Realizing a cloud-enabled economy in Indonesia:

How cloud drives economic and societal impact through micro, small, and medium-sized businesses

2023

By 2030, MSMEs can deliver greater societal value in a cloud-enabled Indonesia

Across key sectors[i] this opportunity is expected to represent:

Rp79.6 trillion combined annual productivity benefits unlocked through cloud-enabled MSMEs in healthcare, education, and agriculture

This represents a 141% increase on current levels

17.6 million people in Indonesia (12% of the workforce) employed by cloud-enabled MSMEs within healthcare, education, and agriculture

7 million telehealth consultations using cloud supported by MSMEs' services

21 million school students engaging in online learning via cloud-enabled MSMEs

1 in 9 farms using cloud-enabled precision agriculture technologies supported by MSMEs
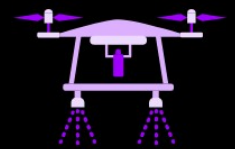
MSMEs is the abbreviation of micro, small, and medium enterprises.
Current values are annual 2022-2023 values based on the latest available data.
i. Key societal sectors are healthcare, education, and agriculture.

Overview

Micro, small, and medium enterprises (MSMEs, businesses with between 1 and 250 employees) are a major driver of economic performance. In Indonesia, MSMEs collectively account for about 99% of all firms, 97% of jobs, and about 61% of Gross Domestic Product (GDP).[1] MSMEs are also a major source for innovation and disruption in the economy, leveraging both old and new transformative technologies to find gaps in the current market, and bringing new products and services to bear.

By allowing users to procure on-demand, scalable IT products and services over the internet or a private network, cloud technology has driven economic and societal benefits by creating new business models, reducing costs, and supporting new opportunities for entrepreneurs and startups. Approximately 29% of all businesses across the Indonesia are estimated to utilize at least some basic form of cloud technology such as office tools and storage, although usage of more intermediate and advanced tools, such as artificial intelligence and big data analytics, is expected to be far lower based on adoption data observed in comparable economies. Cloud technology has most profoundly impacted MSMEs by allowing them to start, operate, and scale their organization more effectively.

The use of cloud technology by MSMEs is expected to become increasingly widespread, advanced, and mature. With continuous advancements in technology and the decreasing costs of cloud services, MSMEs will have access to an even wider range of scalable and cost-effective technology solutions across functions, occupations, and industries. We refer to this potential future state as the "cloud-enabled economy," a future characterized by high levels of overall cloud technology adoption across Indonesian businesses. It is anticipated that under this scenario, 90% of all businesses would adopt at least a basic level of cloud technology.[2,3] For many businesses, however, this represents only the beginning of their cloud journey. As businesses increase their sophistication and adopt more advanced applications of cloud technology, such as artificial intelligence (AI) and machine learning (ML), countries with already high rates of overall adoption can expect to derive even greater benefits.

By 2030, a cloud-enabled Indonesian economy is expected to deliver even greater societal impact by supporting MSMEs to produce novel, new products and solutions or augment their existing operations. In certain societal sectors, namely health, education, and agriculture, this annual contribution is expected to reach Rp79.6 trillion. Not only that, but by 2030, cloud-enabled MSMEs are expected to support seven million remote health consultations, 21 million school students to access online education, and one in nine farms access more efficient and sustainable farming practices in Indonesia. Cloud-enabled MSMEs are also heavily involved with developing solutions to transition the economy towards more a more sustainable future and designing digital finance solutions (through 'fintechs') that are helping to support better financial inclusion and wellbeing.

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[1] OECD (2022) Financing SMEs and Entrepreneurs 2022
[2] Gartner (2022), The future of cloud computing in 2027: From technology to business innovation.
[3] Gartner (2021), Gartner says cloud will be the centerpiece of new digital experience.

Although these benefits are substantial, the opportunities of the cloud-enabled economy will not eventuate without action. To unlock this potential, Indonesian businesses and governments will need to collaborate to foster the continued adoption and maturity of cloud usage. Businesses can achieve this by:

- identifying how cloud can help them scale and deliver global impact
- investing in embedding cloud technology into their strategy; and
- developing a migration plan, and training employees to leverage the benefits of cloud technology.

Indonesian governments can support businesses in achieving a cloud-enabled economy by:

- prioritizing cloud education across all levels
- investing in digital infrastructure to ensure innovation can continue unimpeded; and
- and leading by example through promoting cloud adoption across all levels and divisions of government.

1 The cloud-enabled economy

Cloud technology has changed the way many businesses operate, particularly for MSMEs (businesses with between 1 and 250 employees)[4], by enabling them to scale quickly, reduce costs, reach global markets, and access a range of technology resources that were previously unattainable.

1.1 Cloud technology enables the digital economy

Cloud technology refers to the provision of on-demand IT products and services delivered over the internet or a private network.[5] This involves housing digital resources from centralized servers owned and operated by cloud service providers, reducing the need for individual businesses to procure and maintain physical hardware. Outsourced technology provides greater flexibility to support MSMEs through the early stages of the business lifecycle by:

- reducing overheads and time to market
- providing greater ability to scale up or down depending on business demands
- offering specialized technology solutions
- increasing computational power of ordinary devices; and
- enhancing security and resilience.[6]

Figure 1: The most significant benefits of cloud for MSMEs

Average % of cloud-enabled MSMEs across several industries in Indonesia that find cloud somewhat or extremely significant in providing a particular benefit
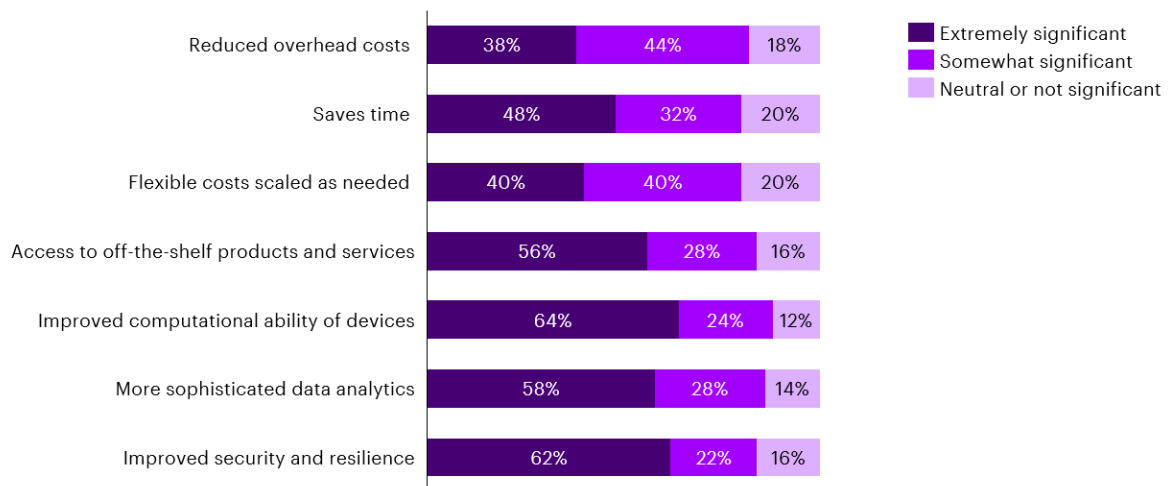
Source: Accenture societal impact survey (2023), n = 53. 'Neutral or not significant' includes responses of neutral, somewhat insignificant, and not significant at all.

