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Realizing a cloud-enabled economy:

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

2023

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

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

$161 billion combined annual productivity benefits unlocked through cloud-enabled MSMEs in healthcare, education, and agriculture across 12 major economies[ii]

This represents a 44% increase on current

95.8 million people (8% of the workforce) employed by cloud-enabled MSMEs in healthcare, education and agriculture (up from 4% on current)

1 in 3 telehealth consultations using cloud supported by MSMEs' services (up from 1 in 10 currently)

1 in 3 school students engaging in online learning via cloud-enabled MSMEs (up from 1 in 5 currently)

1 in 8 farms using cloud-enabled precision agriculture technologies supported by MSMEs (up from 1 in 34 currently)

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.
ii. Focus countries are Australia, Brazil, Canada, France, India, Indonesia, Japan, New Zealand, Singapore, South Korea, the United Kingdom, and the United States.

Executive summary

Micro, small, and medium enterprises (MSMEs, businesses and startups with between 1 and 250 employees)[1] are a major driver of economic performance. Collectively, they account for about 99% of all firms, 70% of jobs, and about 60% of Gross Domestic Product (GDP) on average across developed economies.[2] MSMEs are also a major source of innovation and disruption in the economy, leveraging old and new technologies to fill gaps in the current market and bring 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 computing has driven economic and societal benefits by creating new business models, reducing costs, and creating new opportunities for entrepreneurs and startups. Almost half of all businesses across developed economies now utilize cloud technology.[3] The ability to centralize and access digital technologies and data conveniently over a network has found a multitude of potential applications, including online learning platforms and digitized health records, as well as enabling a new range of technologies supported by cloud, such as artificial intelligence (AI) and machine learning (ML). Through these pathways, cloud has generated a wave of digital innovation and productivity that is expected to continue as adoption and the technology continues to advance.

Cloud has most profoundly impacted MSMEs by allowing them to start, operate, and scale their organization more effectively. MSMEs have access to on-demand, pay-as-you-go hardware and software — developed and maintained by specialized providers — allowing MSMEs to focus their time and investments towards their core objectives. Cloud has also democratized advanced technologies supported by cloud, such as AI and ML, allowing MSMEs access to tools previously accessible only to large enterprises with the scale to develop them internally. The power of cloud computing has enabled MSMEs to drive societal impact through resources that can help communities access healthcare, education, financial and other services, along with improving agricultural efficiency.

Cloud-enabled economy

By 2030, the use of cloud computing by MSMEs is expected to become increasingly ubiquitous, 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 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. 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, such as AI and ML, countries with already high rates of overall adoption can expect to derive even greater benefits.

Societal impact

A cloud-enabled economy can significantly enhance societal outcomes across a wide variety of sectors. This report examines twelve major global economies[4], showing that there is a

[1] The term 'MSME' is used instead of small-to-medium businesses (SMBs), a term commonly used to refer to similar sized businesses, in order to more explicitly include micro and startup business in the definition. MSME terminology is used by both the Organization for Economic Cooperation and Development (OECD) and the United Nations (UN).
[2] Measured by the average for countries included in the Organization for Economic Co-operation and Development (OECD).
[3] OECD (2023)
[4] Focus countries include Australia, Brazil, Canada, France, India, Indonesia, Japan, New Zealand, Singapore, South Korea, the United Kingdom, and the United States.

significant opportunity by transitioning to a cloud-enabled economy. A cloud-enabled economy can significantly enhance societal outcomes by broadening access to healthcare, education, and finance, and supporting improved agricultural productivity and environmental sustainability. Telehealth can reduce barriers to receiving healthcare, online learning platforms can help democratize education, and digital finance can promote economic inclusion, financial literacy, and overall financial wellbeing. Moreover, the integration of cloud technology in agriculture can help support a more sustainable agricultural industry through automating farming tools and equipment, introducing smarter, data-driven resource management techniques, and optimizing output through precision agriculture techniques. The combined productivity benefits unlocked by MSMEs across societal sectors of healthcare, education, and agriculture — fields which have a profound impact on society and could significantly benefit from technological advancement — is expected to reach US$161 billion a year by 2030.[5] In addition, cloud-enabled MSMEs in these sectors of the economy will employ approximately 95.8 million people in these 12 economies, averaging approximately 8% of the total workforce.

By 2030, cloud-enabled MSMEs are expected to facilitate one in three remote health consultations and support one in three school students to access online education annually in the 12 economies examined.[6] Furthermore, data-driven agriculture practices enabled by MSMEs are expected to be used by one in eight farms in 12 economies, resulting in increased production and reduced waste. Approximately one in four people across the 12 focus economies are expected to be accessing digital finance solutions through MSMEs, helping more people and businesses make choices about their finances. Through data-driven and innovative technologies, one in five businesses are expected to rely on sustainability solutions provided by cloud-enabled MSMEs in the 12 focus economies. This modelling demonstrates the economic benefits of increasing cloud adoption as part of the cloud enabled economy will be significant. However, the economic potential of cloud computing is poised to stretch well beyond 2030, as the advanced adoption of cloud by MSMEs becomes increasingly prevalent. Innovations such as quantum computing, augmented and virtual reality, and advanced AI algorithms mature, will inherently rely on the cloud's vast storage and computational capabilities, ensuring that cloud services remain integral to the technological and economic landscapes of the future.

Realizing a cloud-enabled economy

While these benefits are substantial, the opportunities of the cloud-enabled economy will not occur without action. To unlock this potential, 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;
- developing a migration plan, and training employees to leverage the benefits of cloud technology.

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

[5] The economic impact of MSMEs in finance and sustainability is not estimated as part of this measure, as there are challenges in attributing societal impact to all of the economic activity of finance, and sustainability is not clearly defined by industry estimates of economic activity.
[6] Remote health consultations can also be supported by telephone or through large cloud-enabled firms.

- leading by example by promoting cloud adoption across all levels and divisions of government.

1 The cloud-enabled economy

Cloud computing has changed the way many businesses operate, particularly for MSMEs who employ between 1 and 250 employees[7], by enabling them to scale quickly, reduce costs, reach global markets, and access a range of technology resources that were previously unattainable.

Box 1: 12 focus countries in this report
Cloud adoption and usage varies across the world, making the impact highly localized. To account for this, the report has chosen to focus on 12 diverse economies with varying rates of cloud adoption to provide a global perspective while also including a degree of country-specific context and nuance. The 12 countries in focus within this report are Australia, Brazil, Canada, France, India, Indonesia, Japan, New Zealand, Singapore, South Korea, the United Kingdom, and the United States.

1.1 Cloud technology enables the digital economy

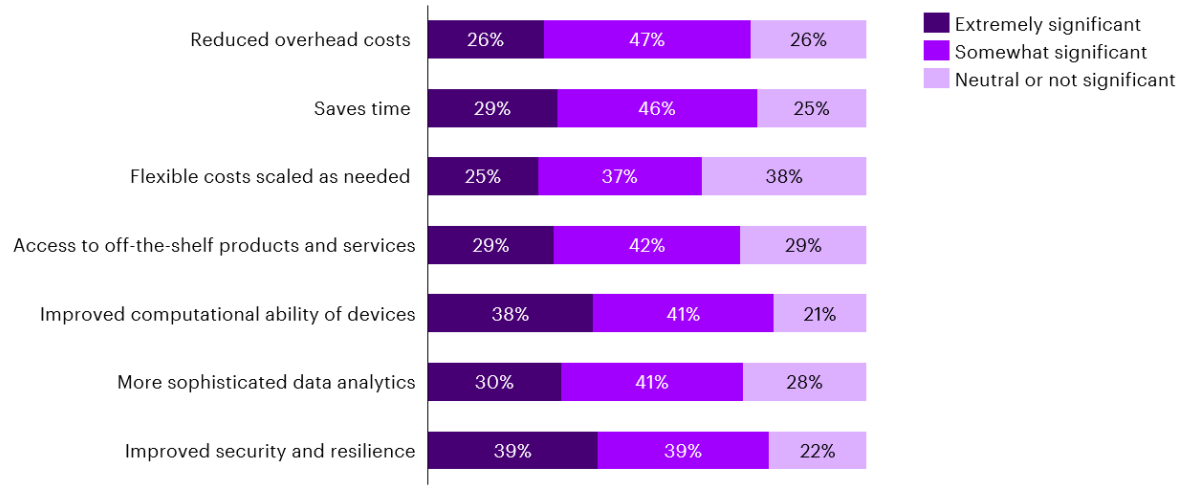
Cloud technology refers to the provision of on-demand products and services delivered over the internet or private network.[8] This involves housing digital resources from centralized servers owned and operated by cloud service providers, reducing the need for individual businesses to procure and maintain physical hardware. Research by Accenture has shown that migrations to public cloud result in up to 30-40% total cost of ownership (TCO) savings[9]. As shown in Figure 1, 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 demand
- offering specialized technology solutions
- increasing computational power of ordinary devices; and
- enhancing security and resilience.

[7] The definition of MSME is taken from the OECD (2023).
[8] AWS (2023), What is cloud computing.
[9] Accenture (2020), 'The green behind the cloud'

