

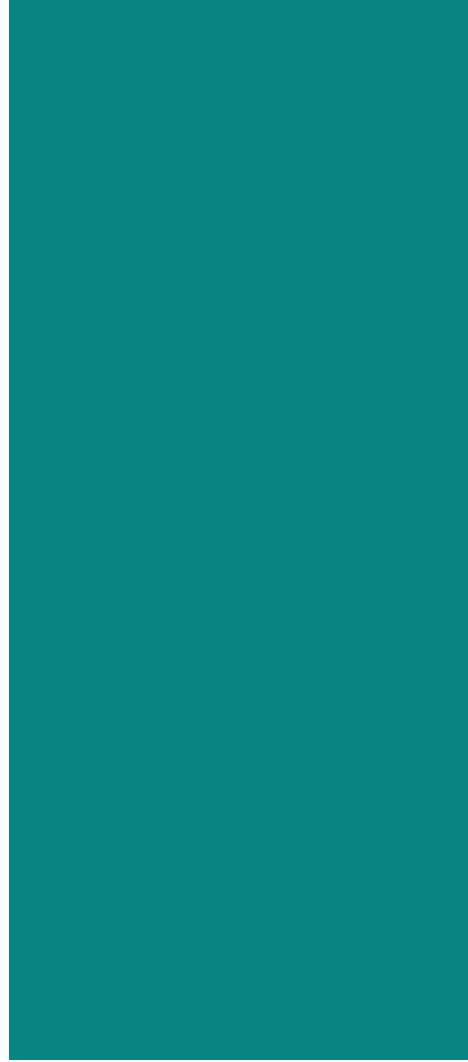
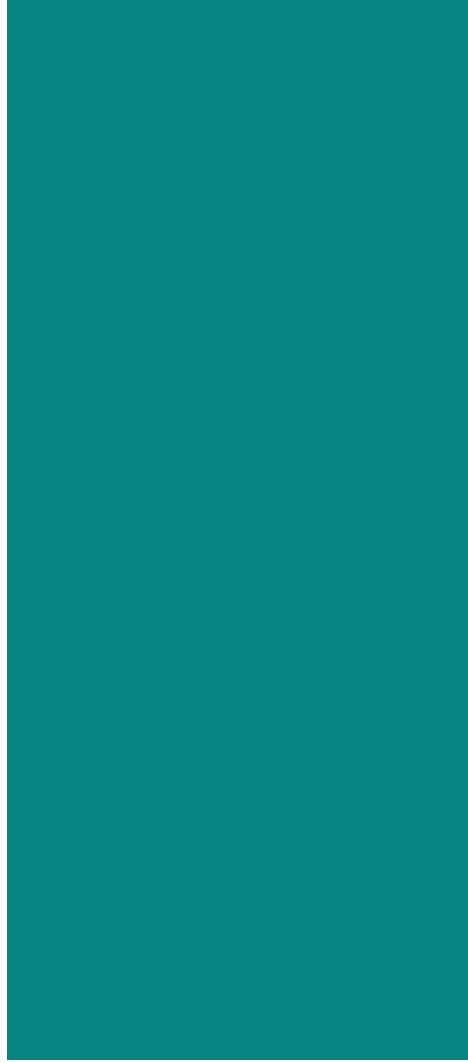
May 2024

ECONOMIC IMPACT REPORT

Strengthening
Singapore's AI leadership
with Google



Content





Executive summary

Strengthening Singapore's AI leadership with Google

Artificial Intelligence (AI) has already changed how we work and live, and could further revolutionise Singapore's biggest industries: manufacturing, wholesale and retail trade, and finance.¹ This also means that its effects can ripple through economies in complex ways, making it difficult to measure its economic impact.² This report aims to plug that gap. It analyses the potential economic benefits of AI for Singapore and also outlines how leading tech companies like Google have been supporting Singaporean businesses and households on their AI journey.

Singapore's innovative AI initiatives, such as the world's first AI governance framework and toolkit AI Verify, and its refreshed National AI Strategy (NAIS 2.0), shows its ambition to be a leading global AI hub.³

The economic opportunity provided by AI in Singapore is significant. If fully harnessed, AI-powered solutions could provide up to to **SGD 198.3 billion (USD 147.6 billion) of economic benefits in 2030**. This potential, equivalent to almost 30% of Singapore's 2023 GDP, highlights the need for effective partnerships with leading private sector players to maximise AI's impact.⁴

The AI opportunity

For businesses

With strong governmental support for AI initiatives, Singapore is well-placed within the region to leverage AI to drive economic growth.⁵ Nurturing local AI talent, driving adoption in key sectors, and promoting partnerships will be essential to driving this effort.

SGD 198.3 billion of economic benefits

(USD 147.6 billion) are expected for businesses in Singapore in 2030, if AI-powered products and solutions are adopted.

In tackling cybercrime

While AI promises to transform sectors, bad actors are potentially using it to increase the scale, speed, and sophistication of cybercrime. Singapore's investment in AI development must be paralleled with robust cybersecurity infrastructure, where AI will play a key role in strengthening it.

SGD 18.5 billion of cybercrime losses prevented

(USD 13.8 billion) for Singapore in 2030 if businesses deploy AI-powered cybersecurity capabilities.

Executive summary

Google's impact in Singapore

Google is collaborating with the Singapore government to encourage AI adoption. Singaporeans can also access Google AI capabilities directly, including Gemini, which is integrated in Google products they are already using, such as Gmail, Docs and Slides. They can even chat with Gemini directly to increase creativity and productivity. Initiatives to develop critical digital skills are part of Google's commitment to developing a strong AI ecosystem, providing both businesses and the general public with the support they need to realise the benefits of this transformative technology.

By partnering with public and private sector stakeholders, Google is bringing economic benefits to businesses and households. Small and medium businesses (SMBs) especially benefit from Google's tools, becoming more efficient and increasing their earnings at home and abroad, all of which supports jobs. Google's products and solutions are also being used to tackle broader societal priorities, such as to fight dengue fever, or to develop AI models for Southeast Asian languages.⁶



Google AI for businesses and organisations

Google's AI-powered products and services open the door to wider AI adoption in Singapore, even for companies and SMBs without deep technical knowledge. Programmes like AI Trailblazers and AI First Accelerator are further helping businesses and government agencies create their own generative AI solutions to solve industry-specific challenges.⁷



Google's solutions to keep Singaporeans safer online

From smarter searches to safer emails, Google's AI-powered products are helping to make life smoother and more secure. The company's commitment to keeping Singaporeans safer online also takes the form of programmes like Be Internet Awesome and the Google Online Safety Park, and initiatives like Project PRAISE with wider society.⁸ Google is empowering Singaporeans of all ages to navigate the digital world safely.

Key highlights of Google's impact

SGD 14.7 billion of economic benefits

In 2023, Google's AI-powered products and solutions helped provide SGD 14.7 billion (USD 10.9 billion) of economic benefits for Singaporean businesses and households.

SGD 9.8 billion of economic activity for businesses

In 2023, Google Search, Google Ads, Google AdSense, Google Play, Google Cloud, and YouTube helped provide SGD 9.8 billion (USD 7.3 billion) of economic activity for businesses.

SGD 4.9 billion of economic benefits for households

In 2023, Google Search, Google Maps, Google Play, Google Drive, and YouTube helped provide SGD 4.9 billion (USD 3.6 billion) of economic benefits for households.

