

Digital Southeast Asia

Opportunities for Australia–India cooperation to support the region in the post-Covid-19 context

Dr Huon Curtis, Bart Hogeveen, Jocelinn Kang, Dr Huong Le Thu, Dr Rajeswari Pillai Rajagopalan, Trisha Ray



About the authors

Dr Huon Curtis is an Analyst working with the International Cyber Policy Centre at ASPI.

Bart Hogeveen is the Head of Cyber Capacity Building working with the International Cyber Policy Centre at ASPI.

Jocelinn Kang is a Technical Specialist working with the International Cyber Policy Centre at ASPI.

Dr Huong Le Thu is a Senior Analyst working with the Defence Strategy and National Security Program at ASPI.

Dr Rajeswari Pillai Rajagopalan is the Director of the Centre for Security, Strategy and Technology at the Observer Research Foundation.

Trisha Ray is an Associate Fellow at the Centre for Security, Strategy and Technology at the Observer Research Foundation.

Acknowledgements

ASPI and ORF would thank all of those who peer reviewed drafts of this report, including Arindrajit Basu and Akshay Mathur, for their valuable feedback. We would also like to acknowledge the contributions of Baani Grewal, Samyak Leekha, Antara Vats, Ariel Bogle, Karly Winkler and Albert Zhang to this report. We are also grateful to the individuals consulted across government, industry and academia, including participants at the Southeast Asia Internet Governance Forum and the ASPI-ORF-hosted Track 1.5 Dialogue on Digital Southeast Asia that helped to shape and focus this report.

This report was commissioned by the Australian Department of Foreign Affairs and Trade (DFAT). The work of ASPI ICPC wouldn't be possible without the support of our partners and sponsors across governments, industry and civil society.

A draft of this report was shared with DFAT and valuable comments were incorporated, but, as with all our research, ASPI remains fully independent in the editorial judgements and policy recommendations made by our authors.

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ASPI

Tel +61 2 6270 5100

Email enquiries@aspi.org.au

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First published February 2022. ISSN 2209-9689 (online). ISSN 2209-9670 (print). Cover image: Wes Mountain.



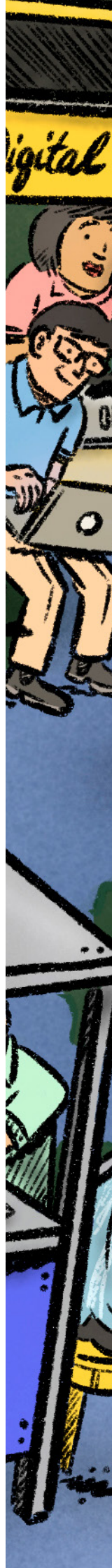
Funding support for this publication was provided by the Australian Department of Foreign Affairs and Trade

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Policy Brief
Report No. 57/2022



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What's the problem?

Covid-19 and the subsequent public-health responses have disrupted social and economic lives across the globe. Fiscal support measures may have alleviated the initial fallout in some places, but one of the bigger shocks has been the accelerated adoption and integration of and reliance on digital technologies. While this is a positive contribution towards digital development, it has also accentuated the already large gap between those able to adopt digital technologies and those without sufficient means to do so.

For the many fragile democracies in the Indo-Pacific, this is creating conditions that could undermine democratic resilience. A central question for these democratic governments is how to drive accelerating digital transformation and ICT-enabled growth towards poverty reduction, sustainable economic growth and building social cohesion while maintaining resilience to cybersecurity threats.

Southeast Asians are exceptional consumers of online goods and services. The region is also home to a growing number of technology start-ups, and governments are pushing this 'drive for digital' through ambitious national strategies. Despite those positives, digital growth within the region and within individual economies is uneven.

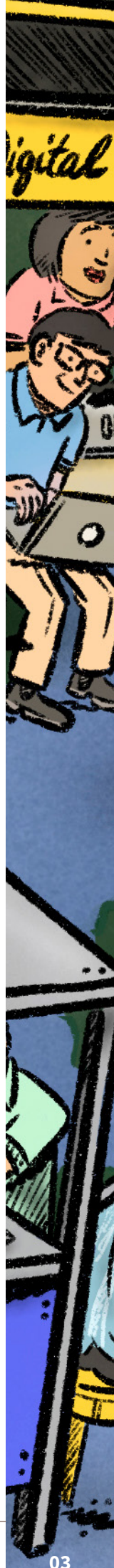
Human capital is a central driver of poverty reduction, sustainable growth and social cohesion,¹ but, in Southeast Asia, digital literacy and skills are lagging behind usage and infrastructure. The adoption of technology is progressing, but problems of affordability, connectivity and coverage remain. There's a limit to the growth trajectory due to weak demand from micro, small and medium-sized enterprises (MSMEs) that don't have the means, skills or opportunities to adopt or integrate digital technologies. This is particularly affecting the livelihoods of non-metropolitan communities, women, MSMEs and those whose jobs may be affected by the introduction of technology and automation.

The digital divide and rising inequality are now the everyday bromides of earnest policymakers. But the phrases have become policy clichés, stripped of meaning, with no sense of the underlying dynamics at play, making the prospects for any viable solutions slim. The Covid-19 pandemic has offered a harsh look at the role of the digital divide in driving inequality and the unedifying future that lies ahead as major technological advances compound and permanently entrench inequality.

— Huong Le Thu, 'Investing in Southeast Asia's tech future', in *The Sydney Dialogue: playbook*, 2021²

Since the outbreak of Covid-19 in early 2020, digital adoption has further accelerated and driven greater demand for online services in retail, education and health. However, the pandemic has also contributed to the further widening of pre-existing digital divides. Women have been disproportionately affected, as many are employed in the informal and 'gig economy' sectors, which were hit hard by lockdowns. The pandemic has also further exposed more users to cybersecurity and online safety risks in an environment in which practices of cyber hygiene are generally poor.

As a result, the region is now faced with a dual transformation challenge: **how can we stimulate further digital development while ensuring that future growth is inclusive?**



What's the solution?

This report recommends Australia and India leverage their bilateral partnership in cyber and critical technologies to support inclusive digital development in Southeast Asia, and strengthen the foundations of Southeast Asia's digital economy.

The governments of Australia and India should take a more coordinated approach to their digital engagements with Southeast Asian countries, and further consider establishing a Joint Working Group on Digital Engagement to bring together like-minded partners.

Given that India and Australia face digital development challenges that are similar to Southeast Asia, an Australia-India spearheaded cooperation should be approached through a troika-type collaboration with Southeast Asian partners. This collaboration should look to address the region's digital skills shortage, improve cyber resilience and contribute to digital public infrastructure. This requires a multi-stakeholder effort involving governments, the private sector, civil society and the technical community.

A priority area for additional support are efforts that enhance the digital knowledge and digital business skills of the Southeast Asian workforce. International initiatives should seek to augment or connect with existing local digital skilling programs. Specific areas of focus for Australia and India could include support to female digital entrepreneurship, and improvement of access to online courses and training to upskill MSMEs.

To improve cyber resilience operationally, Australia and India could strengthen and deepen relationships with Southeast Asia's national cybersecurity agencies and national Computer Emergency Response Teams by exploring ways to share collective resources, expertise and experiences more effectively and more widely across each country's economic sectors and non-metro areas.

At a strategic level, through the Australia-India Joint Working Group on Cyber Security Cooperation, the two countries could consider the possibility of sharing strategic assessments of the regional cyber threat landscape with Southeast Asian partners.

Finally, India and Australia should explore regional marketplaces for digital public goods and infrastructure which could offer further business incentives to digital, technology and cybersecurity communities in Australia, India and Southeast Asia.

Introduction

Southeast Asia is home to one of the world's fastest growing markets of internet users. Pre-pandemic, there was enormous optimism about the growth of Southeast Asia's digital economy. Estimates from 2019 showed a trajectory that would triple its US\$100 billion internet economy by 2025.³ During the first year of the Covid-19 pandemic, the region's internet economy gained more traction, and even achieved double-figure growth in Vietnam and Indonesia.⁴

Today, the region continues to struggle with new and more contagious variants of the virus, as the majority of the region's population remains unvaccinated.⁵ Economic hardship, overburdened health systems and, in some cases, repressive public-order responses are posing challenges to political stability and societal resilience. As a consequence, when combined with the effects of climate change, there's uncertainty about the long-term economic and social effects and the shape and speed of economic recovery.

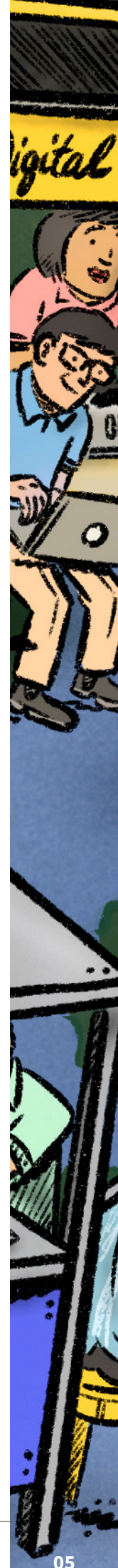
Digital technologies⁶ are playing an integral part not just for contact tracing or getting public-health messages out into the community but also as a driving force for post-pandemic economic recovery. For years, governments in Southeast Asia have been pursuing ambitious digital transformation agendas that have laid a foundation for their emerging digital economies. In a post-Covid world, international partnerships of governments, industry and civil society organisations, such as between India, Australia and Southeast Asia, could form a key element in the region's digital economic recovery and help set digital standards and norms.

Focusing on Indonesia, Malaysia, the Philippines, Thailand and Vietnam, which are some of the region's largest and emerging technology-enabled economies, this report explores what efforts can be made by an Australia–India collaboration to support Southeast Asia's digital capacity and resilience in the aftermath of the Covid-19 crisis. Collaboration between Australia and India in the area of cyber and critical technology is an emerging partnership that brings opportunities for strengthening both countries' digital cooperation with Southeast Asian partners.

What are the digital economy, digital transformation and Industry 4.0?

There's no agreed definition or framework that defines the *digital economy*. Different frameworks highlight, to varying degrees, macro policy foundations (such as competition, trade, governance), digital enablers (infrastructure, platform policies, skills, finance) and sectoral transformation (such as ICT applications in key economic sectors such as public services).⁷ Digital economy frameworks rarely consider the whole digital ecosystem and its interaction with the rest of the economy. The Asian Development Bank, for instance, has introduced the term 'core digital economy',⁸ which it defines as the contribution to GDP of any economic transaction involving both digital products and digital industries. In this report, we also consider wider aspects within the digital economy, including gender and inclusion.

Digital transformation refers to the process of moving from analogue to digital processes, integrating technology into working processes and, in its most advanced stages, doing so under the guidance of a strategy.



Industry 4.0 or the ‘fourth industrial revolution’ (4IR) refers to the application in industry of the convergence of physical and digital technologies. This can include artificial intelligence, machine learning, ‘internet of things’ (IoT) devices, advanced robotics, augmented reality, cloud computing, big data and analytics, and 3D printing.

The first section of the report reviews the enablers and attendant challenges of Southeast Asia’s digital economy, such as the supply of infrastructure, demand for digital services and general uptake of technology by individuals and businesses. In addition, it looks at intersecting policy issues that enable, support and sustain digital transformation, such as inclusivity; skills and talent; online security and safety; and regulations and governance. It then touches upon the region’s adoption of advanced technologies such as 5G and artificial intelligence (AI) that could equally be enablers of the region’s next leap in digital transformation.

The second section offers an overview of the pandemic’s effects on Southeast Asia’s digital landscape. Although there’s been continued investment into digital infrastructure, it shows there are fundamental weaknesses in the rate of digital growth within MSMEs.

The third section looks at a troika type of collaboration between India, Southeast Asia and Australia. As the digital development challenges faced by Southeast Asia are equally relevant to Australia and India, we provide a selection of relevant skills, expertise and flagship programs that India and Australia could contribute to the region in a common effort to adapt to a digital future that’s free, open and secure.

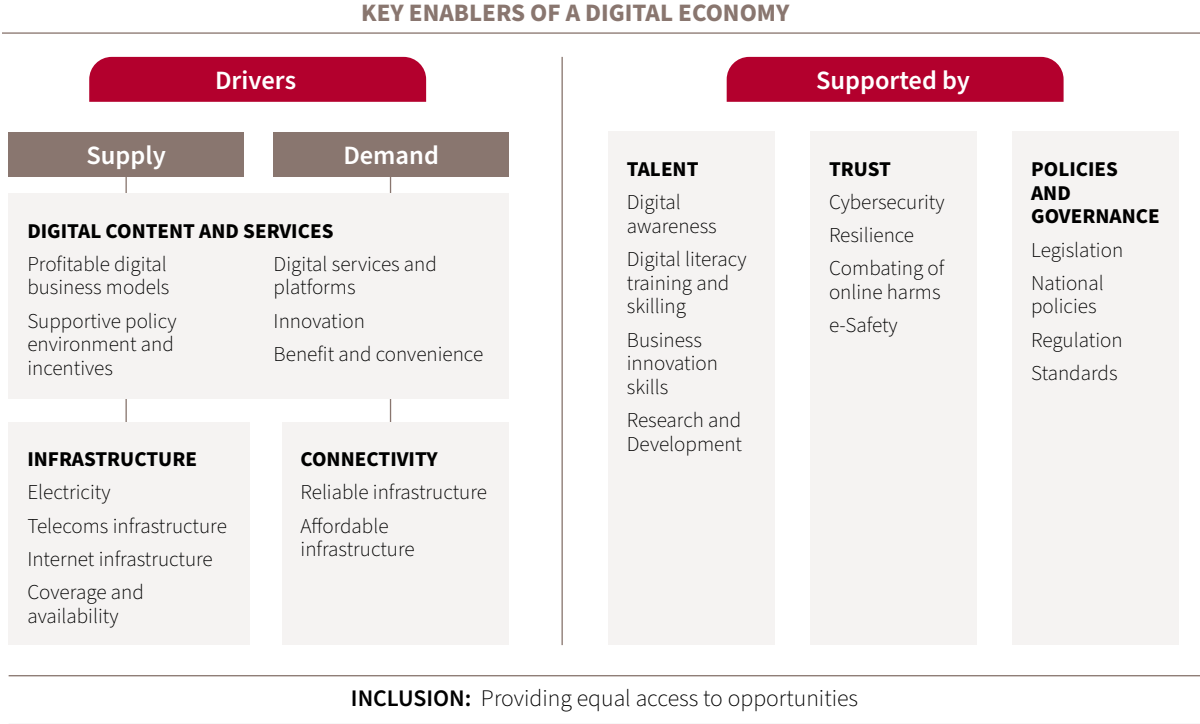
Finally, this report concludes with a set of policy recommendations for Australia and India on areas in which they could extend meaningful and targeted support to Southeast Asia’s digital economic recovery.

The state of digital Southeast Asia in 2021

Activating digital resilience requires a comprehensive view of cyber- and technology-related features, trends and challenges. This section examines the key enablers of the digital economy in Southeast Asia, such as the supply of network infrastructure and digital services, alongside demand in the form of internet and technology usage and connectivity trends. Additionally, we look at factors that cut across those areas—digital skills and online risks.

Figure 1 is a non-exhaustive overview of enabling factors in a digital economy. It looks at both physical and technology issues and human dimensions such as usage, acceptance, content, services and trust.

Figure 1: Key enablers of a digital economy



Source: ASPI.

Given the number of interdependent and interrelated factors to consider, it’s no surprise that there’s no ready-made digital toolkit available to policymakers. The wide variety of possible activities or instruments shouldn’t distract us from what works; that is, promoting digital transformation through a clear set of priorities based on the circumstances of each country, but also with gestures towards knowledge sharing and shared goals across the region. Successful digital transformation might rely on a strong institutional environment or enabling regulatory environments that are shared across different countries.

In recent years, various initiatives have been undertaken, including through support from Australia’s Department of Foreign Affairs and Trade (DFAT), to assess individual Southeast Asian digital economies. The most detailed and recent are listed in Figure 2 and have informed this report. These reports are characterised by deep levels of analysis based on data and surveys, but generally also by an absence of practical recommendations for next steps.