By promoting shared resources, cloud has fundamentally changed the way that individuals and businesses interact with technology, with the number of potential applications of cloud technology far eclipsing simple, remote data storage. Most applications, platforms, and smart products have some functionality facilitated by cloud technology as shown in Figure 2. Having
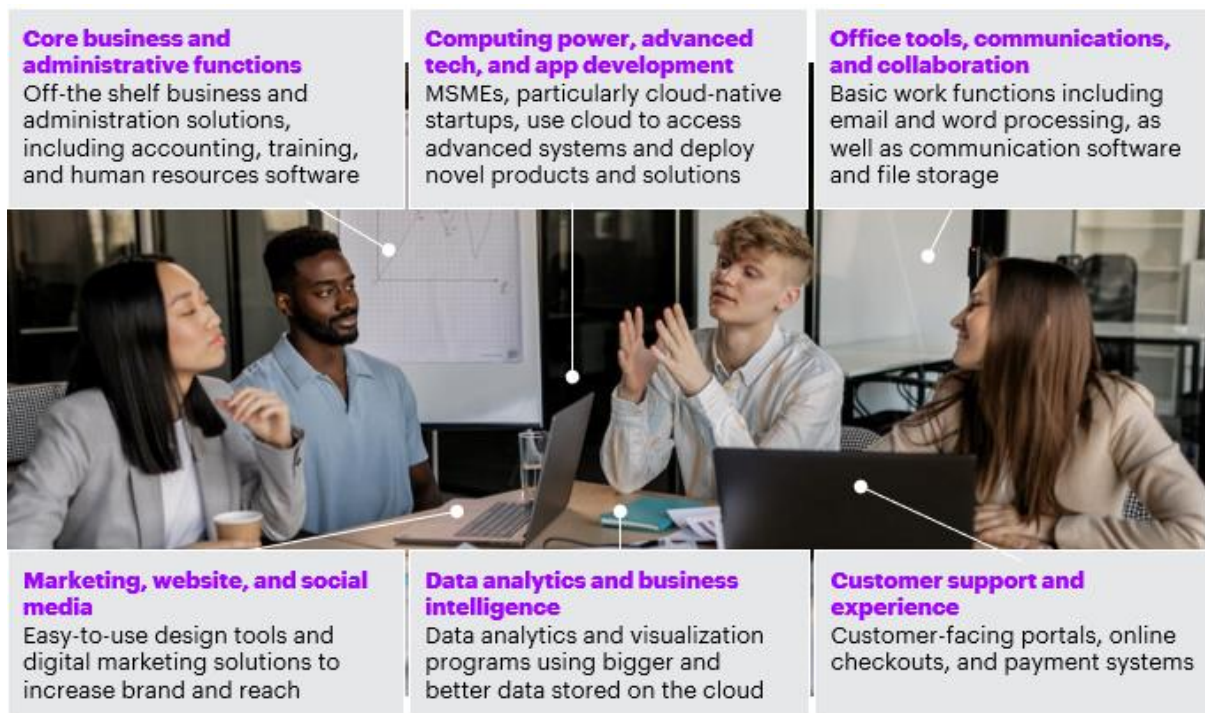
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[4] The definition of MSME used in this report is taken from the OECD (2023) and covers enterprises with businesses between 1-250 employees.
[5] AWS (2023), What is cloud computing?
[6] Accenture societal impact survey (2023), n = 562.

access to on-demand functionalities supports MSMEs to start, operate, and scale their business more efficiently and effectively.

Figure 2: End-to-end cloud applications for MSMEs

Core business and administrative functions
Off-the shelf business and administration solutions, including accounting, training, and human resources software

Computing power, advanced tech, and app development
MSMEs, particularly cloud-native startups, use cloud to access advanced systems and deploy novel products and solutions

Office tools, communications, and collaboration
Basic work functions including email and word processing, as well as communication software and file storage

Marketing, website, and social media
Easy-to-use design tools and digital marketing solutions to increase brand and reach

Data analytics and business intelligence
Data analytics and visualization programs using bigger and better data stored on the cloud

Customer support and experience
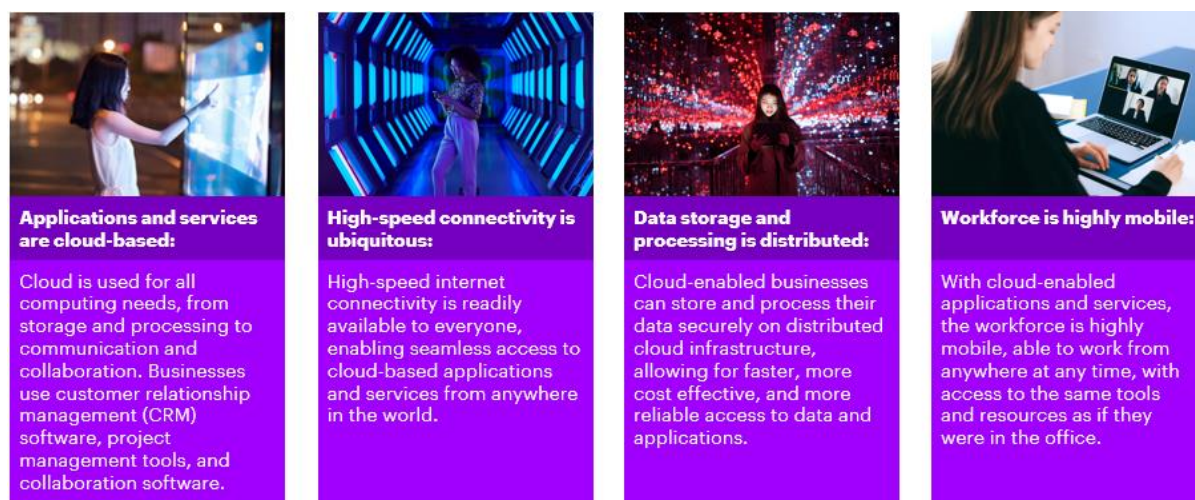Customer-facing portals, online checkouts, and payment systems

Source: Accenture

1.2 Achieving a cloud-enabled economy can unlock significant societal and economic potential

With continuous advancements in technology and the decreasing costs of cloud services, economies will continue to experience a wave of digital disruption and productivity as businesses find more ways to produce novel, new products and solutions or augment their existing operations. We refer to this potential future state as the "cloud-enabled economy," a future characterized by high levels of cloud adoption; based on an assessment of cloud industry forecasts, this report expects 90% of all businesses will adopt at least a basic level of cloud technology in a cloud-enabled economy. As cloud technology applications mature, a cloud-enabled economy would increasingly involve digital applications and services being cloud-based, high internet speed and connectivity, cloud-enabled data storage and processing, as well as a mobile workforce (see Figure 3).