22,000 jobs were supported by Google

In 2023, Google supported 22,000 jobs by helping businesses expand through their use of Google Search, Google Ads, Google AdSense, Google Cloud, and YouTube.

A nighttime photograph of the Singapore skyline, featuring numerous illuminated skyscrapers and buildings. Overlaid on the image are several glowing white arcs that connect various points across the city, symbolizing a network or data flow. The arcs are most prominent in the upper half of the image, creating a sense of connectivity and technology.

Chapter 1

Accelerating Singapore's economic potential with AI

Accelerating Singapore's economic potential with AI

Artificial intelligence (AI) offers Singapore an opportunity for a new phase of economic growth. Building off the strength of its knowledge economy and depth of research and development (R&D) capabilities, the country has turned its sights to AI.⁹ Today, Singapore ranks amongst the world's leaders in terms of government AI-readiness.¹⁰

This chapter takes stock of Singapore's approach to AI, and sizes the potential economic benefits of AI across different sectors of the economy, as well as in tackling growing issues such as cybercrime.

AI advancement is a national ambition

The government has shown commitment to bringing the economy to the next stage of growth with AI. One of the first in the world to set out a National AI Strategy (NAIS) in 2019, Singapore is investing a substantial SGD 1 billion (USD 0.7 billion) on the development of AI, in line with its updated NAIS.¹¹ This ensures that Singapore has the talent, compute power, and the right level of support for businesses to adopt the technology.

Complementing the national AI agenda are other efforts to promote cybersecurity skills and tools — especially as cybercriminals create more malicious attacks with AI. Recognising this, the government is pushing for more cybersecurity training and investing SGD 50 million to boost the domestic cybersecurity workforce, strengthening Singapore's digital ecosystem.¹²

Building a trusted AI environment

As with all advanced technologies, there is a balance to strike between the safe and ethical development of AI and the promotion of its growth and innovation.

To this end, Singapore's Infocomm Media Development Authority (IMDA) launched AI Verify in 2022, the world's first AI governance testing framework and toolkit designed to help companies develop AI responsibly and comply with governance standards.¹³





In 2024, Singapore also assumed the role of Chair at the ASEAN Digital Ministers' Meeting, with the meeting endorsing the 'ASEAN Guide on AI Governance and Ethics' and setting the pace for AI governance around the region.¹⁴

Ministries and public agencies in key sectors are also leading the implementation of AI by outlining best practices and guidelines, such as from the Ministry of Health (MOH) for the healthcare sector, and the Monetary Authority of Singapore (MAS) for the finance sector.¹⁵

▶ To promote AI literacy within the next generation, the Ministry of Education also ensures schools are using AI ethically and responsibly in classrooms, bringing the country a step forward to creating a

population that is both adept at AI and aware of its limitations.¹⁶ As Ms Tan Soon Keow, Director of School of IT at Nanyang Polytechnic, says: "AI has great potential to revolutionise industry, enhance efficiency, and create new avenues and channels for innovation. Alongside that, we also need to be mindful of guiding learners and users to leverage AI responsibly."

Fostering an enthusiastic and thriving ecosystem

With 78% of Singaporeans saying that they are keen to learn more about AI¹⁷, and more than half already using generative AI as of today*, it is clear that the adoption of AI in Singapore is grounded in a healthy level of public interest. At the same time, many Singaporeans also hope that AI can be

developed responsibly while it continues to be adopted. A survey by Ipsos found that 'responsible' AI development is the preferred approach for 38% of Singaporeans — relatively higher than other developed markets such as the UK (29%) and the US (33%).¹⁸

Singapore's AI development has a strong foundation. The next step is to support businesses as they adopt AI, and to help Singaporeans understand how AI can benefit their daily lives. As Mr Yik Jiawei, Director of Strategy and Planning at the Cyber Security Agency of Singapore (CSA), puts it: "The possibilities offered by AI are immense, but we must help Singaporeans and Singapore businesses adapt to the new technology and harness the potential of AI safely and securely."

*Note: According to Access Partnership's consumer survey conducted in 2024. For more information, please refer to the [Methodology page](#).

Advancing Singapore's AI adoption

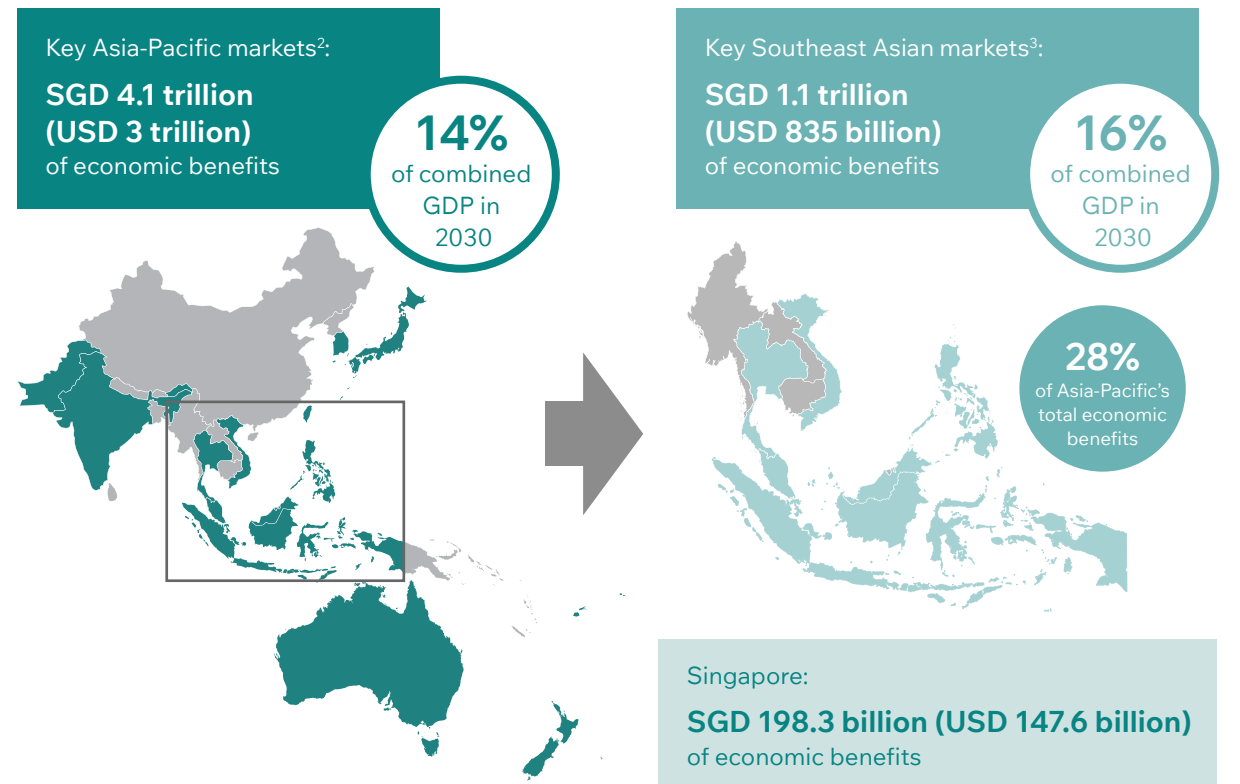
AI applications and tools, including generative AI, are unlocking significant economic benefits. From automating repetitive tasks to boosting analytics, workers and businesses are now able to do more with less time. All of these applications potentially translate into revenue expansion, cost improvements, and productivity gains.