Figure 1: The most significant benefits of cloud technology for MSMEs

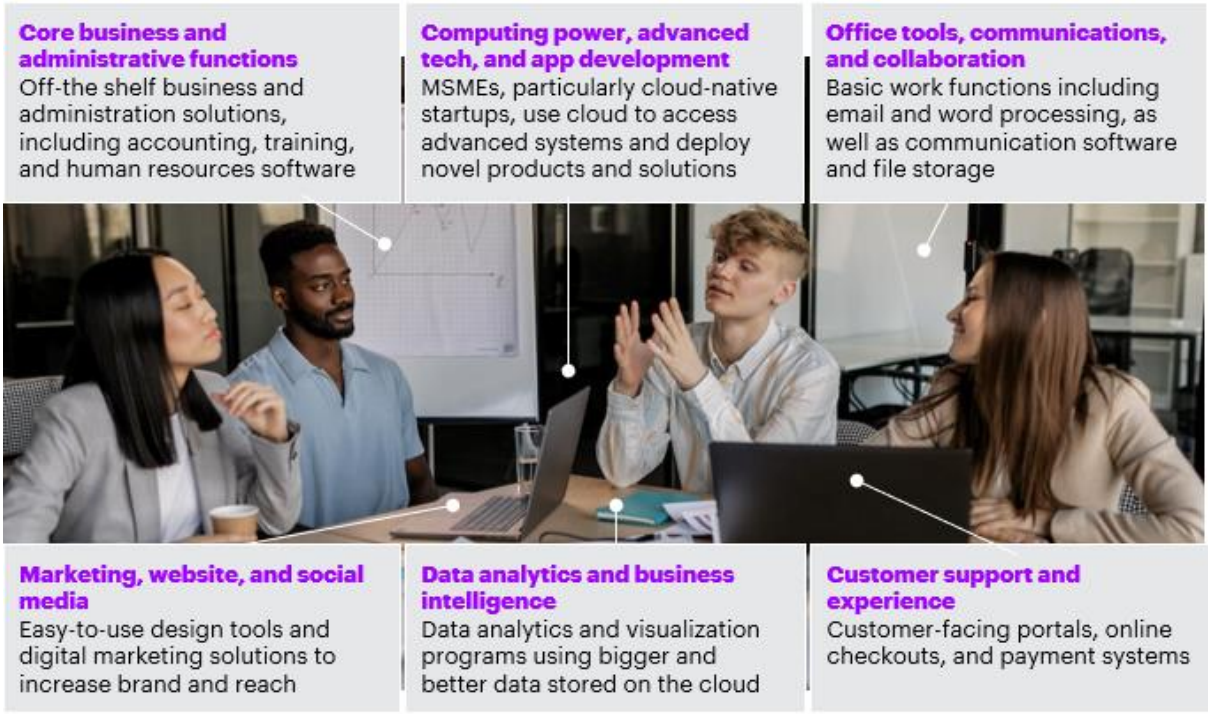
Average % of cloud-enabled MSMEs across several industries that find cloud somewhat or extremely significant in providing a particular benefit



Source: Accenture societal impact survey (2023), n = 562. '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 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



Source: Accenture

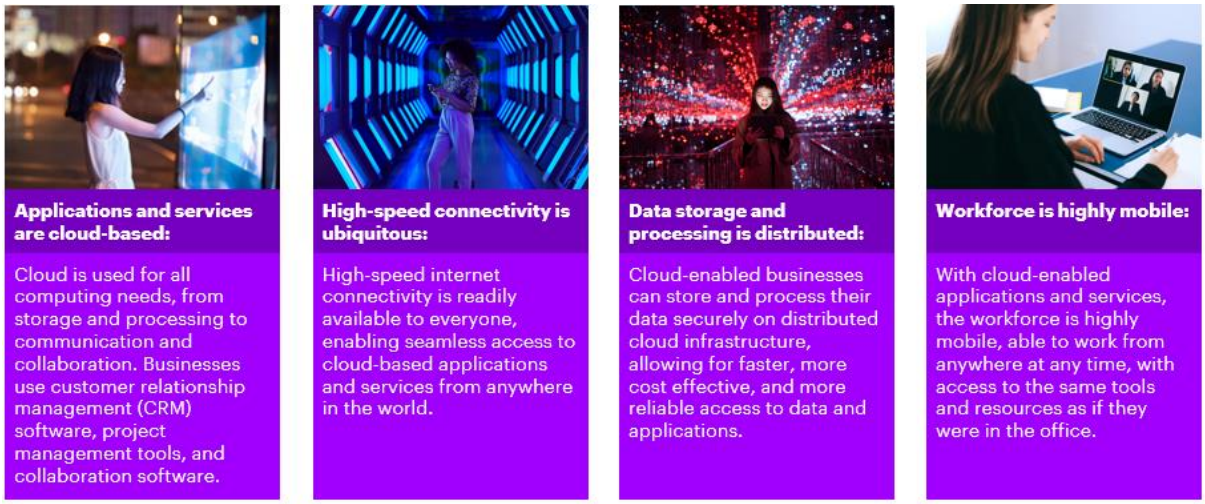
A large and growing network of interconnected businesses, ranging from startups to large multinationals, has gradually developed around cloud, with participants sharing cloud as the

common infrastructure underpinning their operations. Global cloud providers deliver the infrastructure that unlocks a network of at least six million business globally, 98% of which are MSMEs (see Appendix D1).

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



Source: Accenture

1.2.1 The spectrum of cloud adoption

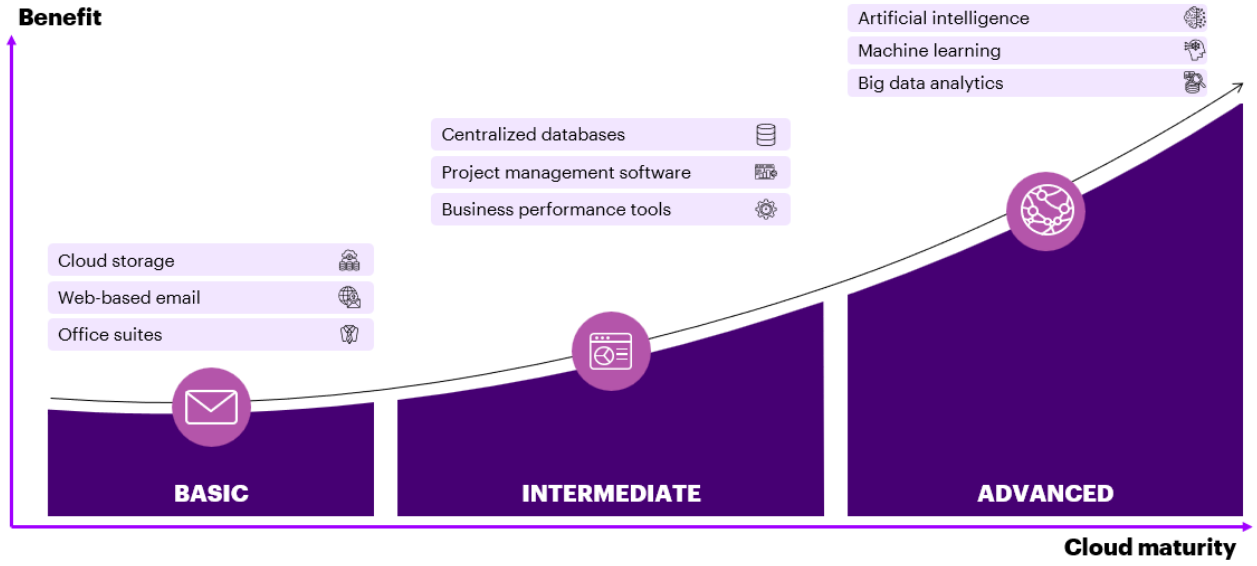
The definition of cloud adoption used in this report is consistent with the OECD, and refers to the share of businesses that purchased cloud services[10] as a proportion of all businesses, across all levels of maturity.[11] However, cloud technologies have a range of applications across a suite of business 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:

[10] 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
[11] OECD (2023), OECD Going Digital Toolkit

- **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 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

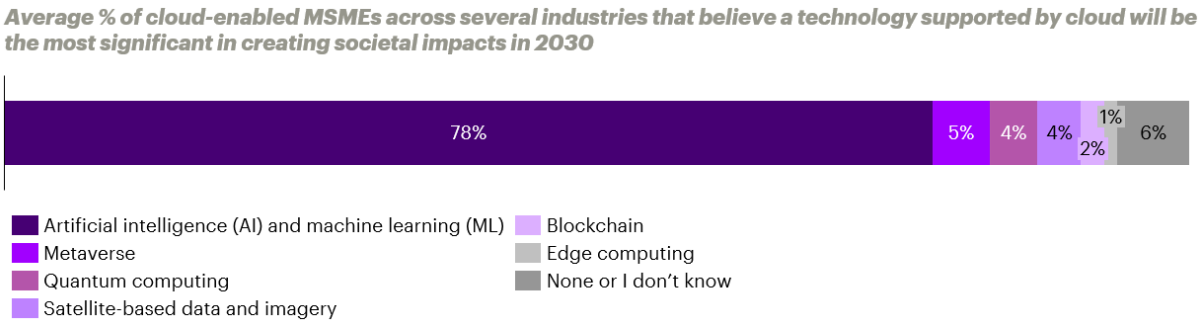
1.2.2 Advanced cloud usage unlocks the potential for emerging and innovative technologies

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. Cloud technology 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), including 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 cloud technology (see Appendix D for a full description of each technology supported by cloud).[12] 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%.[13] Although the technology is still nascent, generative AI is already disrupting and changing businesses processes, occupations, and 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.[14] As shown in Figure **5**, 78% of MSMEs across several industries and countries identified AI (including generative AI and natural language processing (NLP)) and ML as the technologies likely to be most significant in creating societal impacts in 2030.[15] 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 exam questions and instant feedback to support individualized learning pathways.

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



Source: Accenture societal impact survey (2023), n = 562. 'Artificial intelligence 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

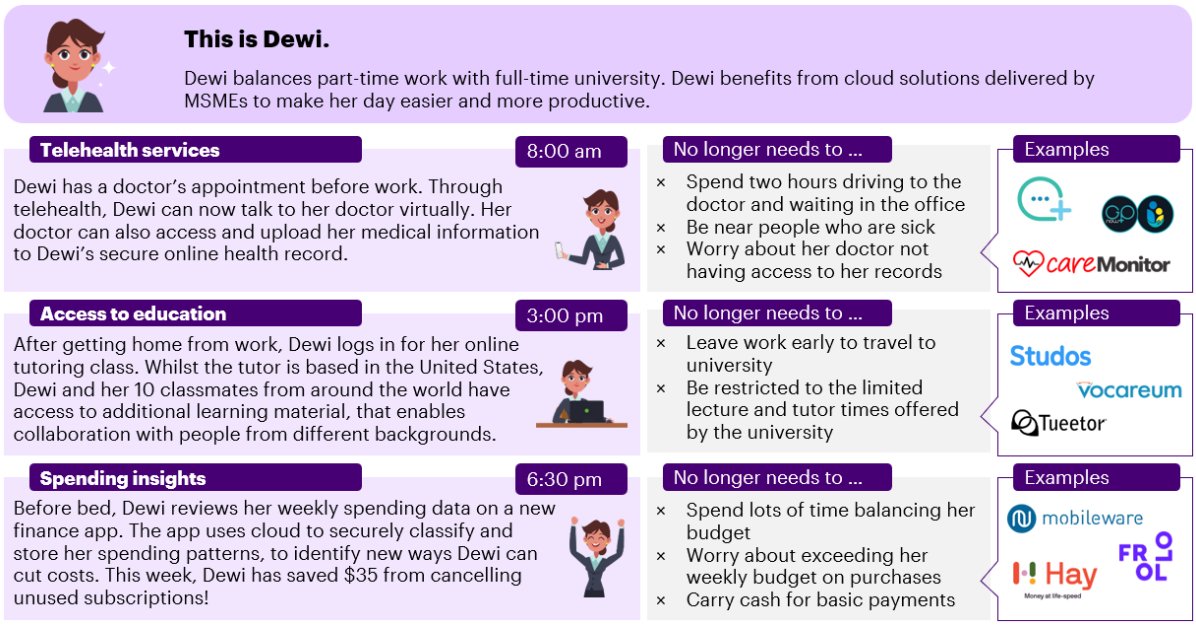
While the opportunity to scale and grow businesses has a clear impact on economic activity (see Chapter 2), in many cases businesses can also create a positive societal impact. Cloud has opened up a range of emerging technologies that are underpinning a new wave of digitally-led innovation to address 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:

[12] Damian Mazurek, (2023), Leveraging Cloud-based AI/ML Services to elevate your business.
[13] Precedence Research (2023), Generative AI Market size to hit USD 118 Bn by 2032
[14] AWS (2023), Generative AI on AWS.
[15] Survey responses were from MSMEs working in healthcare, education, agriculture, finance, and sustainability.

