August 2021

Indonesia's AI Promise in Perspective

CSET Issue Brief

AUTHORS
Kayla Goode
Heeu Millie Kim

Executive Summary

> "We do not wish to choose between China and the United States. Any competition between these two is not beneficial to us or the region."
>
> *- Desra Percaya, Ambassador Extraordinary and Plenipotentiary of the Republic of Indonesia to the United Kingdom, and Former Director General for Asia-Pacific and Africa at the Indonesian Ministry of Foreign Affairs*[1]

Indonesia is at a crossroads. Although it is the largest Southeast Asian nation by population, geography, and gross domestic product, Indonesia has historically maintained a comparatively low international profile. Yet its booming e-commerce market, rapidly growing internet user base, and proliferation of artificial intelligence (AI) companies have placed the country at an important juncture in more ways than one. Stretching between the Pacific and Indian Oceans, bridging continental Asia and Australia, the Indonesian archipelago already sits on one of the largest corridors of international trade.[2] Moreover, President Joko Widodo, also known as Jokowi, is attempting to balance an influx of investments and development opportunities, especially from China, with domestic politics historically steeped in protectionism, anti-colonialist impulses, and anti-Chinese public sentiment. On the international stage, Indonesia eschews "megaphone diplomacy" to avoid provoking a rivalry between the United States and China, as both are seen as strategic partners.[3]

This report assesses the promise and shortcomings of Indonesia's AI sector. With a high rate of AI adoption in the region, Indonesia is dubbed the "digital archipelago."[4] Its AI startups and AI-enabled e-commerce companies have flourished, but there are barriers to their continued success. Indonesia lags behind its peers in internet infrastructure, and needs to invest in education and its workforce to meet AI talent demands. Critical sectors of the economy have

been hit by cyberattacks at higher rates than its neighbors, indicating a need for more robust cybersecurity measures.

Both the United States and China are investing heavily in Indonesia's commercial AI sector and helping the country address its challenges in infrastructure, talent, and cybersecurity. China views Indonesia as an anchor for its economic, digital, and political inroads in Southeast Asia. Through government and company-led initiatives, China has been bolstering educational partnerships, investing in AI startups, and advancing cybersecurity cooperation with Indonesia. In contrast, the United States has largely taken a private sector-led approach to invest in Indonesia's AI capabilities. Despite robust political and economic relations rooted in public diplomacy and shared democratic ideals, the United States has relied on existing educational exchanges and venture capital-driven investments to tap into Indonesia's AI potential. However, the United States has an opportunity to forge new high-level agreements to leverage its comparative advantages in AI talent, research, and development.

The enduring competition between China and the United States on the technological front will inevitably impact the development of Indonesia's AI sector. Indonesia might be able to navigate these competing interventions with a "free and active" foreign policy that equally balances U.S. and Chinese interests for its own gain. Failing that, Indonesia might instead be subject to Beijing's own plans for AI supremacy. The United States should not risk such an outcome, particularly when it concerns a key player in Southeast Asia that is on an AI journey full of untapped potential.

Table of Contents

Indonesia's AI Potential

Over the last five years, the growth of Indonesia's technology sector has received international attention, which earned the country the title as Asia's "sleeping giant" and "next AI startup hub."[5] In August 2020, Indonesia published its first National Strategy on Artificial Intelligence 2020-2045 (Strategi Nasional Kecerdasan Artifisial), becoming the second Association of Southeast Asian Nations (ASEAN) country to do so after Singapore.[6] Emphasizing education and research, health services, food security, mobility, and "smart cities," the strategy's 186 programs seek to transform Indonesia from a natural resource-based country to an innovation-driven one.[7] Indonesia's strategy suggests a focus on developing AI, Internet of Things (IoT), advanced robotics, augmented reality, and 3D printing, to enrich state projects that already leverage AI.[8]

Indonesia's national AI strategy builds on existing government initiatives that have sought to advance AI development and integration, including the Jakarta Smart City Initiative and "Making Indonesia 4.0" program. Introduced in 2014 to rapidly respond to public needs, the JSC Initiative has established digital mapping with IoT and AI technology to improve smart governance, mobility, and living.[9] Jakarta's provincial government has already connected more than five thousand CCTVs on major road points and resolved 99.8 percent of all complaint reports about illegal parking, disturbance of peace, and more.[10] Indonesia's AI firm Nodeflux, which develops deep-learning computer vision and intelligent video analytics, has played a critical role equipping Jakarta's provincial government and Indonesian National Police with data solutions and surveillance technology.[11] Jokowi's "Making Indonesia 4.0" from 2018, which refers to a fourth industrial revolution powered by technology, also encourages such public-private partnerships in hopes of transforming Indonesia into a globally competitive player. By promoting both domestic and foreign direct investment in Indonesia's AI and technology-based sectors, the initiative seeks to accelerate the automation of Indonesian society and become one of the world's top 10 economies by 2030.[12]

Indonesia's sheer size of nearly two hundred million active internet users and rapid digitization are promising components for the government's desired growth in the technology sector.[13] Smartphone penetration has risen from 28 percent six years ago to a projected 80 percent next year.[14] With one of the fastest growing internet user bases in the world and the largest in Southeast Asia, Indonesia is already home to an internet economy that dwarfs regional competitors. In 2020, Indonesia's internet economy was valued at $44 billion, more than those of the next three countries (Thailand, Vietnam, and Malaysia) combined.[15]

This "digital first" economy is partly why Indonesian tech companies have had enormous success at home and, to some extent, abroad.[16] Indonesian AI companies have focused on natural language processing and big data analytics, while AI-enabled companies that support digital payments, e-commerce, or on-demand logistics have attracted international investors and expanded operations overseas. For example, Indonesia's Eureka AI built a proprietary AI enterprise software system to offer businesses real-time mobile data analytics. The company already serves one billion customers throughout India, Southeast Asia, and the Middle East with plans to expand to Europe and the United States.[17] Indonesian startup Katai.ai uses conversational AI or "virtual assistants" to serve around three million active monthly users across Indonesian businesses. Katai.ai's success is especially impressive given that Google considers Bahasa Indonesia to be one of the world's hardest languages to use in AI-powered natural language processing.[18] Snapcart, another rapidly growing AI startup that collects smart receipts for consumer data, has raised $14 million since 2015 and now operates in the Philippines, Singapore, and Brazil.[19]

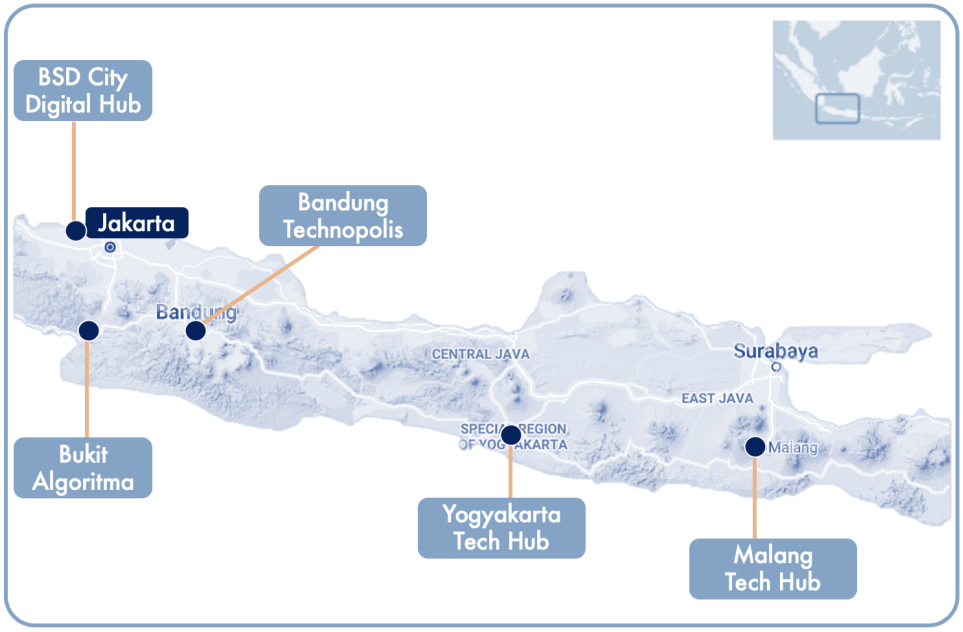
One of Indonesia's most popular startups, Gojek, began in 2010 with only 20 motorbike taxis and grew into an enormous delivery, ride-hailing, and digital payments platform with more than $5 billion in funding.[20] As one of Indonesia's six "unicorns" or startups valued over $1 billion, it is now one of the top five most-funded startups in the Asia-Pacific, following Ant Group, Grab, and One97 Communications.[21] Gojek also offers its services regionally in the Philippines, Singapore, Thailand, and Vietnam, and aims to be a

"one-stop shop" application. Gojek's success is partly due to its ability to leverage AI and machine learning to run its multiservice platform. The application offers biometric security features through fingerprint and facial recognition, uses ML to identify fictional orders, and personalizes preferences for its millions of users.[22] Constantly seeking to develop scalable ML models, Gojek's data scientists have partnered with Google Cloud to deliver dynamic pricing and predict changes in demand.[23] Job postings requiring a master's in computer science and five years of work experience with ML development indicate that Gojek possesses and continues to look for advanced AI talent.[24] CEO and founder Nadiem Makarem has expressed that Gojek will work towards applying reinforcement learning and innovative solutions to develop a "super app." This aspiration has been boosted by the recent merger between Gojek and Indonesian e-commerce giant, Tokopedia, that formed a multiservices platform called GoTo Group. Though both companies will retain separate businesses, GoTo's public valuation goal is $40 billion and will boast more than one hundred million monthly active users of its digital insurance, payment, and financial services.[25] Tokopedia has independently raised around $3 billion from U.S., Chinese, Japanese, and Singaporean investors.[26] Together, Gojek and Tokopedia would encompass 2 percent of Indonesia's GDP.[27]

Tokopedia not only integrates AI and ML in every Tokopedia initiative, but also promotes AI research at the university level. The e-commerce giant partnered with the University of Indonesia (UI) in 2019 to launch an AI research center focusing on deep learning supercomputer technology, NVIDIA DGX-1.[28] Through the center, Tokopedia's goal is to advance product development, AI research dissemination, and talent pool expansion. Most recently in March 2020, Tokopedia rolled out cloud, AI, ML, and data technologies to 97 percent of districts nationwide.[29] In doing so, Tokopedia is advancing the local adoption of such technologies, adding strength to the Indonesian government's initiatives to further integrate AI into the economy. By building AI and ML capabilities into their user platforms, AI-enabled unicorns like Gojek and Tokopedia are spearheading AI development and adoption in Indonesia.

Indonesia ranks fifth in global startup rankings with more than 2,100 startups, just behind the United States, India, the United Kingdom, and Canada.[30] As of June 2021, 99 startups were focused on AI and developing consumer behavior analytics, ML for credit ratings, chatbots, and big data processing among other technologies.[31] Harnessing the power of emerging technology, Indonesia's startups are rapidly developing local cloud computing and AI capabilities. Bukit Algoritma, a private sector initiative to build a special economic zone in West Java, aims to create a tech hub of startups exploring digital technology, biotech, AI, and semiconductors. In hopes of creating Indonesia's Silicon Valley, the project will initially provide $1 million each to 48 startups in the area.[32] Bumi Serpong Damai, commonly referred to as "BSD City," another tech hub located south of Jakarta, already houses 40 tech firms, including the headquarters of Traveloka and Grab. The city aspires to become an ecosystem of startups, educational institutions, and multinational tech giants to encourage "smart city" and digital hub projects.[33] These initiatives will serve as springboards for more AI and tech startups to grow and join Indonesia's unicorns on the global stage.