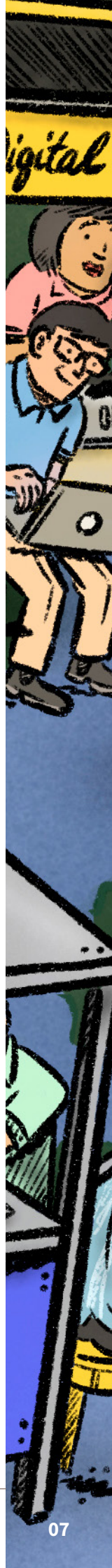


Figure 2: Individual Southeast Asian country reports on the digital economy



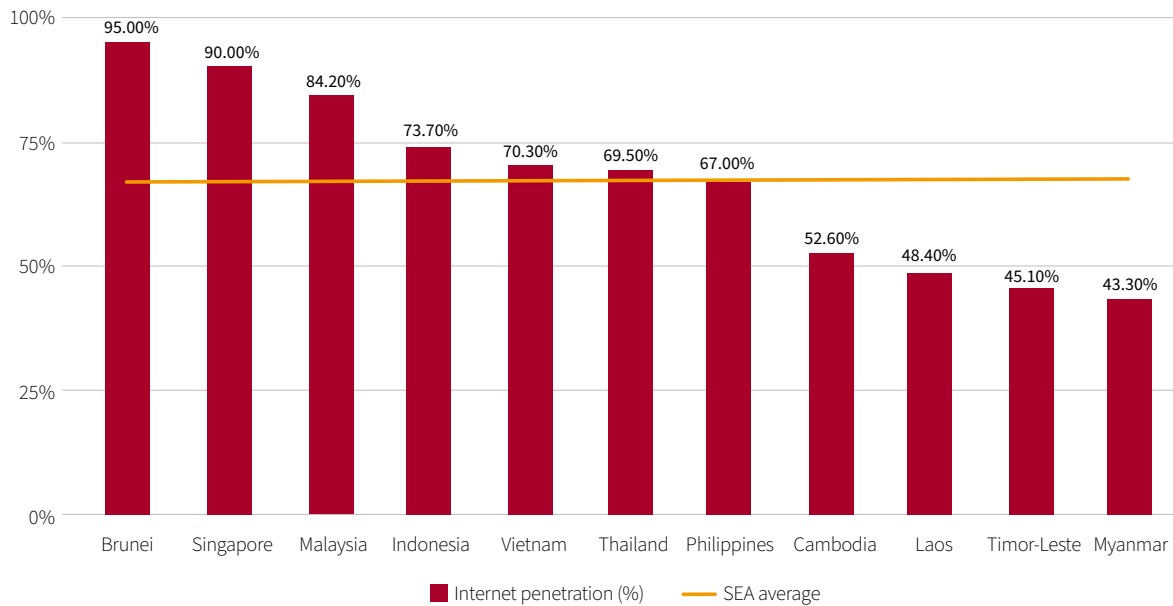
Indonesia, Malaysia, the Philippines, Thailand and Vietnam have some of the largest populations in the region and are economies at different stages on the digital development ladder.⁹ All have digital strengths, such as in connectivity (Malaysia), platforms supporting a gig economy (Indonesia), social media use (Philippines), internet penetration (Vietnam) and government vision (Thailand). Collectively, those economies continue to face challenges in the areas of affordability, inclusivity, transitioning from analogue practices, sufficient digital human capital and effective policymaking and regulation.

At the same time, Southeast Asian countries share ambitious national digital agendas that collectively seek 'to propel the region towards a digitally-enabled economy that is secure, sustainable and transformative'.¹⁰ At the regional level, in early 2021, the Association of Southeast Asian Nations (ASEAN) endorsed an updated Digital Master Plan 2025. Including an early assessment of the impact of Covid, the regional group reaffirmed its priorities of universal access to online government services, education and health services; bringing down trade barriers; and increasing digital literacy.¹¹

Demographics, internet penetration and devices

As a bloc, Southeast Asia is the world's fifth largest economy. It has a population of 660 million, of whom 23% are 'millennials'—the first generation of digital technology natives with consumer spending power and immense influence over technology trends.¹² The region has an average internet penetration rate of around 70% (Figure 3), although there's a stark contrast between the most connected (Brunei at 95%) and least connected (Myanmar at 43.3%) countries. Overall, the region's 460 million connected users make up just under 10% of global internet users, and many global tech companies see the region as a growth market.¹³

Figure 3: Internet penetration in Southeast Asia (%)

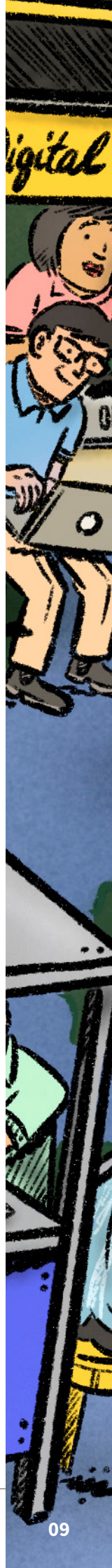


Source: Hootsuite / We are Social.

Although an estimated 200 million people are still unconnected, Southeast Asians once online, are among the heaviest internet users in the world measured by their time spent online. Beyond mainstream expansion in social media and gaming usage,¹⁴ the region has also experienced an enormous growth in the use of e-commerce and digital payment service platforms offered by homegrown tech ‘unicorns’.^{15 16}

The region is the largest adopter of Facebook, which offers huge opportunities for social connectivity. Media platforms are offering critical channels for journalists (such as *Rappler* in the Philippines) and civil society organisations to play their democratic roles, but those channels are equally at risk of being misused for the propagation of disinformation by state and non-state groups.¹⁷

Country data from Indonesia and the Philippines suggests that young people are leading the way in smartphone adoption. This aligns with trends in emerging economies globally.¹⁸ Research by UNICEF found that young people value digital skills as being important to their future but identify inadequate quantity and quality of digital training at school, lack of digital devices and lack of internet access as major barriers to building their digital skills.¹⁹ Some of this is related to a rural–urban divide and is affected by factors such as belonging to an ethnic minority.²⁰



Digital skills

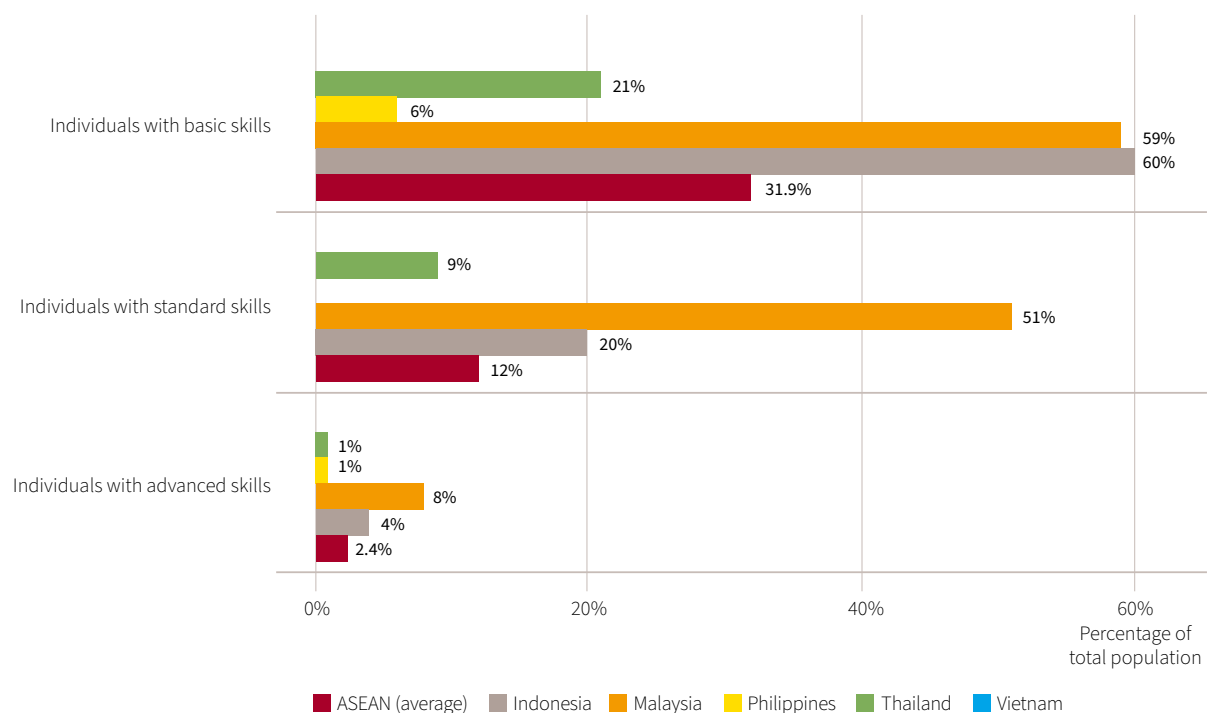
The region has seen a dramatic increase of internet connections, predominantly through mobile phone internet. In itself, internet usage isn't sufficient for accelerating digital transformation. A nation's workforce needs to possess technical ICT skills and social and communication skills alongside the ability to integrate technologies into business processes.

There are a number of different ways to define skill levels in a digital environment. The International Telecommunication Union (ITU) defines basic ICT skills as using devices and software, and completing basic online transactions; standard skills include being able to use digital technology in meaningful and beneficial ways; and advanced skills include the ability to perform programming, software development, data science and network management.²¹ As self-reporting of skills is subjective, the ITU measures skills based on whether an individual has performed a particular task recently.

Additional measures for today's modern and evolving digital skill set should also include operating smartphones, the ability to respond to common online risks, and social and communication skills such as critical thinking and adaptability. A recent report by the Asian Development Bank (ADB) affirms that employers believe the 4IR will lead to a shift from routine to non-routine and analytical work tasks. This requires skills in 'evaluation, judgment and decision-making' in conventional industries, 'written and verbal communications' in tourism and 'numeracy skills' in ICTs.²²

Measurements of skill levels across Southeast Asia show that Thailand and the Philippines are lagging in the region in numbers of people possessing basic and standard ICT skills despite, for instance, the Philippines having high uptake and being a relatively highly educated nation (Figure 4).²³ While data from the same survey isn't available for Vietnam, a different study shows that the Vietnamese workforce has a strong desire to be technologically educated and to become more proficient in adapting to new technologies.²⁴

Figure 4: Levels of basic, standard and advanced ICT skills graphed from ITU data



Source: International Telecommunication Union.

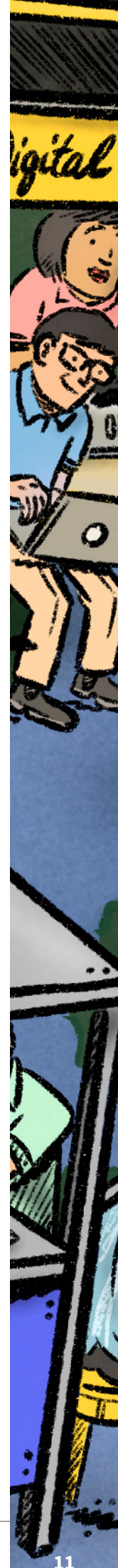
Where internet access is available, opportunities exist to reduce inequalities in access to general education. For instance, on the remote islands of Indonesia and the Philippines, it's traditionally difficult to attract and retain skilled educators. Access to the internet offers opportunities to skill, upskill or re-skill in newer applications and technologies that haven't yet found their way into educational curriculums. Online learning companies have noted the opportunity and interest in online learning resources.²⁵ Various ed-tech start-ups and massive open online courses (MOOCs) have emerged, such as Topica (Vietnam), Ruangguru (Indonesia) and Thai-MOOC (Thailand).²⁶ Government departments, such as the Philippines' Department of Science and Technology, have partnered with existing MOOC platforms such as Coursera to offer accounts with access to free online courses through scholarship grants.²⁷

Skilling initiatives are further affected by a gendered picture of internet and mobile phone usage, access and affordability. For those in Asia who know about mobile internet but don't use it, the top barriers are literacy and digital skills; affordability of smartphone handsets (although costs are decreasing).²⁸ These are large barriers to digital adoption for non-urban and poorer populations in Southeast Asia, and they affect women more than they affect men.²⁹ In addressing the gender digital divide, it's important to look beyond the single aspect of internet usage. Other important areas include having opportunities for women and girls to improve their digital skills, participate in STEM professions and be involved in tech-sector leadership and entrepreneurship.

At the regional level, a focus on digital gender equality is only very recent and requires continued attention. The ASEAN Comprehensive Recovery Framework, published in 2020, places gender equality at the centre of its post-Covid recovery strategy and recognises women's digital inclusion as a core part of female economic empowerment. Currently, most national strategies on women's economic empowerment don't specifically address digital gender equality.³⁰

Data from the Inclusive Internet Index 2021 published by *The Economist Intelligence Unit* showed that there are policies supporting digital inclusivity generally, but that specific policies that directly address female digital inclusion, including internet access, female-focused digital skills training and STEM education plans, were lacking in Indonesia and Vietnam.³¹ In Indonesia, advocacy for gender issues in the digital space is spearheaded by civil society organisations,³² while private industry and international organisations are the main drivers in Vietnam.³³ The Philippines stands out for its strong policy support for female digital inclusion and its rate of access: a higher proportion of women than men have access to mobile handsets and internet access.³⁴

Workforce equality and equity are important dimensions of the digital economy. Diversity and inclusion are ever more central to the development and deployment of technologies driven by machine learning and AI. Biases in machine learning can be magnified and reinforced, so that when the systems are applied at scale they can have a disproportionate impact on already marginalised groups. Diverse teams are a strategic asset and essential for driving innovation.³⁵ It's critical that those designing and deploying advanced technologies are reflective of society.



Digital integration in micro, small and medium-sized enterprises

The development of human capital enables workers to understand and assimilate new technologies. For this reason, collective training and upskilling is crucial to technology and innovation diffusion and adoption. How governments can provide MSMEs with incentives to take part in this is a key issue in the region.

Across Southeast Asia, MSMEs make up 88.8% to 99.9% of total establishments and account for between 51.7% and 97.2% of total employment.³⁶ Although 75% of SMEs see opportunity for their business in digital adoption, only 16% of SMEs are digitised.³⁷ Two of the barriers are a lack of understanding about digital technology and a shortage in the workforce's digital skills.³⁸ Moreover, the use of digital tools and services doesn't automatically equate to possessing the skills to integrate technology into work processes.

To address skills shortages, governments in the region are developing partnerships with global technology firms such as Microsoft (including LinkedIn and GitHub), Facebook and Google to deliver digital skills training programs for MSMEs. Each of the programs claims to put digital training in front of a large number of workers and managers and in support of government-led initiatives such as Singapore's SkillsFuture.³⁹ However, most programs are concentrated on high-end technical skills, and their economic outcomes are unclear. The Go Digital ASEAN program supported by Google and administered by the Asia Foundation is working at the grassroots community level in the Philippines and Vietnam. It reports that the confidence in the use of digital skills of 3,385 trained jobseekers and entrepreneurs increased from 18.62% before the training to 52.55% after the training.⁴⁰

Digital warungs: bringing micro-businesses online

'Digital warungs' is a business model in Indonesia used by local e-commerce platforms such as Grab, Tokopedia and Bukalapak that seeks to digitise the supply chain of traditional street stalls (*warungs*), and onboard the offline and unbanked population onto online platforms. Stall vendors use the mobile apps of the e-commerce platforms to sell to their customers digital goods and services, such as phone credit, or to help the unconnected pay bills digitally. On the supply side, the vendors themselves can use the app themselves to buy goods wholesale to replenish their own stock.⁴¹

Technology start-up Warung Pintar runs a variation on this business model. Although transactions are still conducted through a mobile app, Warung Pintar's agents operate out of brightly coloured prefabricated kiosks that are a complete digital re-envisioning of traditional street stalls. They're stocked with standard daily consumer items (such as drinks and snacks) but are also supplied with technology such as point-of-sale machines for vendors, and phone charging stations and free Wi-Fi for customers.⁴²

One challenge for the e-commerce platforms operating in this space is to improve the technology literacy of the stall owners.⁴³ Another is access to connectivity and modern devices. For instance, in late 2020, Tokopedia said that uneven internet connectivity, the use of outdated devices and gaps in infrastructure for physical deliveries were inhibiting the company's ambition to incorporate the *warungs* into its online-to-offline platform.⁴⁴

Training and investing in upskilling are expensive undertakings, particularly for MSMEs. In most cases, they can't share costs among a large enough training audience and they lack information about the relative merits of certain products and forms of training.⁴⁵ More structurally, research suggests a mismatch between the skills and knowledge that are offered and those that are required by employers.⁴⁶ All together, this is impeding the ability of MSMEs to digitise their work processes, move to online operations and increase their scale. As a consequence, most research on skills formation and human capital development focuses on coordination problems, such as the question of how training costs can be spread among firms with similar types of digital skill demands.

Governments could encourage cooperation between SMEs in similar sectors and the pooling of training resources.⁴⁷ This would allow for costs to be shared and support the creation of quasi-public goods in the economy. Firms then avoid collective-action problems (such as when all firms would benefit by cooperating but fail to do so) and support knowledge diffusion (that is, lifting the general quality of human capital across an economy).

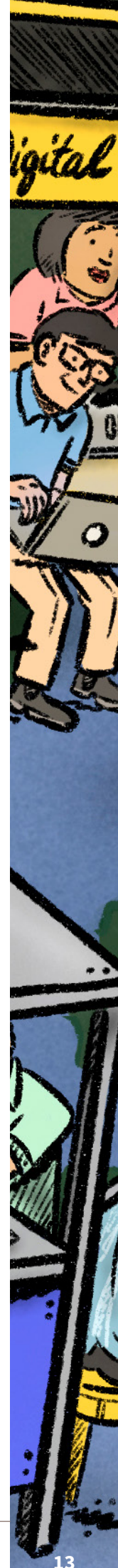
The way in which training is delivered is also key. Informal on-the-job training (such as showing someone how to use a spreadsheet at work) may require fewer resources, but the evidence suggests that externally provided training is a decisive factor in productivity returns and that formal training is significantly more often associated with enhanced firm performance than is informal training.⁴⁸ Formal education is relatively well established in Southeast Asia, where tertiary training facilities operate throughout the region. The ADB considers governments' policy on (lifelong) learning and education in the light of the ever-evolving technology landscape to be generally weak.⁴⁹

'A Future That Works': digital skills road maps for the Philippine economy

With support from DFAT, Philippine Business for Education (PBE) runs the 'A Future That Works' initiative. The mission of PBE is to develop the Philippine workforce by making education and training more responsive to the needs of the economy.

The project is seeking to build coalitions among industry leaders and to form sector skills councils. Three councils have been established, on agriculture and food manufacturing, on semiconductor and electronics industries, and on analytics and analytics-enabled technologies.

A number of virtual learning sessions have been organised, focused on exchanging experiences with Australian peer organisations, such as the Australian Department of Education, Skills and Employment and the CEO of the Digital Skills Organisation. The initiative further builds the capacities of regional partners and leverages Australia's advantages in the service economy.



Digital services

Southeast Asia's large, social-media-savvy population, a growing middle class and high population density in megacities have contributed to a significant take-off of online retail, which commenced around 2017.⁵⁰ E-commerce platforms such as Lazada, Shopee and Zalora have become successful regional platforms. Similar local-language platforms, such as Tokopedia and Bukalapak in Indonesia and Tiki in Vietnam, have also contributed to this rapid growth.