- healthcare
- education
- agriculture
- finance; and
- sustainability and disaster response.[16]

While these industries are not the only ones that are impacted by cloud technology, they 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), and economic prosperity and equality (Goal 9 and 10).[17] 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[18]

[16] 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).
[17] United Nations (2023), Sustainable development goals.
[18] AWS (2023), Customer Success Stories.

2 Unlocking US$161 billion in productivity benefits within key societal sectors

MSMEs are a major driver of economic performance accounting for about 99% of all firms and 70% of jobs in OECD countries.[19] They also generate between 40% and 60% of GDP[20] across the 12 focus countries.[21] Cloud technology is helping to create and scale MSMEs (see Chapter), 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 Section 2.1, 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 2: 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.

2.1 The path to the cloud-enabled economy differs across jurisdictions but the opportunity is equally significant

Across the world, countries are on different paths and trajectories regarding cloud adoption. The reasons for these differences include a wide range of political, cultural, economic, and geographic factors that ultimately have accelerated or hindered cloud adoption within a specific country. Barriers to cloud adoption and maturity, as well as policy options for MSMEs and government, are discussed in greater detail in Chapter 3.

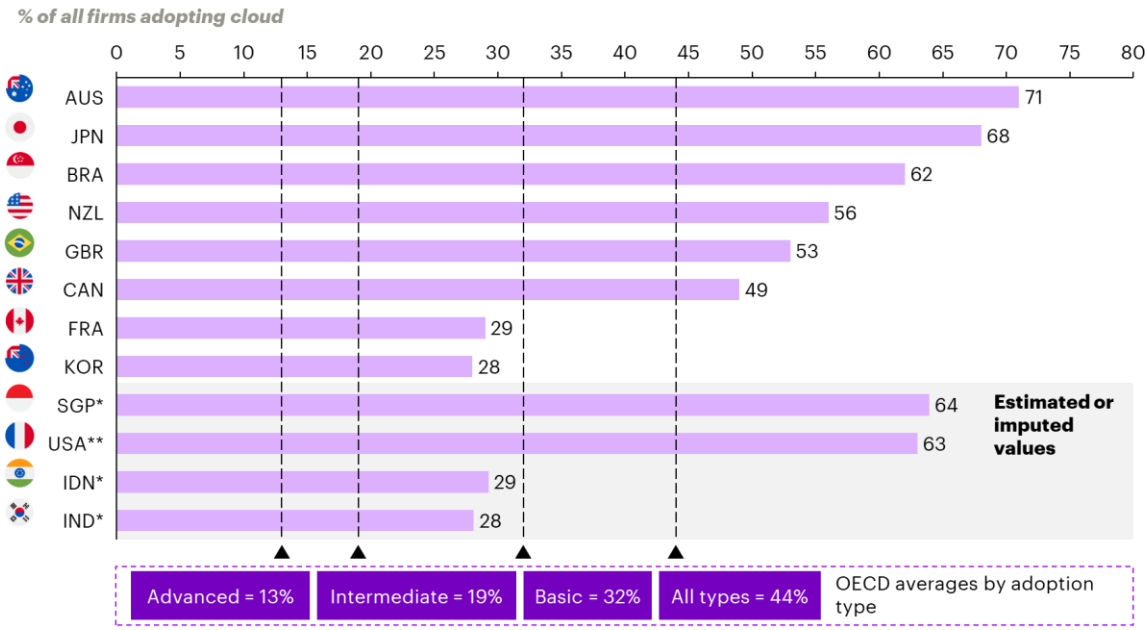
Cloud adoption varies across the focus countries ranging from 13-71% as shown in the figure below. Australia has the highest level of overall adoption, with 70% of businesses using cloud technology to varying degrees of sophistication. Countries such as France and South Korea fall below the current OECD average with adoption rates below 30% and have a significant economic opportunity to stimulate growth through further adoption (see Figure 7).[22,23]

Countries that have high levels of adoption across all uses of cloud can also drive additional economic growth through increasing their sophistication and maturity of cloud technology usage. Currently, OECD countries demonstrate advanced adoption of cloud at only 13%, and intermediate adoption of 19%. Australia is the leader of adoption across all forms of cloud application, but only has advanced and intermediate adoption levels of 15% and 41%, respectively.

[19] OECD (2017), Enhancing the contributions of SMEs in a global and digitalized economy.
[20] All estimates for GDP impact are calculated in real GDP terms (2022 US dollars) and are not adjusted for purchasing power.
[21] OECD (2020), Structural Business Statistics (ISIC Rev. 4): Value added of SMEs and large firms.
[22] As the largest publicly available, time series dataset, the OECD ICT statistics were used to measure the cloud adoption rates of 32 countries by year. See appendix A for full methodology.
[23] OECD (2022), ICT Access and Usage by Businesses.

The escalating sophistication in cloud technology beyond basic applications will be a pivotal driver for economic growth in the future. As MSMEs tap into advanced cloud functionalities, such as AI, big data analytics, and serverless computing, they can foster innovation, streamline operations, and customize consumer experiences at global scale. These advanced uses can unlock new revenue streams, catalyze the birth of novel business models, and enhance global competitiveness, collectively underpinning the future of the digital economy.

Figure 7: Cloud adoption (all maturity types) across all businesses, 2020-21



Note: Based on latest data available from the OECD (2020 or 2021). Definition of adoption includes basic through to advanced applications due to varying levels of data availability across countries.
*Data for countries not included in the OECD dataset has been imputed using the method described in Appendix A.
**Cloud adoption for the United States has not been collected since 2018 (44%) so current value has been brought forward based on growth rates of comparable economies.
Source: OECD, Accenture analysis

2.2 A cloud-enabled economy presents a US$161 billion opportunity in societal sectors by 2030

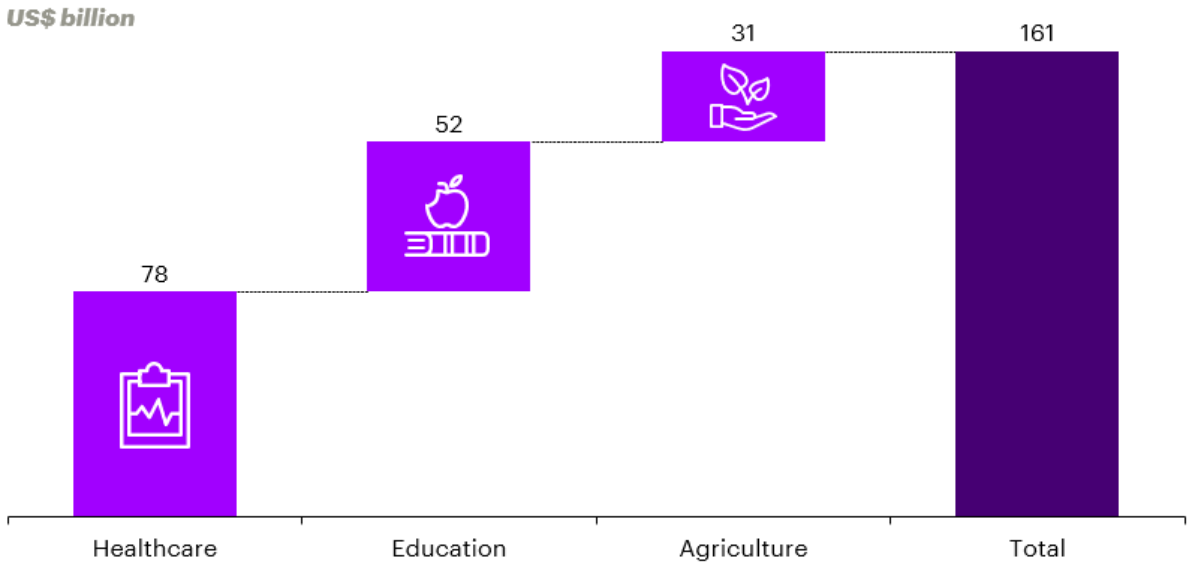
Irrespective of where each economy currently is on their path towards a cloud-enabled economy, the economic opportunity is substantial. By 2030, the economy-wide productivity benefits accruing to cloud-enabled MSMEs are expected to amount to 2.4% of GDP on average across the 12 economies, representing a sizeable aggregate economic contribution. For perspective, this is equivalent to half of the contribution of the entire retail industry as a share of the economy in the United States (5.8% of GDP in 2022).[24]

At a more granular level, cloud-enabled MSMEs are implementing cloud technology to deliver stronger societal outcomes across the 12 economies. Societal impact is measured in a number of ways (see Chapter 3 for more estimates), including the share of economic activity attributable to sectors with a specific societal focus including healthcare, education, and agriculture. The economic impact of MSMEs in finance and sustainability is not estimated, as there are challenges in attributing societal impact to all the economic activity of finance, and sustainability is not clearly defined by industry estimates of economic activity. Based on this

[24] Bureau of Economic Analysis (2022), Value Added by Industry.

approach, the productivity benefits associated with MSME adoption of cloud technology in health, education, and agriculture are estimated to be worth US$161 billion by 2030 across the 12 economies, a 44% increase from current productivity benefits of US$112 billion.