The Asia-Pacific region is on the cusp of an AI-led transformation. Spending on AI in the region is expected to accelerate over the next few years, growing annually by more than 25% and reaching SGD 105.3 billion (USD 78.4 billion) in 2027, showcasing increased levels of commitment by businesses to integrate AI into their operations.¹⁹

For key economies in the Asia-Pacific region, this AI opportunity is expected to provide **economic benefits of up to SGD 4.1 trillion (USD 3 trillion) in 2030**, if AI-powered products and solutions are adopted. Among key Southeast Asian economies, this could be up to **SGD 1.1 trillion (USD 835 billion) worth of economic benefits in 2030** — or 28% of the Asia-Pacific region's total opportunity.

Singapore is well-placed to tap Asia Pacific's 2030 AI opportunity

Businesses in the region and the fast-growing sub-region of Southeast Asia are expected to see significant economic benefits from adopting AI-powered solutions.¹



1. The economic opportunity of AI refers to the economic benefits such as cost savings, revenue increments, and productivity gains that businesses experience from adopting AI-powered products and solutions. These figures reflect a high-impact scenario where there is rapid AI adoption among businesses. In a scenario where AI is adopted at a slower pace across different economic sectors, leading to fewer firms benefitting from the use of AI in 2030, conservative estimates of SGD 2.4 trillion (USD 1.8 trillion) for key markets in the Asia-Pacific region, SGD 674 billion (USD 501.7 billion) for key markets in Southeast Asia, and SGD 118.3 billion (USD 88.1 billion) for Singapore are expected.

2. This estimate accounts for the impact of AI in 14 key markets in the Asia-Pacific region: Australia, Hong Kong, India, Indonesia, Japan, Malaysia, New Zealand, Pakistan, the Philippines, Singapore, South Korea, Taiwan, Thailand, and Vietnam.

3. This estimate accounts for the impact of AI in six key markets in Southeast Asia: Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam.

Source: Access Partnership analysis.

Singapore is well-placed to tap the AI opportunity, with AI adoption in Singapore expected to provide **economic benefits of up to SGD 198.3 billion (USD 147.6 billion) in 2030**. This is equivalent to more than twice the size of the finance sector's economic value-added today.²⁰ Achieving this opportunity would involve actors across Singaporean society to undertake pivotal steps, including nurturing domestic AI talent, identifying key sectors for AI adoption, and supporting partnerships to boost innovation.

Nurturing a homegrown AI talent pool

One key ingredient in the move towards full AI adoption in Singapore, and capturing the full benefits of the technology, is the availability of skilled AI workers.²¹ These workers, such as data scientists or machine learning engineers, can develop and translate the use of AI in organisations across the economy. Singapore aims to have around 15,000 such AI workers by 2028.²²

Educational initiatives, such as the AI Accelerated Masters programme run by AI Singapore, a national multi-stakeholder programme, are therefore vital for nurturing homegrown AI talent.²³ Increasing the momentum of AI development initiatives will also help to attract world-leading AI talent from industry and academia to Singapore to further its AI innovation.



55%
are using
generative AI tools
in their
everyday lives



60%
of those who are
working are using
generative AI
at work



84%
of 18 to 35 year-olds
are using AI tools
(including generative AI)
today

Source: Access Partnership's consumer survey conducted in 2024. For more information, please refer to the [Methodology page](#).

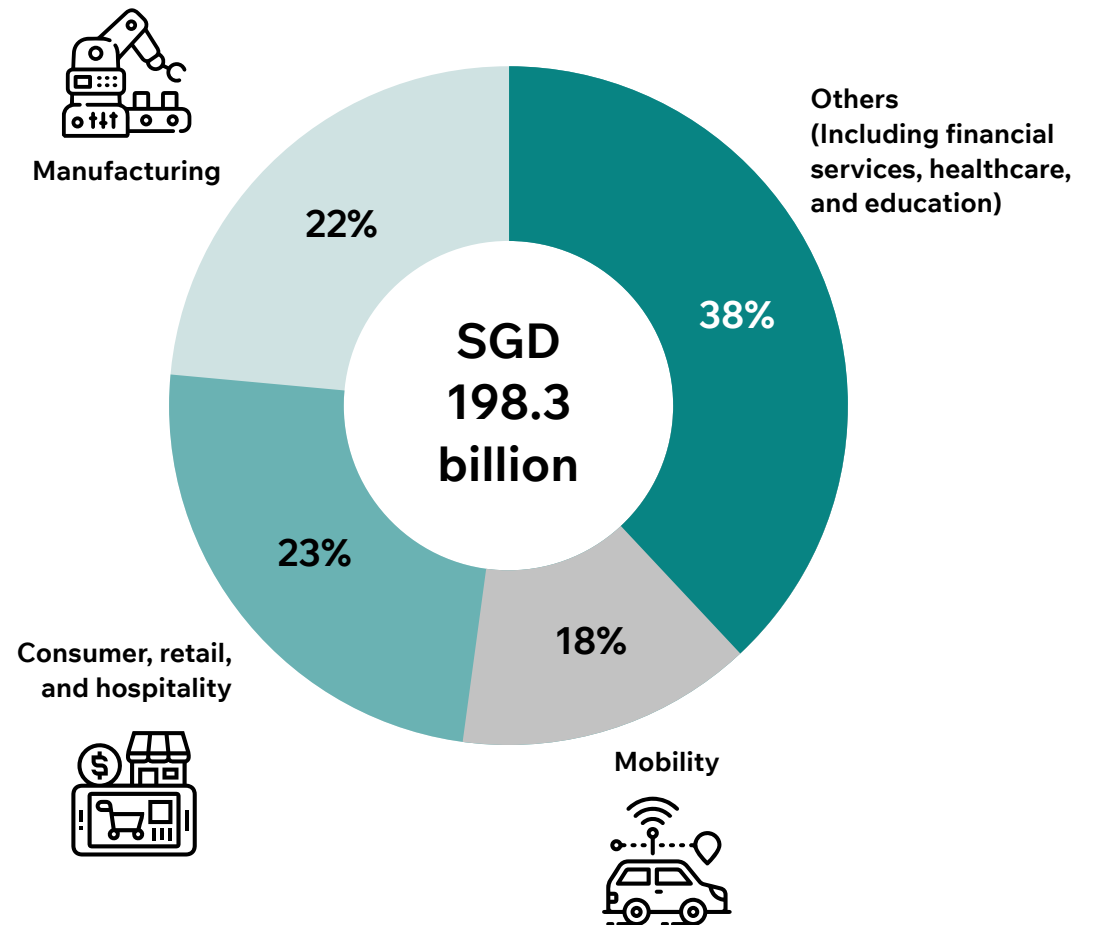
Driving adoption of AI in key sectors

The **retail, manufacturing, and mobility sectors** — all of which are key drivers of Singapore's economy today — are expected to gain the most from AI in 2030. Across all sectors, businesses and employees alike display remarkable enthusiasm to adopt AI tools. In fact, 95% of surveyed businesses and 94% of surveyed employees expect to use generative AI tools on the job within the next five years.²⁴

This enthusiasm is complemented by existing industry efforts to embrace AI. With an anticipated share of 22% of the total AI economic benefits in 2030, the manufacturing sector is primed for growth. To support this, the Ministry of Trade and Industry and A*STAR are jointly establishing an AI Centre of Excellence to help manufacturing companies use AI effectively and co-develop AI solutions, launching at the end of 2024.²⁵

Retail is another sector that can benefit significantly from AI in the coming years, with Singapore's retail businesses expecting to capture a 23% share of the total economic benefits projected for 2030. These businesses are well-placed to seize these benefits, given that 80% of local retailers with e-commerce capabilities are already leveraging AI to generate sales.²⁶ Key AI applications include targeted advertising or product recommendations.