Grab: How Malaysia lost the region's biggest technology company

Grab was founded in 2012 in Malaysia as a ride-hailing app. Nearly 10 years later, the app has turned into a super-app offering food, grocery and package deliveries and digital payment services. Now considered one of the biggest tech companies in the region, Grab is operating in Singapore, Malaysia, Cambodia, Indonesia, Myanmar, the Philippines, Thailand and Vietnam.

While it was founded in Malaysia, the company quickly moved to Singapore in 2014. The move was attributed to the more favourable business conditions in Singapore, which include subsidies and tax breaks, but, in particular, an ecosystem for seed funding that draws the attention of international investors and generates higher valuations when companies are publicly listed.⁵¹ When Grab announced its plans in early 2021 to list on the US stock exchange in a special-purpose acquisition company merger, it was valued at around US\$40 million. In response, Malaysian politicians called for a review into the factors that contributed to Grab's move to Singapore and for improvements to Malaysia's technology environment.⁵²

Malaysia has since released the Digital Investments Future5 (DIF5) Strategy. Through this strategy, the government aims to generate multibillion-dollar investments in the digital economy by attracting foreign tech companies and creating 50,000 high-value jobs in five sectors: AgTech; HealthTech; Islamic Digital Economy and FinTech; CleanTech; and EduTech.⁵³

In recent years, a market for digital financial services has opened up due to increasing internet penetration, growth in the popularity of e-commerce and the existence of a large unserved market of underbanked and unbanked people.⁵⁴ In 2019, the financial technology sector reached an annual revenue of \$11 billion. Digital payments providers such as PayPal expect to double that growth every two years to reach about \$38 billion by 2025.⁵⁵ In parallel, regional efforts are undertaken, through ASEAN, to dismantle regulatory and interoperability barriers to cross-border digital payments.⁵⁶

As a consequence of a larger online population and the use of digital services, the amount of user data that's generated has surged. This has allowed firms such as Grab to develop alternative methods of credit assessment. They're now able to provide lending products to unbanked and underbanked individuals and small businesses.⁵⁷ At the same time, the massive collection of consumer data also presents risks involving privacy, discrimination and cybersecurity. Formulating adequate regulation for privacy and data protection, ideally in a coordinated regional manner under the ASEAN Personal Data Protection Framework, will ensure that this doesn't become an obstacle to further growth and development.

The cyber risk landscape

There's increasing awareness of online risks such as cybercrime, cyber intrusions and other online harms. However, the region's ability to address those risks is lagging behind the accelerating pace of digital technology adoption. The exponential increase of new online users, the growing use of online financial transactions and the elevated strategic relevance of the region are some factors that contribute to Southeast Asia's exposure to cyber threats.⁵⁸ These are whole-of-economy risks that affect individuals, businesses, governments and critical infrastructure alike.

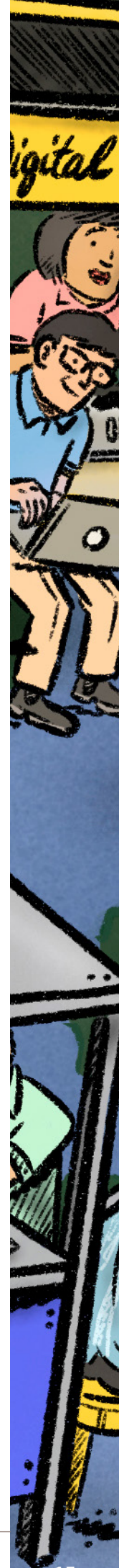
In 2020, several notable data breaches affected customers of major companies, such as Indonesian e-commerce companies Tokopedia and Bukalapak.⁵⁹ The reported average cost of cyber breaches in Southeast Asia in that year was \$2.71 million.⁶⁰ However, some of the largest threats facing the region in 2020 were business email compromise, phishing and ransomware.⁶¹ Cybersecurity companies as well as Interpol have been working with government agencies and national computer emergency response teams (CERTs) to combat cybercrime and strengthen local incident-response capacities in Southeast Asia.

The threats facing the region aren't restricted to cybercrime. Government and critical infrastructure networks have become the target of cyber operations sponsored by foreign nations.⁶² Across Southeast Asia, states have started to expand the cyber capabilities of law enforcement and military units and further strengthened national CERTs and the coordination between the different public entities.

In combination with the introduction of new and often far-reaching regulations, this has given rise to concerns by human rights advocates about an increasing exercise of control over the internet. Authorities have stepped up efforts to control online information using methods that include compelling internet service providers to perform blacklisting and invalidating domain names,⁶³ as well as pushing social media platforms to take down accounts and messages⁶⁴ and introducing national internet gateways.⁶⁵

Equally, industry has been calling on regulators to clarify and properly enforce regulations covering privacy, personal data and end-to-end encryption. For instance, initially far-reaching data-localisation requirements in Vietnam and Indonesia were relaxed after considerable pushback was received from global technology companies.⁶⁶ In attempts to protect the domestic ICT environment, governments across Southeast Asia have introduced diverging requirements for data storage, incident reporting and privacy.

The reflexive use of regulatory and repressive instruments, as currently done by some Southeast Asian governments, is causing commercial risks and social distress. International partners should be encouraged to explore and engage in a dialogue about alternatives that won't infringe human rights, undermine the integrity of internet infrastructure and complicate doing business, but that do address potentially legitimate national security concerns, including those that particular vendors and their home jurisdictions might bring.



Telecommunications and digital infrastructure

Reliable, low-latency broadband infrastructure, which can come in the form of fixed and mobile broadband, is important to digital development.⁶⁷ Significant improvements to 4G mobile coverage have occurred in recent years, and commercial 5G networks are starting to be rolled out. However, most users continue to face problems with affordability and the quality of mobile services.

Mobile broadband alone isn't sufficient for a nation's digital transformation. Wired broadband is essential, as it provides the backbone for mobile wireless networks, data centres and smart cities and the means to deliver those services at scale. Although governments in the region, at varying degrees of priority, are investing in their national broadband plans,⁶⁸ fixed broadband is still relatively expensive and uptake is relatively low in many nations.⁶⁹

Net Pracharat: connecting rural areas in Thailand

Net Pracharat is the national fixed broadband network that the Thai Government is laying across the nation with a focus on connecting remote, non-commercialisable areas. Between 2016 and 2018, the number of rural households without internet connectivity nearly halved.⁷⁰ The installation of infrastructure was accompanied with training on internet fundamentals. The Ministry of Digital Economy and Society developed a curriculum for basic use of the internet and then trained some 1,000 teachers from the Office of Non-formal and Informal Education, who returned to their communities and in turn trained 100,000 community leaders.⁷¹ Net Pracharat is part of the government's Digital Economy and Society Development plan.

To address access and affordability issues, governments and telecom operators have entered into infrastructure-sharing arrangements. In Thailand, the Philippines and Indonesia, these resource-sharing deals have effectively resulted in a reduction in costs, improved connectivity, more competition and increased revenue for operators.⁷² National universal service provisions, accompanied by dedicated funding, have provided adequate incentives for the deployment of internet infrastructure in local and rural hubs in some countries.⁷³ In situations in which retail prices are the dominant factor, cybersecurity and safety issues are likely to be deprioritised.

What statistics don't show

Reliability of electricity

The reliability of electricity supply is still a problem in some countries in Southeast Asia. In Indonesia, the extent of the problem is being obfuscated by government reporting, which treats access to electricity for part of the day as 'full electrification'.⁷⁴

Coverage doesn't always equate to usage

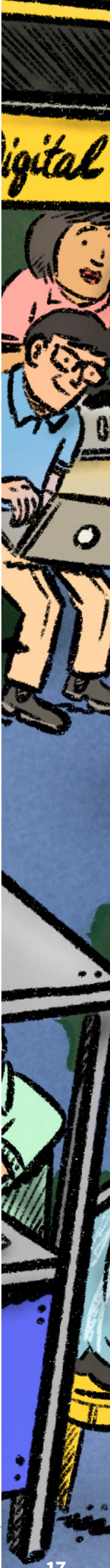
Despite relatively wide 4G coverage in the Philippines, users tend to remain on the slower 3G network due to the high prices of both data plans and 4G-capable handsets.⁷⁵ For those who are using the 4G network, the quality of the network experience is inconsistent and poor for high-bandwidth activities.⁷⁶ Although it's slowly improving, the quality of the Philippines' internet through its two mobile operators, Smart and Globe, is lagging behind that of its ASEAN peers.⁷⁷ These factors may be addressed with the deployment of 5G, but it's too early to gauge the level of success.⁷⁸ In moves that should help with affordability, the telecom operator duopoly was recently broken in early 2021 with the introduction of China Telecom-backed Dito Telecommunity.

Telecommunications network operators and US-based content service providers are equally contributing to the pan-regional infrastructure through investments in the construction of submarine cables. Links are being planned to the US in the east, to India in the west and also to intra-Asia centres (Table 1). Facebook’s new cables were built to meet expected demands from an increase in 4G, 5G and broadband access. Alone, the new cables should increase trans-Pacific capacity to the region by 70%.⁷⁹ International development agencies such as the UN Economic and Social Commission for Asia and the Pacific (UNESCAP), the World Bank and the ADB are closely following these developments to adjust and match their own funding and lending portfolios.⁸⁰

Table 1: Planned submarine cables for the region

Cable name	CAP-1 (2022)	SJC2 (2022)	Asia Direct Cable (2022)	SING (2023)	Echo (2023)	Bifrost (2024)	Apricot (2024)
Owner	Facebook (US) Amazon (US)	Facebook (US) China Mobile (CN) Chuan Wei (HK) Chunghwa Telecom (TW) Donghwa Telecom (HK) KDDI (KR) Singtel (SG) SK Broadband (KR) Telin (ID) True (TH) VNPT (VN)	CAT (TH) China Telecom (CN) China Unicom (CN) PLDT Inc (PH) Singtel (SG) SoftBank Corp (JP) Tata Communications (IN) Viettel (VN)	Datawave Networks (CY)	Facebook (US) Google (US)	Facebook (US) Telin (ID) Keppel T&T (SG)	Facebook (US) Google (US) PLDT (PH)
Connected countries (Southeast Asia)	Philippines	Singapore Vietnam Thailand Cambodia	Singapore Vietnam Thailand Philippines	Singapore Indonesia Thailand	Singapore Indonesia	Singapore Indonesia Philippines	Singapore Indonesia Philippines
Connected countries (rest of world)	United States	Hong Kong Mainland China Japan Taiwan Korea	Hong Kong Mainland China Japan	India Oman	United States Guam	United States Guam	Japan Guam Taiwan

Source: Submarine Cable Networks, [online](#).



Emerging technologies

There's no doubt that Southeast Asian economies have the potential to reap economic and social benefits from the adoption of emerging technologies such as cloud computing, IoT sensors and 5G technologies and the use of AI and machine learning. In different countries, the adoption and development of these technologies are growing, although to varying degrees. However, across the region, foundational elements such as infrastructure, connectivity, workforce skills and regulatory frameworks need to be further strengthened before the broader economy can reap the benefits from these technologies. Without those foundations, Southeast Asian nations will risk being mere 'price takers' of products, services, approaches, standards and regulations designed and decided by others. That would have implications for community wellbeing, prosperity and security. Furthermore, part of the challenge is in recognising that the implementation of technology doesn't bring organisational improvements in and of itself, but rather that technology is an enabler that requires appropriately skilled talent to lead and deliver organisational changes.

In this section, we look at a selection of emerging technologies and their use in the region.

Data centres and cloud services

Cloud-based services such as distributed storage, processing power and applications can bring a wealth of efficiencies and security enhancements for businesses. Southeast Asian economies were considered cloud laggards, but cloud adoption has picked up in the past 24 months due to pandemic-accelerated digital transformation and security concerns.⁸¹ However, some analysts suggest that this adoption is basic. Southeast Asian economies aren't using the full potential of available cloud services, and cybersecurity and privacy risks need to be addressed.⁸²

Singapore has been the launching point for the Asia–Pacific operations of global hyperscale cloud service providers. The city-state's skilled workforce and robust internet and electricity infrastructure, including international subsea cable connections, have enabled Singapore to develop as the region's data centre hub.

Today, Indonesia looks to be the next hub for cloud providers that are attracted by its large and growing internet population and blossoming start-up scene.⁸³ There's clear interest by international cloud providers, indicated by the construction of submarine cables and investment in data centres (a first step before further investment to mature cloud service offerings) in the archipelago. Alibaba Cloud has an existing presence, Google Cloud Platform launched in 2020, and Amazon Web Services and Microsoft plan to have data centres by 2022. Factors such as 5G deployment and the adoption of renewable energy in data centres, big data and IoT are likely to contribute to further growth of the data centre market.⁸⁴

The operation of data centres (regardless of cloud offerings) requires significant power and cooling, and thus raises issues of sustainability and energy efficiency.⁸⁵ Singapore is beginning to see investments in renewable energy such as solar and wind sources from hyperscalers and co-location data centres such as Equinix and Sun Cable.⁸⁶

5G technologies

Telecom operators in the region are pushing ahead with consumer-driven 5G rollouts while simultaneously furthering the development of future enterprise 5G use cases. Operators in Thailand, Singapore, the Philippines and Indonesia have launched commercial 5G networks and are expanding coverage, encouraging adoption and developing their network capabilities on the consumer side. On the enterprise side, some operators are exploring partnership opportunities with cloud providers and other private partnerships related to edge computing.⁸⁷ In Thailand, operators are looking into developing smart factory use cases.⁸⁸ The low latency provided by 5G will enable greater possibilities with IoT technology, and both will certainly contribute to smart city plans in the region. But both technologies will bring greater cybersecurity risks, especially as they begin to be used for much more critical applications.

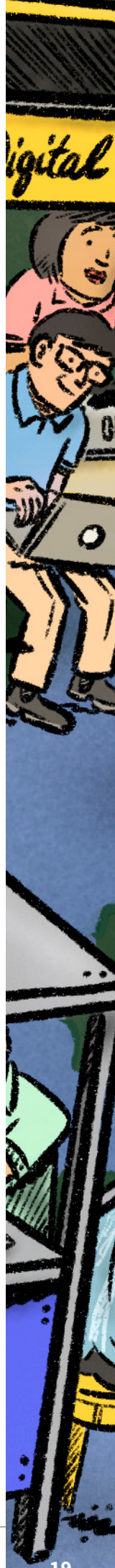
Artificial intelligence

With the exception of Singapore, Southeast Asia is still in the early stages of AI adoption, and investments have been generally directed towards revenue growth (through front-end applications such as product and services management and marketing) and less towards digitally transforming the way businesses operate by optimising organisational productivity and efficiency.⁸⁹ Overall, Southeast Asia's investments in AI are comparatively small; within the region, Singapore is leading investment in AI, while Vietnam and the Philippines are lagging behind.⁹⁰ Governments are eager to capitalise on the benefits that the application of AI may bring to their societies and economies. That requires each economy to develop into an informed customer when applying AI technologies that are developed elsewhere.

National AI strategies have already been launched by Singapore, Indonesia and the Philippines, while Malaysia and Vietnam are in the process of creating national strategies. However, integrating AI into business requires more than a technology solution—it needs to build and maintain public trust. Therefore, AI solutions require a multidisciplinary approach to data management, planning and monitoring, tailoring to user needs, and well-articulated ethical and legal frameworks. Above all, the beneficial use of AI will require a skilled workforce, a user base that possesses technology and data literacy, and ongoing high-level cybersecurity measures.

Summary

Much of Southeast Asia is 'mobile first'. Once connected, Southeast Asians are heavy users of social media and gaming. However connectivity and usage are uneven and heavily gendered. Weaknesses in digital skills within MSMEs are contributing to economic vulnerabilities across the region. Digital skills development is a necessary complement to technology adoption and a key driver of resilience for economies to be able to weather disruptive changes and external shocks. Governments and their international partners need to prioritise the region's digital skills growth to unlock the productivity gains often claimed to accompany the adoption of technology. Investments in ICT need to be accompanied with investments in skills, organisational change and process innovations (that is, knowledge-based capital).⁹¹ This is the key to remaining part of modernising systems of trade and development. It lays a foundation upon which more specialised skills can be further developed to enable countries to take advantage of greater levels of connectivity, including international submarine cables, as well as emerging technologies such as AI and 5G.



The impact of Covid-19 on Southeast Asia's digital landscape

Covid-19 and subsequent public-health measures have disrupted lives, economies, societies and governments across the world. In this section, we examine the effects and the consequences of the pandemic on Southeast Asia's digital transformation and the role of technology choices in broader international affairs.

The impact of the Covid-19 pandemic on Southeast Asia's digital landscape has largely been predicated on the state of the region's digital transformation. The pandemic has progressed digital development and in doing so compounded longstanding issues in relation to socio-economic divides in the diffusion of technology.

The outbreak of Covid is hitting countries and regions hard, and the uncertainties about new variants add to that strain. While many Southeast nations managed to deal with the first phase of Covid-19 relatively well, some are facing mounting public-health and economic pressures, which are exacerbating pre-existing political crises. Citizen protests have continued in Thailand and Malaysia.⁹² In Malaysia, amid a political impasse, parliamentarians have embraced technology. In lieu of voting in a parliament sitting, lawmakers were asked to send in their votes through email and WhatsApp messages.⁹³

As part of their pandemic responses, all Southeast Asian nations deployed or promoted digital tools. Some adopted mobile apps for contact tracing and vaccinations; Vietnam established a government services portal with great success; and Cambodia's central bank actively promoted the use of mobile payments to prevent the spread of disease.