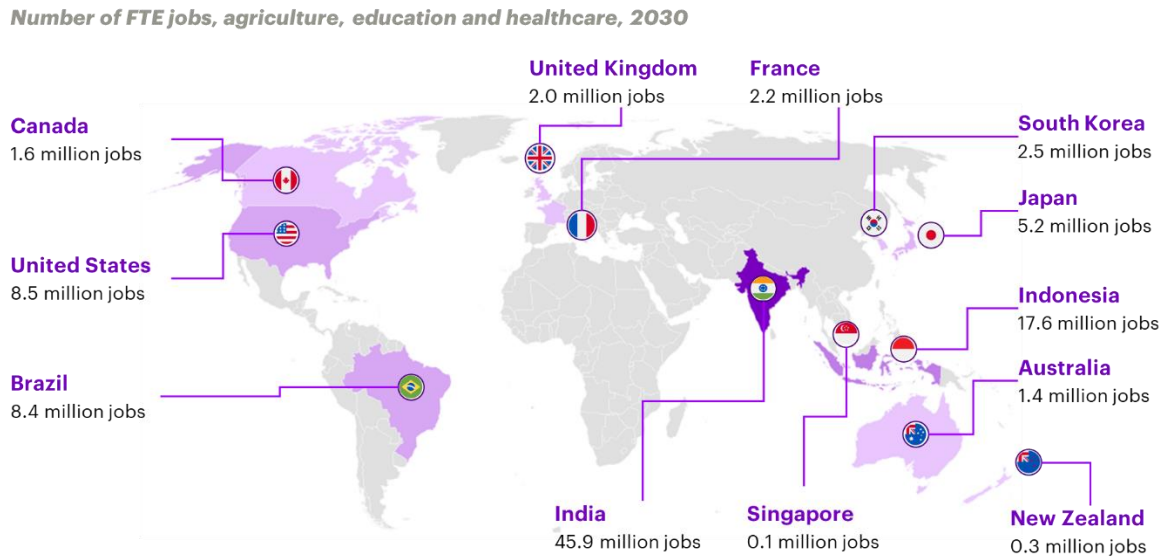
Figure 8: Productivity benefits unlocked by MSMEs in societal sectors under a cloud-enabled economy, 2030



Source: Accenture analysis

As cloud technology stimulates productivity, activity and new business, the jobs generated and hired will occur in these parts of the economy. In a cloud-enabled economy, it is estimated that 95.8 million jobs would be in cloud-enabled MSMEs in industries like healthcare, education, and agriculture (see Figure 9). This would represent an average of 8% of total jobs across the 12 countries, an increase from an average of 4% of total jobs currently.

Figure 9: Estimated number of societal impact jobs in cloud-enabled MSMEs by 2030



Note: Employment numbers are modelled based on employment and industry data, as well as cloud adoption rates. Jobs figures refer to total jobs in these industries using cloud, not jobs created. See Appendix A for details.
Source: Accenture analysis.

This modelling demonstrates the economic benefits of increasing cloud adoption as part of the cloud enabled economy will be significant. However, the economic potential of cloud computing is poised to stretch well beyond 2030, as the advanced adoption of cloud by MSMEs becomes increasingly prevalent. Innovations such as quantum computing, augmented and virtual reality, and advanced AI algorithms mature, will inherently rely on the cloud's vast storage and computational capabilities, ensuring that cloud services remain integral to the technological and economic landscapes of the future.

3 The societal impact of the cloud-enabled economy

The productivity benefits generated by cloud technology not only helps MSMEs contribute to economic output, but it also supports MSMEs to deliver positive societal impact. We define "societal impact" as the positive changes and improvements in outcomes in areas such as healthcare, agriculture, education, financial wellbeing, or sustainable practices facilitated by cloud technology. By leveraging cloud computing, MSMEs can enhance the efficiency, affordability, and accessibility of services in these industries, enabling advancements such as telemedicine, precision agriculture, and remote education, ultimately leading to improved societal wellbeing and development.[25]

3.1 Driving innovation and improving access to healthcare and life sciences

Basic and affordable healthcare is essential to achieving Goal 3 of the SDGs which is to ensure healthy lives and well-being. However, cost, complexity, and distance often arise as barriers to accessing care, particularly for underserved or disadvantaged communities. With smartphones becoming commonplace across developed and developing countries, MSMEs are able to utilize cloud-based applications to overcome these barriers, enabling more people to receive care remotely through smart devices. Through successful transition to a cloud-enabled economy across 12 countries, MSMEs are expected to unlock US$77.7 billion in annual productivity benefits in the healthcare sector by 2030.[26] More providers and patients could be using tools developed by MSMEs to improve healthcare efficiency and delivery, shown by increasing uptake in cloud-enabled services (see box below).

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

$77.7 billion in annual productivity benefits unlocked through cloud-enabled MSMEs in the healthcare sector, a 35% increase from $57.5 billion currently

1 in 3 (284 million per year) telehealth consultations supported by cloud-enabled MSMEs, an increase from 1 in 10 currently

Note: Figures refer to estimates across the 12 in-focus economies. Current values are annual 2022-2023 values based on the latest available data. Estimates for the number of telehealth consultations produced through bottom-up estimates (see Appendix C) and are calculated separately to the GDP contribution.
Source: See Appendix A and C sources.

Through harnessing emerging developments in technologies supported by cloud, MSMEs can stay at the forefront of healthcare innovation, helping to deliver positive societal outcomes into the future. Figure 10 outlines the ways in which cloud technology can support improved

[25] From the Accenture societal impact survey, n = 171. See Appendix B for methodology.
[26] See Appendix A for methodology.

outcomes in healthcare. Technologies supported by cloud, particularly generative AI, also have significant potential to change the healthcare industry, from the delivery of healthcare to administrative functions. 78% of cloud-based MSMEs in healthcare identified AI and ML (including generative AI and NLP) as the technology supported by cloud which is likely to be the most significant in creating societal impacts in 2030.[27,28] MSMEs can use generative AI to support clinical decision making, helping medical professionals analyze data and testing results more accurately, along with supporting personalized care plans.[29] With the ability to synthesize high volumes of information, test a higher number of scenarios, and optimize inputs, generative AI are expected to play a role in the development of up to 30% of all new drugs by 2025.[30]

Figure 10: How cloud enables MSMEs to deliver improved outcomes in healthcare

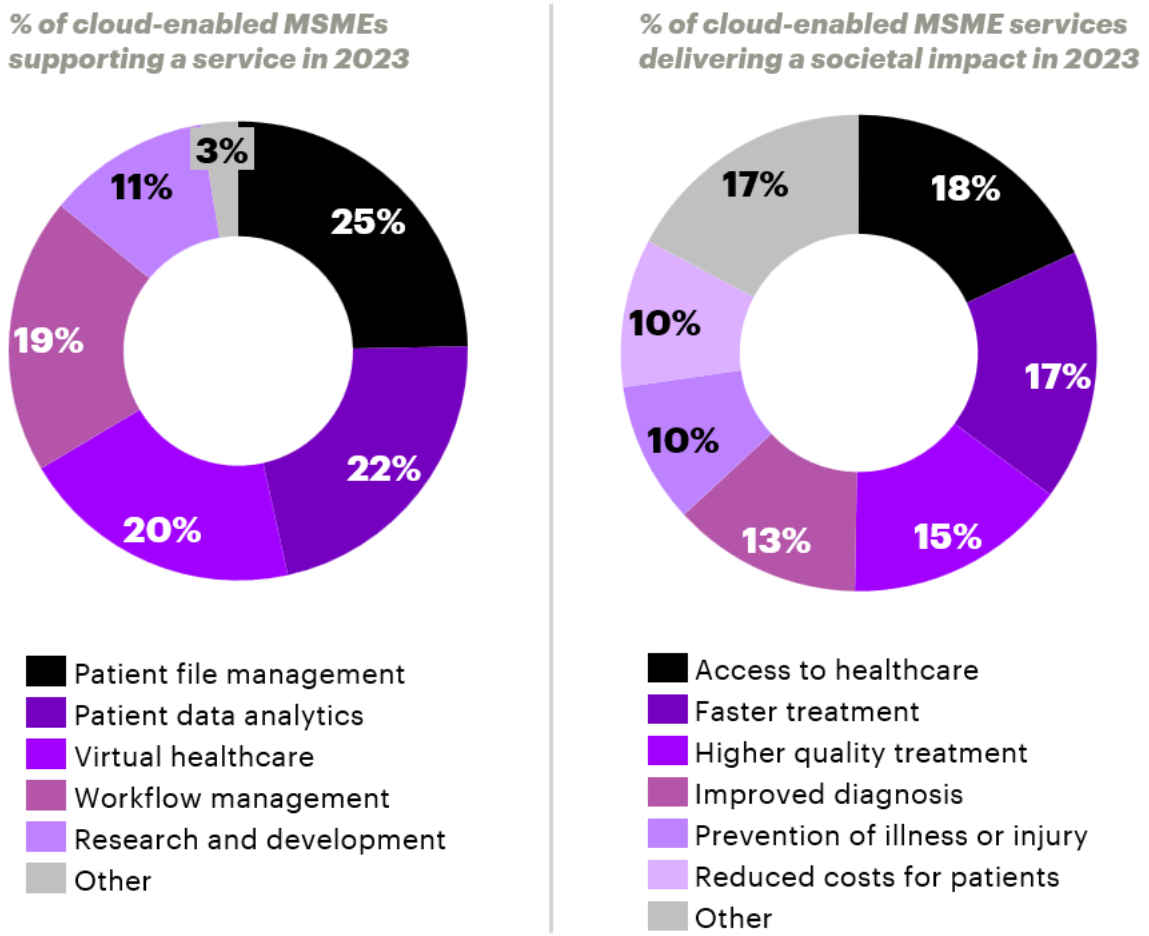
Source: Accenture interviews and research[31,32,33,34,35]

MSMEs are already working with healthcare providers and patients to deliver remote care and utilize advances in health information analysis. Pair Team, for example, is a US-based company using cloud technology to connect underserved communities to high quality care, acting as extensions of the clinical staff for safety-net primary care providers they partner with.[36,37] Cloud-enabled MSMEs are also helping providers sift through information and support decision making for diverse tasks such as diagnostic imaging, identifying patients in need of follow up, and better, more accurate assessment of risk.[38] The types of analytics tools

[27] From the Accenture societal impact survey, n = 171. See Appendix B for methodology.
[28] Other options included ML, NLP, quantum computing, metaverse, blockchain, edge computing, and satellite-based data and imagery.
[29] WE Forum (2023), How will generative AI impact healthcare?
[30] CBInsights (2023), 7 applications of generative AI in healthcare.
[31] Eze et al. (2020), Telemedicine in the OECD: An umbrella review of clinical and cost-effectiveness, patient experience and implementation.
[32] OECD (2021), Laying the foundations for artificial intelligence in health.
[33] OECD (2019), Health in the 21st Century: Putting Data to Work for Stronger Health Systems.
[34] OECD (2021), Empowering the health workforce to make the most of the digital revolution.
[35] OECD (2023), The COVID-19 Pandemic and the Future of Telemedicine.
[36] AWS (2022).
[37] PairTeam (2023).
[38] OECD (2021), Laying the foundations for artificial intelligence in health.

provided include the use of cloud technology and AI to process X-ray images from Medical IP in South Korea, and the maternal risk tools from the US-based company CognitiveCare which uses cloud technology to help healthcare providers plan their care.[39,40] Communication can become easier through more healthcare providers using cloud-based phone and messaging applications, supporting data and information sharing to improve healthcare. The range of healthcare industry applications and societal impacts supported by MSMEs using cloud technology is shown in Figure 11.

