partnerships.



11. Conclusions

Generative AI (GenAI) is recognised as a transformative technology with the potential to significantly impact the global economy and society. Governments worldwide are racing to lead in both the development and regulation of GenAI, aiming to ensure fairness, equity, and the elimination of inherent biases in AI systems.

However, GenAI also lowers the barriers for malicious actors, enabling the creation of hyper-realistic synthetic content and misinformation campaigns, which can erode public trust and disrupt social cohesion. Singapore and the UK are proactively addressing these challenges through innovative AI initiatives, particularly in the public sector.

The Global Expert Mission (GEM) to Singapore in April 2024 highlighted the country's efforts in advancing AI governance, nurturing a growing ecosystem of start-ups, and fostering international collaboration. With shared goals and strong partnerships, the UK and Singapore are well-positioned to collaborate on the detection and mitigation of deepfake content and jointly shape global AI governance and standards.

12. Annex 1 – List of UK Experts

CameraForensics

Home Office

Logically

University of Edinburgh

Faculty AI

Metropolitan Police

Home Office





**Innovate
UK**

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Innovate UK, part of UK Research and Innovation (UKRI), is the UK's innovation agency.

It works to create a better future by inspiring, involving and investing in businesses developing life-changing innovations. Its mission is to help companies to grow through their development and commercialisation of new products, processes and services, supported by an outstanding innovation ecosystem that is agile, inclusive and easy to navigate.

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