Digital trends emerge

As elsewhere, movement restrictions due to the pandemic have accelerated digital adoption and pushed forward transformation plans where they were already underway. In 2020, Southeast Asia welcomed 40 million new internet users, accompanied by an increase in smartphone uptake. That was four times the number of new users compared with the previous year.⁹⁴ Furthermore, the majority of the new users in Malaysia, Indonesia and the Philippines were from non-metropolitan areas—a positive contribution to a narrowing of the urban–rural digital divide.⁹⁵

Following lockdowns, internet use shifted from business locations that used fixed-line connections to residential locations that use mobile broadband connections. Mobile network operators in Vietnam and Thailand were able to increase bandwidth and address the surge in demand, while the Philippines, Indonesia and Malaysia saw a drop in internet quality.⁹⁶ Thai telecom operators accelerated their 5G rollout to meet the rising demand in hospitals for telemedicine services and 5G-enabled robots to minimise contact between doctors and patients.⁹⁷

Over 2020 and during the first quarter of 2021, capital investment in Southeast Asia's technology companies continued to grow.⁹⁸ Southeast Asia was the most resilient emerging market, in which capital investment dropped only slightly from 2019 figures.⁹⁹ That said, almost 50% of the investments were directed to the e-commerce giants Grab, Go-Jek, Go-Pay, Bukalapak and Traveloka.¹⁰⁰

The already connected population increased their use of digital services. More than one-third of consumers tried a new digital service, and nine out of 10 continued this use in 2021.¹⁰¹ The pandemic ignited markets for online education and telemedicine, and the already vibrant e-commerce sector grew further. This helped to boost supporting elements in the value chain, such as logistics and online payments. But not all parts of the technology industry did well. Ride-hailing apps gave way to food and goods delivery apps, while online travel services declined significantly.

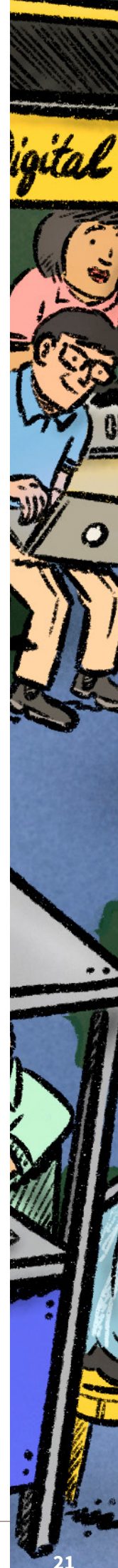
Traditionally, the region has suffered from low bank-card penetration, and people favour cash-on-delivery payments for e-commerce transactions.¹⁰² However, digital payments surged during the pandemic, and cash transactions reportedly dropped by 11% during its first year.¹⁰³ Factors driving the move towards a more cashless economy include the rise in e-commerce as well as digital payments being more widely accepted by merchants for safety reasons (to counter the risk of infection and theft).¹⁰⁴

Telecommuting is a new trend in Southeast Asia and one that affects mostly larger organisations and workers in highly skilled occupations. It's less the case for those self-employed or working in the gig economy, and where the nature of the work doesn't allow for it.¹⁰⁵ However, should this trend continue, it will put more pressure on improving connectivity to residences and the affordability of computers and other internet-connected devices. In the early days of the pandemic, the initial rush to shift to work-from-home arrangements brought an exposure to cybersecurity risks that organisations weren't necessarily prepared for. One common example is staff use of personal computers and devices (that aren't security-controlled by the enterprise) to access enterprise networks and data.

Digital divides emerge

Not all businesses were able to adapt to working remotely. Shortly after the first lockdowns in 2020, a survey run by the ADB found that 13%–21% of MSMEs in Indonesia, the Philippines, Thailand and Laos reported that remote working wasn't viable and that they were ill-equipped to engage in digital transactions.¹⁰⁶ The same survey found that 40%–70% of MSMEs, primarily in the manufacturing and services sectors, had to temporarily close.¹⁰⁷ Many who worked in the large informal economy, which makes up around 75% of the economy, also lost their employment.¹⁰⁸

Manufacturing has also been affected by extended lockdowns and disruptions to supply chains. This was compounded in Vietnam by a large number of infections in industrial hubs.¹⁰⁹ In some cases in Vietnam, companies resorted to having workers sleep at their factories.¹¹⁰ These disruptions have affected global technology and electronics supply chains, including for semiconductor manufacturing.



Grassroots online business communities: the case of SONJO

Amid the pandemic, SONJO, an online grassroots movement, was born in Yogyakarta, Indonesia. Consisting of 1,500 members, the community coordinated a variety of self-help initiatives through WhatsApp groups. Among its successes, the group helped to bring some local businesses online in Yogyakarta.¹¹¹

The group used free cloud-based software to collect product details and contact details from sellers, then advertised the items to potential buyers through a mobile browser-based app created by using an online, code-free mobile app development service.¹¹² SONJO has also helped the local government find suitable premises to quarantine Covid-19 patients and initiated a crowdfunding campaign for hospitals' protective gear.

Online learning has been a solution for schooling and tertiary education during the pandemic, but a solution that isn't equally available to or beneficial for everyone. Some 463 million children globally have been unable to access remote learning due to a lack of internet access at home, and many of them are in developing Asia.¹¹³ Around 60% of ASEAN youth increased their use of online learning, but a similar percentage also felt that their learning was constrained due to factors that included low internet quality and high internet costs.¹¹⁴ Some higher education institutions in the region that initially turned to online learning later reverted to a blended distance learning approach following similar issues, which also included a lack of ICT skills.¹¹⁵ The availability of devices for both teachers and students has also been an issue.

Women have been disproportionately affected by the pandemic. Many are employed in the informal and gig economy sectors hit hard by lockdowns. Southeast Asian countries are also struggling with first-order issues such as online violence against women.¹¹⁶ During the pandemic, in general, more female-led MSMEs had to close temporarily. Women's businesses suffered greater losses compared with male-led MSMEs, and they also sought out more government support for mentoring and business literacy, as well as assistance on teleworking arrangements.¹¹⁷

Cybersecurity risks and global technology competition

The pandemic period involved a rise in an already upward trend in cybercrimes and incidents, including ransomware, denial-of-service attacks, data breaches, phishing, child pornography and financial fraud.¹¹⁸ Communities that are new to the online world are particularly vulnerable to such risks. Although the significant increase in and exposure of cyber incidents during the pandemic have raised general awareness, the region's ability to effectively detect, address and remedy incidents is uneven: Singapore and Malaysia outperform the rest of the region. At the moment, organisations in the Asia-Pacific take three times longer to detect cyber intrusions than the global average.¹¹⁹

The dominant role of social media in daily life, the use of e-commerce platforms and the introduction of e-government solutions, in combination with immature levels of cybersecurity, online safety and literacy, are making Southeast Asia an easy target for malicious state and criminal actors.

Digital development in Southeast Asia has become the focus of geostrategic competition and geo-economic interests. The interconnected and interdependent nature of the region, which hosts a tech-savvy young population, means that recovery can't be achieved by nations in isolation. The profound economic impact of the pandemic on the region is likely to increase Southeast Asian governments' appetite for support and investment from other countries.

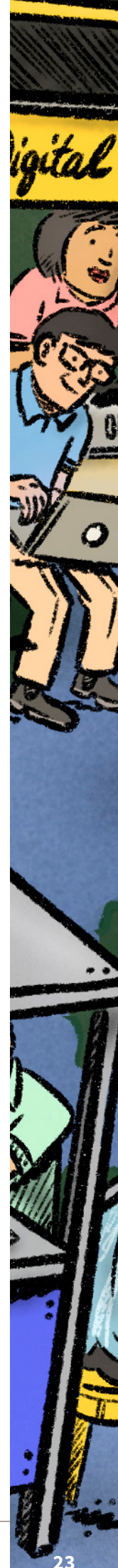
At the recent Belt and Road Summit, ASEAN ministers expressed increased willingness to partner with the Chinese Government as they seek investment to mitigate pandemic-induced stagnation.¹²⁰ Current Digital Silk Road offerings (part of China's Belt and Road Initiative), introduced in 2015, include infrastructure, business and regulation with an aim to develop a network of internationally interoperable digital infrastructure, including terrestrial and submarine communications cables, 5G networks, data centres, satellite navigation systems, smartphones and smart-cities infrastructure.¹²¹ Even as Covid-19 has made foreign infrastructure harder to build and has prompted China's leadership to concentrate resources on domestic stimulus, in the medium term, many in Southeast Asia will be at further risk from reliance on external funding for critical infrastructure and from foreign vendors' influence on domestic digital markets.

As a response to China's Belt and Road Initiative, the US coordinated with the G7 economies to initiate the Build Back Better World Partnership, in which digital technologies is one of four focus areas, alongside 'climate, health security, and gender equality'.¹²² The leaders of the four Quadrilateral Security Dialogue (Quad) countries also launched an Infrastructure Coordination Group that will share assessments of regional infrastructure needs, and coordinate approaches to deliver infrastructure, technical assistance and capacity-building efforts.¹²³ During the recent US-ASEAN Summit in 2021, the Biden administration announced the Science and Technology Innovation Cooperation Program to support the digital economy and a new US International Development Finance Corporation loan portfolio for vocational training and higher education.

This suggests continued attention by Washington to the region and its opportunities, particularly in areas that leverage key strengths of the US and its partners in the region (data centres and submarine cables), and in areas where China has struggled to gain a foothold (green financing, financial inclusion and health care).¹²⁴ The EU is also investing in Southeast Asia's digital capabilities, with a focus on improvements in connectivity.¹²⁵

Summary

Southeast Asia is a centre of gravity for many international actors that are adamant about integrating with the region's developing digital ecosystems. Its highly connected and young population and growing economic weight mean that the direction of Southeast Asia's digital economy and its technology posture will shape relations across and within the region. The Covid-19 crisis, however, is highlighting the various digital divides within the region as well as within individual economies. The need for the rapid adoption of digital platforms and services, driven by each society's adaptation to a 'Covid world', is bringing increased vulnerability, ranging from dependence on large foreign technology platforms to domestic businesses and industry sectors being disproportionately disadvantaged due to a lack of skills or access to digital technology.



India–Australia and cyber and technology cooperation in Southeast Asia

India and Australia are new but growing strategic partners. The changing geostrategic environment and the rise of a more assertive China have led to a convergence of political–economic interests to ensure ‘an Indo-Pacific order that is free of hegemonic and muscular policies’.¹²⁶ The emergence of new technologies is a key driver of the current rearranging of political, security, economic and connectivity relationships and dependencies.

This is presenting opportunities for new partnerships and forms of collaboration in which India and Australia can collaboratively address digital development challenges with Southeast Asia.

In 2020, India and Australia elevated their bilateral relationship to a comprehensive strategic partnership (CSP), signalling a maturity in relations as well as a convergence of interests and an intent to further broaden and deepen ties between the two countries. Besides defence and trade, cooperation in cyber and critical technologies is presented as an ‘essential pillar’ of the India–Australia relationship.¹²⁷ The subsequent framework arrangement on cyber and cyber-enabled critical technology includes a five-year plan to work together on the digital economy, cybersecurity and critical and emerging technologies. Also, a A\$12.7 million fund for bilateral research and development activities to improve regional cyber resilience has been set aside.¹²⁸

The CSP and framework arrangement have provided capstones for bilateral dialogues that focus on a range of cyber and critical technologies issues: an annual Cyber Policy Dialogue; the new Joint Working Group on Cyber Security Cooperation; a joint working group on ICTs; and a commitment to hold an India–Australia Foreign Ministers Cyber Framework Dialogue.

Besides strengthening mutual bonds, India and Australia reaffirmed their close ties with Southeast Asian partners and renewed their commitments to ‘ASEAN centrality’ in their Indo-Pacific strategies. Both countries are long-time dialogue partners of ASEAN. In 2021, Australia and ASEAN elevated their relationship to a CSP.¹²⁹ Separately, India’s and Australia’s ties with Southeast Asian nations include multiple bilateral CSPs and free trade agreements. Furthermore, Indonesia, India and Australia have held a few ‘trilateral’ senior officials’ meetings in 2017–2019.

A common theme in the partnerships is a focus on economic prosperity. Recent joint statements highlight leveraging the digital economy and new technologies for common prosperity in the region and building in security from the outset.¹³⁰ As both India and Australia have committed to strengthening cooperation and capacity-building initiatives with ASEAN in areas such as cybersecurity, the digital economy, digital-ready workforces and new technologies for inclusive economic growth, a joint India–Australia collaboration with Southeast Asia could harness each country’s strengths to deliver further economic and digital growth of all partners and ensure a more prosperous and inclusive Indo-Pacific.

CSPs will ‘only be as good as the time, effort and diplomatic resources’¹³¹ the signatories are willing to commit. Therefore, in this section we explore options for the Australian and Indian governments to consider based on their nations’ experiences, expertise and international engagement initiatives that are relevant for partners in Southeast Asia as part of their digital development and Industry 4.0 aspirations. We also reflect on engagements with Southeast Asia by partners such as Japan, Korea and the EU.

India's digital development and engagement in the Indo-Pacific

India embarked upon its Southeast Asia engagement policy after it liberalised its economy in the early 1990s. Focused on economic engagement, New Delhi's 'Look East' policy led to stronger trade relations, which culminated in the India–ASEAN Free Trade Agreement in 2010. However, strategic and technological engagement remained low as ASEAN states took a balanced approach in choosing between the two growing Indo-Pacific economies: India and China. In 2014, India decided to put more strategic weight onto its neighbouring region with the introduction of its 'Act East' policy. Spurred by China's growing dominance, including in the cyber and technology sphere, India and Southeast Asian countries moved to a partnership motivated more by politico-economic, technological and strategic interests. The result has been a broader and deeper engagement across the political, economic and security arenas.

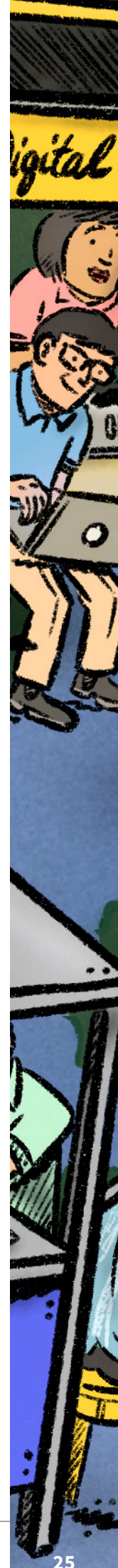
Digital India

India is an emerging cyberpower and a powerhouse for IT services.¹³² Even though New Delhi's international engagement in digital issues has been comparatively passive and has tended to concentrate on *Aatmanirbharta* or self-sufficiency, its domestic digital development experience contains certain initiatives, expertise and lessons that could be relevant for partners in Southeast Asia that are on a similar pathway.

India's digitisation push has a long history, but it coalesced into one major initiative in 2015 under the name of 'Digital India'. This government-led flagship program to transform India into an empowered digital economy was ambitious. At the start, only 19% of the population was connected to the internet, and a mere 15% had access to mobile phones, but the program captured a palpable shift in the public's conception of India's place in the world. Digital India was conceptualised as an umbrella, consolidating disparate efforts involving connectivity, skilling and digital governance. Precursors such as the National e-Governance Plan (2006), the National Optical Fibre Network (2011) and the National Digital ID (2009) were revamped and relabelled.

Yet initiatives under Digital India have been beset by implementation problems, sometimes due to the lack of enabling legislation and policy, but often due to poor planning and foresight. Hiccups included legal challenges to the constitutionality of Aadhaar (India's biometric ID), intense debates about the Personal Data Protection Bill, and a problematic draft national encryption policy that was ultimately shelved. Also, India's current lack of robust cybersecurity measures is having a pernicious effect on citizens' trust and confidence in digital technologies.

Underpinning Digital India is BharatNet. Set up in 2011, this national optical fibre network is set to provide connectivity to all local government administrations. Despite its momentous task, the rollout has had to address issues such as the durability of infrastructure, challenging terrain and climatic conditions, ensuring practical use of the network, and encouraging last-mile connectivity.