Potential annual economic benefits from AI-enabled technologies, by sector %, 2030



Source: Access Partnership analysis.

Supporting diverse partnerships to boost innovation

Collaboration between the public sector, academia, and private industry can accelerate AI innovation and skilling by pooling resources, knowledge, and expertise. In Singapore's case, this ecosystem not only helps to drive faster technological advancements but also ensures that these innovations are grounded in responsible development and deployment. This helps to create practical and scalable innovations that can address real-world challenges.

One example of a successful collaboration between the public and private sector is AI Trailblazers, a joint initiative between the Ministry of Communications and Information (MCI), Digital Industry Singapore (DISG), Smart Nation and Digital Government Office (SNDGO), and Google Cloud.²⁷

This initiative aims to catalyse the adoption of generative AI in Singapore. By working within innovation sandboxes, participants have been able to responsibly develop and deploy generative AI solutions into the workplace to solve their specific challenges. Many participating organisations have benefited from this initiative, including Nanyang Polytechnic and STEPVR (more on them in [Chapter 2](#)).

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Tech leaders from industry and the educational institutions have to work together very closely. By networking with industry partners, we can be in touch with the latest industry needs and understand how to apply these new AI technologies.

Tan Soon Keow
Director of School of IT
Nanyang Polytechnic

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With AI Trailblazers, we're orchestrating a clear pathway for organisations to quickly, easily, and responsibly develop and deploy generative AI solutions with baked-in security and data governance. It is the first of a series of initiatives under our joint four-pronged strategy with MCI, as we look to establish a local AI ecosystem that fundamentally and sustainably positions Singapore as an open and trusted global AI hub.

Karan Bajwa
Vice President, Asia Pacific
Google Cloud

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[Josephine Teo, Minister for Communications and Information, Google executives, and teams from organisations that successfully built their own generative AI solutions through the AI Trailblazers initiative]. 2024. [Photo]. Google Cloud.

Securing Singapore's digital future with AI



As the digital economy grows, cybersecurity threats are an increasing concern

To effectively mitigate cybersecurity losses, Singapore must promote cybersecurity investments, digital literacy programmes, and integrate government initiatives to equip Singaporeans and businesses to deal with cybersecurity challenges.



60%
year-on-year increase

in scam and cybercrime incidents between 2021 and 2023²⁸

SGD 18.5 billion
(USD 13.8 billion) of cybercrime losses prevented
for Singapore in 2030 if businesses deploy AI-powered
cybersecurity capabilities.

Strong digital infrastructure and robust cybersecurity are both critical to the growth of Singapore's digital economy. Furthermore, as AI adoption grows, safeguarding user data becomes paramount for responsible use of the technology.

Unfortunately, the growth of any digital economy makes it an attractive target for bad actors. Cybercrime is a growing threat in Singapore, with scam and cybercrime incidents rising over 60% year-on-year between 2021 and 2023.²⁸

Emerging technologies such as generative AI will change the size and shape of digital threats.²⁹ For example, hackers today are becoming more adept at refining their operations and programming with the help of AI, leading to more sophisticated campaigns that can target states or other groups.³⁰ This makes it increasingly important for cybersecurity professionals to stay up to date with current trends and understand how AI is integrated into malicious applications.

Investing in AI as a powerful tool against cybercrime

AI is itself a critical tool in the fight against cybercriminals as it can continuously monitor systems for cyber threats, and respond in real-time in the event of an attack. AI programmes can also recommend actions based on investigation, run automatic searches and detection, analyse networks and flag potential vulnerabilities. In the finance sector, for example, AI and Machine Learning (ML) techniques have been used to great effect in tasks such as identifying anomalous financial transactions.³¹

Empowering Singaporeans for online safety

Digital solutions must also be combined with positive user behaviour. With more Singaporeans engaging in digital transactions, training on cybersecurity principles is more important than ever. Singaporeans remain vulnerable to cybercriminals, with almost SGD 652 million (USD 485 billion) being lost to scams in 2023, including ones that occur on social media or e-commerce platforms.³²

Teaching Singaporeans to identify common scams like phishing and investment scams, educating them

about digital risks, and helping them implement basic cybersecurity measures such as firewalls and antivirus software are therefore all important steps in empowering them to protect themselves online.³³

Ensuring online security is a team effort

AI-powered cybersecurity solutions and improved digital literacy must also be underpinned by government initiatives. Singapore has shown that online safety and security are priorities, with plans to set up a National Cybersecurity Command Centre,

update its Cybersecurity Act, and introduce new codes of practice to hold platforms accountable for user safety.³⁴

Collaboration with the industry is a priority that emerges across these initiatives, showing how tackling cybercrime is seen in Singapore as a team effort across government, industry and academia, and such integrated government initiatives will continue to be key in the fight against more sophisticated cyberattacks.

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Collaboration between the three Ps – People, Public, and Private sectors – is needed to make cybersecurity initiatives work. The people sector, such as NGOs and social service agencies, provides the platform for outreach while the government creates effective policy. The wider (tech) industry provides the knowledge and skills that empower our stakeholders.

Edna Leong
*Executive Director
RSVP Singapore*

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Case study

Cyber Security Agency of Singapore (CSA): Partnering with industry to secure the digital future

The cybersecurity landscape has become a lot more challenging to navigate. As Mr Yik Jiawei, Director of Strategy and Planning at the Cyber Security Agency of Singapore (CSA) explains, it's one where cyber criminals, or the 'attacking team', have become increasingly skilled in recent years, leveraging more sophisticated technology, tactics, and processes than ever. In addition, there is now more to defend, as more and more Singaporeans now live, work and play online.

CSA strongly believes that multistakeholder cooperation is key in the endeavour to secure the cyberspace. Industry, in particular, plays a critical role. "Our digital terrain is made up of digital infrastructure, devices, and products and services that industry players put to the market. If we want to move the needle, industry must recognise that they too are accountable for the safety and security of these tools that they provide," says Mr Yik.

1. Joining forces with industry

Therefore, CSA has been doubling down on efforts to collaborate with industry. This has culminated in the announcement of several memoranda of understanding (MOUs) with key industry players, including Google and Microsoft, to cooperate on matters pertaining to digital security.³⁵

The MOUs set out frameworks to facilitate the exchange of cyber threat intelligence, joint operations against cybercrime and malicious online activities, and the co-development of solutions to improve the safety and security of Singapore's digital domain. CSA and its partners will also work closely together to deepen the collective understanding of the risks posed by emerging technologies, such as AI.