Figure 3: Characteristics of a cloud-enabled economy

Applications and services are cloud-based:	**High-speed connectivity is ubiquitous:**	**Data storage and processing is distributed:**	**Workforce is highly mobile:**
Cloud is used for all computing needs, from storage and processing to communication and collaboration. Businesses use customer relationship management (CRM) software, project management tools, and collaboration software.	High-speed internet connectivity is readily available to everyone, enabling seamless access to cloud-based applications and services from anywhere in the world.	Cloud-enabled businesses can store and process their data securely on distributed cloud infrastructure, allowing for faster, more cost effective, and more reliable access to data and applications.	With cloud-enabled applications and services, the workforce is highly mobile, able to work from anywhere at any time, with access to the same tools and resources as if they were in the office.

Source: Accenture

1.2.1   The spectrum of cloud adoption

The definition of cloud technology adoption used in this report is consistent with the Organisation of Economic Cooperation and Development (OECD), and refers to the share of businesses that purchased cloud services[7] as a proportion of all businesses, across all levels of maturity.[8] However, cloud technologies have a range of applications across a suite of business functions that mean that the use of cloud technology can be considered on a spectrum of maturity or sophistication as shown by the figure below, which includes:

- **Basic adoption:** user-friendly solutions designed for everyday tasks. These solutions typically do not require specialized technical knowledge to operate and primarily serve to simplify and enhance common digital activities. These include simple cloud-based storage solutions, web-based email services, and collaborative office suites.

- **Intermediate adoption**: applications and platforms that cater to more specialized needs but still largely consist of off-the-shelf products with intuitive interfaces. Such tools include customer relationship management, enterprise resource planning, project management tools, developer platforms, and cloud-based databases.

- **Advanced adoption**: highly specialized cloud applications and cutting-edge technologies tailored for expert tasks. This category encapsulates machine learning and AI platforms, big data analytics tools, internet of things (IoT) platforms, serverless computing, container management systems, and advanced security and compliance tools.

As the global economy increasingly digitizes, the need for MSMEs to increase their cloud maturity is becoming increasingly pertinent. MSMEs that fail to leverage the scalability of cloud solutions may not only forfeit the ability to compete more effectively with fewer fixed IT costs, but may also pass up more sophisticated data analysis tools, more secure safeguards for digital assets, streamlined compliance with international regulations, and advanced technology applications (such as artificial intelligence, see Section 1.2.2). For many MSMEs to maintain their competitive edge in a dynamic, cloud-enabled economy, the sophistication of

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[7] Cloud computing as part of this definition includes information and communications technology (ICT) services that are provided over the internet or a private network to access servers, storage, network components and software applications

[8] OECD (2023), OECD Going Digital Toolkit

their adoption will need to evolve and adapt with the technology according to their specific needs.

Figure 4: Spectrum of cloud maturity and example applications
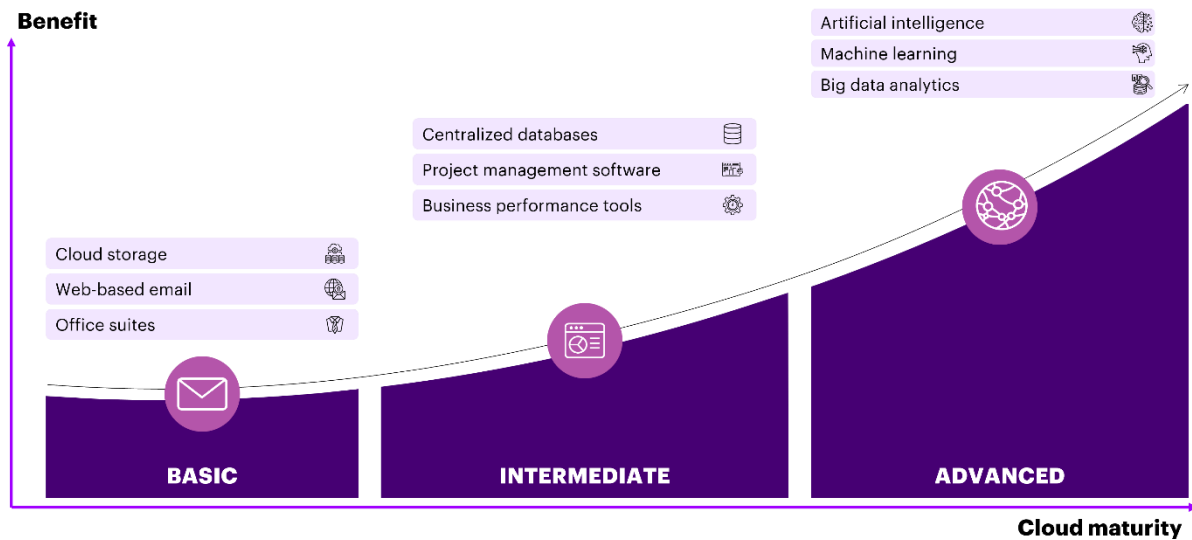
Note: Applications above are examples of types of uses for each of the levels of maturity. The lists are not exhaustive.
Source: Accenture

1.2.2 Advanced cloud usage unlocks the potential for emerging and innovative technologies

Embracing advanced cloud adoption also allows businesses to select from a variety of innovative and cutting-edge technologies to meet their unique business needs and secure a competitive edge in the market. The cloud has increased the viability and proliferation of a wide range of tools, business models, and technologies that, together with cloud, generate societal and economic impact. Advanced applications of cloud include:

- artificial intelligence (AI), encompassing generative AI

- machine learning (ML)

- internet of things (IoT)

- quantum computing; and

- edge computing.

These examples form a growing list of advanced technologies that have become accessible to a wider base of users though the cloud (see Appendix D of the global report for a full description of each technology supported by cloud).[9] Of these technologies, generative AI is experiencing the most rapid and dramatic growth; over the next 10 years generative AI is expective to grow at an annual average rate of 27%.[10] Although the technology has only recently been adopted by the wider public, generative AI is already disrupting and enhancing businesses' processes, accelerating innovation, and facilitating greater speed and creativity across a variety of industries. Businesses and employees are already experimenting with generative AI to create content that supports a range of tasks from writing text and code to generating images.[11] As shown in Figure 5, 73% of Indonesian MSMEs across several industries identified AI (including generative AI and natural language processing (NLP)) and ML as the

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[9] Damian Mazurek, (2023), Leveraging Cloud-based AI/ML Services to elevate your business.
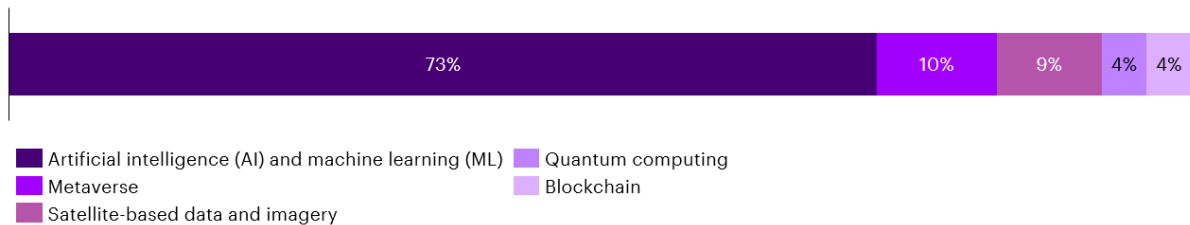[10] Precedence Research (2023), Generative AI Market size to hit USD 118 Bn by 2032
[11] AWS (2023), Generative AI on AWS.

technologies likely to be most significant in creating societal impacts in 2030.[12][13] Generative AI could be used by cloud-enabled MSMEs for a wide variety of applications, such as helping medical professionals analyze patient data and testing results to inform decision making, or generating practice exam questions and content with instant feedback available to support individualized learning pathways.