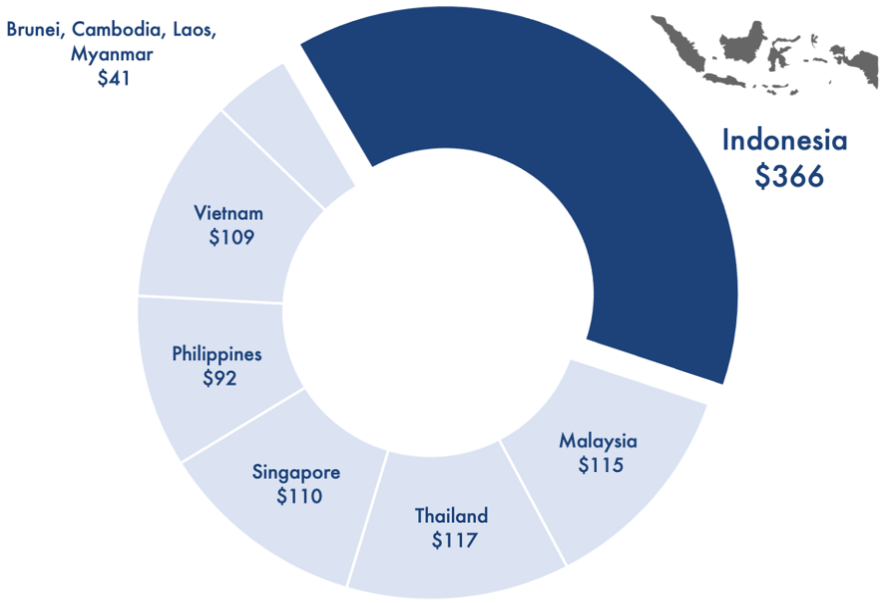
Figure 1. Indonesia's tech hubs are concentrated on Java and located near the capital of Jakarta



Source: Tech in Asia, Google Maps; edited by CSET.

In addition to being home to such a thriving AI startup environment, Indonesia boasts the highest rate of AI adoption in Southeast Asia. The 2018 International Data Corporation Survey reported that 24.6 percent of Indonesia's surveyed organizations integrated AI into their operations.[34] Compare this with its regional competitors, 17.1 percent for Thailand and 9.9 percent for Singapore, and it is understandable why Indonesia is viewed as the next frontier for AI.[35] As shown in Figure 2, the expected contribution of AI to Indonesia's GDP by 2030 is estimated to be the greatest among Southeast Asian countries.

Figure 2. Expected contribution of AI to GDP by 2030 (USD billions)



Source: Kearney, edited by CSET.

Scientific publication numbers are an additional metric that can indicate a country's competitiveness in AI research. In 2019, Indonesia ranked third among Southeast Asian countries for the number of academic-corporate peer-reviewed AI publications.[36] Now, Indonesia has the highest number of AI-related scientific publications in Southeast Asia. According to the Organisation for Economic Co-operation and Development, Indonesia had between

five thousand and ten thousand AI-related papers published every year over the past five years. In contrast, all other ASEAN member states did not have more than five thousand publications in a single year during the same time period.[37] Though trailing behind regional tech leaders India, Japan, and South Korea, Indonesia published 38,204 papers over the past five years—not too far behind South Korea's 51,639 publications.[38] Overall, Indonesia notably ranked 24th for peer-reviewed AI publications and their citation impacts, which points to Indonesia's potential to compete with global leaders in AI.[39]

Challenges in Infrastructure, Talent, and Cybersecurity

Despite these successes, Indonesia's AI sector faces shortcomings in internet infrastructure, domestic talent, and cybersecurity. Infrastructure is arguably the starting point for Indonesia to tackle the latter two obstacles, creating more secure networks, better education systems, and wider internet access. The archipelago, consisting of around six thousand inhabited islands out of 17,508 total, faces unique challenges in physical and digital connectivity.[40]

Although Indonesia has made significant strides in the last five years, expanding internet access to 76 percent of the population, its progress in internet infrastructure has been markedly slower than its neighbors.[41] A study from *The Economist*, which measures internet availability, affordability and usability, placed Indonesia 57th out of 100 countries.[42] Between 2017 and 2020, Indonesia improved by one point in the rankings, whereas India advanced 7.3 points to overtake Indonesia.[43] The 2020 Network Readiness Index, which measures the sophistication of a nation's internet technology, availability, governance, and impact, ranked Indonesia far lower than neighboring Malaysia, Thailand, and Vietnam.[44] Concerning startups and tech firms, the 2018 Asian Productivity Organization Productivity Databook reported that only 1 percent of Indonesian economic growth comes from Total Factor Productivity, which measures technological capacity and institutional quality.[45] These reports reveal Indonesia's struggle to build both physical and soft infrastructure.

Beyond the challenging geographic ones, additional factors limit Indonesia's internet infrastructure progress, including uneven government intervention and President Jokowi's tendency to shift between economic liberalism and protectionism.[46] Overreliance on poorly-run state-owned enterprises is also a barrier to progress.[47] The total debt of state-owned construction companies in Indonesia was more than $11 trillion as of September 2020, but SOEs continue to dominate infrastructure projects and sideline the private sector.[48] The recently launched Indonesian Investment Authority, intended to attract infrastructure investments for both SOE-led and private sector projects, is unlikely to offset Indonesia's overreliance on SOEs.[49] Its current funding is low relative to SOE

debt in critical infrastructure sectors, and it will take time for the INA to build a proven track record of managing projects to secure external capital contributions, something it has yet to do.

Cultivating AI talent has also been a challenge, as evidenced by the shortcomings of investment and education for Indonesia's students and young workers.[50] Although there is no definitive way to measure AI talent, people with advanced degrees in AI-related fields such as computer science and computer engineering provide one proxy for assessment. Most of Indonesia's youth receive only a high school education, work in blue-collar or low-level service jobs, and earn an average monthly income of $150.[51] In 2018, the proportion of Indonesians over 25 years old with a bachelor's degree was 9.3 percent, the lowest among ASEAN nations with less than 0.04 percent holding graduate degrees.[52] Perhaps more concerning, Indonesia has fallen further behind in recent years. It ranked 75th on the Global Innovation Index for having 19.4 percent of tertiary graduates in science and engineering in 2020, which was markedly lower than 68th in 2019 and 54th in 2018.[53] In the category of "knowledge workers," or high-level workers who apply analytical knowledge to product development, Indonesia ranked 125th of 131 countries, which demonstrates a clear weakness in finding advanced talent for innovation.[54]

These educational results come as demand for skills such as software engineering and data science is expected to rise with the growth of Indonesia's tech sector.[55] Already, the demand for domestic talent is so high that Indonesian startups are poaching employees from one another, resulting in higher-than-average turnover rates.[56]

To address the challenge, Indonesian AI companies have begun to invest in domestic universities and AI research centers to cultivate talent. The Tokopedia-UI AI Center of Excellence hopes to develop digital talent by advancing deep learning technology for academics and researchers. Bukalapak also partnered with the Bandung Institute of Technology to launch an Artificial Intelligence and Cloud Computing Innovation Center to train Indonesian students, educators, and researchers.[57] Sharing an outlook for vibrant tech

development, Indonesian companies are stepping up to address the digital talent gap.[58]

Foreign companies are also providing assistance, albeit modestly. In 2020, Google announced that it would grant $1 million to the "fight against youth unemployment" in Indonesia, whereas China's telecommunication giant Huawei has provided training and internship opportunities to Indonesian students since 2009 and dedicated $1 million to the cause in 2011.[59] In 2013, Huawei began collaborating with Indonesia's Ministries of Communication and Information Technology; Manpower; and Education, Culture, Research, and Technology, to give roughly one thousand students vocational training in information and communications technology (ICT) infrastructure.[60] Both Amazon Web Services and Alibaba Cloud Indonesia, a subsidiary of Alibaba Group, are also competing to roll out cloud training programs targeting Indonesian students.[61] While these initiatives are a good start, they largely offer ad hoc solutions that fall short of meeting the human capital demands of Indonesia's technology strategy, which envisions a comprehensive strengthening of vocational education and research at technology-based universities. As the demand for AI talent grows, these talent pipelines will need to go beyond a few concentrated urban centers and cast a wide net to develop and leverage talent throughout the country.[62]

To partly address disparities in rural and remote areas, Indonesia is looking to generate talent through upskilling programs and coding schools supported by education-focused tech companies, also referred to as edTech. EdTech companies service not only primary, secondary, and university students with their online learning platforms, but also workers and adult learners who are looking to secure competitive jobs through reskilling. During the COVID-19 pandemic, more than 60 million Indonesian students utilized EdTech services for remote learning, which demonstrated the potential of EdTech to expand.[63] The lockdown restrictions revealed new opportunities for such enterprises and technology-enabled companies.

Each year, roughly two million Indonesian youth enter the workforce, which presents a daunting challenge should Indonesia

fail to address its shortcomings in education and job training. An analysis by *The Financial Times* suggests that Indonesia is not generating enough investment for sufficient job growth, and others caution against what they view as Jokowi's "obsession" with digital innovation as a silver bullet to fix structural problems.[64] A mismanaged demographic surplus of young workers could become destabilizing if flashy labels such as "unicorns" and "digital archipelago" overshadow necessary investments in education and employment opportunities.

Finally, as its digital economy expands, Indonesia must address challenges in cybersecurity.[65] Recent cyber attacks have exposed the vulnerabilities of Indonesia's key services and public sectors, but the country's booming e-commerce sector has also been increasingly threatened. Although all nations are vulnerable to cyber attacks, Indonesia appears to be the victim of more attacks than its neighbors. In 2019, it registered the highest malware rate in the Asia-Pacific region.[66] Even with a 39 percent reported decrease, the rate is still double the regional average.[67] A lack of robust cybersecurity can negatively impact the rollout and implementation of AI-enabled systems, as cyber attacks could either target datasets used for training AI systems or undermine the effectiveness of AI models once deployed.

Indonesia has had critical sectors hit by high-profile cyber attacks. Perhaps the most notorious occurred in May 2017 when the WannaCry malware spread to an estimated 150 countries worldwide. While Cambodia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam did not report any hits to government agencies or critical infrastructure, two of Indonesia's major hospitals were locked out from accepting patients.[68] Roughly a dozen other Indonesian institutions were affected by WannaCry, including its manufacturing sectors, universities, and vehicle registration centers.[69] The previous year, the nation's central bank was hit by the Anonymous group's preannounced attacks, which flooded servers with spam emails and viruses.[70]

After these attacks exposed the vulnerability of key services, Jokowi established the National Cyber and Encryption Agency (BSSN) in May 2017 to coordinate cybersecurity at the national

and international level. As the government charts a path forward on cyber issues with organizations like BSSN, a greater focus on cyber diplomacy has emerged. Indonesia's Ministry of Foreign Affairs is working with the United Nations to discuss cyber norms and cyber crime, and Indonesia has signed memorandums of understanding (MOUs) with Australia, China, India, and Russia to establish norms in cyberspace. It has also formed a cybersecurity agreement with the Office of the U.S. Attorney General that includes training programs in digital forensics.[71] Indonesia's national cybersecurity strategy also ties its efforts to ASEAN and South Korea's Cybersecurity Alliance for Mutual Progress.[72]

The myriad of agreements and partnerships reflect Indonesia's foreign policy modus operandi: "*a million friends, zero enemies.*" However, it is not clear how this nonaligned stance in cyberspace benefits Indonesia when conflicts arise. Recent U.S.-Russia tensions resulting from ransomware attacks on U.S. infrastructure, for example, have brought divergent views of cyber governance into sharp contrast. At a certain point, Indonesia's middle-of-the-road and "appease everyone" approach may be untenable as fundamental differences between international powers like the United States, Russia, and China arise over cyberspace governance. For example, Indonesia's cyberspace agreements with Australia and China, two countries with very different values, may prove difficult to reconcile. Despite its attempt to please all sides, Indonesia cannot have a cybersecurity strategy that simultaneously touts democratic values of human rights, transparency, and the free flow of information while acknowledging a completely different approach that prioritizes censorship, surveillance, and "internet sovereignty."