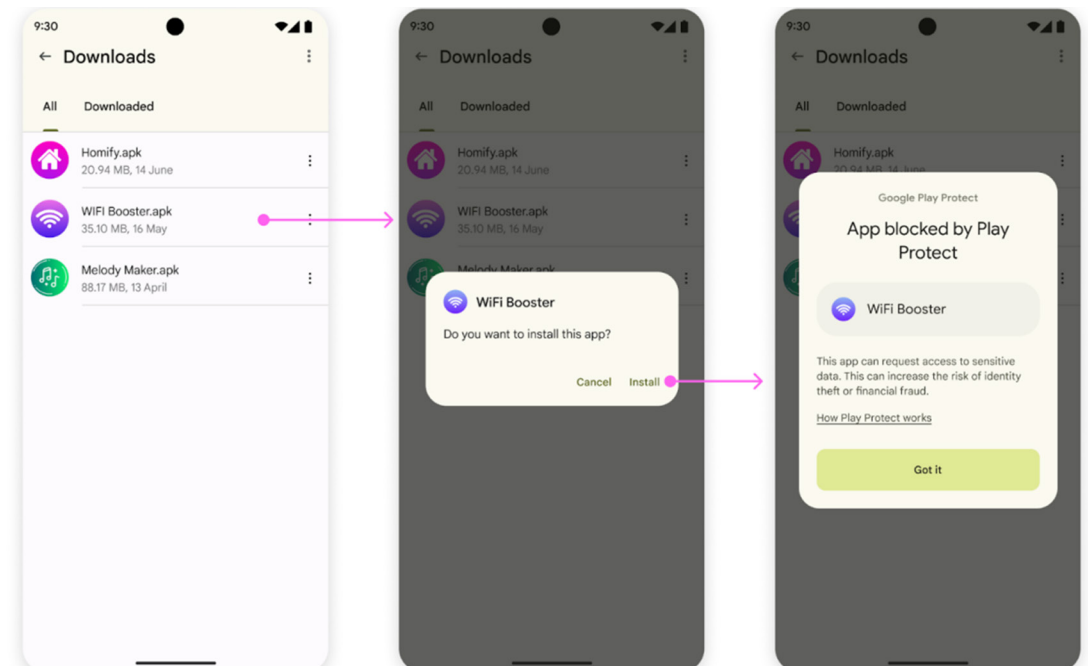


2. Piloting a world-first security feature with Google

An example of a fruitful collaboration is Google's piloting of a new Google Play Protect feature in Singapore, launched in partnership with CSA as a first in the world.³⁶ This feature protects users in Singapore by blocking high-risk apps from being downloaded onto Android devices through unverified sources like web browsers, messaging apps, and file managers.

"Initiatives such as this show how companies like Google are important contributors to the safety and security of Singaporeans and Singapore businesses," says Mr Yik.

Cybersecurity is a team effort, and everyone has a part to play. Google is also a new member of CSA's Cybersecurity Awareness Alliance, a platform which brings together members from the government, companies, trade associations and non-profit organisations, to promote the adoption of good cyber hygiene practices amongst Singaporeans. Looking ahead, Mr Yik hopes to see further collaborations between government and industry in advancing the use of emerging technologies for cybersecurity and addressing the security risks for emerging technologies. He is hopeful that the close partnership between government and industry will put Singapore in a better position to confront the cybersecurity challenges of tomorrow.



[Illustration of Google Play Protect]. 2024. [Photo]. Google Singapore.



Chapter 2

Strengthening the AI ecosystem in Singapore with Google

Strengthening the AI ecosystem in Singapore with Google

For Singapore to fully benefit from AI across industries and society, fostering a secure and trusted digital environment is crucial. Public-private sector partnerships will be essential to do this. Leading tech companies are innovating what is possible with AI while driving widespread adoption — and Google has been a key partner in this ever since it became an AI-first company from 2016.³⁷

This chapter analyses the current economic contribution of Google to Singapore's economy, through the benefits created from its various products and services (including AI solutions) to consumers, businesses and society.

SGD 14.7 billion of economic benefits

In 2023, Google's AI-powered products and solutions helped provide SGD 14.7 billion (USD 10.9 billion) of economic benefits for Singaporean businesses and households.



[The Google Singapore office]. (n.d.). [Photo]. Google Singapore

Google's economic impact in Singapore

By integrating AI into products and solutions that users interact with in their everyday life, Google has been playing a part in making AI readily accessible to businesses, institutions, and consumers in Singapore. These AI-powered tools are also helping to keep users safer from cyber threats.

Google AI is enabling developers to harness the power of generative AI through Google Cloud, or helping individuals to learn, create, and communicate through Gemini on its web interface or productivity apps such as Docs and Sheets — making AI helpful for everyone while driving economic growth and contributing to public good.³⁸

Google's AI-powered products and solutions unlock a host of benefits including increased productivity, enhanced creativity, and entirely new ways of creating value.

Prioritising safety and protecting users

As these benefits continue to grow, and with the increasing uptake of digital products and services in all areas of society, Google is redoubling its efforts to help users stay safer online. Through initiatives such as Be Internet Awesome and features such as Google Safe Browsing, the company plays a role in educating users on online misinformation or navigating them away from dangerous websites.

Empowering businesses in Singapore by democratising AI

Google's AI-powered products and solutions are widely accessible to businesses in Singapore, even for those that do not have their own deep expertise or in-house AI infrastructure.

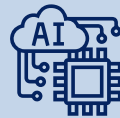
In the last year alone, over a million people and thousands of companies globally have used Google Workspace's generative AI functions, such as writing and refining drafts in Gmail.³⁹ Users of Gemini can even chat with it for help with highly complex tasks like coding, logical reasoning, and collaborating on creative projects, boosting their productivity.⁴⁰

All of this is helping businesses to unlock new economic opportunities.

Supporting business growth and jobs

SGD 9.8 billion of economic benefits

In 2023, Google Search, Google Ads, Google AdSense, Google Play, Google Cloud, and YouTube helped provide SGD 9.8 billion (USD 7.3 billion) of economic activity for businesses.



**Nearly 50%
or SGD 4.9 billion
(USD 3.6 billion)**

of the total economic activity provided to businesses was attributed to small and medium businesses (SMBs) who use Google's AI-powered tools.

In 2023, Google Search, Google Ads, Google AdSense, Google Play, and YouTube helped provide **SGD 6.3 billion (USD 4.7 billion) of export benefits from overseas markets for local businesses.**

This was facilitated by the increased visibility and international reach that businesses enjoy from products such as Google Ads and YouTube.

In 2023, Google **supported 22,000 jobs**

by helping businesses expand through their use of Google Search, Google Ads, Google AdSense, Google Cloud, and YouTube. As businesses use Google products and solutions, they unlock new audiences and enjoy revenue gains, all of which supports job creation.



**Employees derive
34 work days**

of time savings per year, facilitated by Google Workspace features that help to boost productivity such as real-time collaboration on documents and access to online storage.

For more information on these estimates, please refer to the [Methodology page](#).

Fostering AI skills adoption

Google also runs initiatives to promote AI adoption and skilling among businesses in Singapore. For example, the company supports startups in building new AI capabilities through the Google for Startups Accelerator and also equips individuals with AI skills through Google Cloud Skills Boost learning courses to build a sustainable pipeline of talent.⁴¹

Google is helping to improve access to AI expertise and tools through pioneering programmes such as the AI First Accelerator, which supports AI startups, and AI Trailblazers, aimed at organisations across government and industry.⁴² These initiatives give participants the boost they need to accelerate the development of home-grown AI solutions and promote AI within local businesses and the public sector. Nanyang Polytechnic and STEPVR are among the many organisations that have benefitted from this initiative.