Figure 5: Technologies supported by cloud creating the most significant societal impacts in 2030

Average % of cloud-enabled MSMEs across several industries in Indonesia that believe a technology supported by cloud will be the most significant in creating societal impacts in 2030

Artificial intelligence (AI) and machine learning (ML)	Metaverse	Satellite-based data and imagery	Quantum computing	Blockchain
73%	10%	9%	4%	4%

- Artificial intelligence (AI) and machine learning (ML)
- Metaverse
- Satellite-based data and imagery
- Quantum computing
- Blockchain

Source: Accenture societal impact survey (2023), n = 53. 'Artificial intelligence (AI) and machine learning (ML)' includes subsets generative AI and natural language processing (NLP).

1.2.3 A more productive, cloud-enabled economy offers societal as well as economic benefits

While the opportunity to scale and grow businesses has a clear impact on economic activity (see Chapter 2), in many cases businesses can also create a positive societal impact. Cloud has opened up a range of emerging technologies that are underpinning a new wave of digitally-led innovation to address some of society's most pressing, global issues. Cloud technology offers MSMEs new ways to produce and commercialize technological solutions that generate positive societal benefits, in addition to economic benefits, across a range of industries. Although this list of industries is not exhaustive, the estimation of the societal impact of cloud technology is focused on the following industries:

- healthcare
- education
- agriculture
- finance; and
- sustainability and disaster response.[14]

While these industries are not the only ones that are impacted by cloud technology, these industries face increasingly complex challenges that could lead to less equitable societal outcomes if they do not adapt and harness the benefits offered by cloud technology. These industries are also directly linked to the UN Sustainable Development Goals (SDGs), particularly the overarching objectives of improved healthcare (Goal 3), education (Goal 4),

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[12] Survey responses were from MSMEs working in healthcare, education, agriculture, finance, and sustainability.
[13] Accenture societal impact survey (2023), n = 53. 73% of Indonesian MSMEs is consistent with the 78% of MSMEs globally out of a sample of 562 who identified AI and ML as the technologies likely to be most significant in creating societal impacts by 2030.
[14] The report chose to focus on these industries since most societal impact case studies reviewed fell into one or more of these industries. These labels also benefit from matching the economic modelling data as they are taken directly from the International Standard Industrial Classification (ISIC).

and economic prosperity and equality (Goal 9 and 10).[15] Figure 6 demonstrates through a stylized cameo how cloud technology supports access to these industries for individuals through digitization.

Figure 6: The impact of cloud-enabled MSMEs on individuals
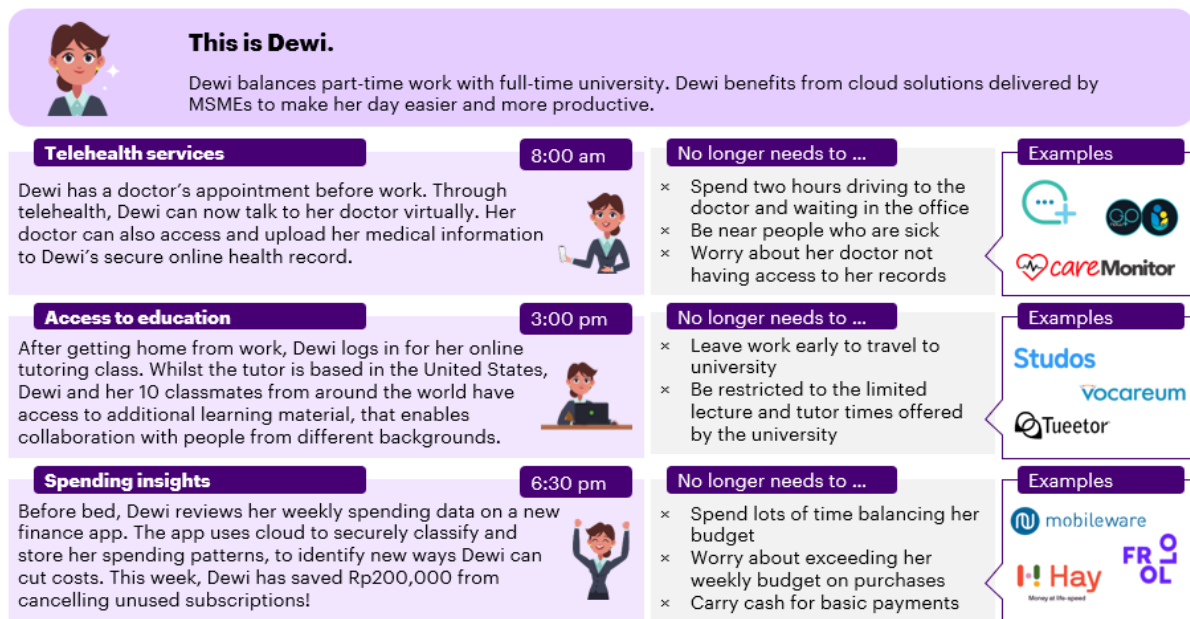
Notes: Examples include MSMEs and startups using cloud solutions from AWS case studies
Source: AWS[16]

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2 Unlocking Rp79.6 trillion in productivity benefits within key societal sectors

MSMEs are a major driver of economic performance in Indonesia, account for about 99% of all firms, 97% of jobs, and about 61% of Gross Domestic Product (GDP).[17] Cloud technology is helping to create and scale MSMEs (see Chapter 0), the impact of which can be identified in overall, aggregate economic performance. The impact of further cloud adoption and maturity on aggregate economic output is estimated with a novel economic model, based on analyzing current data that captures the relationship between adoption and economic activity. In Chapter 3, this analysis is taken to the next level of granularity, assessing how much of this impact can be attributed to key societal sectors of healthcare, agriculture, and education.

Box 1: Modelling the economic potential of a cloud-enabled economy
This research estimates the impact of cloud on economic productivity at the country level using data from the OECD to capture the relationship between cloud adoption rates and GDP (controlling for capital and labor inputs). A full explanation of the modelling approach, data, and outputs can be found in Appendix A of the global report.