Domestically, Indonesian officials are increasingly focusing on cybersecurity, but bureaucratic inertia has stalled progress. Following a number of high-profile attacks against some of Indonesia's largest e-commerce companies, including the theft of personal data from ninety-one million accounts on Tokopedia in March 2020, the government called upon tech companies to improve data protection.[73] In 2020, the government introduced the Personal Data Protection Bill, modeled after the European Union's 2018 General Data Protection Regulation, as the first

comprehensive set of standards to protect user data. However, the bill remains under deliberation for contentious exceptions that allow the government to access personal data for certain reasons, including national security and law enforcement.[74] The legislation is also at a standstill due to domestic disagreement over establishing an independent data protection body or giving oversight to the Ministry of Communication and Information Technology.[75] Government efforts to safeguard data touch on both economic and political concerns: election security is a top priority for a nation with the world's third largest electorate. In May 2020, the country's election commission said the private information of 2.3 million voters had been illegally copied and put up for sale on the dark web.[76]

As Indonesia advances in AI, data protection regulations will be critical.[77] With the expansion of digital services in both public and private spheres, government efforts will probably continue to focus on implementing a regulatory framework to reduce cyberattacks, secure consumer data, and encourage innovation and competitiveness in cyberspace. However, without an official agency to oversee AI development, Indonesia could struggle to ensure that digital services and data are properly protected.[78] The National AI Strategy itself cited that Indonesia faces hurdles such as data misuse without provisions or an agency to regulate AI.[79] As Indonesia strives toward AI innovation, the nation will benefit from having, at the very least, a unified federal vision for AI and a central governing body that can coordinate and oversee AI development, standardization, and regulation.

Going forward, Indonesia is looking to imitate the successful, technologically-driven transformations of regional neighbors like Japan, South Korea, and Taiwan and take a more prominent role in the Indo-Pacific.[80] A flourishing domestic AI industry and adoption of such technologies by both the public and private sector may provide the boost Indonesia needs to shake the "sleeping" from its "Asian giant" designation. To get there, Indonesia will need to sustain its economic growth, in part, by increasing the quality of its labor pool for technology businesses to thrive. Japan, South Korea, and Taiwan instituted policies that encouraged innovation, investment in research and development (R&D), and improved

education quality to escape low- and middle-income status. Early into its economic transition, South Korea implemented critical reforms, including privatizing SOEs in construction, banking, and energy sectors. Building manufacturing bases led to the rise of the middle class, and today, South Korea continues to enhance its economic and technological competitiveness by investing over $2 billion in AI research and training. If Indonesia can implement reforms to reduce reliance on SOEs in critical sectors, improve education, and fully leverage external support to overcome human capital and infrastructure challenges, then its AI development goals are more likely to be within reach. Where this leaves the United States, China, and the future of the Indo-Pacific is the subject of the following section.

> "A flourishing domestic AI industry and adoption of such technologies by both the public and private sector may provide the boost Indonesia needs to shake the 'sleeping' from its 'Asian giant' designation."

AI Promises and Great Powers: China and Indonesia

The United States and China are increasingly focused on Indonesia's tech sector. Under Xi Jinping's leadership, China has taken a proactive and assertive posture to advance its interests, particularly in Southeast Asia. Meanwhile, the United States is recalibrating its approach to the region as it realizes that strained relations with China may be the new normal.[81] This diplomatic churn is neither unfamiliar nor unique to Indonesia. For roughly the last century, Southeast Asian countries have balanced interventions and the disparate interests of intervening powers through alignment or strategic hedging. However, heightened U.S.-China competition around AI may change this dynamic and prove challenging for Indonesia, which has consistently favored independence over entanglement with foreign powers.[82] As Indonesia's tech and AI ecosystem becomes another venue for great powers to gain influence, geopolitical dynamics will color Indonesia's AI development.

Although China-Indonesia relations have historically been complex and at times tense, today the two countries have robust trade and investment ties, cultural and educational exchanges, and political cooperation.[83]

In the past five years, China has helped Indonesia address its objectives in AI talent, digital infrastructure, and cybersecurity. This should not come as a surprise: China's 2017 *New Generation Artificial Intelligence Development Plan* deemed AI to be a "new focus of international competition."[84] Under the plan, China encourages Chinese AI enterprises to pursue overseas mergers and acquisitions, equity investment, venture capital, and R&D centers. China hopes to encourage partnership with foreign AI enterprises and strengthen its own AI services for global platforms.[85]

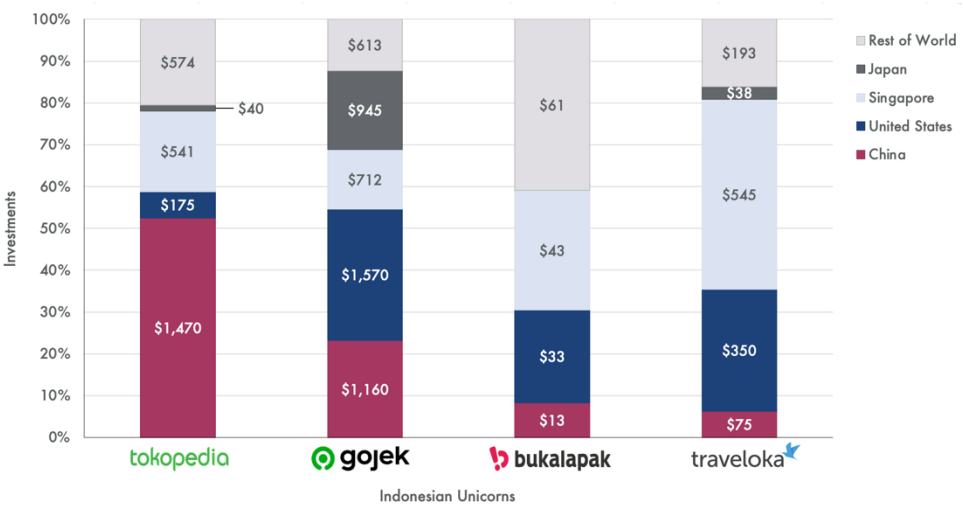
Through the Digital Silk Road, a component of the Belt and Road Initiative (BRI) launched in 2015, China also seeks to improve an array of network and technology capabilities including AI and surveillance tech in recipient countries.[86] Though Indonesia has not signed a formal DSR agreement with China, China's venture

capital-driven investments, AI talent trainings, digital infrastructure assistance, and cybersecurity collaboration fall under China's vision for a stronger and interconnected DSR.

Investments in AI Startups

Chinese companies have invested heavily in Indonesia's tech sector. In 2017, Chinese investments accounted for 95 percent of the total investment value of Indonesian startups.[87] Chinese venture capital firms raised $150 million with investors from Japan and India for Traveloka.[88] In 2018, Chinese internet company Tencent Holdings led a $1.5 billion funding series for Gojek, which helped the ride-sharing and multiservice platform expand its areas of operation.[89] Similarly, Alibaba's Ant Group provided funding for Indonesia's e-commerce unicorn, Bukalapak, and now holds a minority stake in the company.[90] These investments indicate a broader Chinese government and venture capital-driven strategy of reorienting China's economic relationship with Indonesia from one centered on trade in raw materials to one that also prioritizes innovation and knowledge-based development.[91]

Figure 3. Investment in Indonesia's Unicorns (USD millions)[92]



Source: Crunchbase and CSET analysis. Amounts presented do not account for undisclosed funding. Investment data for Indonesia's fifth unicorn, digital payment company OVO, was not available.

Indonesia's AI ecosystem is an increasingly attractive space for Chinese investors, especially since a recent souring of China-India relations turned a number of Chinese companies away from India. Chinese firms Shunwei Capital and BAce Capital both looked to Indonesia after India's rejection of Chinese investment proposals.[93] Moreover, Chinese companies and investors are participating in earlier stages of series funding, which indicate opportunities to increase equity or partial ownership of startups. SIG China invested twice in the earliest funding phase (Series A) for Indonesia's Neurosensum, a small company that uses AI and neuroscience to understand consumer behavior, raising around $1.8 million in 2019 and $6 million in 2020.[94] With greater equity in these companies, China will not only be able to share in the profits and growth of Indonesian firms, but also influence the direction of the business to align with the Chinese Communist Party's broader ambitions. This was evident when Chinese internet giant ByteDance purchased one of Indonesia's top news applications as a majority investor and filtered out stories critical of the Chinese government for the app's eight million monthly users.[95]

Through investments in nascent Indonesian AI companies, China seeks to normalize and export its rules of the road for AI use in censorship and surveillance. In doing so, China can continue to leverage its extensive investments to shape public perceptions of China in Indonesia, where anti-Chinese sentiments linger and one of the world's largest Chinese diasporas live. China will continue to advance the adoption of its own AI practices and capabilities by budding tech companies in Indonesia to ensure China gains a digital foothold where AI standards are still developing.[96]

Digital Infrastructure

In 2013, Xi Jinping chose to launch the BRI in Indonesia, which signaled China's recognition of Indonesia's importance as a maritime power and largest country in Southeast Asia.[97] Together with the DSR initiative, the BRI's promotion of maritime connectivity aligns with President Jokowi's vision for "maritime infrastructure" development.[98] Under the Global Maritime Fulcrum (GMF) plan announced in 2014, Jokowi hopes to transform Indonesia into a hub for maritime governance, economy,

environmental protection, and infrastructure.[99] Xi and Jokowi agreed in March 2015 that China's Maritime Silk Road proposal and Indonesia's Global Maritime Fulcrum were "highly complementary."[100] The clear overlap between the DSR and GMF has guided China-Indonesia cooperation in infrastructure, as China recognized Indonesia's need for interisland connectivity. Between 2012 and 2018, China signed 66 international treaties with Indonesia, mostly covering infrastructure, economic, and science and technology.[101]

By tying digital infrastructure and security cooperation with Indonesia to the DSR, China seeks to achieve its wider BRI objectives of strengthening collaboration on safety and security, improving interoperability of infrastructure, and deepening supply chain cooperation.[102] As the 14th Five-Year Plan indicates, China's goal of promoting a "high-quality" BRI would require Indonesia's deeper integration into the BRI framework. China's emphasis on the overlap between the DSR and GMF creates the necessary buy-in to expand two-way trade, investment, and production capacity cooperation.[103]

Supported by the DSR, Chinese ICT firms are leading ICT connectivity in Indonesia. Echoing Xi Jinping's concept of "win-win" (双赢, shuāngyíng) relations in foreign policy, Huawei seeks to boost Indonesia's digital ecosystem while gaining greater market share in Southeast Asia.[104] Huawei's 2019 MOU with a major Indonesian wireless network provider aims to accelerate infrastructure development and broadband connections in remote areas.[105]

Private and public collaboration with Huawei reflects Indonesia's commitment to raise its digital competitiveness. Indeed, the Indonesian government is dedicating $2 billion of its 2021 national budget of $185 billion to ICT development.[106] Huawei's goal of securing the digital infrastructure of partner countries closely aligns with Indonesia's plans for a "Digital Indonesia."

At the same time, Indonesia's embrace of Huawei has raised concerns that Southeast Asia's largest economy may become too reliant on a company regarded as having close ties to the Chinese

government.[107] Recent studies have highlighted collaboration between Huawei employees and Chinese armed forces personnel, as well as with China's Central Military Commission, and its National University of Defense Technology, though Huawei has denied these claims.[108] In 2019, the United States added Huawei to the Bureau of Industry and Security Entity List, which requires specific license requirements to export any items to Huawei.[109] The United States, the United Kingdom, Japan, Australia, and others have expressed concern over vulnerabilities or backdoors in Huawei's equipment that could allow the Chinese government to access communications and user data transmitted over the network.[110] Indonesia's October 2020 memorandum with Huawei came after the United States banned Huawei for security reasons and pressured partners to exclude Huawei from their 5G rollouts.[111] This revealed the limits of U.S. pressure against Chinese 5G companies in Indonesia, and the United States will be increasingly concerned about Indonesia's reliance on Huawei as the single vendor for AI expertise and digital infrastructure.[112] It is noteworthy, however, that Indonesia is conducting field trials for Open Radio Access Networks, provided by U.S. telecom vendors, to gauge the potential of Open RAN architectures as an alternative to Huawei.[113] This could diversify hardware and software vendors for 5G development in Indonesia and ameliorate national security concerns of Huawei monopolizing networks and supply chains.[114]

AI Talent

China and Indonesia have also committed to exchanging AI talent through various university-to-university agreements, scientific exchange programs, and joint laboratories. In 2015, China established the Indonesia-China Technology Transfer Centre as one of China's five bilateral ASEAN technology transfer centers. The body promotes transfers of advanced technologies among members of the BRI.[115] The center offers scholarships, training, and internship programs for young Indonesian scientists through a partnership with the Indonesian Ministry of Research and Technology.[116]

Alongside people-to-people exchanges coordinated at the government level, Huawei has been a central player in providing

training on information and communication technologies to Indonesians. In October 2020, Huawei signed an MOU to train one hundred thousand Indonesians in cloud, AI, and 5G technology and cooperate with Indonesia's second-largest telecom company to install 5G infrastructure.[117] Indonesia has also been part of Huawei's Seeds for the Future program since 2011, through which Indonesian students receive ICT training, scholarships, and internships.[118] This year, the Chinese telecom giant opened the Huawei ASEAN Academy Engineering Institute in Jakarta to offer more than three thousand comprehensive ICT and cybersecurity courses for Indonesian students. The academy hopes to produce one hundred thousand digital talents in Indonesia by 2025.[119]

Indonesia's government hopes that embracing Huawei will improve information-sharing and research on Indonesia's digital economy and strengthen Indonesia's envisioned "triple-helix" collaboration between industry, academia, and government.[120] To be successful, however, these efforts would need to continue at scale and be sustained by Indonesia's government and industry to adequately address the digital talent and training deficit in Indonesia. While the Huawei ASEAN Academy Engineering Institute will certainly raise ICT and cybersecurity literacy, Indonesia must sustain and expand access to such training and educational opportunities to meet AI talent demands in both public and private sectors.