Case study

Nanyang Polytechnic: Delivering a personalised, efficient learning experience with AI

At Nanyang Polytechnic (NYP), there is a real buzz around AI and how it can benefit both students and staff. For learners, the institute recognises the technology's huge potential in delivering a customised experience tailored to their individual needs, learning objectives, and preferences. Staff, on the other hand, can benefit from delegating repetitive and mundane tasks to AI, giving them more time to focus on higher-value work and delivering better services for students.

It was with this vision in mind that NYP took part in AI Trailblazers in partnership with Google Cloud — an innovation programme designed to apply generative AI solutions to 100 use cases across government and industry in Singapore.⁴³

Using AI to design job-ready training courses

NYP wanted to see if AI could be used to speed up the course development process, starting from IT courses in the Continuing and Training Education (CET) space. As a key partner for industry, NYP is often approached by organisations in various sectors to upskill their workforce through tailored educational and training courses. Creating these courses is extremely time-intensive for lecturers, resulting in long lead times for NYP's industry

partners to receive their training. “The demands mean that educators may sometimes take weeks to design even short two-day courses — time that could be better used toward valuable research or providing mentorship and guidance to students”, says Ms Tan Soon Keow, the Director of the School of Information Technology, NYP.

Thanks to AI Trailblazers, NYP was able to work closely with Google Cloud AI experts to build **Course AutoBot** — its very own course creation tool, powered by generative AI.

Now, lecturers can accelerate their course development process and improve the quality of their learning plans, assignments, and quizzes simply by keying in prompts including desired learning outcomes or course synopses. This leaves them with much more time to engage with students and deliver a higher-value learning experience.

“The support we received from the AI Trailblazers initiative was really instrumental in driving our own AI initiatives forward. We're looking forward to working even more closely with Google Cloud to explore leveraging other powerful tools to enhance our teaching and learning process”, Ms Tan adds.

Such tools and initiatives help NYP to meet the needs of its industry partners in a more agile manner, enhancing its role in upskilling the workforce in Singapore. As Mr Russell Chan, Principal and Chief Executive Officer of NYP, states: “Through the use of sandbox environments and sharing of best practices and expertise, we will continue to leverage the necessary tools, optimise learning resources, and streamline processes, to succeed in the AI-powered world.”



[Josephine Teo, Minister for Communications and Information, and NYP at the AI Trailblazers initiative]. 2024. [Photo]. LinkedIn.

Case study

STEPVR: Democratising video production with AI and Metaverse expertise

Businesses who need a video to promote their goods or services can find traditional video production daunting — with high costs, lengthy production times, and the need for specialised personnel. That is where STEPVR comes in.

The Singapore-based company is leveraging its expertise in cutting-edge technologies like metaverse technology, virtual reality, and AI to revolutionise how businesses create video content. Dr Guo Cheng, STEPVR's founder and CEO, emphasises the company's forward-looking nature: "AI represents an indispensable direction for future endeavours, one that must be seized proactively."

STEPVR's AI-powered video generation platform empowers businesses to create professional-looking videos with ease, much like how you would put together a PowerPoint presentation. This user-friendly approach translates into big wins for businesses. By eliminating the need for expensive equipment and professional crews, STEPVR cuts video costs and production times by up to 90%.

Building stronger products with Google AI

STEPVR's success was not achieved alone. Participating in AI Trailblazers gave the business the help they needed to define their initial technical roadmap, integrate AI plugins into the video generation process, and build their video generation platform on Google Cloud's Vertex AI. As Dr Guo notes: "The Graphics Processing Unit and computational support provided by Google Cloud gave STEPVR a competitive edge in both research and commercialisation endeavours". Importantly, Google Cloud also connected STEPVR with potential investors and showcasing opportunities, enabling them to reach real users early on and refine their offering based on market feedback.

The result? STEPVR's AI video platform is making waves, especially in Southeast Asia. With their ability to create videos featuring avatars speaking local languages, STEPVR is opening doors for businesses of all sizes to reach new markets.

As the demand for video content continues to rise, STEPVR's innovative platform is empowering organisations to create high quality videos, and engage with their audiences like never before.



[STEPVR team, including Dr. Guo, and an example of STEPVR's GenAI product in action]. 2024. [Video]. Channel News Asia.

Google Play — from Singapore to the world

In the past few years, developers have built countless digital products and services that have revolutionised the way we shop, play, work, and live. The mobile app developer community in Singapore might be small, but it is mighty, with an outsized impact on the world's economy.

App platforms such as Google Play give developers access to the tools and distribution methods they need to make their businesses a success. This includes benefits such as Gemini, the lightweight, open AI model Gemma, the AI-powered coding companion Studio Bot, and the ability to optimise and customise their offerings through data analytics.

Going global with Google Play

With over 3 billion active monthly Android devices worldwide, Google Play offers developers a ready audience for their apps, allowing them to go global easily.⁴⁴

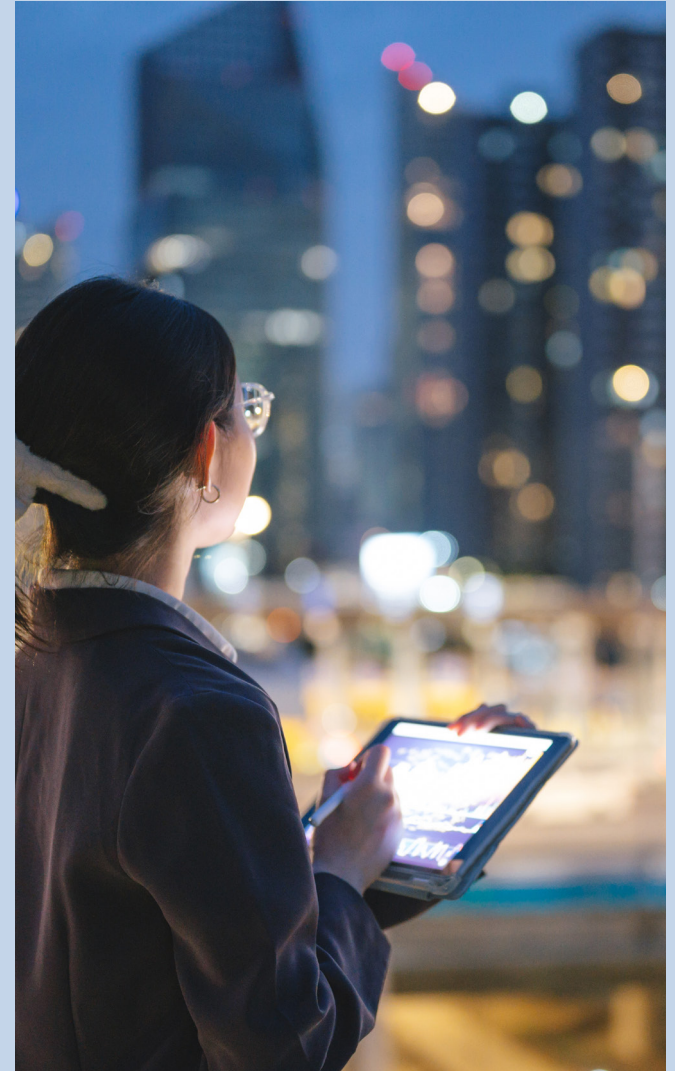
This facilitates significant economic benefits for Singapore's developers. In 2023, Google Play is estimated to have helped app developers secure **SGD 2.3 billion (USD 1.7 billion)** in revenue. Notably, **99%** of this total came from overseas users, with the majority of business coming from **India, Indonesia, and the US**.