India's digital engagement in the Indo-Pacific

India's US\$200 billion digital economy is a big part of its outreach to the region and the permutations and combinations of emerging regional and international partnerships. India has been leveraging its growing homegrown technology sector, global standing and thriving economy and has entered into bilateral agreements with countries including Vietnam, Thailand, Indonesia and the Philippines¹³³ to foster ICT adoption and technological collaboration under its Act East policy since 2014.¹³⁴

India has established centres of excellence in software development and training in Myanmar, Vietnam, Lao PDR and Cambodia to strengthen digital cooperation between nations.¹³⁵ It's also funding projects, such as the Building Capacity on Digital Public Services Implementation and Cyber Security for Government Agencies project and the Child Online Risks Awareness Campaign, in Cambodia. To support a conducive growth environment for SMEs in Thailand and India, GlobalLinker, a Mumbai-based platform, signed an MoU with the Thailand–India Business Council in 2019 to facilitate business networking between SMEs from both nations and across Asia.¹³⁶ The 3rd India–Vietnam Joint Working Group on Information Technology met in July 2021 to implement various projects under Digital India to bolster Vietnam's IT Industry, digital literacy, start-up development and innovation.¹³⁷

To build academic and research partnerships as part of India and Thailand's bilateral scientific and technological cooperation, India's Department of Science and Technology and Thailand's Ministry of Science and Technology invited universities and researchers to submit joint proposals for development projects and to build on scientific and technological research in 2018.¹³⁸ India and ASEAN also inaugurated the ASEAN PhD Fellowship Program for 1,000 ASEAN citizens to be allowed to pursue their PhDs at prestigious Indian institutes of technology in 2020. This educational collaboration was part of India's contribution to upskilling ASEAN cyber capacity and preparing future generations for the 4IR. The Indian ministries of Education and External Affairs and ASEAN collaborated to organise an ASEAN–India Hackathon in early 2021 to further promote youth cooperation on digital connectivity. The All India Council for Technical Education, with support from nodal agencies, education ministries and distinguished universities of all ASEAN countries, implemented the Hackathon.¹³⁹

Indian flagship digital development initiatives

Pradhan Mantri Kaushal Vikas Yojana and digital skilling

At the turn of the decade, India faced a severe shortage of well-trained, skilled workers relative to its population. It was estimated that only 2.3% of the workforce in India had undergone formal skill training as of 2014.¹⁴⁰ In 2015, Prime Minister Modi launched Skill India under the National Skill Development Corporation, which aimed to train 400 million Indians with new skills.¹⁴¹

The Pradhan Mantri Kaushal Vikas Yojana (PMKVY) is a flagship scheme of the Ministry of Skills Development and Entrepreneurship to train 2.4 million people in a span of one year. With a budget of ₹15 billion (~US\$200 million) for its first phase, it was implemented by the National Skill Development Corporation.¹⁴² Skills training included IT and IT-enabled services. The second phase aimed to train 10 million people in four years through short-term training, recognition of prior learning and special projects with a budget of ₹120 billion (~US\$1.6 billion).¹⁴³ By 19 July 2021, 112,000 candidates had been trained under this phase of the scheme.¹⁴⁴ The program

has reported that 56% of the candidates trained under the scheme received job offers.¹⁴⁵ Those certified under the scheme earn 15%–19% higher wages than those without certification.¹⁴⁶

The next phase of the scheme, PMKVY 3.0, aims to increase those numbers.¹⁴⁷ One adopted solution is to stagger payments to training providers: 30% will be paid upon commencement of training batches, 40% on successful certification and 30% upon a successful job offer.¹⁴⁸

Experience with PMKVY further demonstrates the importance of having local industry involved to drive the requirements and content of the skills training. PMKVY 3.0 aims to train 800,000 candidates in a span of two years, with a budget of ₹9.489 billion (~US\$128 million). Even though the scheme's track record has been mixed, it provides valuable insights for nationwide skilling initiatives in other countries.

IndiaStack

IndiaStack is a set of homegrown application programming interfaces (APIs) that allow for easy programmatic access to data and software in larger systems. Some 1.2 billion people—almost 90% of India's population—have signed up for a digital ID associated with IndiaStack in less than a decade, and about half have linked their digital ID to their bank account.¹⁴⁹ The APIs now underpin much of the country's digital infrastructure and could be a useful shared resource for other partners, including in Southeast Asia. One such set of APIs is the Unified Payments Interface (UPI), which is a platform for interbank online transactions. Tech giants such as Google have cited UPI and requested the US Federal Reserve to implement a similar platform.¹⁵⁰ Another API is the CoWIN platform for vaccination registration. The Indian Government has offered the platform for use by other national governments.¹⁵¹

BharatNet

India's Bharat Broadband Network (BharatNet) is one of the biggest rural telecom projects in the world. Its objective is to connect India's 600,000 villages by laying 800,000 kilometres of fibre and using radio links and satellites to connect remote and rural communities. The project aims to achieve those objectives for a cost of US\$6.2 billion.¹⁵² While the project has been beset by delays arising from the varied terrain and heavy rains in the northeastern regions, low transport connectivity and labour shortages during the Covid pandemic, nearly 300,000 village councils had been connected by October 2021 in phases I and II.¹⁵³

Developing technology with options for various connectivity levels

Despite India's low score for its telecommunications infrastructure, its online service score, which measures how governments deliver online services, exceeds those of countries with a higher level of telecommunications infrastructure (Figure 5). It's likely that contributing factors include India's 'mobile-first' model (aided by the availability of cheap data) and its effort to adapt e-government solutions to differing citizen connectedness levels. For instance, for citizens with mobile phones but without advanced smartphones, there are alternative solutions using SMS for app-based solutions. The SMS solutions facilitate both 'push' services (sending information to citizens) and 'pull' services (citizens requesting information on government services).

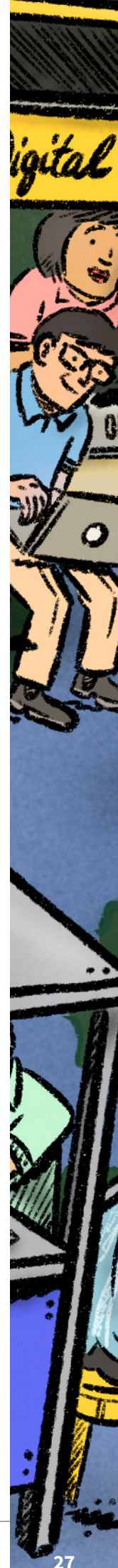
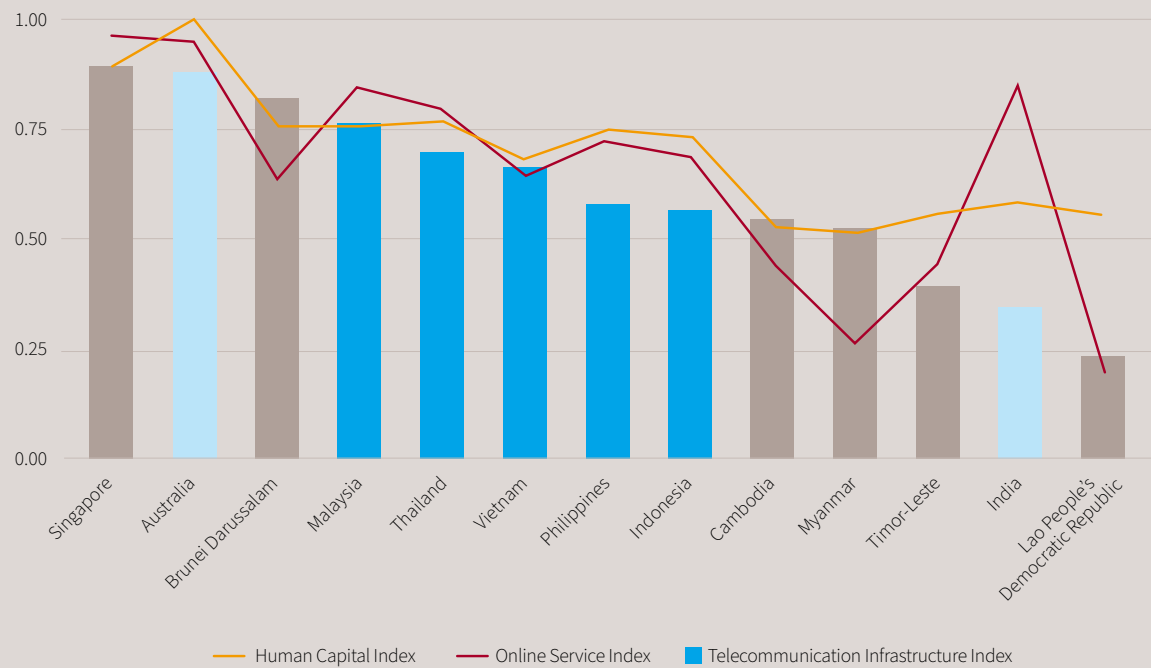


Figure 5: India ranks highly in the Online Services Index despite scoring low in the Telecommunications Infrastructure Index



Source: UN, E-Government Development Index, [online](#).

Cheap data access

In 2020, India boasted the world's cheapest mobile data, at US\$0.09 per gigabyte.¹⁵⁴ Data prices in India have trended on the lower side of the global average for over a decade, especially due to intense competition for subscriber share. When Reliance Jio entered the telecom market in 2015–16, a fresh data tariff war was triggered.¹⁵⁵ For the first three months following its launch in September 2016, Jio offered 4G services and unlimited free data. After that, subscribers could purchase 1 gigabyte of data for ₹50 (US\$0.68). It also made calls and texts completely free. This cheap data revolution supported an explosion in mobile subscribers, app downloads and digital payments.¹⁵⁶ Cheap data has fuelled India's high level of digital engagement in combination with a rapid decline in the cost of internet-enabled handsets. This trend appears to have affected women particularly positively, and Covid-19 restrictions have provided women with reasons to own a personal smartphone in order to comply with check-in registration and to access education and medical support.¹⁵⁷

Australia's digital engagement in the Indo-Pacific

In Australia's outlook in cyber, technology and digital issues, engagement with partners in the Indo-Pacific has been front and centre. The main anchors for that engagement are reflected in Australia's International Cyber and Critical Technology Engagement Strategy 2021 and the 2017 Foreign Policy White paper.

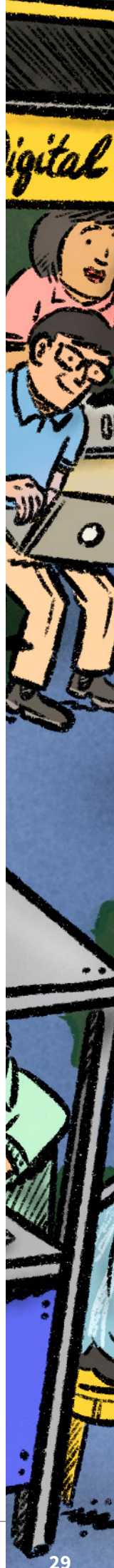
Since Australia's inaugural International Cyber Engagement Strategy (2017), a variety of cybersecurity policy dialogues have been conducted. Currently, Australia has bilateral cybersecurity capacity-building arrangements with Indonesia, Singapore and Thailand and in addition engages in capacity building and cooperation activities with Malaysia, Cambodia and Vietnam through the Cyber and Critical Tech Cooperation Program. Australia supports the multilateral ASEAN–Singapore Centre of Cybersecurity Excellence. Cybersecurity is a major area of focus of initiatives funded through Australia's Cyber and Critical Tech Cooperation Program as well as trade promotion schemes such as the Australian Trade and Investment Commission (Austrade) and AustCyber.

In the 2021 update to Australia's cyber engagement strategy, critical technologies were added to the portfolio and have since formed the core of both the bilateral partnership with India and the Quad. While these initiatives provide value in their own right, the financial depth from the Cyber and Critical Tech Cooperation Program is limited (a total of A\$74 million between 2016 and 2024). A separate A\$12.7 million is earmarked for the Australia–India Cyber and Critical Technology Partnership, of which A\$1.8 million is expected to be available for single- and multi-year research projects. Funding for regional cyber resilience efforts is yet to be announced.

While these activities can have an impact in enabling or kickstarting certain developments, they'll require more substantial investments to sustain efforts with regional or whole-of-country impact. Equally, these activities need to extend beyond relatively small target audiences that are mostly associated with government agencies located in the capital cities. In fact, one of the main challenges in cybersecurity awareness-raising in Southeast Asia is to reach the broader population and MSMEs in a culturally appropriate fashion.

In the area of science and technology, Australia's CSIRO delivers the Aus4Innovation program. The A\$11 million program, which commenced in 2018, concentrates on Vietnam and involves work on strategic foresight, scenario planning, commercialisation and innovation policy. Austrade has initiated a number of bilateral tech exchanges, such as in Malaysia and Indonesia, to bring tech companies from both countries together for commercial partnerships.¹⁵⁸

More generally, Australia continues to be an education powerhouse in the Indo-Pacific. It's a key destination for Southeast Asian students and professionals to pursue technical education and academic careers. Equally relevant are the expertise and experience of Australia's federal, state and territory education departments as well as local schools. They were able to include digital technology¹⁵⁹ and boost STEM disciplines as part of the national curriculum while at the same time experimenting with immersive and hybrid forms of formal learning.



Australian flagship digital development initiatives

National Broadband Network (NBN)

In 2009 the Australian Government established NBN Co. and announced an initiative to provide affordable, fast broadband internet to all Australians and bridge the digital divide through the provision of a wholesale-only access network, thus creating a more competitive market among retailers. In late 2018, the peak budget for the project was A\$51 billion (US\$37.5 billion).¹⁶⁰ Despite contention about whether it would have provided better quality and value for money to install fibre-optic cable to the premises from the start, compared to a mixed technology network that included some parts of the old copper telephone network that would need replacing, the NBN was declared complete and fully operational in December 2020, six months after initially planned, and activated at 8 million premises.¹⁶¹ The Australian Government ensured that NBN Co. was aligned with government objectives by binding it to the government's statement of expectations. This included principles such as project transparency through weekly updates to the public through NBN Co.'s website, prioritising locations that are poorly served and proactive engagement with regional and remote Australia.¹⁶² The NBN is available in regional and remote Australia, including remote islands, through the NBN's Sky Muster satellite service. It has been reported that 'Australia is one of the most affordable markets for broadband' and that 'Australian broadband is relatively affordable in every speed tier'.¹⁶³

The ACSC, ACSC Partnership Program and AustCyber

The Australian Cyber Security Centre (ACSC) leads Australia's national cybersecurity efforts. Australian Government cybersecurity expertise has been brought together under the ACSC and includes staff from national law enforcement, crime investigation, national security and intelligence agencies. It provides cybersecurity information, advice and assistance across the whole of the economy. The ACSC is headquartered in Canberra but has local offices ('joint cyber security centres') operating out of most state capitals. To improve public-private collaboration and build Australia's cyber resilience, the ACSC Partnership Program was established with industry to facilitate faster collective threat information and intelligence sharing. Separately, the government established AustCyber, which is an initiative to grow an internationally competitive domestic cybersecurity industry.

Cyber bootcamps for ASEAN countries

Under Australia's Cyber and Critical Tech Cooperation Program, the Cyber Bootcamp project provides working-level government officials from ASEAN countries with a two-week exposure to Australian experts and organisations. The cyber bootcamps aim to build participants' knowledge and awareness across the full breadth of cyber affairs, from reaping the benefits to dealing with threats emanating from the use of cyberspace and technology, and from cyber policy, operations and governance to decision-making. Bootcamps have been provided for cohorts from Indonesia, Thailand, and Vietnam.

Supporting the empowerment of women in the digital economy

Promoting gender equality and women's economic empowerment is an integral part of Australia's Partnerships for Recovery development program. DFAT has been supporting a variety of initiatives at the intersection of women's empowerment and the digital economy. Investing in Women is a six-year A\$4 million program that will run into mid-2022 and aims to ensure greater inclusive economic growth through women's economic empowerment in Southeast Asia. With QBO, a local Philippine innovation hub, a program was launched to foster a community of female-led tech start-ups by providing funding, mentoring and exposure. Under the ASEAN–Australia Council (a grant-making scheme managed by DFAT), small people-to-people and relationship-building activities that look at female participation, innovation, digital skills and economic resilience have been funded.

Other regional partnerships

Southeast Asian governments strive to maintain productive relationships with all relevant global technology players, states and industry partners, including through ASEAN. Australia and India, although important, aren't the only international actors in Southeast Asia's digital space, which also includes China, Japan, Korea, the US and the EU. This section offers a brief sketch of some of those players' digital engagement with Southeast Asia.

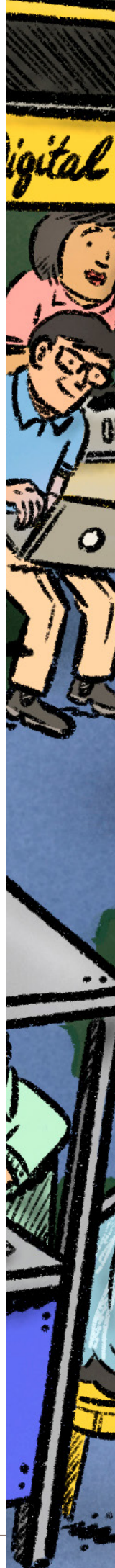
The Quad's engagement in digital Southeast Asia

Southeast Asia and Quad members India, Australia, Japan and the US have a common interest in maintaining and strengthening peace, stability, trade and development, and a rules-based international order in the Indo-Pacific. This pertains to technology, data flows as well as cyberspace broadly.¹⁶⁴ The establishment of several technology and infrastructure working groups and initiatives, including the Critical and Emerging Technology Working Group, the Quad Infrastructure Coordination Group and the Quad Senior Cyber Group further signal this commitment.

The Quad principles on technology, published in September 2021, could provide a starting point for a dialogue of the Quad and Southeast Asia as Australia, India, Japan and the US commit themselves to 'fostering an open, accessible, and secure technology ecosystem' that supports universal values, including respect for freedom of expression and privacy; builds trust, integrity, and resilience; and fosters competitive technology ecosystems that welcome new market entrants, including start-ups, and enhance innovation, resilience and sustainability.¹⁶⁵

Japan's engagement in digital Southeast Asia

Tokyo has been a steadfast partner with ASEAN on infrastructure, connectivity, e-government and services since the early 2000s, when the Japan–ASEAN Integration Fund was launched. Recently, through the Ministry of External Trade and Industry and the Japan External Trade Organisation, Japan has been concentrating on supporting digital transformation efforts by offering competitive grants to eligible Japanese companies for pilot projects across Southeast Asia. Japan also entered into a digital partnership with India in 2018. Both countries seek to establish a start-up hub in Bengaluru,



foster collaboration between SMEs and larger companies, promote mutual business investments and facilitate digital skills (im)migration.¹⁶⁶

Additionally, Japan funded the establishment of the Economic Research Institution for ASEAN and East Asia (ERIA). This organisation was intended to function as an OECD-lite and is an example of how Japan aims to contribute to Southeast Asia's economic foundations. ERIA is managing a growing workstream of research on the digital economy, digital government, innovation and technology.