China's efforts to develop human capital in Indonesia not only sets the scene for the growth of AI-focused startups, but also directly addresses the digital talent gap prioritized in Indonesia's national AI strategy.[121]

Cybersecurity and Collaboration in Cyberspace

China is working to strengthen cybersecurity cooperation with Indonesia and shape the development of its regulatory framework. In January 2021, China and Indonesia signed an MOU to build cybersecurity capacity and increase technical cooperation, which marked China's first such agreement with a foreign country.[122] The two countries agreed to work towards a "multilateral, democratic, and transparent international Internet governance system," to build a secure cyberspace for Indonesia's ICT development.[123] This

agreement reflects China's goal to set international "rules and standards for digital fields," as prioritized in its most recent Five-Year Plan.[124]

The origins and nuances of the 2021 MOU can be traced back to 2016, when Indonesia's cyber agency and China's cyberspace administration initiated plans for bilateral cybersecurity cooperation. They agreed to establish a cybersecurity cooperation program that would cover cyber war simulations, joint research in cybersecurity, and capacity-building for cyber risk mitigation and network security.[125] The agreement emphasized the importance of an ICT strategy that would help Indonesia prepare for future cyber attacks through national infrastructure development.[126]

This year's cyber MOU similarly emphasizes cybersecurity and capacity building of both civil and economic sectors. Moving forward, China will strive to build on this common understanding to shape the regulatory environment of Indonesia's cyberspace. Here, China has an opportunity to export its digital security standards, which tend to disincentivize encryption and transport layer security to allow for greater government surveillance.[127] Although a gain for China, introducing such standards to Indonesia could weaken the country's nascent cyber defense capabilities. More broadly, this could undermine the country as a key ASEAN member state in its attempts to establish digital data governance and security standards for the region. Ultimately, these cyber governance and security standards may be as crucial to Indonesia's cyber capabilities as they are to its AI development, and the more China has a hand in guiding that

"Ultimately, these cyber governance and security standards may be as crucial to Indonesia's cyber capabilities as they are to its AI development, and the more China has a hand in guiding that development, the less likely Indonesia's standards will lend themselves to democratic norms and ideals."

development, the less likely Indonesia's standards will lend themselves to democratic norms and ideals. By strengthening bilateral cooperation with Indonesia on an issue that currently lacks widely accepted international norms and regulations, China can more readily push its own standards for cyberspace in Indonesia and the region at-large.

Challenges in the China-Indonesia Partnership

China's engagement with Indonesia is not without challenges, namely on maritime security and anti-Chinese public sentiment in Indonesia. Tensions persist over the waters off of Indonesia's Natuna Islands, to which both Indonesia and China lay claim. In January 2020, Indonesian warships and patrol ships confronted Chinese coast guard vessels and fishing boats, resulting in a tense two-week standoff.[128] China has sought to pressure Indonesia into accepting negotiations over its right to access contested waters, with more than 63 encroachments in December 2019 alone.[129] Although the maritime clashes have not halted educational partnerships, investments in infrastructure, and cybersecurity cooperation, an accident or escalation of military action in the waters off of the Natuna Islands could sour relations and undermine cooperation between the two countries on AI and cybersecurity.

China's maritime behavior is one of many factors impacting Indonesians' perceptions of the country, which have drastically worsened in the last decade. The Pew Research Center found that the proportion of Indonesians with favorable views of China fell from 66 percent in 2014 to 53 percent in 2018, and still further to 36 percent in 2019.[130] Additionally, long-standing anti-Chinese prejudices, rooted in the three-decade ban of Chinese language and culture under President Suharto, still impact Indonesians' perceptions of Chinese policies, culture, and people.[131] In recent years, Indonesians have not only protested against China's treatment of Uyghurs in Xinjiang, but also demanded that their government prevent the entry of Chinese workers.[132] The Indonesia-China High-Level Meeting on People-to-People Exchange Mechanism, one of China's five bilateral forums for political, economic, and social exchange, has done little to reduce

the wariness of Chinese motives and objectives. China's public diplomacy through its Confucius Institutes have similarly struggled to reduce Indonesians' suspicions of China. Anti-Chinese sentiment in Indonesia will remain a barrier to Chinese-backed growth and assistance to Indonesia's digital development.[133]

Moreover, China has clearly demonstrated its interest in profiting from and influencing Indonesia's digital economy.[134] With its early investments in Indonesian tech companies, support for infrastructure projects and education, and cooperation on cybersecurity, China is pursuing multiple avenues to strengthen ties. Whether this will assuage strong anti-Chinese public sentiment in Indonesia and disagreements over the South China Sea is unlikely. There is little doubt, though, that China's involvement in Indonesia could become coercive tools for Beijing to enhance its global technological reach and lend credibility to its own standards and norms for cyber and AI. The United States, in contrast, has not matched China's political and economic investment in Indonesia's ICT sector. As Indonesia embraces AI, the United States has an opportunity to guide the country's democratic path in AI, in part, by helping Indonesia address talent gaps through corporate and academic partnerships, internet infrastructure development support, and collaboration on standard-setting.

The United States and Indonesia

Although the United States has an interest in cultivating Indonesia as a democratic leader and U.S. partner in Southeast Asia, progress in the partnership has been underwhelming, in part due to episodic U.S. engagements with Indonesia and ASEAN more broadly.[135] A U.S. "Pivot to Asia," which sought to establish new and strengthened ties across the Asia-Pacific and specifically looked to Indonesia for "greater voice and responsibility" in leading the region, has had some progress with mixed results.[136]

Today, the United States' interest in the region is increasingly shaped by concerns about China's activities. In March of this year, the U.S. Indo-Pacific Command's Admiral Philip Davidson warned that the military balance in the region is "becoming more unfavorable" and that this change led by China "could be permanent."[137] China is also more aggressively prioritizing strategic, long-term engagement with Indonesia than the United States. It is in the United States' interest to sustain a cooperative partnership with Indonesia that spans beyond trade and security for the decade to come—a decade which U.S. intelligence agencies deem will be defined by emerging technologies like AI.[138] Indonesia's blossoming AI sector presents the United States with an economic and strategic opportunity to benefit from growth in Indonesia's tech sector. While U.S.-based venture capital firms and tech giants have been quick to flock to Indonesia's AI startups, the U.S. government has taken a back seat in initiating mutually-beneficial technology partnerships with Indonesia. As China continues to use both high-level agreements and private sector initiatives to gain footholds in Indonesia, the United States could miss out on a critical opportunity to strengthen technology partnerships with Indonesia.

Investment in AI Startups

U.S. tech giants have demonstrated keen interest in investing in Indonesia's burgeoning AI industry. In June 2020, Facebook and PayPal led $375 million in funding for Gojek to empower the business and drive financial inclusion across the archipelago.[139] Following suit, Google led a $920 million investment in Gojek,

becoming the unicorn's second-largest stakeholder with a 6.9 percent stake.[140] Google also led the charge with Singapore's Temasek Holdings to raise $350 million for Tokopedia in its final funding round.[141] In addition to Indonesia's unicorns, U.S. venture capital firms are investing in smaller startups in their earlier funding rounds. In June 2021, U.S.-based Valar Ventures and Goodwater Capital raised $60 million in the first funding round for BukuWarung, a fintech firm targeting micro, small and medium enterprises (MSMEs). This marked the largest Series A funding ever raised by a startup for MSMEs.[142] Such investments reveal U.S. companies' strong confidence in Indonesia's AI landscape, especially the e-commerce industry, which is expected to be worth $83 billion by 2025.[143]

More broadly, the United States seeks to nurture technology environments that align with democratic values. The recent Democracy Technology Partnership Act, introduced in the U.S. Congress in March 2021, aims to set international standards and norms, research emerging technologies, and coordinate export controls and investment screenings for critical technologies.[144] The act acknowledges a "new era" of technological and geostrategic competition with China and stresses that the U.S. competitive advantage is better preserved through strong democratic partnerships.[145] This act demonstrates potential for the U.S. and Indonesia to establish a mutually beneficial technology partnership, which would allow the United States to help guide Indonesia's cyber and AI development. Given China's active involvement in Indonesia's technological transformation, the United States should build on the proposed legislation through stronger cybersecurity cooperation and educational partnerships with Indonesia.

Digital Infrastructure and AI Talent

U.S. private companies have rolled out training and infrastructure programs to profit from and bolster Indonesia's digital economy. In West Java, Amazon is planning to build three data centers by 2022, investing nearly $3 billion in what the Indonesian Ministry of Industry states is the biggest investment in the country's information and tech sector thus far.[146] The Indonesian government hopes the development of an AWS region will accelerate the

country's position as a digital economic hub by bringing small and medium enterprises—which account for 99 percent of Indonesian businesses—online.[147] Another U.S. information technology giant, IBM has long played an integral role in helping shape Indonesia's IT industry by working with major Indonesian firms—including 19 of the top 20 banks in the country—to provide bespoke IT solutions.[148]

U.S. companies also are providing training opportunities to promote growth in the digital sector and increase AI talent for both U.S. and Indonesian companies. Google is assisting employers of AI talent through partnerships with Indonesian learning platforms to expand course offerings, particularly in IT and recruitment processes.[149] Additionally, the U.S. Department of State's Fulbright-Indonesia Research in Science and Technology (FIRST), an exchange program with $15 million in scholarships, allows both Indonesians and Americans to study, teach, and conduct research in priority science and technology fields. Ideally these efforts will help Indonesia meet its AI talent demands and boost the competitiveness of U.S. companies expanding operations there. In this area, China maintains an advantage with more than fifteen thousand Indonesians studying in China compared to the roughly eight thousand in the United States.[150] China has increased its scholarship opportunities, particularly to attract Indonesian students to study technology. China will probably continue to offer such opportunities at no cost to Indonesian students, increasing its access to AI talent and other avenues for China-Indonesia digital cooperation.

However, the United States retains an advantage in higher education quality over China and can emphasize this qualitative difference to promote either sustained work in the United States or a return to Indonesia to work for U.S. companies. One avenue to promote such exchanges is the "American Corners Indonesia" program, which maintains partnerships between the public affairs section of the U.S. Embassy in Indonesia and nine Indonesian universities, including the Bandung Institute of Technology, one of the top AI research institutes in the country. These partnerships provide Indonesian students with opportunities to study in the United States, English-language learning resources, massive open

online courses (MOOC) offered by U.S. universities, and access to makerspace activities, such as 3D printing and invention kits. Ideally, the U.S. Congress would increase funding for these State Department initiatives to expand their emphasis on research collaboration and study exchanges on topics of emerging technology.[151]

In sum, U.S. private sector efforts to support Indonesia's digital infrastructure and talent development better enable the country to resist Chinese overtures and economic pressure. However, business ties and economic dependence between Beijing and Jakarta will probably continue to strengthen as Indonesia's digital economy and AI sector grow. Chinese businesses have a comparative advantage because they can receive direct support from the state to better compete on cost. To counter this, the United States can address a key gap in Indonesia's AI ambitions: its talent development and education. The combination of the United States' MOOCs, private sector training programs, and U.S. exchange programs could all address Indonesia's talent needs, enhance a technology partnership, and assure Indonesia that the United States is not solely motivated by concerns over Chinese dominance in the region.