Figure 11: Cloud-enabled MSME services and associated societal impacts in healthcare



Source: Accenture societal impact survey (2023), n = 171. Respondents could select multiple answers.

The case study below outlines the work of Akrivia, an UK-based MSME using cloud-based analytics to enhance medical research and clinical trials.

[39] Medical IP (2023), TiSepX.
[40] CognitiveCare, (2023).

Akrivia uses natural language processing to analyse previously under-used health records, supporting research into drugs and treatments.

AKRIVIA HEALTH

Industry: Healthcare

Size: Small (<50 employees)

Locations: England and Wales

Akrivia is a small health-tech company operating since 2019 across England and Wales. Akrivia's founders identified an opportunity to harness large volumes of previously underutilized medical data to streamline and fast-track medical research and pharmaceutical trials relating to dementia and mental health issues.

There is a significant unmet need for treatments to dementia and mental health conditions, with around 7% of people in the UK over age 65 living with dementia, and one in four adults in the UK experiencing a diagnosable mental health issue in a given year. To develop new treatments and identify suitable trial participants, researchers require large volumes of health data. However, the majority of health records are free-form text that can't be analyzed at scale, representing a significantly underutilized source of data. Akrivia uses cloud-based natural language processing (NLP) to capture, decipher, consolidate and arrange de-identified patient data covering medical history, symptoms, and medications.

"We use Akrivia Synapse, our AI driving NLP data enrichment solution to unlock and additional 75% of data providing insights that have previously been inaccessible."

David Newton, COO.

So far, Akrivia has applied its NLP technology, Akrivia Synapse, to over 4.5 million patient records, deriving millions of pieces of vital information about patient treatments and their outcomes. The National Institute of Health and Care Research (NIHR), National Health Service (NHS) trusts, academia, and pharmaceutical

and biotech companies have used Akrivia's data to conduct observational research based on real patient data as well as to efficiently and effectively target clinical trials.

Over 20 publications have been made utilizing Akrivia's data platform, including research on outcomes for people with treatment resistant depression. Clinical trials are increasingly focused on sub-groups with specific conditions, and Akrivia's platform helps pharmaceutical companies find relevant sites for trials, including in places with disadvantage or greater clinical need.

Patient data security and confidentiality is essential for healthcare companies, and cloud allows Akrivia to maintain the highest security standards, including an internationally recognized ISO27001 certification. This same security certification will facilitate and streamline Akrivia's planned international expansion in the future. Akrivia indicated that, without cloud, the upfront costs of the infrastructure required to operate the NLP tool across such large datasets would have proved prohibitively expensive for the company. Similarly, without cloud Akrivia would not be able to share such quantities of information with end users.

Sources removed: World Health Organisation (2021), World failing to address dementia challenge; World Health Organisation (2022), World mental health report: Transforming mental health for all.

3.2 Improving access to engaging and personalized education

Education inequality, either due to cost, distance, or convenience associated with getting an education, continues to be a major source of disadvantage across the world. Educational inequality can not only result in entrenched, multigenerational disadvantage for individuals, but also represents a large cost to society through lower economic capacity, innovation, and activity.[41] Cloud-enabled MSMEs are combatting some of these sources of disadvantage, by providing a range of digital enhancements that make education more accessible to all. If the 12 countries transition to cloud-enabled economies, US$51.8 billion in annual productivity benefits are expected to be unlocked through cloud-enabled MSMEs in education by 2030.[42] With the ability of cloud technology to provide new types of content, mechanisms of delivery, and improved efficiency for institutions, the applications of cloud technology in education could continue growing (see box below).

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

$51.8 billion in annual productivity benefits unlocked through cloud-enabled MSMEs in the education sector, a 40% increase from $36.9 billion currently

1 in 3 (167 million) primary to high school students using online education via cloud-enabled MSMEs, an increase from 1 in 5 currently

1 in 4 (454 million) adults accessing education via cloud-enabled MSMEs, an increase from 1 in 8 currently

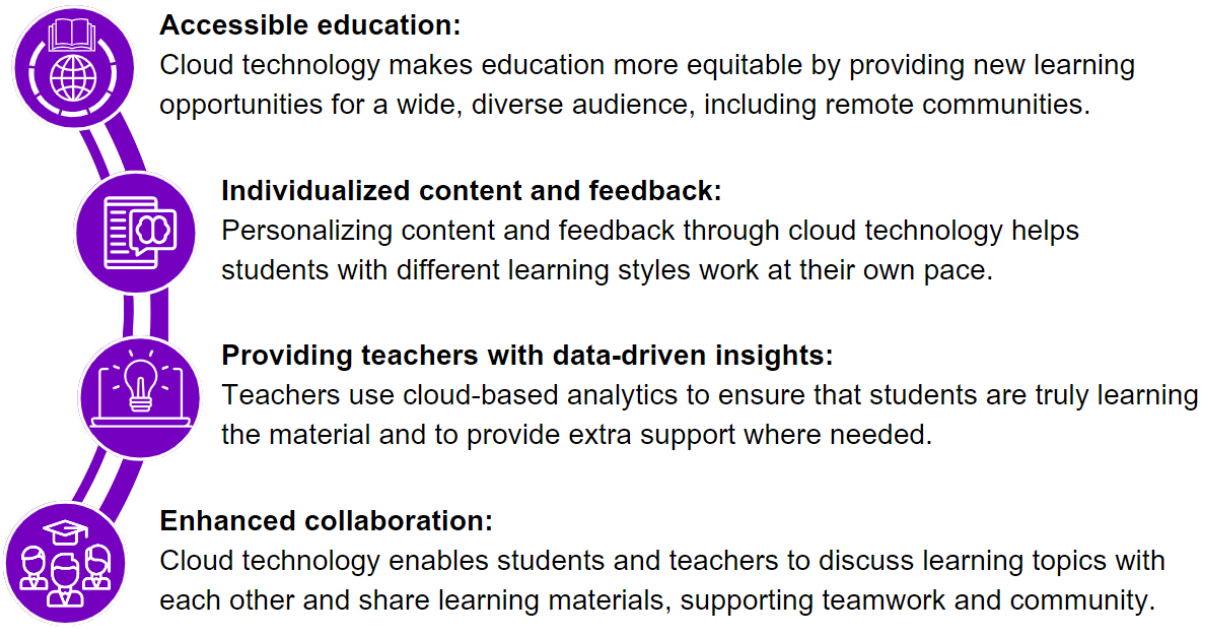
Note: Figures refer to estimates across the 12 in-focus economies. Current values are annual 2022-2023 values based on the latest available data. Estimates for the number of students and adults accessing cloud-enabled education are calculated separately to the GDP contribution (see Appendix C).
Source: See Appendix A and C for methodology and sources.

By helping to support teaching and learning, innovative MSMEs within a cloud-enabled economy can make the future of education more engaging and accessible (see Figure 12).[43,44] MSMEs are personalizing learning, and 12% of cloud-enabled MSMEs working with the education industry are already supporting data-driven tailoring of educational outcomes.[45] AI, and in particular, generative AI could be particularly useful in helping educators to provide differentiated learning pathways based on the needs of individual students by review curriculums and learning materials, generating practice exam questions, and providing instant feedback to responses that students submit. By 2030, 82% of cloud-based MSMEs in education expect AI and ML (including generative AI and NLP) to be the technology supported

[41] OECD (2012), Equity and quality in education: supporting disadvantaged students and schools.
[42] See Appendix A for methodology.
[43] Based on the services that innovative MSMEs are currently delivering.
[44] Accenture societal impact survey (2023), n = 186.
[45] Accenture societal impact survey (2023), n = 186.

by cloud which is likely to be the most significant in creating societal impacts.[46,47] Imanyco, a US-based MSME, is using Generative AI to providing a real-time transcription app to help deaf and hard-of-hearing people understand what others are saying in group conversations, which removes a significant barrier to education for these students.[48]

Figure 12: How cloud supports MSMEs to improved access to quality education

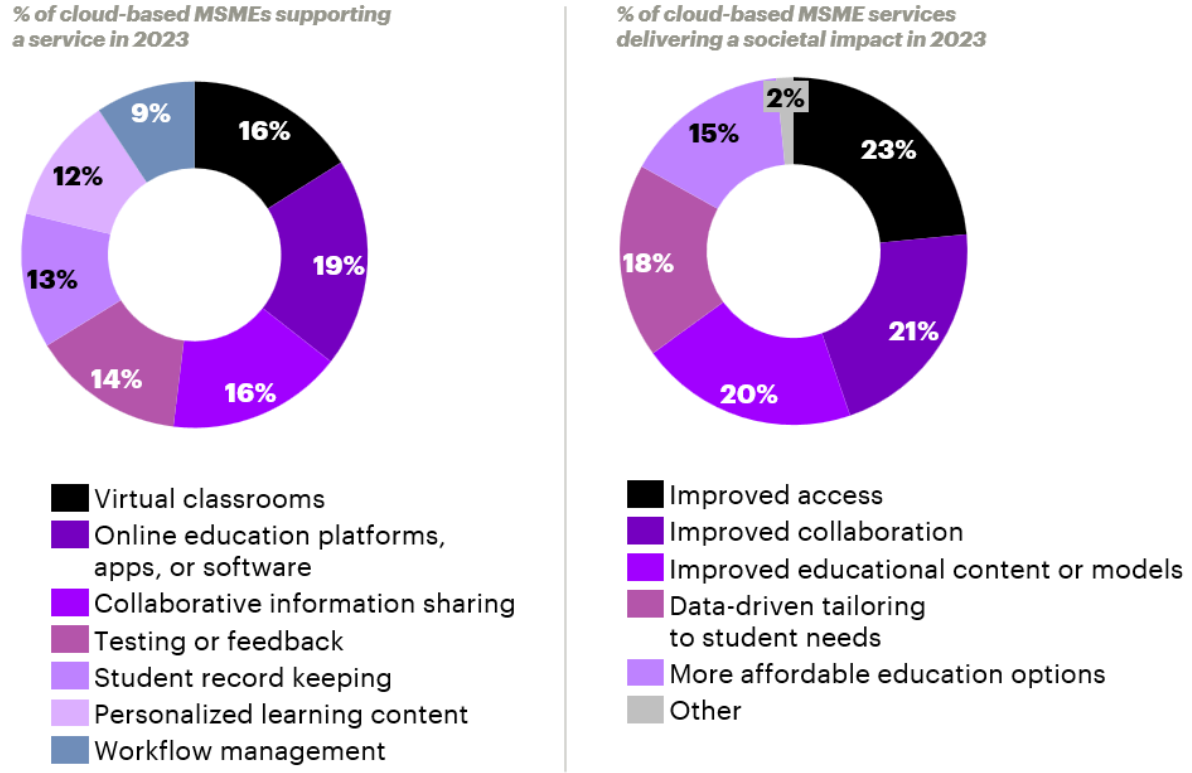


Source: Accenture interviews and research[49,50,51]