South Korea's engagement in digital Southeast Asia

Under South Korea's New Southern Policy Plus (2020) foreign policy strategy, digital engagement is predominantly organised through Seoul's development cooperation. In 2019, an MoU on development cooperation was signed with Laos, Myanmar, Vietnam, Cambodia and the Philippines. Official development assistance has been increased from ₩87 million (~A\$100 million) in 2019 to ₩180 billion (~A\$210 million) for 2023, and flagship programs on the digital economy, higher education, Mekong cooperation, smart cities and the development of transportation infrastructure have been launched.¹⁶⁷

As part of South Korea's partnership agreements with the US and Australia, Seoul committed to enhanced cooperation on digital matters in Southeast Asia. Focus areas included in the MoU underpinning the Australia–Republic of Korea Comprehensive Strategic Partnership are expressly targeted towards joint activities in digital, cyber and critical technology cooperation in Southeast Asia, including a foreign ministers' meeting and a joint working group.¹⁶⁸ With the US, Korea has agreed to work on developing open, transparent and efficient 5G, 6G and open radio access networks, artificial intelligence, quantum technologies and biotechnologies and on expanding regional coordination in Southeast Asia.¹⁶⁹

The EU's engagement in digital Southeast Asia

Historically, the EU has been an important trade and development partner of Southeast Asia. Now, with the launch of the EU's Indo-Pacific Strategy, the region is increasingly presented as an area of 'great political, economic and geostrategic importance to the EU'.¹⁷⁰ In the area of digital engagement, cooperation initiatives of the EU and its member states have concentrated on connectivity, digital inclusion and human rights. This includes 'fostering sustainable and secure digital infrastructures, and regulation and governance that respects norms of openness, decentralisation, privacy and transparency that benefit the whole society'.¹⁷¹ The EU's main channels of engagement include financial allocations to long-term multi-donor initiatives and political–economic dialogues.

Summary

Intensifying engagement with Southeast Asia on digital issues is high on the list of priorities for many stakeholders with a declared interest in a free and open Indo-Pacific. India and Australia share those ambitions with like-minded partners such as Japan, Korea and the EU in the absence of formal or informal consultation mechanisms that involve all the players.

The depth and style of engagements differ, however. While India and Japan prioritise the involvement of national private-sector industry and IT providers, which are also important drivers of the relationships, the EU and Australia pursue relationships more through political–economic

dialogues. Australia, India, Japan and Korea are equally involved in a variety of projects that address cybersecurity awareness and skills development across Southeast Asia. Of the like-minded partners, they also appear to have the ability to match words with the delivery of tangible outcomes with visibility in the political, economic and technological arenas.

The Australian and Indian cyber and technology communities hold a wealth of relevant experience and expertise that could underpin a meaningful, mutually beneficial and strengthened regional digital partnership with Southeast Asia. This includes the ability to leverage domestic education and skilling resources as well as existing deep people-to-people links.

Conclusion

As in other parts of the world, the economic and social disruption from the Covid-19 pandemic, in combination with a boost in digital usage and accompanying risks is creating a backdrop of uncertainty across Southeast Asia.

Before the pandemic, the emerging digital foundation of the region was supported by national digital strategies, improvements in infrastructure and a demographic shift to a growing online population. Even when issues of affordability, lack of connectivity and coverage still had to be addressed, significant funding sources remained committed to improving the region's network infrastructure.

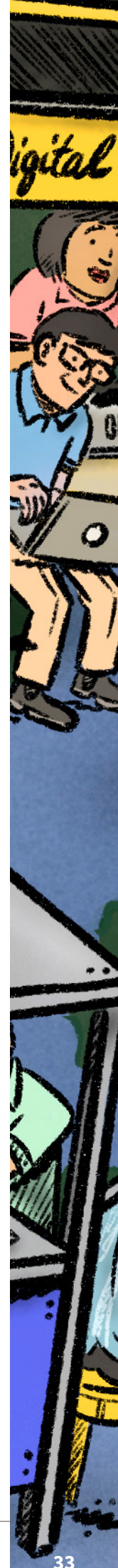
How Southeast Asian governments, in collaboration with industry and civil society, harness their collective strengths and forge new partnerships today, will determine the shape of their next phase of digital transformation.

As this report has shown, there are many moving parts to digital transformation and the development of the digital economy. One thing, however, stands out as a key lever and a main area of attention when considering the role of digital development in the region's post-Covid economic recovery. This is the need to unreservedly address digital skills shortages across the economy. Those shortages are particularly pronounced among traditionally under-resourced segments of the economy, such as MSMEs, women and those in non-metropolitan areas.

A digitally resilient Southeast Asia post-Covid will need a collaborative effort involving governments, industry, civil society and the technical community. Only through a multistakeholder effort, will nations be able to adapt to the changing nature of work and grow a workforce that has the skills to operate confidently, securely and safely online.

Digital development, cybersecurity and inclusivity challenges of Southeast Asia are equally relevant to Australia and India. They are each in pursuit of the next level of digital transformation to secure future economic growth; and they all face the challenge of making sure there are equal opportunities for jobs and innovations. Furthermore, they all seek benefits that reach society in an inclusive manner, and that progress the nation's workforce in possessing more advanced digital skills.

Along the way, ample opportunities exist for an Australia–India collaboration to support and strengthen digital enablers for Southeast Asia's economic recovery after the worst effects of the Covid-19 pandemic fade. In partnership, they can bolster foundations for a prosperous digital



economy by building a community of shared interest in cyber, digital and technology issues under the common vision of a free and open Indo-Pacific.

Opportunities span areas of national security, economic relations and business-to-business trade, the role of higher education, research and technology, as well as people-to-people connection, and are propelled by geopolitical interests. Hence, they require an integrated and comprehensive whole-of-government approach leveraging various aspects of a nation's digital competitiveness.

Recommendations for India–Australia cooperation with Southeast Asia in cyber and technology

The Australia–India arrangement on cooperation in cyber and technology is an emerging one. It coincided with the deepening of the Quadrilateral Security Dialogue, which features prominently in the strategic outlook of both nations. The two countries have been important strategic partners for ASEAN as a regional body as well as for individual Southeast Asian governments, but they aren't the only actors interested in the digital development in the region.

The nature of India's cyber and tech relations with Southeast Asia is different from that of Australia's. Therefore, the recommendations from this report are explorative in nature and focus on potential common activities that could collectively benefit Southeast Asia, Australia and India. This exploration draws on the existing and self-recognised strengths and experiences of Australia and India, is guided by the requirements of the Southeast Asia and its people, and could provide an even greater diversity of digital development pathways for Southeast Asia.

Recommendation 1: Develop an integrated government approach to international digital engagement and establish a Joint Working Group on Digital Engagement

Australia's and India's government relations with Southeast Asia on digital issues are quite diverse and channelled through different parts of their administrations. Currently, digital engagements consist of a patchwork of smaller and bigger initiatives covering political, operational, infrastructure and trade issues but they have lacked an overarching capstone framework. There needs to be a full-picture and up-to-date understanding of what India and Australia are doing, including through non-governmental tracks, in their respective forms of digital engagements with partners in Southeast Asia.

The Australian Government should take the initiative in developing an integrated approach for its digital engagement policies for each of the countries in Southeast Asia. For coordination purposes, this effort should describe the nature and extent of the bilateral digital cooperation projects, initiatives, funding contributions and policy forums that are overseen by the political, trade and international assistance arms of DFAT.

Further integration can be achieved by matching and connecting the different interventions towards a common Australian Government vision and objectives for its engagement. This could form the basis for aligning Australia's efforts with India and like-minded third partners of Southeast Asia such as the

US, Korea and Japan. The international alignment of digital engagements could be organised through a Joint Working Group on Digital Engagement that could sit under the various bilateral cyber and technology collaboration arrangements.

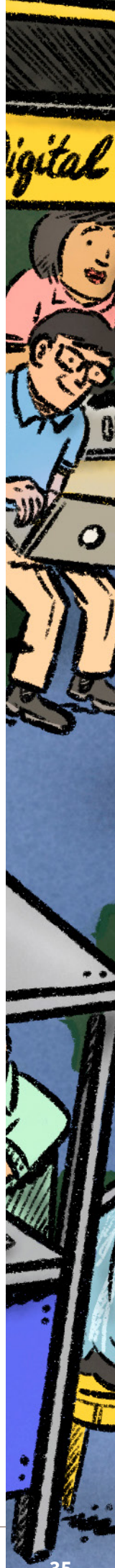
Recommendation 2: Concentrate Australia–India digital development initiatives on enhancing digital knowledge and skills of the workforce in Southeast Asia

Australia and India each have strong educational capabilities, which form an important pillar in bilateral and cross-regional relations and partnership arrangements with Southeast Asia. Preparing Southeast Asia's workforce for the changing nature and task content of jobs will be critical to ensure that the next phase of digital transformation is sustainable and 'digital' plays its enabling role in the region's post-Covid economic recovery. The role of MSMEs in this effort is fundamental; they're major drivers of the real economy and the major source of employment.

The Australian and Indian governments should explore arrangements to connect current and future cooperation initiatives with local digital skilling programs that are run in and by Southeast Asia. An example is the Harnessing Impact with Resilient Employability Digitally (HIRED) project spearheaded by Brunei. The project operates as a virtual training and mentorship platform in cooperation with the ASEAN Future Workforce Council. Industry partners from Australia, India and Southeast Asia could be brought onboard to ensure that training initiatives pair with industry demand for skills. The pledge framework used by the World Economic Forum under the ASEAN Digital Skills Vision initiative could provide a useful point of reference.¹⁷²

In conjunction with this, Australia and India should jointly determine areas where they provide niche value, such as by:

- *Supporting female digital entrepreneurship.* This effort could build on the partnership between DFAT's Investing in Women program with QBO in the Philippines.¹⁷³ They run a program that offers opportunities for female-led tech start-ups by providing funding, mentoring and exposure. Such efforts could be run in other Southeast Asian economies too, in collaboration with local civil-society organisations. Female-led SMEs that are profitable and looking to integrate digital technologies into their businesses could form a priority target audience.¹⁷⁴
- *Improving access to online courses and training to upskill local MSMEs.* Many online learning products are available on the market, often for free, that offer digital learning and upskilling opportunities for local SMEs. To enhance accessibility, the Australian and Indian governments could encourage educational service providers in Australia and India together with online course platforms that have a foothold in Southeast Asia to pool their offerings in a central online repository or catalogue.¹⁷⁵ Similarly to such initiatives in other parts of the world, current offerings should be checked for common impediments to access such as low-data mobile subscriptions, lack of materials in local languages and socio-economic and culturally appropriate curriculums.



Recommendation 3: Strengthen and deepen relationships with Southeast Asia's national cybersecurity agencies to improve whole-of-economy cybersecurity resilience

The dominant role of social media in daily life, the use of e-commerce platforms and the introduction of e-government solutions, in combination with immature levels of cybersecurity, online safety and literacy, are making Southeast Asia an easy target for malicious state and criminal actors. During the height of the pandemic, an increase in an already upward trend of cybersecurity incidents was observed. Communities that are new to the online world are particularly vulnerable to such risks. The region's ability to effectively detect, address and remedy these kinds of cyber incidents is uneven: Singapore and Malaysia outperform the rest of the region.

At a strategic level, through the Australia-India Joint Working Group on Cyber Security Cooperation, the two countries could consider the possibility of sharing strategic assessments of the regional cyber threat landscape with Southeast Asian partners.

This would contribute to a common cross-regional operational picture.¹⁷⁶ These products could include information about the strategic intent of state actors that may negatively affect regional cybersecurity, the *modus operandi* of regionally operating cybercriminal groups and lessons learned from incident response measures.

Most of all, Australia and India should continue to develop and strengthen their partnerships with the national cybersecurity centres and authorised national CERTs in Southeast Asia. They should explore possibilities to share collective resources, expertise and experiences more effectively, in particular to reach relevant audiences across the economy and beyond the capital cities. Areas of collaboration and exchange could include cyber risk awareness campaigns, arrangements for public-private partnerships, coordinating the use of a common, free, open-source threat intelligence-sharing platforms and security advisories. This would enable sectoral CERTs, businesses and other organisations to defend themselves against vulnerabilities, cybercrime and the theft of, for instance, intellectual property.

Recommendation 4: Explore a regional open-source marketplace for public digital infrastructure

Across the region, foundational elements such as infrastructure, connectivity, workforce skills and regulatory frameworks need to be strengthened before the broader economy can reap benefits from new and emerging technologies such as cloud computing, IoT and 5G technologies and the use of AI and machine learning. Presently, Southeast Asian nations break down these analogue barriers individually. Ample opportunities exist, however, to conduct activities jointly and thus leverage economies of scale.

In supporting digital development in Southeast Asia, Australia and India should explore the feasibility of enabling a regional marketplace for digital public goods¹⁷⁷ and an operational-level working group of national broadband providers.

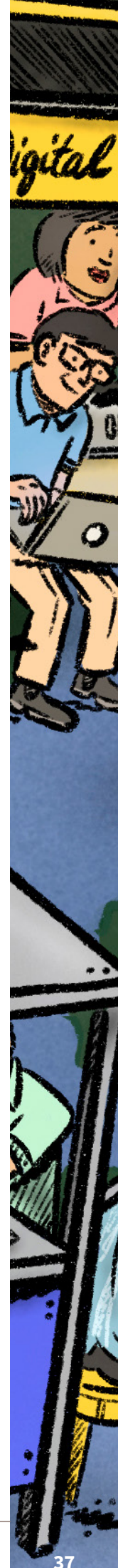
India is already a significant contributor to digital public goods, in particular through IndiaStack and its participation in the Digital Public Goods Alliance.¹⁷⁸ Through the Australia-India arrangement,

both countries should map the availability of existing open-source technologies in their economies that could serve as regionally relevant digital public goods. For instance, the recent agreement by Singapore and India to link their respective PayNow and Unified Payments Interface could develop into an interoperable regional platform on which additional financial service providers link in using open-access software standards.¹⁷⁹

At the same time, such a regional marketplace could offer the digital, technology and cybersecurity communities in Australia and India business and marketing opportunities.

A second area of public digital infrastructure of common interest to Australia, India and Southeast Asia is that of national and rural broadband deployments. Given shared challenges in areas such as technical deployment, financing arrangements, commercial uptake and community awareness, an operational-level working group between BharatNet, NBN and peers in Southeast Asia, and in conjunction with UNESCAP's Asia-Pacific Information Superhighway¹⁸⁰ and the UN Broadband Commission¹⁸¹ could provide a valuable platform for collaboration, support and exchanges of lessons learned.

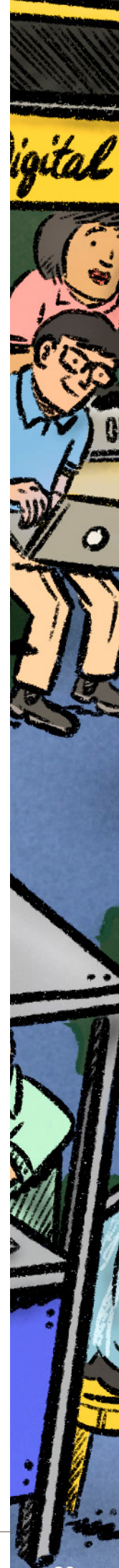
In conclusion, many opportunities and needs exist for increased cooperation in the sphere of strengthening the Indo-Pacific's digital economy. This should be approached as a trilateral Australia-India-ASEAN partnership, as all three subregions are confronted with similar challenges of adapting to and adopting existing and emerging digital technologies.