The productivity benefits of the cloud-enabled economy to Indonesian societal sectors would be significant. Approximately 29% of all businesses across the Indonesia are estimated to utilize at least some basic form of cloud technology such as office tools and storage, although usage of more intermediate and advanced tools, such as artificial intelligence and big data analytics, is expected to be far lower based on adoption data observed in comparable economies. Through successful transition to a cloud-enabled economy, MSMEs in the healthcare, education, and agriculture industries within Indonesia are expected to unlock Rp79.6 trillion in combined annual productivity benefits by 2030, a 141% increase from Rp33.0 trillion. Under this scenario, it is estimated that 17.6 million people would work at cloud-enabled MSMEs in these industries, which would be 12% of the total jobs in Indonesia, an increase from 4% currently.

Indonesia has the potential for significant growth in unlocking the potential of cloud, given it is still at a nascent stage of adoption compared to mature markets. Although Indonesia has lower expected growth in cloud spending than other developing countries such as India, cloud expenditure in Indonesia is still increasing quickly, with an expected growth rate of 18% over the next five years.[18]

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[17] OECD ([2022](#)) Financing SMEs and Entrepreneurs 2022
[18] Statista ([2023](#))

Annual productivity benefits unlocked by cloud-enabled MSMEs in key societal sectors are expected to reach Rp79.6 trillion by 2030

17.6 million people in Indonesia are expected to be employed by cloud-enabled MSMEs in key societal sectors by 2030

3 The societal impact of the cloud-enabled economy

MSMEs that harness cloud have the potential to create significant societal impact in Indonesia. We define "societal impact" in reference to the positive changes and improvements in outcomes facilitated by cloud technology in areas such as healthcare, agriculture, and education. By leveraging cloud, MSMEs can enhance the efficiency, affordability, and accessibility of services in these industries, enabling advancements such as telemedicine, online education, precision agriculture, financial access and autonomy, and sustainable technology. These technologies will support improved social wellbeing and development.

3.1 Driving innovation and improving access to healthcare and life sciences

Approximately 42% of Indonesians live in rural areas spread across Indonesia's islands, which imposes additional barriers to accessing healthcare.[19] Cloud is helping to overcome these barriers by enabling MSMEs to make healthcare easier to access whilst also driving efficiency in healthcare delivery and supporting decisions around patient healthcare. Through remote consultations and monitoring of health indicators, cloud technology can help make healthcare more accessible to underserved communities throughout Indonesia. AlteaCare, an Indonesian MSME, uses cloud to connect patients to doctors over video through an app with over 100,000 downloads.[20,21] If Indonesia were to achieve a cloud-enabled economy, MSMEs in healthcare are expected to unlock Rp6.0 trillion in annual productivity benefits by 2030. Cloud-enabled MSMEs are expected to support seven million virtual health consultations per year by 2030.[22]

Impact of MSMEs on healthcare in the cloud-enabled economy, by 2030

Rp6.0 trillion in annual productivity benefits unlocked through cloud-enabled MSMEs in the healthcare sector, an increase from Rp2.5 trillion currently

7 million virtual consultations supported by cloud-enabled MSMEs

Note: Estimates for the number of telehealth consultations produced through market size estimates (see Appendix C of the global report) and are calculated separately to the GDP contribution. Current values are annual 2022-2023 values based on the latest available data.

Cloud is also important for streamlining administrative tasks, creating efficiency for healthcare providers. Healthcare providers can use cloud technology to support informed

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[19] World Bank (2022), Rural population.
[20] AWS (2022), AlteaCare Provides Digital Gateway to Hospitals with App Built on AWS.
[21] AlteaCare (2023).
[22] Remote health consultations can also be supported by telephone or through large cloud-enabled firms.

patient healthcare decisions, helping providers to collaborate and easily share patient information, and assisting them to take insights from large amounts of data to make treatment personalized and tailored. Technologies supported by cloud, particularly generative AI, also have significant potential to change the healthcare industry, from the delivery of healthcare to administrative functions. While generative AI is still a nascent technology, MSMEs can use it to support clinical decision making, helping medical professionals analyze data more accurately, along with supporting efficiency in research and development.[23]

3.2 Improving access to engaging and personalized education

MSME education services which utilize the cloud are improving access to quality education. Cloud technology can make education more equitable, safe, and accessible by providing new learning opportunities for a wider audience, including remote communities or adults with limited time who are looking to boost or diversify their skills. These students and adults will be able to learn in a more collaborative environment, as cloud supports them to interact and share content more readily. Simak Online is a small cloud-based digital education provider that has supported over 300,000 students to access online learning materials and tests, along with helping to reduce the administration burden for over 16,000 teachers.[24,25] Under a cloud-enabled economy, MSMEs in education are expected to unlock Rp15.0 trillion in annual productivity benefits by 2030. Through supporting the education industry, cloud-enabled MSMEs are expected to facilitate 21 million school students and 48 million adults in Indonesia to receive online learning by 2030.

Impact of MSMEs on education in the cloud-enabled economy, by 2030

Rp15.0 trillion in annual productivity benefits unlocked through cloud-enabled MSMEs in the education sector, an increase from Rp6.0 trillion currently

21 million primary to high school students using online education via cloud-enabled MSMEs, a 75% increase from 12 million currently

48 million adults accessing education via cloud-enabled MSMEs

Note: Estimates for the number of students and adults accessing cloud-based education produced through market size estimates (see Appendix C of the global report) and are calculated separately to the GDP contribution. Current values are annual 2022-2023 values based on the latest available data.

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[23] WE Forum (2023), How will generative AI impact healthcare?
[24] AWS (2021), Now Open – AWS Asia Pacific (Jakarta) Region.
[25] Simak Online (2023).

Cloud-enabled MSMEs are also introducing advanced analytics into the classroom, helping to personalize learning. Personalized content and feedback can help students with different learning styles work at their own pace, not to mention reduce the administration burden on teaching staff. Educators are also utilizing cloud-based learning analytics to monitor the quality, safety, and security of online learning environments. AI, and in particular, generative AI has the potential to be particularly useful in helping educators provide differentiated learning pathways based on the needs of individual students.[26,27]

3.3 Developing smarter and more sustainable farming practices

Agriculture is Indonesia's second largest industry after manufacturing, representing about 13% of total GDP and 29% of employment in 2021.[28,29] MSME cloud services are being used by the agricultural industry in Indonesia to support smarter, more sustainable farming practices. These technologies can assist agricultural decision making, by employing sophisticated monitoring devices that provide better, real-time data about crops, livestock health, and resource consumption (referred to as precision agriculture).[30] The cloud-enabled Indonesian company HARA measures crop planting and harvesting data through a mobile phone app, and provides a platform to help institutions access data about farms, land, and weather.[31,32] In addition to supporting the use of data or supply chain tools, cloud is also enabling automated vehicles and equipment which helps to improve the efficiency of agriculture (see Case Study below). Under a cloud-enabled economy, MSMEs in agriculture are expected to unlock Rp59.1 trillion in annual productivity benefits by 2030. Precision agriculture technology supported by cloud-enabled MSMEs are expected to be in operation in one in nine farms across Indonesia by 2030.