MSME learning services are currently supplementing and enhancing teaching, making education more engaging, personalized, and convenient for students that might otherwise face barriers to gaining qualifications.[52] For example, the medium-sized Brazilian company Studos provides learning services to 2.6 million students, using cloud technology to help improve student performance through online assessments.[53,54] While 14% of cloud-enabled MSMEs working with the education industry provide testing or feedback services, there is a broad range of other services being provided by MSMEs, as shown in Figure 13. For example, Simak Online is a cloud-enabled Indonesian company providing access to online learning materials for over 300,000 students, along with providing productivity and administration tools to over 16,000 teachers.[55,56] The case study below outlines how the MSME Wakke Class is utilizing cloud to drive stronger outcomes in Brazil.

[46] Accenture societal impact survey (2023), n = 186.
[47] Other options included ML, NLP, quantum computing, metaverse, blockchain, edge computing, and satellite-based data and imagery.
[48] Imanyco (2023).
[49] OECD (2021), OECD Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots.
[50] UNESCO, (2021), AI and education: guidance for policymakers.
[51] OECD (2021), OECD Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots.
[52] OECD (2021), OECD Digital Education Outlook 2021: Pushing the Frontiers with Artificial Intelligence, Blockchain and Robots.
[53] Studos (2023).
[54] AWS (2020), Studos Helps Students in Brazil Prepare for University Entrance Exams with Assistance from AWS EdStart.
[55] Simak Online (2023).
[56] AWS (2021), Now Open- AWS Asia Pacific (Jakarta) Region.

Figure 13: Cloud-enabled MSME services and associated societal impacts in education



Source: Accenture societal impact survey (2023), n = 186. Respondents could select multiple answers.

Wakke Class is a cloud-based platform that emerged to support continuation and resiliency of school, youth and adult education during COVID-19

wakke CLASS

Industry: Education

Size: Medium (<250 employees)

Location: Brazil

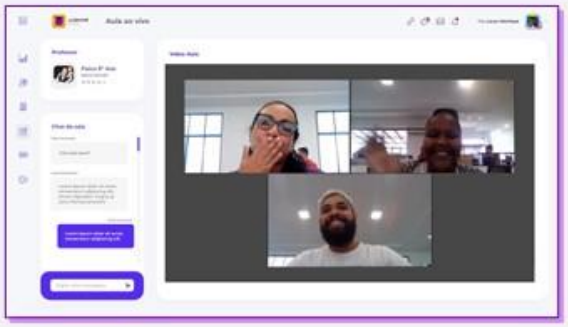
Wakke Class is an online LMS (Learning Management System) platform developed by Wakke, a company founded in 2004 whose main product is Escolaweb, an ERP (Enterprise Resource Planning) aimed at managing and administering schools online. Escolaweb provides a streamlined platform for teachers and school administrators to manage a range of backend tasks, from enrollment and attendance to fees and expenses in one central location. On all its platforms, Wakke operates in 1,300 schools across Brazil.

Wakke Class is an education platform introduced in 2020 in response the outbreak of COVID-19 and widespread lockdowns across Brazilian schools. Brazil experienced some of the worst exposure to COVID-19 and underreporting creating one of the highest per capita infection rates and deaths in the world. Leveraging an existing network of schools through Escolaweb, and the scalability of cloud, **Wakke grew from zero to 20,000 students in under two months after launch**.

"The Brazilian school system was completely unprepared for the outbreak of COVID-19 and we saw a need for a completely new product to keep schools running. Nothing like this existed in Brazil and we simply could not have achieved what we did so quickly without cloud."

Gabriel Nogueira, Operations Director

Wakke offers an entirely cloud-based platform that gives students and teachers access to not only online learning content, but also virtual classrooms (Wakke Meet),



educational games and interactive activities. Wakke's learning dashboards track and monitor a student's progress and provide data and curated feedback to teachers. The benefits of this technology have transcended the pandemic with teachers continuing to integrate the platform into their physical classrooms. Wakke has also since expanded usage across the broader education market, with approximately 20-25% of students engaged through colleges, adult education, microlearning activities, and language schools. Wakke currently has more than **580,000 daily active users across Brazil.**

Wakke has been a cloud-based organisation since 2018, but Wakke Class is entirely cloud-native, having started after migration in 2020. Wakke indicated that the ability to develop and deploy the product so rapidly during COVID-19 would have been inconceivable with on-premises infrastructure as the content library, platform requirements and usage increased exponentially in a matter of weeks. Wakke plans to continue expansion into more schools and other forms of education.

Source: Accenture interviews and research

3.3 Developing smarter and more sustainable farming practices

Ending hunger by 2030 is Goal 2 of the SDGs. Achieving this goal will require a doubling of agricultural productivity and ensuring food production systems are resilient and sustainable.[57] Technology and modernization of the agricultural sector will be essential to improving the efficiency of the sector and ensuring food security is maintained globally. 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).[58] Through transitioning to cloud-enabled economies, US$31.4 billion in annual productivity benefits are expected to be unlocked via cloud-enabled MSMEs by 2030. As cloud technology is increasingly adopted, more agricultural producers are expected to use precision agriculture (see box below).

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

$31.4 billion in annual productivity benefits unlocked through cloud-enabled MSMEs in the agriculture sector, a 82% increase from $17.3 billion currently

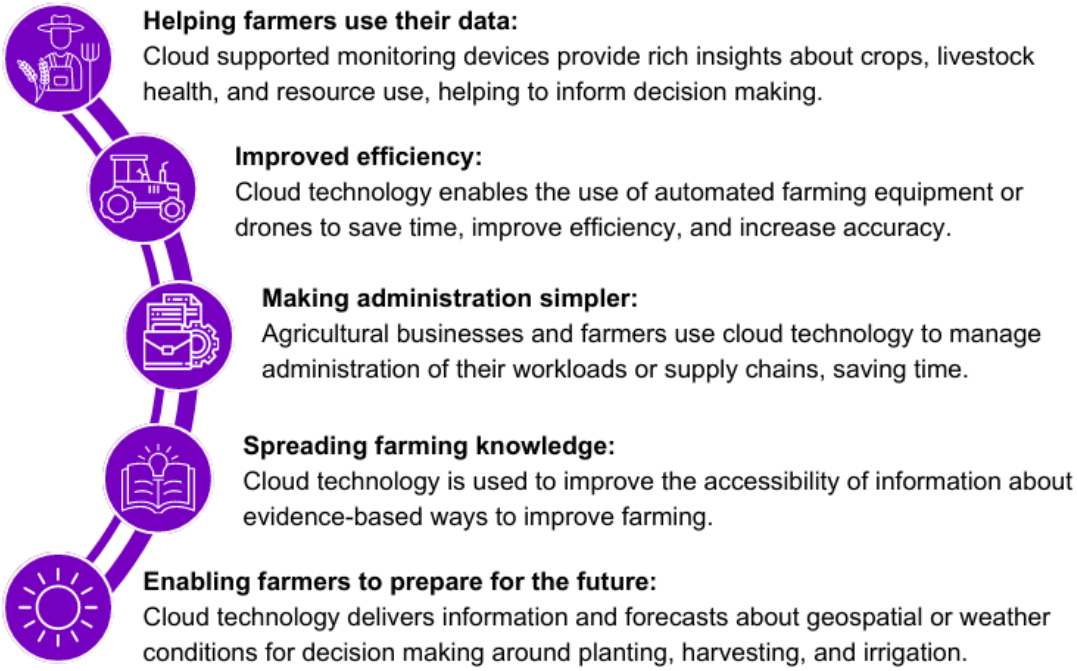
1 in 8 farms using precision agriculture supported by cloud-enabled MSMEs, an increase from 1 in 34 currently

Note: Figures refer to estimates across the 12 in-focus economies. Current values are annual 2022-2023 values based on the latest available data. Estimates for the number of farms using precision agriculture produced through bottom-up estimates (see Appendix C) and are calculated separately to the GDP contribution.
Source: See Appendix A and C for methodology and sources.

Cloud-enabled MSMEs can help drive the adoption of innovative technologies in farming as outlined in Figure 14. These include enabling farmers to use data-driven precision agriculture, helping generate efficiency, and supporting automation. Technologies such as AI and ML could enable the use of more accurate real-time data analytics for precision agriculture, including through analysing crop and satellite images, with gen AI conveying these insights to farmers for decision making.[59,60] 65% of cloud-based MSMEs operating in the agriculture industry identified AI and ML (including generative AI and NLP) as the technology supported by cloud which is likely to be the most significant in creating societal impacts in 2030.[61,62]

[57] United Nations, Sustainable Development Goals, Goal 2: Zero Hunger.
[58] FAO (2022), Leveraging automation and digitalization for precision agriculture: Evidence from the case studies.
[59] World Economic Forum (March 2021), Artificial Intelligence for Agriculture Innovation.
[60] World Economic Forum (January 2021), How AI will solve agriculture's water efficiency problems.
[61] From the Accenture societal impact survey, n = 105. See Appendix B for methodology.
[62] Other options included ML, NLP, quantum computing, metaverse, blockchain, edge computing, and satellite-based data and imagery.