In 2023, Singapore-made apps accounted for **1.3%** of global Google Play revenue and **2.1%** of global app downloads. This is significant considering that Singaporean Google Play developers make up only **0.2%** of the global developer count.⁴⁵ This means that the share of revenue for Singaporean developers is **six times more** than their share of global developers.

How the Android ecosystem supports jobs

Beyond empowering app developers, the Android ecosystem also contributes significantly to Singapore's economy.

In 2023, the Android app ecosystem supported 54,000 jobs in Singapore. Looking at the wider ecosystem, overall, an estimated 70,500 jobs in Singapore are supported by various digital platforms like e-commerce and food delivery apps — many of which are distributed through Google Play.⁴⁶ This highlights the broader economic impact of a thriving app ecosystem, fostering employment opportunities across various sectors.



For more information on these estimates, please refer to the [Methodology page](#).

Empowering Singaporean households with everyday access to AI

At both societal and individual levels, more Singaporeans than ever are reaping the rewards of Google's AI-powered products and solutions: from quicker and easier travel from Point A to B with Google Maps, to using Google Workspace to co-create and collaborate across teams. In fact, Access Partnership's survey found that 68% of employed Singaporeans say that they use Google Workspace to improve remote working and collaboration at work.

By offering easier access to information, entertainment, and increased productivity, Singaporean households have gained an economic benefit of SGD 887 (USD 660) per Internet user in 2023 from Google's products and solutions.

Developing impactful AI solutions for Singapore's community

As well as making Singaporeans' lives easier, Google also invests in innovations that support health, cultural, and environmental efforts.

Notable examples include the fight against dengue fever by Alphabet's life sciences unit Verily, which has partnered with the National Environment Agency of Singapore to control mosquito population levels in the region.⁴⁷

AI Singapore and Google Research are also working together to bring the benefits of Large Language Models (LLMs) to the people of Southeast Asia. Project SEALD is a research collaboration to enhance datasets for LLMs in local languages.⁴⁸ This is an important step in extending the benefits of AI in everyday life, as people can access AI models in their own language that incorporate their local culture, values, and norms.

SGD 4.9 billion of economic benefits

In 2023, Google Search, Google Maps, Google Play, Google Drive, and YouTube helped provide SGD 4.9 billion (USD 3.6 billion) of economic benefits for households.*



81%

of Singaporeans appreciate how AI-powered Google Search connects them to helpful and relevant information.⁴⁹



45%

of YouTube users in Singapore credit the platform with helping them develop a new advanced digital skill, such as AI and software programming.



59%

of Singaporean Google Maps users rely on the app to locate local businesses and services, connecting them to what they need.

Source: Access Partnership's consumer survey conducted in 2024. For more information on these estimates, please refer to the [Methodology page](#).

As sustainability becomes an increasing priority, Google is also driving innovation in climate solutions and empowering people to cut back on their carbon footprints. For example, Google Maps users in Singapore have helped save over **42,000 tonnes of carbon emissions** in 2023 by using the optimal travel routes suggested in the app — equivalent to taking 6,600 passenger cars off the roads.

Creating features that keep users safe

Features such as Google Play Protect are important for ensuring Singaporeans can safely browse the Google Play Store.⁵⁰ In a world-first pilot, Google also introduced a new enhanced protection feature within Google Play Protect in partnership with CSA.⁵¹

In further examples of how Google is contributing to a safe online ecosystem, the company also

uses AI to identify and help steer users away from harmful content on Search.⁵² Google Safe Browsing helps protect over five billion devices globally every day by showing warnings to users when they attempt to navigate to dangerous sites or download dangerous files.⁵³

Enhancing online safety and inclusion

As people's lives increasingly move online, digital literacy and safety is growing in importance. The [Be Internet Awesome](#) initiative educates younger Internet users and their parents on cyberbullying and misinformation, with over 50,000 parents and kids having already taken part.⁵⁴ Through its partnership with IMDA and the Media Literacy Council, the Be Internet Awesome programme aims to train a further 50,000 beneficiaries by the end of 2024.

Promoting awareness of scams helps to drive inclusivity as people become better adept at spotting and dealing with danger, encouraging them to be more digitally savvy. For example, Google partners with RSVP Singapore on Project PRAISE to train seniors in digital skills and identify scams, giving them much-needed confidence to navigate the online world and to know what to look out for to protect themselves.⁵⁵

In partnership with the Ministry of Home Affairs (MHA) and with the support from the Ministry of Communications and Information (MCI), Google also worked with 19 YouTube creators in 2023 to raise public awareness on online scams, including local creators such as The Straits Times, Sethisfy, TheSmartLocal, Our Grandfather Story, and Naomi Neo.⁵⁶ This helped to spread important messages around scams and ways for people to mitigate the associated risks.



Case study

RSVP Singapore: Seniors build digital confidence with Google

Seniors in Singapore are still navigating their way through the digital landscape, with only 44% feeling confident enough to spot scams online.⁵⁷ Recognising this challenge, RSVP Singapore, a group dedicated to empowering seniors, stepped up with an innovative solution.

Teaming up with the Singapore Police Force, the organisation launched Project PRAISE (Police-RSVP Anti-Scam Engagement) to train RSVP Senior Volunteers to become anti-scam advocates.⁵⁸ These PRAISE advocates then share their knowledge with fellow seniors, teaching them how to stay safe online through peer-to-peer sessions.

But with the rapid advancement of scams, RSVP knew they needed to equip their senior volunteers with more — they needed expertise. Enter Google, whose contribution has been instrumental in helping PRAISE advocates learn about security features such as Google Password Manager, Security Checkup, and 2-Step Verification.

“Our seniors were really excited to learn from Google, a brand name they immediately recognised as an industry and thought leader. The partnership has since been a tremendous success. What helped to pull this off was how Google helped train our own volunteers — empowering them to turn to their peers and say: “If I can do it, so can you”, remarks Ms Edna Leong, Executive Director of RSVP.

The impact has been significant. Over 120 PRAISE advocates have been trained by Google, gaining confidence and practical skills to navigate the digital world safely. Overall, Project PRAISE has engaged 7,500 seniors in the community to date. And it's not just about the training — Google's involvement goes beyond, offering support like translating course materials and providing Chromebooks for participants.

As technology evolves, RSVP understands the importance of keeping up. With partners like Google by their side, they are ensuring that seniors stay informed and equipped with the latest tools to thrive in the digital age.



[RSVP members undergoing anti-scam training with Google]. 2023. [Photos]. Google Singapore.

Skills Ignition SG and Google Career Certificates: Google empowers individuals to gain in-demand skills

To help mid-career professionals and graduates gain relevant technology skills, Google partnered with Singapore's IMDA to launch [Skills Ignition SG](#).

In this upskilling initiative, participants take part in a 12-month full-time training programme to learn either cloud architecture or digital marketing, and benefit from a robust training plan and mentorship from Google experts. Skills Ignition SG also offers [Google Career Certificates \(GCCs\)](#) as one of the many pathways to unlock new career opportunities by enabling participants to take courses that cover cybersecurity, data analytics, and IT support.

The recently launched [Google AI Essentials](#) course empowers people from any background to gain essential AI skills. This self-paced program, taught by Google's AI experts, uses practical examples on how AI can boost productivity and be helpful for everyone.