Cybersecurity and Collaboration in Cyberspace

Another area for enhanced partnership between the United States and Indonesia is in cyberspace, especially on cementing internationally agreed upon norms. For the last three years, the United States has initiated cooperation in cyberspace with new Indonesian cyber agencies and initiatives. In 2018, Indonesia's Director General for American and European Affairs at the Ministry of Foreign Affairs, Muhammad Anshor, and U.S. Ambassador to Indonesia, Joseph R. Donovan Jr., signed a Letter of Intent on Promoting Strong Cyber Space Cooperation and laid the framework for Indonesia's cyberspace capacity in its newly established State Cyber and Crypto Agency. In the same year, the Indonesian National Police and the Office of the U.S. Attorney General agreed to strengthen bilateral cooperation against transnational cyber and financial crime on the sidelines of the 87th Interpol General Assembly.[152] The U.S. and Indonesian militaries

have also established the annual Information System and Technology Exchange. Started in 2019, the ISTX is one of the newest military technology initiatives and strives to guide and develop cybersecurity doctrine, enhance cybersecurity capabilities, and protect critical infrastructure from malign intrusions.[153]

"Ultimately, Jakarta may be looking to have its cake (a competitive AI industry and leading role on the world stage) and eat it too (a relationship of 'pragmatic equidistance' between the United States and China)."

Yet, U.S. engagements on cyber have largely been through the ASEAN Regional Forum rather than on an individual basis with Indonesia. Both the U.S.-ASEAN Cyber Dialogue and Digital Connectivity and Cybersecurity Partnership are multiyear efforts to shape norms and enhance cybersecurity and internet connectivity in the region as a whole.[154] The DCCP, in particular, aims to provide an alternative to "top-down, authoritarian approaches to internet and ICT development" for the digitization of Southeast Asian countries.[155] Though cybersecurity cooperation with ASEAN sets the foundation for dialogue, an independent and comprehensive U.S.-Indonesia partnership on cyberspace would bolster Jakarta's cybersecurity. In addition to existing efforts to combat cybercrime and cybersecurity in the military context, the United States can guide Indonesia's approach to cyber regulations, data privacy, and public digital infrastructure security. Some of the United States' allies are also looking to increase its partnership with Indonesia in the cyber domain. Australia commenced a cyber policy dialogue with Indonesia in 2017 to commit to "an open, free and secure internet." Japan and other nations wary of Chinese influence are "counting on Jokowi" to promote Indonesia's growth into a "more diplomatically active power."[156] Ultimately, Jakarta may be looking to have its cake (a competitive AI industry and leading role on the world stage) and eat it too (a relationship of "pragmatic equidistance" between the United States and China).[157]

Conclusion: Leveraging U.S. Comparative Advantages

Nurturing the Next Generation of AI Innovators

Despite the two democracies appearing as "natural partners," the United States and Indonesia have struggled to cement a strategic vision for the relationship.[158] Now, Indonesia's growing commercial AI sector and its desire for innovation-driven growth present opportunities for both U.S. industry and policymakers. Opportunities abound with Indonesia's strong and growing digital economy, a handful of successful AI and AI-enabled companies, and a large working population eager to upskill into competitive tech jobs.

The United States maintains an enduring advantage over China with its soft power initiatives and shared democratic values with Indonesia. It can more effectively leverage these to strengthen technological ties with Indonesia. For example, most Indonesian students believe that the United States offers the highest quality education.[159] Moreover, as democracies, both the United States and Indonesia have better aligned interests and incentives to ensure AI development and applications support democratic norms and preserve public trust.

Given such advantages, the United States has an opportunity to foster Indonesian AI talent to nurture the next generation of Indonesia's AI innovators. U.S. universities, vocational schools, and community colleges that offer courses in computer science and engineering can become more visible and accessible to the Indonesian market through the State Department's EducationUSA fairs. Educational consultants that seek to connect with prospective Indonesian students can facilitate study exchanges and visa applications for study and research in technology. In doing so, the United States will be able to share responsible AI development standards and norms with Indonesians in the field. Doing so strengthens the technological and educational partnerships between the countries and serves as ways for the United States to impact the development of Indonesia's AI talent.

Thwarting Anti-Democratic Influence in AI

Despite strengthened cooperation with China on technology, Indonesia's rocky history with its neighbor to the north and public mistrust of the Chinese government means Indonesia is not fully beholden to China's influence. However, if unchecked, China's commercial success in Indonesia's AI ecosystem will present challenges to Indonesia's attempts to maintain autonomy over its domestic industries and its traditionally nonaligned foreign policy. Indonesia is still in the early stages of its AI development, and China is establishing digital footholds in Indonesia to better cultivate positive perceptions of China and shape Indonesia's political narratives about Chinese activity in Southeast Asia and beyond.

China also has an incentive to overcome the suspicion and contention among Indonesians that stiff-arms Beijing's goals for greater political influence. If China is unable to guide Indonesia's norms for its cyber and AI development, it will at the very least use its economic ties to influence Indonesian political discourse and discourage narratives Beijing considers "anti-China." In at least one instance, China has already demonstrated its technological will and ability to censor anti-China news on a popular Indonesian news aggregator app. This is especially worrisome since Indonesia's governance and regulation of AI is not keeping pace with its AI capabilities. Indonesia can, and should, formulate its own norms and protect its open democracy by collaborating with democratic nations and popular U.S. platforms in the country, like Facebook and Twitter, to better regulate its internet and avoid foreign manipulation of online information.

Indonesia's embrace of the private and public use of AI-powered surveillance also presents an opportunity for China to export intrusive surveillance tools China commonly uses. Some companies and police forces employ facial recognition technology in response to demands for better public security. Indonesia already has AI startups focusing on this technology and hopes to build "AI communities" modeled after "AI Singapore," which integrates the efforts of academia, industry, and government in AI. Partnerships between private sector companies and the Indonesian government

are likely to yield enhanced surveillance and “smart city” initiatives. It is therefore important for Indonesia to establish regulations and standards of use that prevent pernicious uses of AI, which will likely require significant engagement from like-minded democratic nations. Indonesia will benefit from working with the United States to define the scope of government and private sector surveillance before these technologies become ubiquitous.

The United States can step in at this critical juncture to help Indonesia build digital talent pipelines and navigate the regulatory landscape of AI, cyberspace, and where the two intersect. By guiding and investing in Indonesia’s AI journey, the United States can build on positive engagement with Southeast Asia to deepen an important bilateral relationship. Doing so will help Indonesia fully harness its AI potential and make strides in its own digital transformation.

Authors

Kayla Goode is a research analyst with CSET, where Heeu Millie Kim is also a research analyst.

Acknowledgments

For feedback and assistance, we would like to thank John Bansemer, Margarita Konaev, Emily Weinstein, Sara Abdulla, Diana Gehlhaus, Adam Segal, Lisa Curtis, Beltsazar Krisetya, Hannah Stone, Shelton Fitch, and Lynne Weil. The authors are solely responsible for the views expressed in this publication and for any errors.

Document Identifier: doi: 10.51593/2021CA001

Endnotes

[1] David Shambaugh, *Where Great Powers Meet: America and China in Southeast Asia* (New York: Oxford University Press, 2021), 1.

[2] Embassy of the Republic of Indonesia, "Facts and Figures," 2017, https://www.embassyofindonesia.org/index.php/basic-facts/.

[3] Desra Percaya, "Indonesia's Foreign and Security Policies," interview by Veerle Nouwens and Aaditya Dave, *Royal United Services Institute*, https://rusieurope.eu/multimedia/indonesias-foreign-and-security-policies.

[4] Kaushik Das, Toshan Tamhane, Ben Vatterott, Phillia Wibowo, and Simon Wintels, "The digital archipelago: How online commerce is driving Indonesia's economic development" (McKinsey & Company, August 28, 2018), https://www.mckinsey.com/featured-insights/asia-pacific/the-digital-archipelago-how-online-commerce-is-driving-indonesias-economic-development.

[5] Rosalind Mathieson, "Asia's Sleeping Giant Reckons With Its Future," *Bloomberg*, April 17, 2019, https://www.bloomberg.com/news/articles/2019-04-17/asia-s-sleeping-giant-reckons-with-its-future; Hugh Harsono, "Why Indonesia is poised to become the next AI start-up hub," *South China Morning Post*, August 25, 2020, https://www.scmp.com/tech/article/3098596/why-indonesia-poised-become-next-ai-start-hub.

[6] National Secretariat of Artificial Intelligence of Indonesia, "Strategi Nasional Kecerdasan Artifisial Indonesia" (Agency for the Assessment and Application of Technology (BPPT), August 2020), https://ai-innovation.id/strategi.

[7] Mia Hunt, "Indonesia publishes AI strategy," *Global Governance Forum*, August 20, 2020, https://www.globalgovernmentforum.com/indonesia-publishes-ai-strategy/.

[8] Made Anthony Iswara, "Indonesia sets sights on artificial intelligence in new national strategy," *The Jakarta Post*, August 14, 2020, https://www.thejakartapost.com/news/2020/08/13/indonesia-sets-sights-on-artificial-intelligence-in-new-national-strategy.html.

[9] Winston Zhang, "What's next for the AI ecosystem in Indonesia?," *Tech in Asia*, September 30, 2019, https://www.techinasia.com/whats-ai-ecosystem-indonesia.

[10] Aditya Fajar Indrawan, "Jakarta Smart City And Dreams To Overcome Capital Problems," *Voice of Indonesia*, January 18, 2021,

https://voi.id/en/technology/27464/jakarta-smart-city-dan-mimpi-atasi-permasalahan-ibu-kota.

[11] Zhang, "What's next for the AI ecosystem in Indonesia?"

[12] Indonesia Investment Coordinating Board, "Making Indonesia 4.0: Indonesia's Strategy to Enter the 4th Generation of Industry Revolution," *BKPM*, https://www2.investindonesia.go.id/en/why-invest/indonesia-economic-update/making-indonesia-4.0-indonesias-strategy-to-enter-the-4th-generation-of-ind.

[13] Hanadian Nurhayati-Wolff, "Internet usage in Indonesia," Statista, May 20, 2021, https://www.statista.com/topics/2431/internet-usage-in-indonesia/.

[14] Statista Research Department, "Smartphone penetration rate as share of the population in Indonesia from 2015 to 2019 with forecasts for 2020 to 2025," Statista, July 2020, https://www.statista.com/statistics/321485/smartphone-user-penetration-in-indonesia/.

[15] Statista Research Department, "Internet economy size in Southeast Asia in 2020, by country," *Statista*, March 29, 2021, https://www.statista.com/statistics/1007201/southeast-asia-internet-economy-market-size-country/.

[16] "Periodic Table: The Who's Who Of Tech In Indonesia," CB Insights, September 14, 2017, https://www.cbinsights.com/research/indonesia-tech-periodic-table/; Harsono, "Why Indonesia is poised to become the next AI start-up hub"; People Matters Editorial Team, "The journey of AI adoption in ASEAN countries," *People Matters Global*, October 23, 2018, https://www.peoplemattersglobal.com/article/technology/the-journey-of-ai-adoption-in-asean-countries-.

[17] Eureka AI will expand operations overseas with the help of investors, which include Japan's SoftBank and China's Gobi Partners. Doris Yu, "SoftBank-backed Eureka AI bags $20m in series B round," *Tech in Asia*, February 18, 2020, https://www.techinasia.com/eureka-ai-bags-20m.

[18] "Kata.ai: Creating natural language processing solutions to serve 200 million+ Indonesians," Google Cloud, accessed June 28, 2021, https://cloud.google.com/customers/kata-ai.

[19] "Top-11 Artificial Intelligence Startups in Indonesia," Nanalyze, January 10, 2019, https://www.nanalyze.com/2019/01/artificial-intelligence-indonesia/.

[20] "Gojek," *Crunchbase*, accessed June 28, 2021, https://www.crunchbase.com/organization/go-jek.