Notes

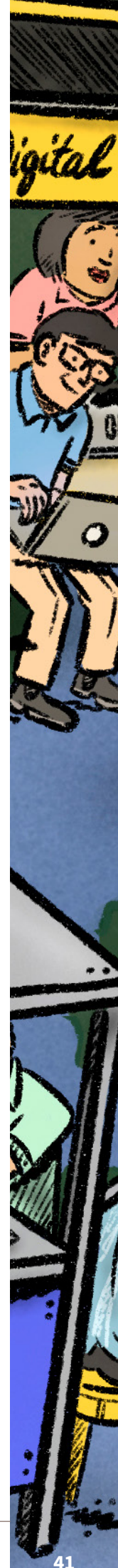
- 1 World Bank, *The Human Capital Index 2020 update: human capital in the time of COVID-19*, World Bank, Washington DC, 2020, [online](#).
- 2 Huong Le Thu, 'Investing in Southeast Asia's tech future', in: Fergus Hanson, Danielle Cave, Madeleine Nyst (eds), *The Sydney Dialogue: playbook*, ASPI, Canberra, 19 November 2021, [online](#).
- 3 Google, Temasek, Bain & Company, *e-Conomy SEA 2019*, 2019, [online](#); *Cybersecurity in ASEAN: an urgent call to action*, AT Kearney, 2018, [online](#).
- 4 Google, Temasek, Bain & Company, *e-Conomy SEA 2020*, 2020, [online](#).
- 5 'Share of people vaccinated against COVID-19, Jan 18, 2022', *Our World in Data*, 2022, [online](#).
- 6 'Digital technologies' refers to the electronic tools, systems, devices and resources that generate, store or process data. Their use requires a level of understanding of how information and communication technologies work and a degree of skill to engage with and create technology applications.
- 7 Nagy K Hanna, 'Assessing the digital economy: aims, frameworks, pilots, results, and lessons', *Journal of Innovation and Entrepreneurship*, 2020, 9(16), [online](#).
- 8 Asian Development Bank (ADB), *Capturing the digital economy: a proposed measurement framework and its applications—a special supplement to Key Indicators for Asia and the Pacific 2021*, ADB, Manila, August 2021, [online](#).
- 9 Various indexes measure the state of a country's digital development. Examples include the ICT Development Index (ITU), the Network Readiness Index (World Economic Forum), the e-Government Development Index (UN) and the Digital Economy and Society Index (EU). See Miroslaw Moroz, 'The level of development of the digital economy in Poland and selected European countries: a comparative analysis', *Foundations of Management*, 2017, vol. 9, [online](#).
- 10 ASEAN, *ASEAN ICT Masterplan 2020*, November 2020, [online](#).
- 11 ASEAN, *ASEAN Digital Masterplan 2025*, 2021, [online](#).
- 12 Millennials are considered to be those born between 1980 and 1995. There are an estimated 155 million millennials in Southeast Asia in 2021, based on 2019 data. Department of Economic and Social Affairs, Population Division, *World population prospects 2019*, UN, New York, 2019. Custom data acquired via EDB Singapore, [online](#).
- 13 'Digital 2021', *We are Social*, 2021, [online](#).
- 14 'Digital 2021', *We are Social*.
- 15 Bain & Company, *The platform economy: Southeast Asia's digital growth catalyst*, Tech for Good Institute, 2021, [online](#).
- 16 In the venture capital industry, a 'unicorn' is a privately held start-up company with a value of over \$1 billion.
- 17 James Massola, 'Facebook is the internet for many people in south-east Asia', *Sydney Morning Herald*, 22 March 2018, [online](#); Jacob Wallis, Ariel Bogle, Albert Zhang, Hillary Mansour, Tim Niven, Elena Yi-Ching Ho, Jason Liu, Jonathan Corpus Ong, Ross Tapsell, *Influence for hire: the Asia-Pacific's online shadow economy*, ASPI, Canberra, 2021, [online](#).
- 18 Laura Silver, *Smartphone ownership is growing rapidly around the world, but not always equally*, Pew Research Center, 5 February 2019, [online](#).
- 19 UNICEF, *Digital literacy in education systems across ASEAN: key insights and opinions of young people*, February 2021, [online](#).
- 20 UNICEF, *Digital literacy in education systems across ASEAN*, [online](#).
- 21 ITU, *Digital Skills Assessment Guidebook*, 2020, [online](#).
- 22 ADB, *Reaping the benefits of Industry 4.0 through skills development in high-growth industries in Southeast Asia*, ADB, Manila, January 2021.
- 23 International Telecommunication Union (ITU), 'Lack of ICT skills a barrier to effective internet use', ITU, Geneva, no date, [online](#); ITU, *Measuring digital development: facts and figures 2020*, ITU, Geneva, 2020, [online](#).
- 24 PwC, *Vietnam digital readiness report*, PwC (Vietnam) Ltd, March 2021, [online](#).
- 25 Coursera, *Global skills report 2021*, Coursera Inc., California, 2021, [online](#).
- 26 Organisation for Economic Co-operation and Development (OECD), *Adapting to changing skill needs in Southeast Asia*, issues paper, 2021 OECD Southeast Asia Regional Forum, [online](#).
- 27 Coursera, *Global skills report 2021*.
- 28 GSMA (Global System for Mobile Communications), *Connected women: the mobile gender gap report 2021*, GSMA, London, 2021, [online](#).
- 29 ITU, *Measuring digital development: facts and figures 2020*; GSMA, *Connected women: the mobile gender gap report 2021*.
- 30 Araba Sey, *Gender digital equality across ASEAN*, discussion paper no. 358, Economic Research Institute for ASEAN and East Asia, February 2021, [online](#).
- 31 *The Economist* Intelligence Unit, *Inclusive Internet Index*, [online](#); A4AI (Alliance for Affordable Internet), *Asia-Pacific regional snapshot: affordability report 2020*, A4AI, 2020, [online](#).
- 32 Marlis H Afridah, Wasisto Raharjo Jati, Sugeng Bahagijo, Denisa Amelia Kawuryan, Bona Tua Parlinggomon Parhusip (eds), *Urgensi kebijakan untuk menangani ketimpangan gender digital, serta pentingnya mempercepat inisiatif baik oms untuk mendorong kesetaraan gender dalam demokrasi Indonesia di era digital [Policy for handling digital gender inequality and accelerating initiatives to promote gender equality in democratic Indonesia in the digital age]*, International NGO Forum on Indonesian Development, September 2021, [online](#).
- 33 APEC Human Resources Development Working Group, *APEC closing the digital skills gap report: trends and insights*, Asia-Pacific Economic Cooperation (APEC), Singapore, December 2020, [online](#).

- 34 ITU, *Digital development dashboard* (beta), 2022, [online](#).
- 35 Huon Curtis, Dion Devow, Meg Thompson, 'Forging a path for Indigenous Australians in cybersecurity and defence', *The Strategist*, 2 February 2021, [online](#).
- 36 OECD, *Enterprise policy responses to COVID-19 in ASEAN: measures to boost MSME resilience*, OECD, Paris, June 2020, [online](#).
- 37 Florian Hoppe, Tony May, Jessie Lin, *Advancing towards ASEAN digital integration: empowering SMEs to build ASEAN's digital future*, Bain & Company, 2018, [online](#).
- 38 Hoppe et al., *Advancing towards ASEAN digital integration*.
- 39 Microsoft, LinkedIn and GitHub (Global Skills Initiative): 1.5 million learners in the Asia–Pacific. Facebook (Upskill with Facebook): 2,700 participants, 1,000 SMEs in Singapore. Google (Skills Ignition SG): 600 traineeships. Through TAF: 200,000 MSMEs across Southeast Asia, AWS Institute open-source and free training including in Bahasa Indonesia.
- 40 'Free digital skills training for 25K Filipinos from the Asia Foundation, Google.org', *Good News Pilipinas*, 10 May 2021, [online](#)
- 41 Kiki Ahmadi, 'Warung as the next frontier of Indonesian startups', *LinkedIn*, 9 February 2020, [online](#).
- 42 Jon Russell, 'Warung Pintar raises \$27.5M to digitize Indonesia's street vendors', *Tech Crunch*, 21 January 2019, [online](#); Deloitte, *Warung Pintar: the digital future of mom-and-pop digital*, no date, [online](#).
- 43 Gilang Khansma, 'Melihat perkembangan Kudo setelah dua tahun diakuisisi Grab' [Watching Kudo's progress two years after Grab's acquisition], *Tech in Asia*, 17 September 2019, [online](#); 'Warung Pintar digital literacy report', *Slideshare*, 5 January 2020, [online](#).
- 44 Yunindita Prasyda, 'Tokopedia struggles to incorporate "warung", cites digital divide', *Jakarta Post*, 5 November 2020, [online](#).
- 45 SE Black, LM Lynch, 'Beyond the incidence of employer-provided training', *ILR Review*, 1998, 52(1):64–81.
- 46 ADB, *Reaping the benefits of Industry 4.0 through skills development in high-growth industries in Southeast Asia*, 26–27.
- 47 UN Industrial Development Organization, 'What are SME consortia?', no date, [online](#).
- 48 H Curtis, *Workforce skills, in-company training and SME productivity: a systematic review of the empirical literature*, working/policy paper, OECD, Paris, 2018.
- 49 ADB, *Reaping the benefits of Industry 4.0 through skills development in high-growth industries in Southeast Asia*, Chapter 3.
- 50 Austrade, *E-commerce in ASEAN: a guide for Australian business*, Australian Government, 2019, [online](#); World Bank, *Beyond unicorns: harnessing digital technologies for inclusion in Indonesia*, World Bank, Washington DC, 29 July 2021, [online](#).
- 51 Ann Shi, 'How Vertex lured Grab to Singapore', *Finance Asia*, 2 June 2017, [online](#); 'Grab leaving Malaysia is Kuala Lumpur's loss to Singapore', *The Independent*, 6 June 2017, [online](#).
- 52 'Grab ke bursa saham AS: Apa yang tinggal untuk Malaysia?—Chean Chung' [Grab to US stock exchanges: What's left for Malaysia?—Chean Chung], *Suara Keadkilan*, 17 April 2021, [online](#).
- 53 Malaysia Digital Economy Corporation, 'MDEC moves forward with "digital investments future5" strategy', news release, 19 July 2021, [online](#).
- 54 According to Bain & Company research, approximately seven out of 10 adults in Southeast Asia are underbanked (for example, without access to credit cards or with no long-term savings products) or unbanked (no basic bank account). Florian Hoppe, Aadarsh Baijal, Thomas Olsen, Usman Akhtar, 'Fulfilling Southeast Asia's digital financial services promise', Bain & Company, 30 October 2019, [online](#); 'Banking Southeast Asia's unbanked', *Asean Post*, 1 January 2019, [online](#); 'Delivering digital financial inclusion in Southeast Asia', *Macquarie.com*, 18 June 2021, [online](#).
- 55 PayPal, *Fintech cybersecurity: an ASEAN outlook*, 2021, [online](#).
- 56 ASEAN, *ASEAN Digital Integration Framework Action Plan (DIFAP) 2019–2025*, 2019, [online](#).
- 57 Grab has leveraged its access to consumer behaviour data through its platform to develop an alternative method of assessing creditworthiness. Using this data, and in a joint venture with a Japanese financing firm, Grab is to provide lending products to unbanked and underbanked individuals and small businesses. Grab, 'Grab and Credit Saison form financial services joint venture to expand access to credit for Southeast Asia's unbanked', news release, 13 March 2018, [online](#); Morgan Demboski, 'APAC's vulnerability to cyber attacks', *IronNet*, 10 August 2021, [online](#).
- 58 'Cybersecurity in ASEAN: an urgent call to action', AT Kearney, no date, [online](#). IoT connections are expected to almost double by 2025, from 2020 figures of 1.8 billion; GSMA, *Mobile economy Asia Pacific*, GSMA, London, 2021, [online](#).
- 59 'Infografis: Rentetan kebocoran data di Indonesia sejak 2020' [Infographic: Series of data leaks in Indonesia since 2020], *CNN Indonesia*, 23 May 2021, [online](#).
- 60 James Henderson, 'Data breaches cost ASEAN businesses \$2.71M', *Channel Asia*, 2 August 2020, [online](#).
- 61 Interpol, 'Interpol report charts top cyberthreats in Southeast Asia', news release, 22 January 2021, [online](#).
- 62 FireEye, Singtel, *Southeast Asia: an evolving cyber threat landscape*, 2015 [online](#); DRACO Team, *Dissecting a Chinese APT targeting South Eastern Asian government institutions*, Bitdefender, no date, [online](#); Cybereason, 'Cybereason exposes Chinese threat actors compromising telecommunications providers for cyber espionage', media release, 3 August 2021, [online](#).
- 63 Jakub Dalek, Nica Dumlao, Miles Kenyon et al., 'Malaysia', in *No access: LGBTIQ website censorship in six countries*, The Citizen Lab, 31 August 2021, [online](#).
- 64 DigitalReach, *Digital rights in Southeast Asia 2020/2021*, 2021, [online](#).
- 65 In Cambodia, the government decreed the establishment of a national internet gateway, which is intended to create a single access point for international internet traffic that can be monitored by an authorised operator or regulator. Prashanth Parameswaran, 'What's in Cambodia's new internet gateway decree?', *The Diplomat*, 24 February 2021, [online](#).
- 66 Arindrajit Basu, 'The retreat of the data localization brigade: India, Indonesia and Vietnam', *The Diplomat*, 10 January 2020, [online](#).
- 67 Broadband Commission for Sustainable Development, *The state of broadband: tackling digital inequalities: a decade for action*, 2020, [online](#).



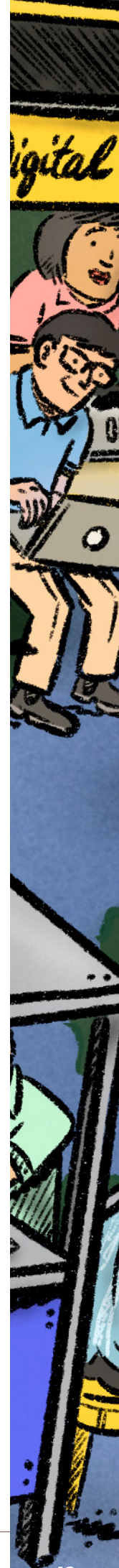
- 68 A4AI, 'What is a national broadband plan?', in *2020 affordability report*, 2020, [online](#).
- 69 Except for Singapore, Malaysia and Brunei Darussalam, fixed broadband prices in Southeast Asia are above 2% of gross national income per capita, which is the affordability target set by the UN Broadband Commission. ITU, *The affordability of ICT services 2020*, policy brief, 2020, [online](#); A4AI, 'Fixed broadband basket (5GB, ≥ 256Kbit/s)', no date, [online](#).
- 70 A4AI, 'How do NBP's make the internet cheaper?', no date, [online](#).
- 71 'NBTC to subsidise fixed broadband for 600,000 households in border regions', *Comms Update*, 7 January 2019, [online](#); *APT report on best practice of connectivity*, Village Broadband Internet Project (Net Pracharat) of Thailand, 2019, [online](#).
- 72 Deloitte, *Unlocking broadband for all: broadband infrastructure sharing policies and strategies for emerging markets*, April 2015, [online](#).
- 73 A4AI, *Guide to public access in Southeast Asia—2019 affordability report*, 2019, [online](#).
- 74 Only Singapore, Malaysia, Lao PDR and Brunei currently offer full electrification. Singapore, Malaysia, Lao PDR and Brunei Darussalam all report 100% electrification, while Myanmar (68.4%), Cambodia (93%), the Philippines (95.6%) and Indonesia (98.8%) are working towards that target; 'Access to electricity (% of population)', World Bank, 2022, [online](#). The numbers mask issues relating to reliable access; Indonesian households with access for part of the day are treated the same as 'full electrification' in government reporting; Stefano Reinard Sulaiman, 'Govt says 98.05 percent of households have electricity. What does it mean?', *Jakarta Post*, 23 January 2019, [online](#).
- 75 Sam Fenwick, 'How to accelerate 3G switch-off to improve the Philippines mobile experience', *Open Signal*, 16 June 2021, [online](#).
- 76 Sam Fenwick, 'Philippines: mobile network experience report', *Open Signal*, April 2021, [online](#).
- 77 'Southeast Asia—state of mobile experience', *Tutela.com*, March 2021, [online](#).
- 78 Rachael Sharpe, 'New data shows more users migrating to 5G in the Philippines', *5Gradar*, 7 July 2021, [online](#).
- 79 Kevin Salvadori, Nico Roehrich, 'Advancing connectivity between the Asia-Pacific region and North America', *Engineering at Meta*, 28 March 2021, [online](#).
- 80 See, for instance, the DigitalxADB: driving digital development across Asia and the Pacific event, 11–29 October 2021, [online](#).
- 81 'Accelerated adoption drives new cloud buying trends across ASEAN, reveals GlobalData', *GlobalData*, 3 September 2021, [online](#).
- 82 'Asia Cloud Computing Association: Covid-19 economic resilience and recovery capability reflected in the Cloud Readiness Index 2020', *MediaOutReach Newswire*, 29 May 2020, [online](#); Asia Cloud Computing Association, *Cloud Readiness Index 2020*, 2020, [online](#).
- 83 Cloud services are most efficient when data centres can be located as close to the end user as possible. It's expensive to construct data centres and lay dedicated fibre between the data centres, especially when the population is dispersed or concentrated in urban areas.
- 84 'The data center market in Southeast Asia is expected to grow at a CAGR of over 6% during the period 2019–2025', *CISION PR Newswire*, 7 April 2020, [online](#).
- 85 Julius Neudorfer, 'Sustainability meets high density data center cooling', *Data Center Frontier*, 25 October 2021, [online](#).
- 86 'The data center market in Southeast Asia is expected to grow at a CAGR of over 6% during the period 2019–2025'.
- 87 A Amir, 'ASEAN 5G Q2 2021 roundup: wider industry collaborations driving enterprise 5G ecosystem', *GlobalData*, 9 July 2021, [online](#). Edge computing is computational processing performed closer to the end user or data source.
- 88 Amir, 'ASEAN 5G Q2 2021 roundup: wider industry collaborations driving enterprise 5G ecosystem'.
- 89 Soon Ghee Chua, Nikolai Dobberstein, Kaushik Sriram, 'Racing toward the future: artificial intelligence in Southeast Asia', AT Kearney, no date, [online](#).
- 90 Singapore has invested US\$68 per capita, whereas the rest of ASEAN has invested less than US\$1 per capita in AI; Soon Ghee Chua et al., 'Racing toward the future: artificial intelligence in Southeast Asia'; Dylan Loh, 'ASEAN faces wide AI gap as Vietnam and Philippines lag behind', *Nikkei Asia*, 9 October 2020, [online](#); Charlotte Trueman, Cristina Lago, 'How is AI benefiting industries throughout Southeast Asia?', *CIO*, 10 January 2020, [online](#).
- 91 OECD, 'Productivity statistics', 2022, [online](#).
- 92 Tracy Beattie, Albert Zhang, Elise Thomas, 'The power dynamics of Thailand's digital activism', *The Strategist*, 14 December 2020, [online](#).
- 93 Anisah Shukry, Yantoultra Ngui, 'Malaysia's new prime minister may be chosen through WhatsApp', *Bloomberg*, 17 August 2021, [online](#).
- 94 Stephanie Davis, 'A wave of change for Southeast Asia's internet economy', *Google*, 10 November 2020, [online](#).
- 95 Google, Temasek, Bain & Company, *e-Conomy SEA 2020*, 2020, [online](#).
- 96 'Southeast Asian broadband providers report varying performance amid COVID-19', *S&P Global*, 17 November 2020, [online](#); Rachel Gong, 'Malaysia's response to COVID-19: mobile data and infrastructure', *LSE*, 23 November 2020, [online](#).
- 97 Apornrath Phoonphongphiphat, 'Thailand leads ASEAN in 5G rollout due to pandemic', *Nikkei Asia*, 20 May 2020, [online](#).
- 98 Amit Anand, 'Investors are doubling down on Southeast Asia's digital economy', *Tech Crunch*, 10 September 2021, [online](#).
- 99 Emerging markets are Africa, China, India and Southeast Asia. Cento, 'Southeast Asia tech investment—FY 2020', 2021, [online](#); Kentaro Iwamoto, 'Singapore VC joins entrepreneurs in hunt for next Grab or Gojek', *Nikkei Asia*, 28 September 2021, [online](#).
- 100 Cento, 'Southeast Asia tech investment—FY 2020', 2021.
- 101 Google, Temasek and Bain, *e-Conomy SEA 2020*. The research found that 36% had tried new digital services and that, of those, 94% were intending to continue their habits after the pandemic. In a survey six months later, in May 2021, the update to the report found that nine out of 10 people were still using at least one of the new digital services that they had adopted in 2020.
- 102 Austrade, *E-commerce in ASEAN: a guide for Australian business*.
- 103 Florian Hoppe, 'COVID-19 helped accelerate Southeast Asia's digital future. Now what?', *Fortune*, 7 August 2021, [online](#).