Through Skills Ignition SG and GCCs, many Singaporeans have been able to reshape their careers and skillsets, as illustrated by the stories from Royce Lua and Aruun Thavabalan.

From takeoff to tech: Royce Lua's unexpected journey into generative AI

[Royce's](#) path to programming was not a typical runway. After attaining a diploma in aviation and a brief stint in the sports and wellness industry, he realised that neither path was the right fit for him.

Taking a leap of faith, Royce signed up for programming courses that led to him landing his first position in the tech industry – a software engineer at [Payboy](#), an SMB that deals in human resource solutions.

He later participated in the Skills Ignition SG programme after reading up on generative AI development. While his long, winding path might have surprised some, the digital training Royce received on the programme helped him to eventually successfully land a generative AI engineer role at [SAP](#).



[Royce Lua]. [Photo]. Google Singapore.

Overcoming doubt: Aruun Thavabalan perseveres to upskill

After only discovering that he liked learning about tech mid-way through his bioengineering degree, [Aruun](#) was worried that his non-tech background would make it hard for him to penetrate the tech space.

When he read about Google's GCC programme, Aruun jumped on the opportunity to take up a scholarship and eventually obtained a Data Analytics certification. He has since successfully completed the programme and joined [Infosys Compaz](#) as a software engineer, where he regularly uses the SQL proficiency that he developed through GCC.



[Aruun Thavabalan]. [Photo]. LinkedIn

Google partners with Singapore to strengthen its AI leadership

Thanks to Singapore's strong and trusted ecosystem of government, businesses, and academia working together to unlock the benefits of AI across society, **Singaporean businesses could derive up to SGD 198.3 billion (USD 147.6 billion) of economic benefits in 2030 if AI-powered products and solutions are adopted.**

The openness of Singaporeans to using AI must be matched with strong cybersecurity measures, as an increasing number of people are exposed to threats online. Initiatives that educate everyone about cybersecurity, digital skills, and safe internet practices are essential. This not only empowers citizens but also helps prevent financial losses to scammers and hackers. Businesses in Singapore can **prevent SGD 18.5 billion (USD 13.8 billion)**

of cybercrime losses by leveraging AI-powered security solutions in 2030. Making sure that digital products and services are secure will also be important. As the threat landscape continues to change, a greater emphasis must be placed on AI-powered cybersecurity tools to combat malicious actors.

Private sector partners like Google play a key role in advancing Singapore's AI agenda. By providing secure access to AI-powered products and services, Google empowers businesses and households, and is driving positive economic, environmental, and social change. With its commitment to online safety and AI innovation, Google is also a trusted partner in promoting responsible AI adoption in Singapore.

“

When there is a powerful collaboration, like [AI Trailblazers] with Google, it gives us the opportunity to avail ourselves of invaluable insights and cutting-edge tools. This allow us to not only harness the potential that AI can bring to the education space, but also to allow the next generation of tech leaders to see for themselves the possibilities and impact AI can bring.

Russell Chan
Principal and Chief Executive Officer
Nanyang Polytechnic

”



Methodology

Estimating the economic benefits of AI and cybersecurity in Singapore

This report estimates the annual economic benefits of digital technology in two key areas: AI and cybersecurity. The analysis takes 2030 as the target year to ensure sufficient runway for reasonable projections (which takes into account increases in technology uptake over the coming years).

The economic benefits of AI in 2030 were assessed by conducting a sector-specific analysis of the impacts of both traditional and generative AI within each sector. This evaluation involved measuring the sector-targeted effects of over 400 traditional AI applications and over 60 use cases related to generative AI. The Asia Pacific value was estimated for each of the mentioned 14 markets, with some market-level estimates relying on an average AI-impact multiplier consistent with peer markets. The Southeast Asia value was estimated for each of the mentioned six markets.

The economic benefits of cybersecurity were estimated based on the cost savings for businesses deploying AI in cybersecurity. This report measures the potential reduction in direct costs (financial losses associated with a cyber-security incident, such as loss of productivity, fines, and remediation cost) and indirect costs (opportunity cost to the organisation, such as customer churn due to reputation loss) as more businesses in Singapore deploy AI in cybersecurity in the year 2030, forecasted based on global trends.

It is important to stress that the economic benefits of AI and cybersecurity are not necessarily incremental, and so should not be simply combined to estimate total economic impact in these two areas.

Estimating Google's economic benefits in Singapore

The household benefits supported by Google are challenging to measure and analyse because individuals typically do not pay to use Google Search, Google Maps, YouTube, Google Play, Google Drive, and Google Workspace (all free tools). In the absence of price indicators, the economic 'willingness to pay' principle provides a proxy for the dollar amount Singaporeans benefit from these tools, representing the perceived economic benefits they derive. Individuals were asked how much they value the specific services, a value amount otherwise known as consumer surplus.

These insights were gathered through a survey conducted in January 2024 with 502 individuals based in Singapore. The sample size of respondents is statistically significant based on the Internet population in the country, at a 95% confidence level and 5% margin of error.

The economic activity generated by businesses from Google products, such as Google Search, Google Ads, Google AdSense, Google Play, Google Cloud, and YouTube was estimated based on the gross revenue, income, or savings generated by businesses in Singapore from leveraging Google products. The value of using Google products does not include the flow-on economic effects generated, such as further purchases from their suppliers or the economic activity generated by employees of these businesses who spend their wages in the broader economy. The value also does not account for the activities that may have been displaced by Google, nor does it attempt to estimate the incremental impact of Google on Singapore's economy in hypothetical instances where Google itself does not exist but similar companies do. The methodology adopted to derive the economic activity generated by businesses in Singapore in this report references the US Google Economic Impact Report methodology.

The export benefits for Google products such as Google Search, Google Ads, Google AdSense, Google Play, and YouTube were estimated based on the economic activity generated by businesses using each product and its respective export ratio. The export ratios for Google Search, Google Ads, Google AdSense, and YouTube were derived based on the share of overseas traffic on search and display advertisements for Singapore. For Google Play, the overseas share was estimated using the 'power law' curve (an established empirical approach to approximate the dynamics of winner-take-all markets like mobile apps).

The number of jobs supported by Google's tools in 2023 was estimated based on the economic benefit to businesses from each advertising product and Google Cloud, the share of digitally-enabled businesses, and the labour productivity in Singapore. The number of jobs supported by the Android app economy in 2023 was calculated based on the methodology from the Progressive Policy Institute, a leading institute studying app economies around the world. This is derived based on the estimated app intensity of Singapore (app economy jobs as a share of total jobs) and the economically active population in the country.

A detailed methodology memo outlining the approach adopted in our study can be accessed on our website [here](#).

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All calculations were done in USD, and have been converted to SGD based on the average exchange rate in 2023 of 1 USD = 1.34 SGD, obtained from OFX. All estimates in this report are expressed in SGD and are based on the latest available data as of time of analysis in 2024.

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Our Economics Strategy team (formerly known as AlphaBeta) is a leading economic and strategy consulting practice with deep experience across a number of topics in the digital economy and the future of skills, sustainability, and economic development.

Access Partnership would also like to thank the Cyber Security Agency of Singapore, Nanyang Polytechnic, STEPVR, and RSVP Singapore for offering their time and support to be interviewed as part of this study. Their invaluable contributions are featured as case studies and quotes throughout this report.

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