[21] As Indonesia's first unicorn (a start-up valued at over $1 billion), Gojek has attracted funds from Chinese companies (JD.com, Tencent Holdings, New World Strategic Investment, and Meituan) and several U.S.-based companies including Google, Capital Group, PayPal, Facebook, and Visa. "Startup Continent: The Most Well-Funded Tech Startups In Asia & The Pacific," CB Insights, February 11, 2021, https://www.cbinsights.com/research/asia-startups-most-well-funded/; Saskia Rizqina Maulida, "Nadiem Makarim and Gojek's runaway success: What you need to know," *The Jakarta Post*, October 24, 2019, https://www.thejakartapost.com/life/2019/10/24/nadiem-makarim-and-gojeks-runaway-success-what-you-need-to-know.html.

[22] Mime Asia Team, "Gojek Uses Machine Learning & AI Technology to Detect Fictional Order," Mime Asia, October 2020, https://www.mime.asia/gojek-uses-machine-learning-ai-technology-to-detect-fictional-order/.

[23] "GO-JEK: Using Machine Learning for forecasting and dynamic pricing," Google Cloud, accessed June 28, 2021, https://cloud.google.com/customers/go-jek.

[24] "Software Engineer, Machine Learning and Big Data - Data Science Platform," Gojek, accessed June 28, 2021, https://jobs.lever.co/gojek/17fd1715-0d92-4110-9653-f697387fe9c9.

[25] Saheli Roy Choudhury, "Indonesia's internet start-ups Gojek and Tokopedia announce merger," *CNBC*, May 17, 2021, https://www.cnbc.com/2021/05/17/goto-indonesia-internet-start-ups-gojektokopedia-announce-merger.html.

[26] "Tokopedia," *Crunchbase*, accessed June 28, 2021, https://www.crunchbase.com/organization/tokopedia/company_financials.

[27] Manish Singh, "Gojek and Tokopedia Merge to Form GoTo Group," *TechCrunch*, May 16, 2021, https://techcrunch.com/2021/05/16/gojek-and-tokopedia-merge-to-form-goto-group/.

[28] "Tokopedia, UI launch AI research center," *The Jakarta Post*, March 28, 2019, https://www.thejakartapost.com/news/2019/03/28/tokopedia-ui-launch-ai-research-center.html.

[29] James Henderson, "Tech trailblazers: How Tokopedia is innovating in Indonesia," *CIO*, March 13, 2020, https://www.cio.com/article/3532319/tech-trailblazers-how-tokopedia-is-innovating-in-indonesia.html.

[30] Eisya A. Eloksari, "Indonesia retains its position as SE Asia's second-largest venture capital market," *The Jakarta Post*, March 27, 2020, https://www.thejakartapost.com/news/2020/03/27/indonesia-retains-its-position-as-se-asias-second-largest-venture-capital-market.html.

[31] "Artificial Intelligence Startups in Indonesia," Tracxn, July 8, 2021, https://tracxn.com/explore/Artificial-Intelligence-Startups-in-Indonesia.

[32] Jofie Yordan, "Will the real 'Silicon Valley of Indonesia' please stand up?," *Tech in Asia*, June 8, 2021, https://www.techinasia.com/real-silicon-valley-indonesia-stand.

[33] Yordan, "Will the real 'Silicon Valley of Indonesia' please stand up?"

[34] Trisha Ray et al., "The Digital Indo-Pacific: Regional Connectivity and Resilience" (National Security College, The Australian National University, February 2021), https://nsc.crawford.anu.edu.au/sites/default/files/publication/nsc_crawford_anu_edu_au/2021-02/thedigitalindopacific.pdf; "Adoption of AI booming in SE Asia, says IDC," *Internet of Business*, https://internetofbusiness.com/adoption-of-ai-booming-in-se-asia-says-idc/.

[35] Ray et al., "The Digital Indo-Pacific"; "Adoption of AI booming in SE Asia, says IDC."

[36] Daniel Zhang et al., "Artificial Intelligence Index Report 2021" (Stanford University AI Index Steering Committee, Human-Centered AI Institute, March 2021), 24, https://aiindex.stanford.edu/wp-content/uploads/2021/03/2021-AI-Index-Report_Master.pdf.

[37] OECD.AI, "AI in Indonesia," accessed July 21, 2021, https://oecd.ai/dashboards/countries/Indonesia.

[38] OECD.AI, "AI in Indonesia."

[39] Zhang et al., "Artificial Intelligence Index Report 2021."

[40] Embassy of the Republic of Indonesia, "Facts and Figures."

[41] Kaushik Das, Michael Gryseels, Priyanka Sudhir, Khoon Tee Tan, "Unlocking Indonesia's digital opportunity" (McKinsey & Company, October 2016), https://www.mckinsey.com/~/media/McKinsey/Locations/Asia/Indonesia/Our%20Insights/Unlocking%20Indonesias%20digital%20opportunity/Unlocking_Indonesias_digital_opportunity.ashx; Hanadian Nurhayati-Wolff, "Internet user penetration in Indonesia from 2015 to 2025," Statista, December 3, 2020, https://www.statista.com/statistics/254460/internet-penetration-rate-in-

indonesia/; "Indonesia completes fiber-optic network to bring internet to remote east," Reuters, October 14, 2019, https://www.reuters.com/article/us-indonesia-infrastructure/indonesia-completes-fiber-optic-network-to-bring-internet-to-remote-east-idUSKBN1WT0XC.

[42] Yunindita Prasidya, "Indonesia ranks 57th in Inclusive Internet Index, among the lowest in the world," *The Jakarta Post*, April 2, 2020, https://www.thejakartapost.com/news/2020/04/02/indonesia-ranks-57th-in-inclusive-internet-index-among-the-lowest-in-the-world.html.

[43] Prasidya, "Indonesia ranks 57th in Inclusive Internet Index."

[44] Soumitra Dutta and Bruno Lanvin, "The Network Readiness Index 2020: Accelerating Digital Transformation in a post-COVID Global Economy" (Portulans Institute, October 2020), 31, https://networkreadinessindex.org/wp-content/uploads/2020/10/NRI-2020-Final-Report-October2020.pdf#page=31.

[45] Trissia Wijaya and Samuel Nursamsu, "The Trouble with Indonesia's Infrastructure Obsession," *The Diplomat*, January 9, 2020, https://thediplomat.com/2020/01/the-trouble-with-indonesias-infrastructure-obsession/.

[46] Ben Bland, "Dream state: Widodo struggles to build his vision for Indonesia," *Financial Times*, September 22, 2020, https://www.ft.com/content/322c7f9b-310a-4c4f-ae6e-598328f59028.

[47] Wijaya and Nursamsu, "The Trouble with Indonesia's Infrastructure Obsession."

[48] Fitch Wire, "Indonesia's SWF Unlikely to Drive Near-Term SOE Deleveraging," Fitch Ratings, March 22, 2021, https://www.fitchratings.com/research/corporate-finance/indonesias-swf-unlikely-to-drive-near-term-soe-deleveraging-22-03-2021.

[49] Fitch Wire, "Indonesia's SWF Unlikely to Drive Near-Term SOE Deleveraging."

[50] Elad Natanson, "Indonesia: The New Tiger Of Southeast Asia," *Forbes*, May 14, 2019, https://www.forbes.com/sites/eladnatanson/2019/05/14/indonesia-the-new-tiger-of-southeast-asia/?sh=61f3c90d76ce.

[51] Karina M. Tehusijarana, "Underprivileged millennials: Being young and poor in Jakarta," *The Jakarta Post*, January 22, 2020, https://www.thejakartapost.com/longform/2020/01/22/underprivileged-millennials-being-young-and-poor-in-jakarta.html.

[52] Tehusijarana, "Underprivileged millennials: Being young and poor in Jakarta"; UNESCO Institute for Statistics, "Educational attainment, at least Bachelor's or equivalent, population 25+," The World Bank, September 2020, https://data.worldbank.org/indicator/SE.TER.CUAT.BA.ZS?locations=BN-KH-ID-LA-MY-MM-PH-SG-TH-VN&view=chart.

[53] "Global Innovation Index 2020: Indonesia" (World Intellectual Property Organization, INSEAD, Cornell University, 2020), https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020/id.pdf; "Global Innovation Index 2019" (World Intellectual Property Organization, INSEAD, Cornell University, 2019), 269, https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2019.pdf; "Global Innovation Index 2018: Indonesia" (World Intellectual Property Organization, INSEAD, Cornell University, 2018), https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2018-profile18.pdf.

[54] "Global Innovation Index 2020: Indonesia."

[55] Google Indonesia's Managing Director Randy Jusuf claimed that a lack of digital skills was the "primary component" limiting the potential of Indonesia's digital economy. The World Bank reports that the lack of IT graduates in Indonesia will lead to a shortage of about nine million skilled and semi-skilled workers in the tech field by 2030. Ray et al., "The Digital Indo-Pacific"; "Edtech in Indonesia – Ready for Takeoff?" (World Bank Group, May 2020), https://openknowledge.worldbank.org/bitstream/handle/10986/33762/EdTech-in-Indonesia-Ready-for-Take-off.pdf?sequence=1&isAllowed=y.

[56] Norman Harsono, "Even unicorns in Indonesia face talent shortfalls," *The Jakarta Post*, June 12, 2019, https://www.thejakartapost.com/news/2019/06/11/even-unicorns-in-indonesia-face-talent-shortfalls.html.

[57] Bukalapak notably struck a deal last year with Microsoft to adopt Azure as its cloud platform. "Bukalapak Launches AI & Cloud Innovation Centre, Bike-sharing Service in Bandung," *Disruptive Tech ASEAN*, February 4, 2019, https://disruptivetechasean.com/big_news/bukalapak-launches-ai-cloud-innovation-centre-bike-sharing-service-in-bandung/; Microsoft Indonesia, "Bukalapak Establishes Strategic Partnership with Microsoft to Enhance Indonesian E-commerce," *Microsoft*, November 3, 2020, https://news.microsoft.com/id-id/2020/11/03/bukalapak-establishes-strategic-partnership-with-microsoft-to-enhance-indonesian-e-commerce/; Karen Gilchrist, "How 3 friends made a multibillion-dollar business of Indonesia's street stalls," *CNBC*, February 2, 2021, https://www.cnbc.com/2021/02/02/bukalapak-indonesias-multibillion-dollar-warung-e-commerce-business.html.

[58] "Tokopedia, University of Indonesia launch AI research center."

[59] Embassy of the People's Republic of China in the Republic of Indonesia, "Chinese firm opens technology training center in Indonesian college," April 25, 2011, http://id.chineseembassy.org/eng/sgdt/t817751.htm; Ratri Adityarani, "China's Huawei Opens Technology Training Center in Indonesia," *Tech in Asia*, April 11, 2011, https://www.techinasia.com/china-huawei-opens-technology-training-center-in-indonesia.

[60] Randy Jusuf, "Rise and move forward together: Indonesia's digital future," *Google*, November 18, 2020, https://blog.google/around-the-globe/google-asia/indonesias-digital-future/; "Huawei helps create win-win digital ecosystem in RI," *The Jakarta Post*, accessed July 21, 2021, https://www.thejakartapost.com/adv-longform/2019/08/27/huawei-helps-create-win-win-digital-ecosystem-in-ri.html.

[61] "Alibaba teams up with Indonesian universities, tech providers, incubator to offer cloud tech training," *The Jakarta Post*, January 20, 2020, https://www.thejakartapost.com/news/2020/01/20/alibaba-teams-up-with-universities-tech-providers-incubator-to-offer-cloud-tech-training.html.

[62] Petir Garda Bhwana et al., "Jokowi Says Govt is Readying Roadmap for Making Indonesia 4.0," *Tempo*, April 13, 2021, https://en.tempo.co/read/1451967/jokowi-says-govt-is-readying-roadmap-for-making-indonesia-4-0.

[63] Eisya A. Eloksari, "Future of Indonesia's education tech lies in untapped categories, experts say," *The Jakarta Post*, October 5, 2020, https://www.thejakartapost.com/news/2020/10/05/future-of-indonesias-education-tech-lies-in-untapped-categories-experts-say.html.

[64] Wijaya and Nursamsu, "The Trouble With Indonesia's Infrastructure Obsession"; Bland, "Dream state: Widodo struggles to build his vision for Indonesia."

[65] Tangguh Chairil, "Cybersecurity for Indonesia: what needs to be done?," *The Conversation*, May 9, 2019, https://theconversation.com/cybersecurity-for-indonesia-what-needs-to-be-done-114009.