Figure 14: How cloud supports smarter, more sustainable agricultural practices

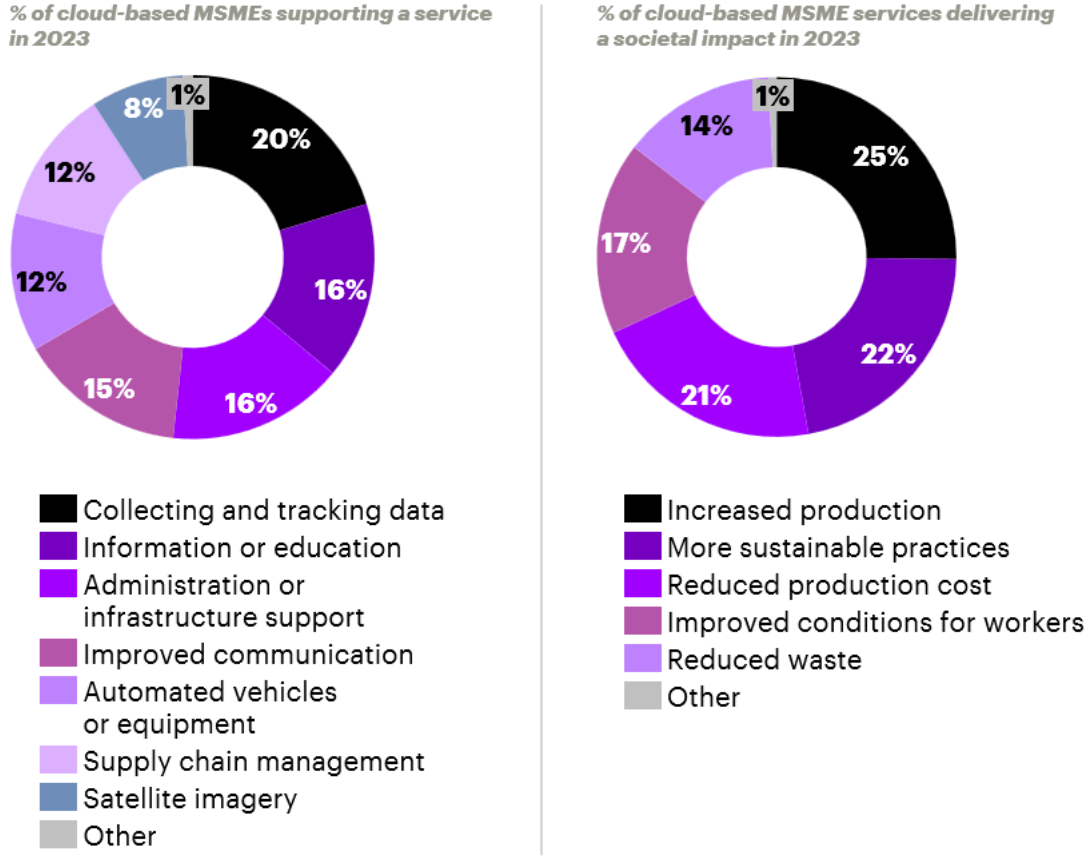


Source: Accenture interviews and research[63,64]

MSMEs are already utilizing cloud technology to develop data-driven and more efficient agriculture practices, as shown in Figure 15. For example, the cloud-enabled Indonesian company HARA measures crop planting and harvesting data through mobile phones, and provides a platform to help institutions access data about farms, land, and weather. Canadian-based OneCup AI uses wearable technology supported via cloud to help farmers monitor livestock remotely.[65,66,67,68] Areete, an India-based MSME, also uses wearable technology but specially designed for cattle, helping to improve the productivity of dairy farmers in India (see case study). MSMEs are also helping to enable automation in agricultural equipment and vehicles. Agtonomy is a US-based MSME using a cloud-based platform and mobile app for farmers to manage autonomous and remote-controlled tractors and machines.[69]

[63] OECD (2022), The digitalization of agriculture: A literature review and emerging policy issues.
[64] World Bank (2021), What's Cooking: Digital Transformation of the Agrifood System.
[65] AWS (2019), HARA Reduces IT Costs by 60 to 70% with AWS.
[66] HARA, (2023).
[67] AWS (2021), OneCup AI Builds Livestock Face Recognition and Monitoring Platform with NVIDIA.
[68] OneCup AI, (2023).
[69] Agtonomy (2023).

Figure 15: Cloud-enabled MSME services and associated societal impacts in agriculture



Source: Accenture societal impact survey (2023), n = 105. Respondents could select multiple answers.

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

eFishery

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.

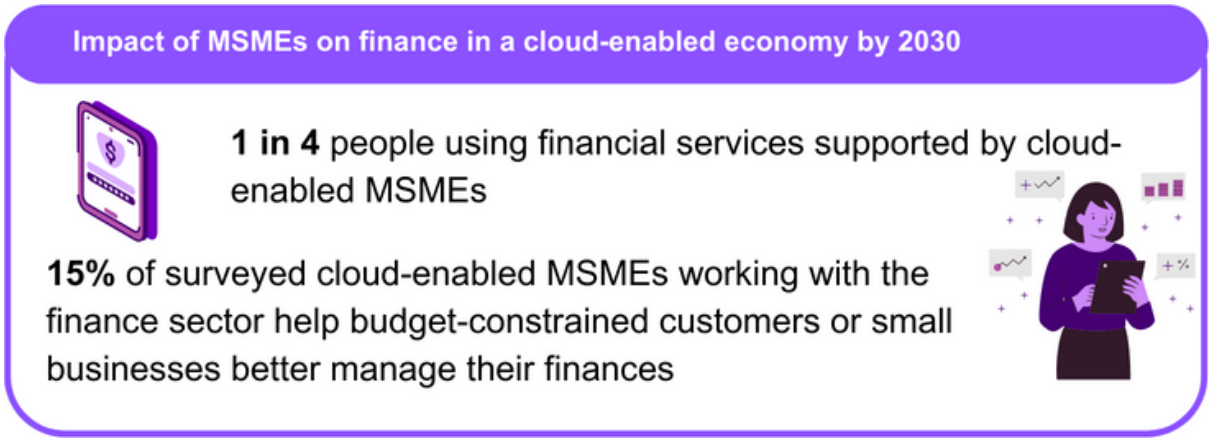
The eFishery Feeder is a cloud-enabled device, providing data and alerts directly to individualized dashboards visible on a smartphone application in farmers' pockets. The app also acts as a link to market, allowing farmers to approach and engage directly with buyers. This reduces the need for market 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

Digitization in the finance sector has led to a wave of disruption, increased competition, and new types of products and services that better service customers.[70] Alongside the rapid adoption of smart devices, a critical part of the proliferation of digital finance options has been cloud technology that supports fast and secure methods of transferring financial information and better access to information.[71] As such, the financial technology sector (fintechs, predominantly cloud-native MSMEs) is one of the fastest growing market segments in the world, expected to rise from US$134 billion in 2022 to US$557 billion by 2030 – more than a 400% increase.[72] According to the Accenture societal impact survey, by 2030 one in four people are expected to be using financial services supported specifically by cloud-enabled MSMEs.[73] 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.[74,75] AI has the potential to unlock even greater individual financial wellbeing in a cloud-enabled economy by allowing customers to automate more elements of personal finances.[76] While the applications of AI across the financial sector are still emerging, the possibility of integrating AI to perpetually monitor and screen for better fees or financial products holds enormous potential to improve financial health.[77] 82% of cloud-based MSMEs in finance identified AI and ML (including generative AI and NLP) as the technology supported by cloud which is likely to be the most significant in creating societal impacts in 2030.[78,79]



Source: Accenture societal impact survey (2023), n = 188.

The rise of fintech apps has not only been seen an increase in the number of financial services companies, but also a boost in convenience and access, individual autonomy over financial decisions, better access to information, and tighter security frameworks. These features of a cloud-enabled financial services sector have distinct societal advantages attached, including greater financial inclusion, wellbeing, and prosperity. The ways in which cloud has most profoundly enabled a digital financial services sector are included in Figure 16.

[70] OECD (2020), "Digital disruption in banking and its impact on competition".
[71] Ibid.
[72] Vantage market research (2023)
[73] Accenture societal impact survey (2023), n = 188.
[74] Accenture societal impact survey (2023), n = 188.
[75] Based on the number of cloud-enabled MSMEs currently supporting this outcome.
[76] Crunchbase (2023) How the future of personal finance is self-driving money
[77] Crunchbase (2023) How the future of personal finance is self-driving money
[78] Accenture societal impact survey (2023), n = 188.
[79] Other options included ML, NLP, quantum computing, metaverse, blockchain, edge computing, and satellite-based data and imagery.

Figure 16: How cloud-enabled MSMEs support improved financial autonomy and access

Open banking:
Cloud technology, smart devices, and mobile applications make it easier for customers to conveniently and securely share their financial information.

Reliable intelligence and insights through data:
Fintechs are utilizing cloud servers to bring a wider range of financial data directly to consumers, enabling more informed decision making.

Helping to make finance more secure and compliant:
Fintechs are designing intelligent, cloud-based software tools that utilize AI and ML to streamline company compliance and regulatory reporting as well as to detect fraud and threats.

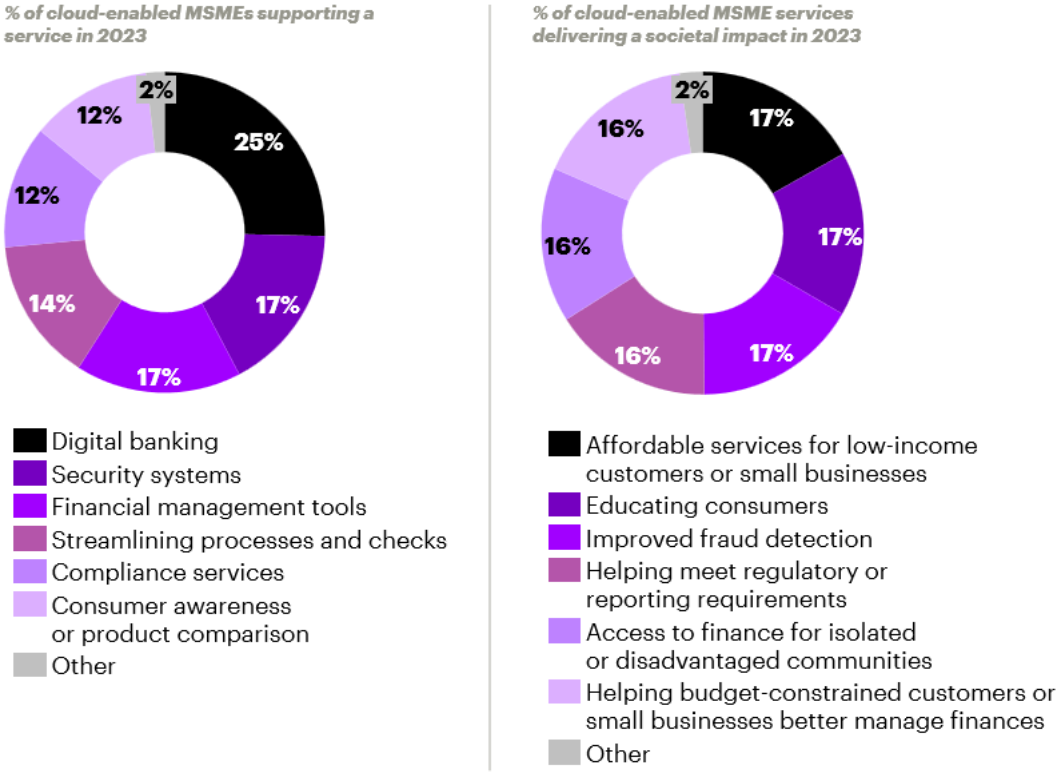
Enabling access and convenience:
Cloud-based platforms are supporting providers reach those in the community still unable to access financial services conveniently due to cost, time, or remoteness.