Impact of MSMEs on agriculture in the cloud-enabled economy, by 2030

Rp59.1 trillion in annual productivity benefits unlocked through cloud-enabled MSMEs in the agriculture sector, an increase from Rp24.5 trillion currently

1 in 9 farms using precision agriculture supported by cloud-enabled MSMEs, a 300% increase from currently

Note: Estimates for the number of farms using precision agriculture produced through market size estimates (see Appendix C of the global report) and are calculated separately to the GDP contribution. Current values are annual 2022-2023 values based on the latest available data.

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[26] World Economic Forum (2023), Can AI improve education? Here are 4 potential use cases.
[27] Stanford University, Human-Centered Artificial Intelligence, (2023) AI Will Transform Teaching and Learning. Let's Get it Right.
[28] Statista (2023)
[29] Statista (2023)
[30] FAO (2022), Leveraging automation and digitalization for precision agriculture: Evidence from the case studies.
[31] Hara (2023).
[32] AWS (2019), Hara Reduces IT Costs by 60 to 70% with AWS.

eFishery's cloud-enabled devices optimize and automate feeding by detecting fish behavior, helping to reduce costs and improve yields

Industry: Agriculture

Size: Large (250+ employees)

Locations: Indonesia

Starting as a small aquaculture businesses in 2013, eFishery has grown into one of Indonesia's most successful tech startups, having expanded internationally in 2023. eFishery now operates across 250 cities in Indonesia that are home to approximately 70,000 fish and shrimp farmers. As an archipelago, aquaculture represents a substantial part of the Indonesian economy, with one-fifth of international aquaculture coming from Indonesia. Aquaculture is also an important segment for low-income, rural populations in Indonesia with 40% of shrimp and fish farmers represented by individual households. The founders of eFishery identified an opportunity to contribute to improved global food security in a sustainable way through technology, while supporting local Indonesian farmers and businesses.

"Our mission is to create a more sustainable fish farming industry that will enable Indonesia to support increased global food security whilst maximizing the benefits for the Indonesian economy and farmers."

Chrisna Aditya, co-founder

eFishery empowers farmers in Indonesia through affordable technology. One of the featured products is the eFishery Feeder is an IoT fish food distribution unit. The feeder senses vibrations in the water caused by fish activity and determines and distributes the optimal amount of food. Automated feeding helps farmers minimize variability in fish size caused by over or under nourishment which often occurs in hand feeding farms. 1 in 5 fish and shrimp harvests are rejected by buyers at market and variability in size is a leading reason for these rejections.

The eFishery Feeder **reduces feed costs for farmers by up to 20%, increases the average harvest in tons by 50%,** and increases the success rate of harvests.

The eFishery Feeder is a cloud-enabled device, providing data and alerts directly to individualized dashboards visible on a smartphone application in farmers' pockets. The app also acts as a link to market, allowing farmers to approach and engage directly with buyers. This reduces the need for market intermediaries and allows farmers to keep more of the profits they make from each harvest.

eFishery indicated that cloud is an essential feature of many of their products. While technology adoption is still relatively low in parts of Indonesia, offline approaches and partial cloud solutions have accommodated all types of farmers across Indonesia. eFishery intends to expand internationally to other aquaculture economies, such as Thailand or India, while also growing their technology offering and intelligence of their devices overtime. In particular, incorporating more sophisticated AI and ML algorithms would help to better identify, learn from, and respond to patterns in fish behavior.

Source: Accenture consultations.

3.4 Improving financial access and wellbeing

Availability, access, and convenience of financial services is an important feature of economic and social development. As of 2021, 48% of Indonesians did not have a bank account.[33] With about 7% of unbanked adults globally living in Indonesia, there is a role for digital finance to help improve access for people in Indonesia.[34] A major reason for Indonesia's sizable unbanked population is the geographical dispersion and of population and variability in services and infrastructure across the spread of islands that make up Indonesia.[35] MSMEs in Indonesia are utilizing cloud to support improved financial equity and outcomes, helping improve access to finance. Cloud technology can enable MSMEs such as Amartha to provide accessible financial services to more people, especially for those who face barriers to financial services, such as distance, affordability, or financial literacy. Amartha is a cloud-based platform operating across Indonesia that provides microfinance to Indonesian small businesses run by women, encouraging and empowering women to be financially independent.[36]

Digitization in the finance sector has also led to wave of disruption, increased competition, and new types of products and services.[37] Alongside the proliferation of smart devices, a critical part of the proliferation of digital finance options has been cloud technology that provides a platform and source of efficiency for the ever-growing number of 'fintech' companies to reach consumers through their phones.[38] As well as greater financial inclusion, fintech companies offer Indonesians more accessible and convenient finance, greater individual autonomy over financial decisions, and enhanced security. According to the Accenture societal impact survey, by 2030, one in four people globally are expected to be using financial services supported specifically by cloud-enabled MSMEs.[39] Globally, 15% of cloud-enabled MSMEs working with the finance sector are expected to be helping budget-constrained customers or small businesses to better manage their finances.[40,41]

Impact of MSMEs on finance in a cloud-enabled economy by 2030

1 in 4 people globally using financial services supported by cloud-enabled MSMEs

Globally, **15%** of surveyed cloud-enabled MSMEs working with the finance sector help budget-constrained customers or small businesses better manage their finances

Source: Accenture societal impact survey (2023), n = 188. Based on global results across 12 countries.

For many countries, a cloud-enabled financial services sector is not far away, with many MSMEs already incorporating or exploring the use of cloud-supported technologies, such as

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[33] World Bank (2021), The 2021 Global Findex Database.
[34] World Bank (2021), The 2021 Global Findex Database.
[35] The Asian Banker (2023)
[36] Amartha (2023)
[37] OECD (2020), "Digital disruption in banking and its impact on competition".
[38] Ibid.
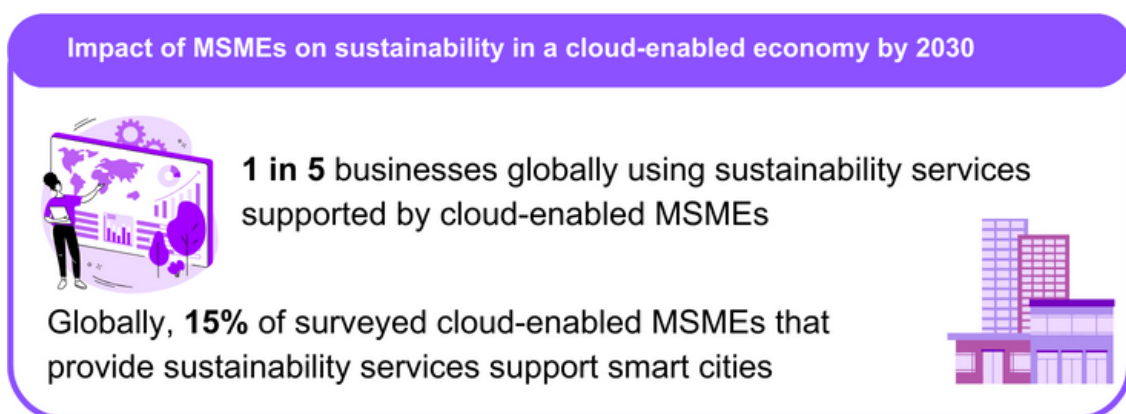[39] Accenture societal impact survey (2023), n = 188.
[40] Accenture societal impact survey (2023), n = 188.
[41] Based on the number of cloud-enabled MSMEs currently supporting this outcome.