[66] Microsoft Indonesia, "Malware encounter rate in Indonesia highest across Asia Pacific: Microsoft Security Endpoint Threat Report 2019" (Microsoft, June 26, 2020), https://news.microsoft.com/id-.

[67] Microsoft Indonesia, "Malware encounter rate in Indonesia highest."

[68] "Cyber attack: Ransomware cases reported in Asia," *The Straits Times*, May 15, 2017, https://www.straitstimes.com/asia/east-asia/cyber-attack-ransomware-cases-reported-in-asia; "Singapore malls, users hit in cyber attack," *The Straits Times*, May 14, 2017, https://www.straitstimes.com/singapore/global-ransomware-attack-hits-digital-directory-at-tiong-bahru-plaza; Medha Basu and Nurfilzah Rohaidi, "Massive cyber attacks hit Asian hospitals, schools and universities," *GovInsider*, accessed July 21, 2021, https://govinsider.asia/innovation/ransomware-attack-asia-wannacry/.

[69] "Menkominfo Sebut 12 Institusi di Indonesia Terserang Wannacry," *CNN Indonesia*, May 22, 2017, https://www.cnnindonesia.com/teknologi/20170520132848-185-216091/menkominfo-sebut-12-institusi-di-indonesia-terserang-wannacry; "Two major Indonesian hospitals attacked in 'ransomware' storm," Reuters, May 13, 2017, https://www.reuters.com/article/us-cyber-attack-indonesia/two-major-indonesian-hospitals-attacked-in-ransomware-storm-idINKBN1890AX.

[70] Brian Patrick Byrne, "Hackers Attack Indonesia, South Korea Central Banks," *Vocativ*, June 21, 2016, https://www.vocativ.com/331644/hackers-attack-indonesia-south-korea-central-banks/index.html.

[71] Indra Rosandry, "Merajut Diplomasi Siber Indonesia," *Media Indonesia*, November 22, 2018, https://mediaindonesia.com/opini/199360/merajut-diplomasi-siber-indonesia; Australian Government Department of Foreign Affairs and Trade, "Memorandum of understanding between the Government of the Republic of Indonesia and the Government of Australia on cyber cooperation," Australian Government, August 31, 2018, https://www.dfat.gov.au/international-relations/themes/cyber-affairs/Pages/mou-indonesia-australia-cyber-cooperation; "Indonesia and United States ink agreement on cybersecurity training," *CISOMAG*, November 21, 2018, https://cisomag.eccouncil.org/indonesia-and-united-states-ink-agreement-on-cybersecurity-training/.

[72] "About CAMP," Cybersecurity Alliance for Mutual Progress, accessed July 21, 2021, https://www.cybersec-alliance.org/camp/about.do.

[73] Mardika Parama, "E-commerce platforms 'under attack', cybersecurity must be improved: Minister," *The Jakarta Post*, May 19, 2020, https://www.thejakartapost.com/news/2020/05/18/e-commerce-platforms-under-attack-cybersecurity-must-be-improved-minister.html.

[74] Jeffrey Hutton, "Indonesia moves to beef up cyber security with data protection law," *The Straits Times*, July 10, 2020, https://www.straitstimes.com/asia/se-asia/indonesia-moves-to-beef-up-cyber-security-with-data-protection-law; Gliddheo Algifariyano Riyadi, "Policy Brief |

Data Privacy in the Indonesian Personal Data Protection Legislation" (Center for Indonesian Policy Studies, March 21, 2021), https://www.cips-indonesia.org/post/policy-brief-data-privacy-in-the-indonesianpersonal-data-protection-legislation.

[75] Riyadi, "Policy Brief | Data Privacy in the Indonesian Personal Data Protection Legislation."

[76] "All Data Breaches in 2019-2021-An Alarming Timeline," *SelfKey*, April 7, 2021, https://selfkey.org/data-breaches-in-2019/.

[77] Rosandry, "Merajut Diplomasi Siber Indonesia."

[78] Hunt, "Indonesia publishes AI strategy."

[79] Iswara, "Indonesia sets sights on artificial intelligence in new national strategy."

[80] Indonesia's Minister of Research and Technology Bambang Brodjonegoro expressed, "There is no harm in us imitating or adapting the South Korean model." Muhammad Zulfikar and Aria Cindyar, "Indonesia should adapt foreign technology schemes: Minister," *ANTARA News*, November 10, 2019, https://en.antaranews.com/news/136292/indonesia-should-adapt-foreign-technology-schemes-minister?utm_source=antaranews&utm_medium=related&utm_campaign=related_news.

[81] Eric Sayers, "Thoughts on the Unfolding U.S.-Chinese Competition: Washington's Policy Towards Beijing Enters Its Next Phase," *War on the Rocks*, February 9, 2021, https://warontherocks.com/2021/02/thoughts-on-the-unfolding-u-s-chinese-competition-washingtons-policy-towards-beijing-enters-its-next-phase/.

[82] Shambaugh, *Where Great Powers Meet*, 95.

[83] Indonesia was the first Southeast Asian country to establish formal diplomatic relations with the People's Republic of China in 1950, but resentment towards Chinese immigrants and laborers in Indonesia surged during two centuries of Dutch colonial rule. Waves of anti-Chinese violence under Indonesia's Suharto regime (1968–1998) froze diplomatic ties from 1967 until 1990. The end of the Suharto regime in 1998 and China's "good neighbor" policy during the 1997 financial crisis and 2004 tsunami improved relations. Indonesia welcomed China's willingness to support ASEAN in the wider Asia-Pacific, but tensions remain. Rizal Sukma, "Indonesia-China Relations: The Politics of Re-engagement," *Asian Survey* 49, no. 4 (July/August 2009): 591-608.

[84] Graham Webster et al., “Full Translation: China's 'New Generation Artificial Intelligence Development Plan' (2017),” *New America*, August 1, 2017, https://www.newamerica.org/cybersecurity-initiative/digichina/blog/full-translation-chinas-new-generation-artificial-intelligence-development-plan-2017/ .

[85] Webster et al., “Full Translation: China's 'New Generation Artificial Intelligence Development Plan' (2017).”

[86] Joshua Kurlantzick and James West, “Assessing China's Digital Silk Road Initiative,” Council on Foreign Relations, December 8, 2020, https://www.cfr.org/china-digital-silk-road/.

[87] “Indonesia Venture Capital Outlook 2017” (Google-AT Kearney Study, September 2017), https://www.thinkwithgoogle.com/_qs/documents/4881/TWG-APAC-Indonesia-VC-Outlook-2017-Report.pdf.

[88] Fanny Potkin, “SE Asia's biggest travel app Traveloka raises $250 million as lockdowns ease,” Reuters, July 27, 2020, https://www.reuters.com/article/us-traveloka-funding/se-asias-biggest-travel-app-traveloka-raises-250-million-as-lockdowns-ease-idUSKCN24T0OG; “Nearly US $500 Million Investment by Expedia, East Ventures, Hillhouse Capital Group, JD.com and Sequoia Capital Highlight Confidence in Traveloka and Potential of Southeast Asia Travel Market,” Traveloka, July 31, 2017, https://www.traveloka.com/en-id/explore/news/nearly-us-500-million-investment-expedia-east-ventures-hillhouse-capital-group-jd-com-sequoia-capital-highlight-confidence-traveloka-potential-southeast-asia-travel-market/63411.

[89] Savannah Dowling, “Go-Jek Raises Another $2B To Own Ridesharing in Southeast Asia,” *Crunchbase News*, September 17, 2018, https://news.crunchbase.com/news/go-jek-raises-another-2b-to-own-ridesharing-in-southeast-asia/.

[90] The minority interest Alibaba Group’s Ant Financial holds in Bukalapak is not disclosed. Minority interests can come with rights to participate in sales or audit rights, but generally reflect little influence over the company. “Ant Eyes Investment In Indonesian eCommerce Co,” PYMNTS, January 11, 2019, https://www.pymnts.com/news/investment-tracker/2019/indonesia-bukalapak-venture-capital-funding/; Will Kenton, “Minority Interest,” Investopedia.com, July 26, 2020, https://www.investopedia.com/terms/m/minorityinterest.asp.

[91] “Money and Muscle Pave China’s Way to Global Power,” *The New York Times*, November 25, 2018,

https://www.nytimes.com/interactive/2018/11/25/world/asia/china-world-power.html; "Indonesia Venture Capital Outlook 2017."

[92] Investment data shows funding since each company's founding, from Series A funding to the most recent funding, excluding Seed rounds. We decided to scope our analysis of investment data to Indonesia's unicorns largely for three reasons. First, these companies are often a focal point for international attention in Indonesia's tech sector. Second, most of these companies are expanding operations overseas and/ or acquiring other businesses to expand services, which shows promise for sustained growth and international influence. Finally, most have established research partnerships with leading Indonesian universities to further AI development, indicating desires to innovate and build AI talent.

[93] "Chinese Tech Investors Turn Attention To Indonesia As India's Economy Shrinks," PYMNTS, November 29, 2020, https://www.pymnts.com/news/investment-tracker/2020/chinese-tech-investors-turn-attention-to-indonesias-as-indias-economy-shrinks/.

[94] "Neurosensum," *Crunchbase*, accessed June 28, 2021, https://www.crunchbase.com/organization/neurosensum.

[95] Fanny Potkin, "Exclusive: ByteDance censored anti-China content in Indonesia until mid-2020, sources say," Reuters, August 13, 2020, https://www.reuters.com/article/us-usa-tiktok-indonesia-exclusive/exclusive-bytedance-censored-anti-china-content-in-indonesia-until-mid-2020-sources-say-idUSKCN2591ML.

[96] Fabian Westerheide, "China – The First Artificial Intelligence Superpower," *Forbes*, January 14, 2020, https://www.forbes.com/sites/cognitiveworld/2020/01/14/china-artificial-intelligence-superpower/?sh=1a66e0c82f05.

[97] Ardhitya Eduard Yeremia Lalisang and Darang S. Candra, "Indonesia's Global Maritime Fulcrum & China's Belt and Road Initiative – A match made at sea?" (Friedrich-Ebert-Stiftung (FES), April 2020), https://library.fes.de/pdf-files/bueros/indonesien/16770.pdf.

[98] Lalisang and Candra, "Indonesia's Global Maritime Fulcrum & China's Belt and Road Initiative."

[99] Tiola, "Jokowi's Global Maritime Fulcrum: 5 More Years?," *The Diplomat*, June 11, 2019, https://thediplomat.com/2019/06/jokowis-global-maritime-fulcrum-5-more-years/.

[100] Ministry of Foreign Affairs of the People's Republic of China, "Joint Statement on Strengthening Comprehensive Strategic Partnership between the People's Republic of China and The Republic of Indonesia," March 27, 2015, https://www.fmprc.gov.cn/mfa_eng/wjdt_665385/2649_665393/t1249201.shtml.

[101] Lalisang and Candra, "Indonesia's Global Maritime Fulcrum & China's Belt and Road Initiative."

[102] "(Authorized Release) Proposal of the Central Committee of the Chinese Communist Party on Drawing Up the 14th Five-Year Plan for National Economic and Social Development and Long-Range Objectives for 2030," *Xinhua News Agency*, November 3, 2020, Translation by Ben Murphy, December 1, 2020, https://cset.georgetown.edu/wp-content/uploads/t0237_5th_Plenum_Proposal_EN-1.pdf.

[103] "(Authorized Release) Proposal of the Central Committee."

[104] "Huawei helps create win-win digital ecosystem in RI."

[105] "Huawei Builds Digital Infrastructure Helps Indonesia's Economy Recover," *Netral News*, January 14, 2021, https://netral.news/en/huawei-builds-digital-infrastructure-helps-indonesias-economy-recover.html.

[106] "BPPT, Huawei team up to develop AI, cloud and 5G," *The Jakarta Post*, October 13, 2020, https://www.thejakartapost.com/news/2020/10/13/bppt-huawei-team-up-to-develop-ai-cloud-and-5g.html.

[107] Resty Woro Yuniar, "Is Indonesia becoming too reliant on Huawei?," *South China Morning Post*, December 4, 2020, https://www.scmp.com/week-asia/economics/article/3112634/indonesia-becoming-too-reliant-huawei.