- 104 Visa, *Visa consumer payment attitudes study 2021: powering the acceleration of digital-first experiences*, 2021, [online](#).
- 105 Diyana Pfordten, 'Interactive: For many Malaysians, working from home may not work out', *The Star*, 6 July 2020, [online](#).
- 106 ADB, *Asia small and medium-sized enterprise monitor 2020, volume II: Covid-19 impact on micro, small, and medium-sized enterprises in developing Asia*, ADB, Manila, 2020, [online](#).
- 107 Percentages of MSMEs that had to close temporarily: Philippines (70.6%), Laos (61%), Indonesia (48.6%) and Thailand (41.1%). ADB, *Asia small and medium-sized enterprise monitor 2020, volume II: Covid-19 impact on micro, small, and medium-sized enterprises in developing Asia*.
- 108 Deepali Khanna, Pitchanuch Supavanich, Nicola Nixon, Geoffrey Ducanes, 'A crisis waiting to happen: unemployment and informality in Southeast Asia during COVID', *The Diplomat*, 19 January 2021, [online](#); Alessia Destefanis, Tetsushi Sonobe, Dil Rahut, Jeetendra Prakash Aryal, 'Lessons for the informal sector from COVID-19', *Asia Pathways*, 13 August 2021, [online](#); Regional Economic and Social Analysis Unit, *Preparing for the future of work: national policy responses in ASEAN +6*, International Labour Organization, 2019, [online](#).
- 109 Sapna Maheshwari, Patricia Cohen, 'Retailers' latest headache: shutdowns at their Vietnamese suppliers', *New York Times*, 29 September 2021, [online](#).
- 110 Chia Woon Eunice Chua, Nguyen Dieu Tu Uyen, 'Factory sleepovers help guard Vietnam's workers from virus outbreaks', *Bloomberg*, 6 July 2021, [online](#).
- 111 SONJO: *Sambatan Jogja*, [online](#); Yanuar Nugroho, Siwage Dharma Negara, 'COVID-19's impact on micro, small, & medium enterprises and tourism in Indonesia', *Perspective*, ISEAS Yusof Ishak Institute, Singapore, 26 October 2020, [online](#); Arlina Arshad, 'WhatsApp group helps tackle bed shortage for Indonesia's Covid-19 patients', *Straits Times*, 14 February 2021, [online](#).
- 112 Gumilang Aryo Sahadewo, 'Etalase Pasar Sonjo', *Pasar Sonjo*, no date, [online](#); Oleh Agung, 'Sonjo, Upaya Kemanusiaan di Tengah Pandemi Covid-19' [Sonjo, humanitarian efforts amid the Covid-19 pandemic], Universitas Gadjah Mada, 4 July 2020, [online](#).
- 113 UNICEF, *COVID-19: Are children able to continue learning during school closures? A global analysis of the potential reach of remote learning policies*, August 2020, [online](#); UN Conference on Trade and Development (UNCTAD), *The COVID-19 crisis: accentuating the need to bridge digital divides*, 6 April 2020, [online](#).
- 114 World Economic Forum, *COVID-19—The true test of ASEAN youth's resilience and adaptability: impact of social distancing on ASEAN youth*, ASEAN Youth Survey, 2020 edition, July 2020, [online](#).
- 115 Jeremiah Joven B Joaquin, Hazel T Biana, Mark Anthony Dacela, 'The Philippine higher education sector in the time of COVID-19', *Frontiers in Education*, 22 October 2020, [online](#).
- 116 'Online violence against women in Asia: a multicountry study', *UN Women*, 2020, [online](#).
- 117 ADB, *Asia small and medium-sized enterprise monitor 2020, volume II: Covid-19 impact on micro, small, and medium-sized enterprises in developing Asia*.
- 118 UN Office on Drugs and Crime (UNODC), *Cybercrime and COVID19 in Southeast Asia: an evolving picture*, April 2021, [online](#); 'Check Point research: Asia Pacific experiencing a 168% year on year increase in cyberattacks in May 2021', *Check Point*, 27 May 2021, [online](#); Interpol, 'Interpol report charts top cyberthreats in Southeast Asia'; 'Ransomware targeting Asean SMEs drops', *Bangkok Post*, 4 May 2021, [online](#).
- 119 FireEye, Mandiant, *M-trends 2021*, 2021, [online](#).
- 120 CK Tan, 'ASEAN needs more Belt and Road money, say ministers', *Nikkei Asia*, 1 September 2021, [online](#).
- 121 Richard Ghiasy, Rajeshwari Krishnamurthy, 'China's Digital Silk Road and the global digital order', *The Diplomat*, 13 April 2021, [online](#).
- 122 'Fact sheet: President Biden and G7 leaders launch Build Back Better World (B3W) Partnership', The White House, 12 June 2021, [online](#).
- 123 'Quad leaders' summit: "Factsheet"', The White House, 24 September 2021, [online](#).
- 124 James Crabtree, Competing with the BRI: the West's uphill task, *Global Politics and Strategy*, 27 July 2021, [online](#).
- 125 Think Tank, 'Prospects for EU-Asia connectivity: the "European way to connectivity"', European Parliament, 6 April 2021, [online](#).
- 126 Rajeswari Pillai Rajagopalan, 'Australia-India 2+2 Dialogue: converging interests', *The Diplomat*, 16 September 2021, [online](#).
- 127 Marise Payne, 'Joint statement on inaugural India-Australia 2+2 ministerial dialogue', media release, 11 September 2021, [online](#).
- 128 Marise Payne, 'Australia and India agree new partnership on cyber and critical technology', media release, 4 June 2020, [online](#); Marise Payne, 'Australia and India elevate cyber and critical technology cooperation', media release, 13 September 2021, [online](#).
- 129 India became a dialogue partner in 1998; Australia was ASEAN's first dialogue partner in 1974, became a strategic partner in 2014 and elevated the relationship to a comprehensive strategic partnership in 2021.
- 130 ASEAN, 'Information and communication technology (ICT)', in *Plan of action to implement the ASEAN-India Partnership for Peace, Progress and Shared Prosperity (2021-2025)*, 2020, [online](#); ASEAN, 'Chairman's statement of the 1st ASEAN-Australia Summit', 27 October 2021, [online](#).
- 131 Henry Storey, 'Do comprehensive strategic partnerships matter?', *The Interpreter*, 9 November 2021, [online](#).
- 132 This section is taken from Trisha Ray, '6 years of Digital India: how successful has PM Modi's plan been?', Observer Research Foundation, 2 July 2021, [online](#). See also Julia Voo, Irfan Hemani, Simon Jones, Winnona DeSombre, Daniel Cassidy, Anina Schwarzenbach, *National Cyber Power Index 2020: methodology and analytical considerations*, Belfer Center for Science and International Affairs, September 2020, [online](#); Pratima Harigunani, 'Inside India: the world's IT powerhouse', *Computer Weekly*, 1 June 2020, [online](#).
- 133 Jacqueline Miranda, 'Philippines, India set to enhance economic ties in digital tech, infrastructure', *OpenGov*, 4 January 2021, [online](#).
- 134 KV Kesavan, 'India's "Act East" policy and regional cooperation', Observer Research Foundation, 14 February 2020, [online](#).
- 135 'Report of the second India-ASEAN track 1.5 dialogue on cyber issues', Observer Research Foundation, 10 June 2020, [online](#).



- 136 Anandi Chandrashekhar, 'SME digitisation platform GlobalLinker signs MoU with Thailand', *Economic Times*, 25 September 2019, [online](#).
- 137 Ministry of Electronics and Information Technology, 'Country wise status', Indian Government, 2022, [online](#).
- 138 Department of Science and Technology, 'India–Thailand joint call for proposals', Indian Government, 1 June 2018, [online](#).
- 139 Dipanjan Roy Chaudhury, 'Act East: India promotes digital connectivity with ASEAN through mega hackathon', *Economic Times*, 18 February 2021, [online](#).
- 140 Ministry of Skill Development and Entrepreneurship, *National Skill Development Mission: a framework for implementation*, Indian Government, 2019, [online](#).
- 141 'The future of India's economy depends on skills', National Skills Network, 3 June 2020, [online](#).
- 142 Ministry of Skill Development and Entrepreneurship, 'Launch of Skill India Campaign on 15th July, 2015', news release, Indian Government, 13 July 2015, [online](#).
- 143 Ministry of Skill Development and Entrepreneurship, 'Revamp of PMKVY', Indian Government, 14 December 2016, [online](#).
- 144 'Training starts in 607 districts under third phase of PMKVY: Pradhan', *Business Standard*, 19 July 2021, [online](#).
- 145 Shina Kalra, 'Under India's Skill Initiative, 1.28 crore youth trained, 56% got jobs', *MSN*, 15 July 2021, [online](#).
- 146 Yogima Seth Sharma, 'Those trained under gov't's flagship skills programme get 15-19% higher wages: minister', *Economic Times*, 19 July 2021, [online](#).
- 147 'Govt to launch PMKVY-III with focus on digital tech, industry 4.0: minister', *Business Standard*, 29 June 2020, [online](#).
- 148 Ministry of Skill Development and Entrepreneurship, 'Resolution: Approval of Pradhan Mantri Kaushal Vikas Yojana 3.0 (2020–21) (PMKVY 3.0)', Indian Government, 30 December 2020, [online](#).
- 149 Yan Carrière-Swallow, Vikram Haksar, Manasa Patnam, *Stacking up financial inclusion gains in India*, International Monetary Fund, July 2021, [online](#).
- 150 'Google cites UPI learnings to US Federal Reserve for proposed RTGS system', *The Hindu Business Line*, 14 December 2019, [online](#).
- 151 'CoWIN platform "freely available" to all countries: Finance Minister', *NDTV*, 10 July 2021, [online](#).
- 152 Bharat Broadband Network Limited, [online](#).
- 153 Karishma Mehrotra, 'BharatNet: Challenges on web highway', *Indian Express*, 17 October 2019, [online](#).
- 154 'What does 1Gb of mobile data cost in every country?', *Visual Capitalist*, 3 July 2020, [online](#).
- 155 GSMA, 'The mobile economy: India 2016', *GSMA Intelligence*, 2016, [online](#); Aakash Agarwal, Kritika Sharma Vignesh Ramanan, 'Assessment of telecom industry in India—from 2007 to 2020', *Asian Journal of Economics, Finance and Management*, 10 May 2021, 3(4):18–33, [online](#).
- 156 Surajeet Das Gupta, 'Five years of Reliance Jio: from disruption to data revolution', *Business Standard*, 4 September 2021, [online](#).
- 157 GSMA, *Connected women: the mobile gender gap report 2021*.
- 158 Huong Le Thu, 'How Australia can supercharge engagement with Southeast Asia', *Australian Foreign Affairs*, February 2021; AustCyber, *Cyber security opportunities un the ASEAN region*, Australian Government, 2019, [online](#).
- 159 Digital Technologies Hub, [online](#).
- 160 The original \$29 billion in funding was topped up by a special \$19.5 billion loan from the federal government in 2017. In 2018, The additional \$2 billion required for the project was sourced from private investment markets. Peter Ryan, 'NBN budget revised up again to \$51 billion as higher costs and slower revenue bite', *ABC News*, 31 August 2018, [online](#).
- 161 Paul Fletcher, 'NBN declared built and fully operational', media release, 24 December 2020, [online](#); David Braue, 'NBN rollout complete: but not everyone is connected yet', *Information Age*, 12 January 2021, [online](#); NBN Co. Ltd, 'National Broadband Network—Rollout information', 2019, [online](#).
- 162 NBN Co. Ltd, 'Statement of expectations', 24 August 2016, [online](#).
- 163 NBN Co. Ltd, submission to the Joint Standing Committee on the National Broadband Network's 'Inquiry into the business case for the NBN and the experiences of small businesses', 24 February 2020, [online](#); AlphaBeta Strategy & Economics, *Australian broadband affordability*, report prepared for NBN Co. Ltd, March 2019, [online](#).
- 164 Huong Le Thu, 'Southeast Asia and Indo-Pacific concepts', *Security Challenges*, 2020, 16(3):53–57, [online](#); 'ASEAN member states agree to move forward on a formal cybersecurity coordination mechanism', media release, CSA Singapore, 2 October 2019, [online](#).
- 165 'Quad principles on technology design, development, governance, and use', The White House, 24 September 2021, [online](#).
- 166 Ministry of Economy, Trade and Industry, 'Announcement of the result of the call for the FY2020 tertiary supplementary budget's Asia Digital Transformation (ADX) Promotion Project', media release, Japanese Government, 3 August 2021, [online](#).
- 167 Choe Wongi, 'New Southern Policy': *Korea's newfound ambition in search of strategic autonomy*, Ifri Center for Asian Studies, January 2021, [online](#); George Ingram, 'Chapter 1: Policy', in *Development in Southeast Asia: opportunities for donor collaboration*, Brookings Institution, 2020, [online](#).
- 168 Department of Foreign Affairs and Trade, 'Australia and the Republic of Korea sign new MoU on a digital cooperation initiative in Southeast Asia', Australian Government, 2021, [online](#).
- 169 Miyeon Oh, *Beyond the peninsula: US–ROK cooperation on digital connectivity in the Indo-Pacific*, Sowcroft Center for Strategy and Security, Atlantic Council, December 2021, [online](#).
- 170 European Commission, *Southeast Asia: Policy background*, 2022, [online](#).
- 171 Maaïke Okano-Heijmans, Wilhelm Vosse, 'Promoting open and inclusive connectivity: the case for digital development cooperation', *Research in Globalization*, December 2021, [online](#).
- 172 World Economic Forum, 'ASEAN Digital Skills Vision 2020', 2022, [online](#).

- 173 Investing in Women, 'Digital: QBO Innovation Hub partners with Investing In Women to champion #Pinaytechsheroes through their Startup Pinay program', Australian Government, 15 October 2020, [online](#).
- 174 See, for example, women digital entrepreneurship workshops that were sponsored through Australia–ASEAN Council grants. DFAT, 'Fostering women's economic empowerment through digital entrepreneurship', Australian Government, accessed on 6 October 2021, [online](#).
- 175 See Digital Skill-up ([online](#)) for a similar initiative. This project, funded by the European Commission and aimed at a European audience, provides learning modules, a training catalogue and a community forum on emerging technologies and learning. The initiative is carried by a multistakeholder community representing schools, other educational institutions, business sectors, the tech industry and governments. The Australian Trade Commission's international education road map (AIE2025) is now at the evaluation stage. The research that drove that road map is now seven years out of date and mostly focused on onshore (Australia-based) rather than offshore opportunities for Australia's tertiary and vocational sectors. The upcoming evaluation should consider opportunities for Australian education providers in ASEAN markets.
- 176 See, for instance, the recently added paragraphs on ICT security included in the ARF Annual Security Outlook.
- 177 Digital public goods are open-source software, open data, open AI models, open standards and open content.
- 178 The Digital Public Goods Alliance ([online](#)) is an initiative overseen by Germany, Sierra Leone, Norway, iSPIRT, the UNDP and UNICEF. Its aim is to accelerate achieving the UN Sustainable Development Goals by facilitating the discovery, development and investment in open-source software, open data, open AI models, open standards and open content. Providing off-the-shelf products that can be implemented and managed locally is a relevant resource for the developing and emerging economies of Southeast Asia.
- 179 'Singapore's PayNow to link with India's Unified Payments Interface in 2022', *Channel News Asia*, 14 September 2021, [online](#).
- 180 The Asia–Pacific Information Superhighway initiative is a region-wide intergovernmental platform that promotes regional policy dialogues and consultations towards a regional seamless information and communication space; mobilises cooperation and partnerships for addressing the digital divide and digital connectivity infrastructure; shares knowledge, policy, technology and good practices; conducts analytical research and surveys; and supports capacity building of member states through North–South and South–South cooperation.
- 181 The Broadband Commission for Sustainable Development was established in 2010 by the ITU and UNESCO to boost the importance of broadband on the international policy agenda and expand broadband access in every country as key to accelerating progress towards national and international development targets.



Acronyms and abbreviations

4IR	fourth industrial revolution
ACSC	Australian Cyber Security Centre
ADB	Asian Development Bank
AI	artificial intelligence
API	application programming interface
ASEAN	Association of Southeast Asian Nations
CERT	computer emergency response team
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSP	comprehensive strategic partnership
DFAT	Department of Foreign Affairs and Trade
ERIA	Economic Research Institution for ASEAN and East Asia
EU	European Union
GDP	gross domestic product
ICPC	International Cyber Policy Centre
ICT	information and communications technology
IoT	internet of things
IT	information technology
ITU	International Telecommunication Union
MOOC	massive open online course
MoU	memorandum of understanding
MSMEs	micro, small and medium-sized enterprises
NBN	National Broadband Network
OECD	Organisation for Economic Co-operation and Development
ORF	Observer Research Foundation
PBED	Philippine Business for Education
PMKVY	Pradhan Mantri Kaushal Vikas Yojana
Quad	Quadrilateral Security Dialogue
SMEs	small and medium-sized enterprises
STEM	science, technology, engineering and mathematics
UN	United Nations
UNICEF	UN Children's Fund
UPI	Unified Payments Interface

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