AI and ML, to improve outcomes for consumers across a range of applications.[42] A sample of MSMEs operating in the global financial services space indicated that the most common areas for these MSMEs to be active were in providing digital banking and budgeting or financial management tools.[43,44] The improvements in societal outcomes most often attributed to these MSMEs were increased affordability of services, improved financial literacy and education, and fraud detection.[45,46]

3.5 Designing a sustainable future

Developing the tools and technologies that will support a sustainable future is one of the most pressing global challenges, but also one filled with enormous economic potential. Cloud-enabled MSMEs can employ technology and digitization to directly reduce environmental impact through innovations such as more efficient resource usage and smarter waste management. According to the Accenture societal impact survey, by 2030, one in five businesses globally are expected to be using services provided by cloud-enabled MSMEs to directly address their climate and sustainability objectives, such as through energy or emissions monitoring and reduction.[47] And it's not only businesses using these services; across the world, cities and towns are increasingly turning to cloud-based technology solutions provided by MSMEs to achieve a range of sustainable outcomes.[48,49] Globally, 15% of cloud-enabled MSMEs providing services to achieve sustainability goals are expected to be supporting "smart cities", such as through optimising traffic flows or making waste removal more efficient, and enabling the tracking or reduction of electricity usage.[50,51,52,53]

Impact of MSMEs on sustainability in a cloud-enabled economy by 2030

1 in 5 businesses globally using sustainability services supported by cloud-enabled MSMEs

Globally, **15%** of surveyed cloud-enabled MSMEs that provide sustainability services support smart cities

Source: Accenture societal impact survey (2023), n = 66. Based on global results across 12 countries.

According to the Accenture societal impact survey of global MSMEs, cloud technologies have already enabled these businesses to provide smarter resource management and usage, access to sustainable and renewable technologies, carbon footprint monitoring, and sustainability information.[54] Through these sustainable solutions, global MSMEs are helping to support wider sustainability goals including more efficient use of energy and water, improving

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[42] IMF (2021), Powering the Digital Economy: Opportunities and Risks of Artificial Intelligence in Finance.
[43] Accenture societal impact survey (2023), n = 188.
[44] Based on the services that cloud-enabled MSMEs are currently delivering.
[45] Accenture societal impact survey (2023), n = 188.
[46] Based on the number of cloud-enabled MSMEs currently supporting this outcome.
[47] Accenture societal impact survey (2023), n = 66.
[48] IDC (2023), Smart Cities.
[49] IDC (2021), The Next Frontier: AI and Digital Twins in Smart Cities.
[50] Accenture societal impact survey (2023), n = 66.
[51] Based on the number of cloud-enabled MSMEs currently supporting this outcome.
[52] AWS (2023), Building Smart Cities with AWS Cloud.
[53] OECD (2021), Measuring smart city performance in COVID-19 times: Lessons from Korea and OECD countries.
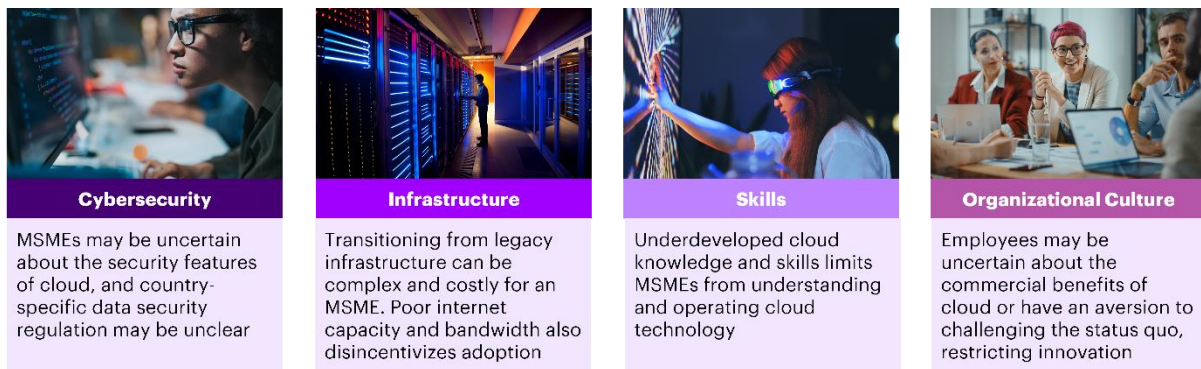[54] Accenture societal impact survey (2023), n = 66.

waste management, supporting better air quality, and increasing the availability of renewable energy.[55]

4 Achieving a cloud-enabled economy

The cloud-enabled economy offers significant potential in terms of both economic and societal impact. As a nascent market, Indonesia's path towards a cloud-enabled economy will primarily focus on increasing adoption rates. As cloud adoption accelerates and awareness of the potential benefits becomes more pronounced, the focus will then shift towards using cloud in new ways within firms who have already adopted to reach the full potential of the cloud-enabled economy. This will involve maturing cloud usage across more complex business functions and implementing more advanced technologies supported by cloud such as AI and ML. Unlocking these opportunities by 2030 requires continued coordinated action from industry and the Indonesian government to address the main barriers to uptake. The main persistent barriers to cloud are included in Figure 7.

Figure 7: Firm-level barriers to cloud adoption

Cybersecurity	Infrastructure	Skills	Organizational Culture
MSMEs may be uncertain about the security features of cloud, and country-specific data security regulation may be unclear	Transitioning from legacy infrastructure can be complex and costly for an MSME. Poor internet capacity and bandwidth also disincentivizes adoption	Underdeveloped cloud knowledge and skills limits MSMEs from understanding and operating cloud technology	Employees may be uncertain about the commercial benefits of cloud or have an aversion to challenging the status quo, restricting innovation

Source: Accenture[56]

4.1 Holistic strategies to overcome firm-specific barriers to cloud adoption

MSMEs can adopt a range of internal policies and actions to adopt cloud solutions across all business functions and maximize their productivity dividend overtime (see Figure 8).