[108] "Huawei Personnel Worked With China Military on Research Projects," *Bloomberg*, June 26, 2019, https://www.bloomberg.com/news/articles/2019-06-27/huawei-personnel-worked-with-china-military-on-research-projects; Arjun Kharpal, "Huawei staff share deep links with Chinese military, new study claims," *CNBC*, July 8, 2019, https://www.cnbc.com/2019/07/08/huawei-staff-and-chinese-military-have-deep-links-study-claims.html.

[109] Camron Greer et al., "U.S. Adds 38 New Huawei Affiliates To Entity List While Again Expanding Foreign-Produced Direct Product Rule," *JD Supra*, August 24, 2020, https://www.jdsupra.com/legalnews/u-s-adds-38-new-huawei-affiliates-to-87506/.

[110] David McCabe, "F.C.C. Designates Huawei and ZTE as National Security Threats," *The New York Times*, June 30, 2020,

https://www.nytimes.com/2020/06/30/technology/fcc-huawei-zte-national-security.html; Katharina Buchholz, "Which Countries Have Banned Huawei?," *Statista*, January 30, 2020, https://www.statista.com/chart/17528/countries-which-have-banned-huawei-products/; Adam Satariano, "U.K. Bars Huawei for 5G as Tech Battle Between China and the West Escalates," *The New York Times*, July 14, 2020, https://www.nytimes.com/2020/07/14/business/huawei-uk-5g.html.

[111] Melinda Martinus, "Huawei and 5G: a test for Southeast Asia's digital transformation," *South China Morning Post*, November 18, 2020, https://www.scmp.com/week-asia/opinion/article/3110145/huawei-and-5g-test-southeast-asias-digital-transformation.

[112] Yuniar, "Is Indonesia becoming too reliant on Huawei?"

[113] "What's up with...Open RAN in Indonesia, Nokia, Enea, Zoom," *Telecom TV*, April 19, 2021, https://www.telecomtv.com/content/open-ran/what-s-up-with-open-ran-in-indonesia-nokia-enea-zoom-41292/.

[114] Federal Communications Commission, "Promoting the Deployment of 5G Open Radio Access Networks," *Federal Register*, March 29, 2021, https://www.federalregister.gov/documents/2021/03/29/2021-06430/promoting-the-deployment-of-5g-open-radio-access-networks.

[115] "CATTC Attending the 2016 China (Dongguan) International Science and Technology Cooperation Week," China-ASEAN Technology Transfer Center, December 12, 2016, http://www.cattc.org.cn/v/article/7922; "Indonesia PR China Decided to Materialize Cooperation on Transfer of Technology," National Research and Innovation Agency, Republic of Indonesia (BRIN), March 16, 2017, https://international.brin.go.id/news/pr-china-decided-to-materialize-cooperation-on-transfer-of-technology/.

[116] "CATTC Attending the 2016 China (Dongguan) International Science and Technology Cooperation Week"; "Indonesia PR China Decided to Materialize Cooperation on Transfer of Technology."

[117] "BPPT, Huawei team up to develop AI, cloud and 5G."

[118] "Indonesia," Huawei, accessed July 21, 2021, https://www.huawei.com/br/sustainability/win-win-development/social-contribution/seeds-for-the-future/indonesia.

[119] Jayanty Nada Shofa, "Huawei Pledges to Support Indonesia's 2045 Vision," *Jakarta Globe*, April 22, 2021, https://jakartaglobe.id/tech/huawei-pledges-to-support-indonesias-2045-vision.

[120] "BPPT, Huawei team up to develop AI, cloud and 5G."

[121] Martha Herlinawati and Aria Cind, "Ministry launches AI strategy on National Technology Day," *ANTARA News*, August 10, 2020, https://en.antaranews.com/news/153890/ministry-launches-ai-strategy-on-national-technology-day.

[122] "China, Indonesia To Strengthen Cooperation In Developing Cyber Security Capacity And Technology," *Fintech*, March 12, 2021, http://fintechbd.com/china-indonesia-to-strengthen-cooperation-in-developing-cyber-security-capacity-and-technology/.

[123] "China, Indonesia To Strengthen Cooperation In Developing Cyber Security Capacity And Technology."

[124] "(Authorized Release) Proposal of the Central Committee."

[125] Medha Basu, "Indonesia and China to cooperate on cyber security," *GovInsider*, February 9, 2016, https://govinsider.asia/connected-gov/indonesia-and-china-to-hold-joint-cyber-war-games/.

[126] Greg Austin, "China and Indonesia: Joint Cyber War Simulations," *The Diplomat*, January 26, 2016, https://thediplomat.com/2016/01/china-and-indonesia-joint-cyber-war-simulations/.

[127] Valentin Weber, "How China's Control of Information is a Cyber Weakness," *Lawfare*, November 12, 2020, https://www.lawfareblog.com/how-chinas-control-information-cyber-weakness.

[128] Niharika Mandhana, "In South China Sea Confrontation, Indonesia Resists China—Cautiously," *The Wall Street Journal*, January 17, 2020, https://www.wsj.com/articles/in-south-china-sea-confrontation-indonesia-resists-chinacautiously-11579257004.

[129] Jefferson Ng, "The Natuna Sea Incident: How Indonesia Is Managing Its Bilateral Relationship With China," *The Diplomat*, January 15, 2020, https://thediplomat.com/2020/01/the-natuna-sea-incident-how-indonesia-is-managing-its-bilateral-relationship-with-china/.

[130] Laura Silver, Kat Devlin, and Christine Huang, "People around the globe are divided in their opinions of China," Pew Research Center, December 5, 2019, https://www.pewresearch.org/fact-tank/2019/12/05/people-around-the-globe-are-divided-in-their-opinions-of-china/.

[131] Lalisang and Candra, "Indonesia's Global Maritime Fulcrum & China's Belt and Road Initiative."

[132] Amy Chew, "Indonesian students in Sulawesi continue protests against Chinese workers," *South China Morning Post*, July 16, 2020, https://www.scmp.com/week-asia/politics/article/3093345/indonesian-students-sulawesi-continue-protests-against-chinese.

[133] Shambaugh, *Where Great Powers Meet*, 234.

[134] Andrew Polk, "China's 'dual-circulation' strategy means relying less on foreigners," *The Economist*, November 7, 2020, https://www.economist.com/china/2020/11/05/chinas-dual-circulation-strategy-means-relying-less-on-foreigners.

[135] Shambaugh, *Where Great Powers Meet*, 15.

[136] Eric Sayers and RADM (Ret) Mark Montgomery, "Seizing the advantage in the Asia-Pacific," *American Enterprise Institute*, December 15, 2020, https://www.aei.org/articles/seizing-the-advantage-in-the-asia-pacific/; Deputy Secretary of Defense Bob Work, "A New Global Posture for a New Era," Speech delivered to the Council on Foreign Relations, September 30, 2014, https://www.defense.gov/Newsroom/Speeches/Speech/Article/605614/a-new-global-posture-for-a-new-era/; Barack Obama, "Indonesia's Example to the World," The Obama White House YouTube Channel, posted November 10, 2010, https://www.youtube.com/watch?v=niDPBTbJqS0.

[137] "A conversation with US Indo-Pacific Command's Adm. Philip Davidson," American Enterprise Institute, March 4, 2021, https://www.aei.org/events/a-conversation-with-us-indo-pacific-commands-adm-philip-davidson/; Jamie McIntyre, "Pacific commander warns China could move to take Taiwan in the next five years if US doesn't increase deterrence," *Washington Examiner*, March 5, 2021, https://www.washingtonexaminer.com/policy/defense-national-security/pacific-commander-warns-china-could-move-to-take-taiwan-in-the-next-five-years-if-us-doesnt-increase-deterrence.

[138] National Intelligence Council, "Global Trends 2040: A More Contested World," Office of the Directorate of National Intelligence, 100, https://www.dni.gov/files/ODNI/documents/assessments/GlobalTrends_2040.pdf.

[139] Shotaro Tani, "Indonesia's unicorns lure US tech giants from Google to Facebook," *Nikkei Asia*, December 4, 2020, https://asia.nikkei.com/Business/Business-Spotlight/Indonesia-s-unicorns-lure-US-tech-giants-from-Google-to-Facebook.

[140] Ayman Falak Medina, “Indonesia’s Digital Economy Attracts Investments from US Tech Giants,” ASEAN Briefing, December 21, 2020, https://www.aseanbriefing.com/news/indonesias-digital-economy-attracts-investments-from-us-tech-giants/ .

[141] Medina, “Indonesia’s Digital Economy.”

[142] Catherine Shu, “BukuWarung, a fintech for Indonesian MSMEs, scores $60M Series A led by Valar and Goodwater,” *TechCrunch*, June 9, 2021, https://techcrunch.com/2021/06/09/bukuwarung-a-fintech-for-indonesian-msmes-scores-60m-series-a-led-by-valar-and-goodwater/.

[143] Shotaro Tani, “Google invests in Indonesian unicorn Tokopedia, joining Temasek,” *Nikkei Asia*, November 14, 2020, https://asia.nikkei.com/Business/Business-deals/Google-invests-in-Indonesian-unicorn-Tokopedia-joining-Temasek.

[144] Mark R. Warner, “Bipartisan Senators Introduce Legislation to Reassert Democratic Leadership in Technology Strategy & Development,” March 4, 2021, https://www.warner.senate.gov/public/index.cfm/pressreleases?ID=3C5C0D90-479F-4657-A66D-93A1120B938E.

[145] Warner, “Bipartisan Senators Introduce Legislation to Reassert Democratic Leadership in Technology Strategy & Development.”

[146] Medina, “Indonesia’s Digital Economy Attracts Investments from US Tech Giants.”

[147] Medina, “Indonesia’s Digital Economy Attracts Investments from US Tech Giants.”

[148] Ernst & Young Indonesia, “Making an Impact: U.S.-Indonesia Investment Report 2019” (AmCham Indonesia and the U.S. Chamber of Commerce, 2019), https://www.uschamber.com/sites/default/files/indonesiareport_makingimpact.pdf.

[149] Jusuf, “Rise and move forward together: Indonesia’s digital future.”

[150] M.Irfan I and Rahmad Nasution, “Indonesian students in China should be cautious with study permits,” *ANTARA News*, April 27, 2020, https://en.antaranews.com/news/146892/indonesian-students-in-china-should-be-cautious-with-study-permits; “Number of international students studying in the United States in 2019/20, by country of origin,” Statista, November 2020, https://www.statista.com/statistics/233880/international-students-in-the-us-by-country-of-origin/.

[151] U.S. Embassy & Consulates in Indonesia, "American Corners Indonesia," US Department of State, accessed July 21, 2021, https://id.usembassy.gov/education-culture/american-corners-indonesia/.

[152] Francis Chan, "US and Indonesia agree on cyber security pact," *The Straits Times*, November 21, 2018, https://www.straitstimes.com/asia/se-asia/us-and-indonesia-agree-on-cyber-security-pact.

[153] Katie Gray, "U.S. and Indonesian service members 'threat hunt' during Information System and Technology Exchange," U.S. Army, July 30, 2019, https://www.army.mil/article/225155/u_s_and_indonesian_service_members_threat_hunt_during_information_system_and_technology_exchange.

[154] Prashanth Parameswaran, "What's Behind the New US-ASEAN Cyber Dialogue?," *The Diplomat*, October 4, 2019, https://thediplomat.com/2019/10/whats-behind-the-new-us-asean-cyber-dialogue/.

[155] Division for International Communications and Information Policy, "Digital Connectivity and Partnership," U.S. Department of State, https://www.state.gov/digital-connectivity-and-cybersecurity-partnership/.

[156] Bland, "Dream state: Widodo struggles to build his vision for Indonesia."

[157] Evan Laksmana, "Pragmatic Equidistance: How Indonesia manages its great power relations," in *China, The United States, and the Future of Southeast Asia*, edited by David B.H. Denoon (New York: New York University Press, 2017), 113-135.

[158] Andreyka Natalegawa, "Enhancing the U.S.-Indonesia Strategic Partnership" (Center for Strategic and International Studies, July 9, 2018), https://www.csis.org/analysis/enhancing-us-indonesia-strategic-partnership.

[159] International Trade Administration, "Indonesia- Education and Training," *Export.gov*, March 15, 2019, https://www.export.gov/apex/article2?id=Indonesia-Education-and-Training.