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[55] Accenture societal impact survey (2023), n = 66.
[56] Accenture (2023), The race to cloud: Reaching the inflection point to long sought

Figure 8: Steps for MSMEs to accelerate cloud maturity

Steps	Description	Cybersecurity	Infrastructure	Skills	Organizational culture
1 Identify how cloud can streamline strategic goals	• Identify how cloud solutions can meet your goals • Identify a cloud partner that can help navigate the process • Examine case studies of how MSMEs have used cloud to transform their business and create impact • Interview employees to determine which barriers are preventing these systems and/or processes from being introduced or optimized at the firm level				✓
2 Evaluate industry and government support	• Examine the Indonesian government's cloud policies and programs offered by industry to address firm-specific barriers and accelerate cloud maturity • This could include R&D tax credits from the Indonesian government, or sponsorship programs for startups run by cloud providers such as AWS	✓	✓	✓	✓
3 Educate all employees	• Support employees to upskill in cloud, and utilize training from cloud providers where relevant • Identify specific skill shortages to focus their training	✓		✓	✓
4 Review data security arrangements	• Review data security arrangements from the cloud provider and determine whether additional internal policies are required • Review security features of cloud and best practice data policies • Simplify and harmonize policy across the business, with clear guidelines for different functional applications of cloud	✓			
5 Create a whole-of-business cloud migration strategy	• Evaluate the costs and benefits of alternative strategies to determine a whole-of-business solution that meets business goals • MSMEs should prioritize solutions which deliver the greatest net benefit in the medium to long term • Determine the scale and complexity of the cloud infrastructure required • MSMEs with less cloud experience could consider enlisting cloud partners such as consultants to achieve this	✓	✓	✓	✓

Source: Accenture

4.2 Strong policy support to address structural barriers and incentivize MSME cloud adoption

While many Indonesian businesses are in the early stages of cloud adoption, future government policy has a significant potential to address the barriers discussed in Section 4.1. The government has already introduced multiple digital skills programs, including targeting general upskilling with Kartu Prakerja, and focusing on digital skills with the National Digital Literacy Movement and the Digital Talent Scholarship.[57,58,59] The introduction of the Data Protection Bill in 2022 also aims to address cybersecurity concerns without imposing data localization requirements, which will likely improve confidence in cloud.[60] As a developing economy, the Indonesian government has a difficult task in delivering the same level of digital infrastructure, skills, and financial support available in leading cloud economies. However, Indonesia can still look to global best practice examples to guide future decision making (see Figure 9). Given Indonesia's earlier stage of cloud adoption, the country has a significant economic opportunity available from further growing cloud adoption.

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[57] Kartu Parkerja (n.d.)
[58] Antara News (2022), Indonesia needs nine million digital talents in 2030: Minister.
[59] International Trade Administration (2021), Indonesia: Digital Economy Opportunities
[60] Future of Privacy Forum (2022), Indonesia's Personal Data Protection Bill: Overview, Key Takeaways, And Context

Figure 9: Global best-practice examples of cloud adoption policies

Legend: ■ Cybersecurity ■ Infrastructure ■ Skills ■ Organizational culture

Policy	Key existing support	Future policy	International policy examples	Barriers addressed (Cybersecurity / Infrastructure / Skills / Organizational culture)			
Invest in digital infrastructure	Indonesia has made some investment into internet infrastructure, with 62% of Indonesians being connected. 26% of broadband connections are optic fiber. Indonesia also has a 5G task force and new spectrum is being made available to support 5G.	Promote competition between internet providers to reduce prices and encourage providers to share infrastructure. Further develop access to spectrum and satellite internet connections.	**Singapore optic fiber** accounts for 93% of broadband connections **Thailand optic fiber** accounts for 94% of broadband connections		✓		
Invest in cloud skills and training	An estimated 19% of Indonesians use basic digital skills in their jobs. Along with the Kartu Prakerja program for general upskilling, Indonesia has introduced a variety of programs to increase the use of digital skills, such as the National Digital Literacy Movement, the Digital Talent Scholarship, and the Government Transformation Academy (GTA) Training for State Civil Servants (ASN).	Continued collaboration with industry to deliver digital skills training programs, with a focus on cloud technology. This should be especially targeted to MSMEs.	**Australia's National Cloud Computing Strategy** includes cooperation with industry and educators to enhance cloud training **Brazil's Digital Transformation Strategy (E-Digital)** includes partnerships with industry and educators to provide cloud training and certifications	✓		✓	✓
Harmonize data privacy policy across regions	Indonesia passed the Personal Data Protection Bill in 2022. While the Bill shares similarities with the EU GDPR, there are still data localization requirements for the public sector and the financial services sector.	Work with world leaders to harmonize policy in line with best practice, while promoting cross border data flows.	**European Union's General Data Protection Regulation (GDPR, 2016)** improved clarity and consistency across the EU, promoting data flow within the EU	✓			
Create clear guidelines for industry	Indonesia has minimum industry specific guidelines to help businesses navigate the compliance uncertainty of cloud solutions in certain sectors, including for the energy sector, while compliance requirements for others, such as financial services, remain ambiguous and cumbersome.	Work with experts to develop industry guidelines on the specific application of cloud.	**Japan's Data Protection Laws** include clear guidelines for the finance, healthcare and telecommunications sectors	✓			✓
Incentivize cloud adoption and maturity	The Indonesian government does not have financial incentive programs for businesses purchasing cloud solutions.	Develop incentives to reduce the cost of transitioning to cloud, especially for MSMEs.	**United States' incentives** include cloud being fully tax deductible and tax credits for cloud-related investments		✓	✓	✓
Improve cloud-first policies	Indonesia does not currently have a cloud-first policy, reducing the ability of the government to lead by example and inspire confidence in cloud.	Develop a cloud-first policy with clear guidelines for implementation and consider the benefits of public cloud to enhance confidence.	**United Kingdom's Cloud-First policy (2013)** is a whole-of-government, public cloud-first approach that outlines clear guidelines and procurement policies for departments	✓	✓	✓	✓

Source: OECD,[61] World Bank,[62] Lim, S.,[63] Statista,[64] AlphaBeta,[65] Santhika, E.,[66] International Trade Administration,[67] Australian Government,[68] Federal Government of Brazil,[69] Future of Privacy Forum,[70] GDPR EU,[71] Coos, A.,[72] Mcguire Sponsel,[73] UK Government[74], World Bank[75], Asian Development Bank[76], GSMA[77]

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[61] OECD (2023), OECD broadband statistics update

[62] World Bank (2021), Individuals using the Internet (% of population)

[63] Lim, S. (2019), The city of the future: What will a full-fiber broadband city look like

[64] Statista (2021), Share of fiber optic internet connection in Thailand from the 3rd quarter of 2019 to the 2nd quarter of 2021

[65] AlphaBeta (2021), Unlocking APAC's Digital Potential: Changing Digital Skills Needs and Policy Approaches

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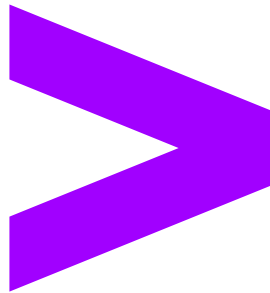[72] Coos, A. (2022), Data Protection in Japan: All You Need to Know about APPI
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