Source: Accenture interviews and research

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 AI and ML, to improve outcomes for consumers across a range of applications (see Figure 17).[80] The most common areas for these MSMEs to be active were in providing digital banking and budgeting or financial management tools (see Figure 17).[81,82] The improvements in societal outcomes most often attributed to these MSMEs were increased affordability of services, improved financial literacy and education, and fraud detection.[83,84]

[80] IMF (2021), Powering the Digital Economy: Opportunities and Risks of Artificial Intelligence in Finance.
[81] Accenture societal impact survey (2023), n = 188.
[82] Based on the services that cloud-enabled MSMEs are currently delivering.
[83] Accenture societal impact survey (2023), n = 188.
[84] Based on the number of cloud-enabled MSMEs currently supporting this outcome.

Figure 17: Cloud-enabled MSME services and associated societal impacts in finance



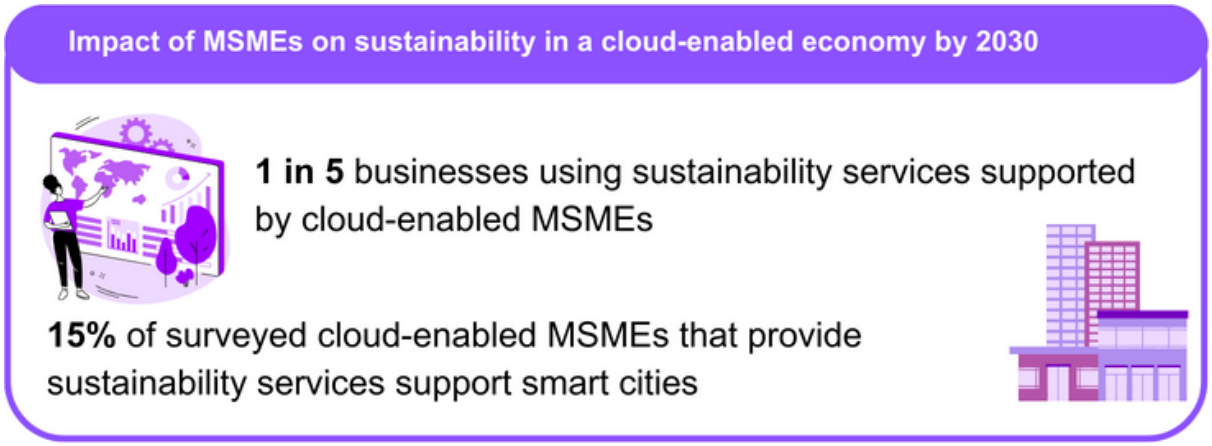
Source: Accenture societal impact survey (2023), n = 188. Respondents could select multiple answers.

In developing countries where financial access and inclusion remains a source of economic disadvantage, MSMEs are using cloud-based platforms and apps to support the financial inclusion of populations in underserved geographies. India's CreditVidya is one such company that uses AI and ML to incorporate smartphone data when assessing loan applications for people without credit history, helping process over 25 million loan applications.[85,86]

3.5 Designing a sustainable future while helping respond to challenges associated with climate change

Confronted by the challenge of global warming, MSMEs in a cloud-enabled economy play a vital role in not only the transition to a more sustainable economy, but also in the response to disasters that are rising in frequency and severity. Cloud-enabled MSMEs are employing technology to directly reduce environmental impact through smarter, less impactful resource usage, and waste management.[87] According to the Accenture societal impact survey, by 2030 one in five businesses 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. 15% of cloud-enabled MSMEs providing services to achieve sustainability goals are expected to be supporting smart cities.[88,89]

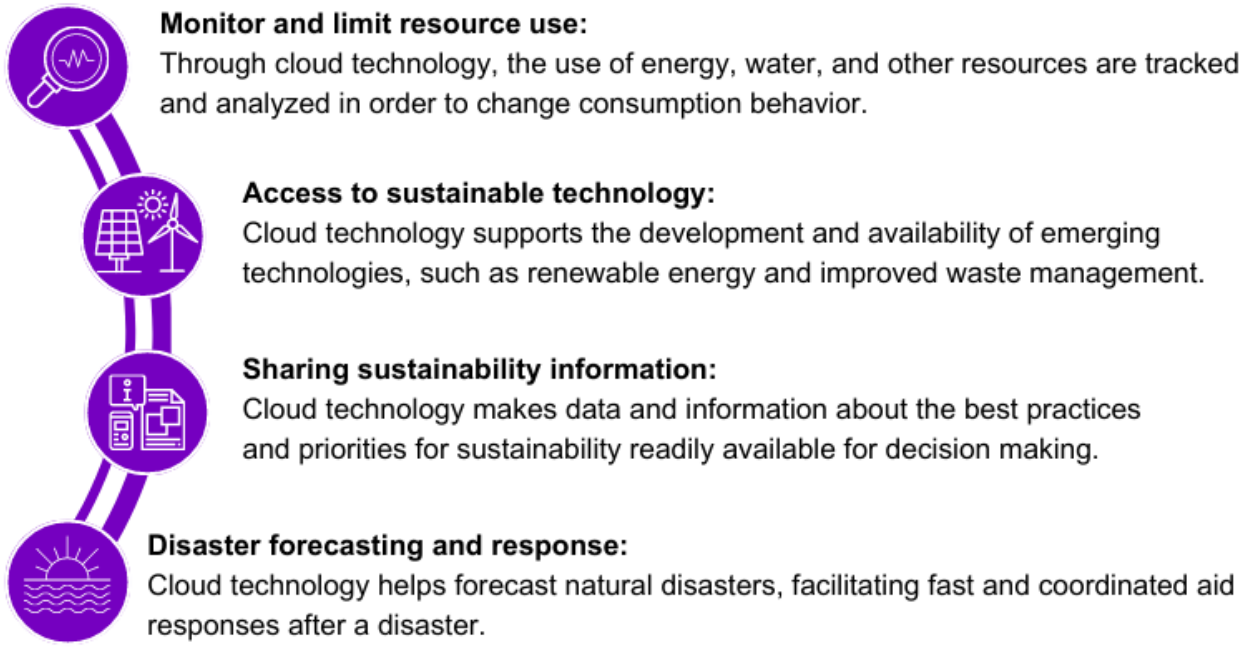
[85] AWS (2019), CreditVidya Extends the Loan Market to Millions of Financially Excluded Indians with AWS.
[86] CreditVidya (2023).
[87] Accenture (2020), The Green Behind the Cloud
[88] Accenture societal impact survey (2023), n = 66.
[89] Based on the number of cloud-enabled MSMEs currently supporting this outcome.



Source: Accenture societal impact survey (2023), n = 66.

The solutions supported by cloud-enabled MSMEs could help societies utilize technological advancements and help manage resource use. Some of the ways that MSMEs could support individuals and businesses to improve sustainability are shown in Figure 18.

Figure 18: How cloud-enabled MSMEs support humanity to manage environmental impact



Source: Accenture interviews and research.

82% of cloud-based MSMEs providing sustainability solutions identified AI (including generative AI) as the technology supported by cloud which is likely to be the most significant in creating societal impacts in 2030.[90,91]The case study below outlines how Canadian MSME, BrainBox AI, is using a cloud-based platform to run AI algorithms that help organizations meet their sustainability objectives in commercial office spaces by reducing their carbon footprint. This case study highlights benefits and potential applications of cloud-based analytics that support better environmental monitoring and data-driven urban planning (smart cities).

[90] Accenture societal impact survey (2023), n = 66.
[91] Other options included ML, NLP, quantum computing, metaverse, blockchain, edge computing, and satellite-based data and imagery.

BrainBox AI's cloud-based platform utilizes integrated AI algorithms to greatly reduce energy consumption and emissions in commercial buildings

BRAINBOX AI

Industry: Sustainability

Size: Medium (<250 employees)

Locations: Canada, United States, Europe, Middle East and Australia

BrainBox AI is a Canadian-based MSME launched in 2019 with the mission to make commercial buildings smarter, greener, and more efficient. In developed economies, commercial buildings are responsible for up to 30% of the energy consumed, stemming primarily from the day-to-day operations to heat and cool them. The typical behaviour of a commercial building is heavily influenced by reactive Heating, Ventilation, and Air Conditioning (HVAC) systems that result in operational inefficiencies and excess energy usage. By deploying an autonomous AI-driven solution that operates 24/7, commercial buildings are ushered into the pre-emptive maintenance of their HVAC systems, that reduces the energy required to run them by up to 25%.

BrainBox AI is currently operating in over 700 commercial and retail buildings, across 21 countries. By utilizing deep learning, cloud-based computing, as well as proprietary algorithms, BrainBox AI seamlessly integrates into a building's existing HVAC system, to predict the energy needs of a building without compromising tenant comfort.

BrainBox AI is able to do this by analyzing information from a multitude of internal and external data points, including historical building data, weather patterns, utility tariff structures, pollution levels and even sun position. With this data, BrainBox AI optimizes the energy consumed to both heat and cool the building thereby ensuring a stable modulated temperature with all of the aforementioned factors taken into account.

"Our AI tool predicts internal and external conditions to optimally manage a building's consumption of electricity. A cloud-based system is the only solution that provides the scale and flexibility our algorithm needs to process and learn from such large volumes of internal and external data as well as seamlessly integrate with building systems around the world."

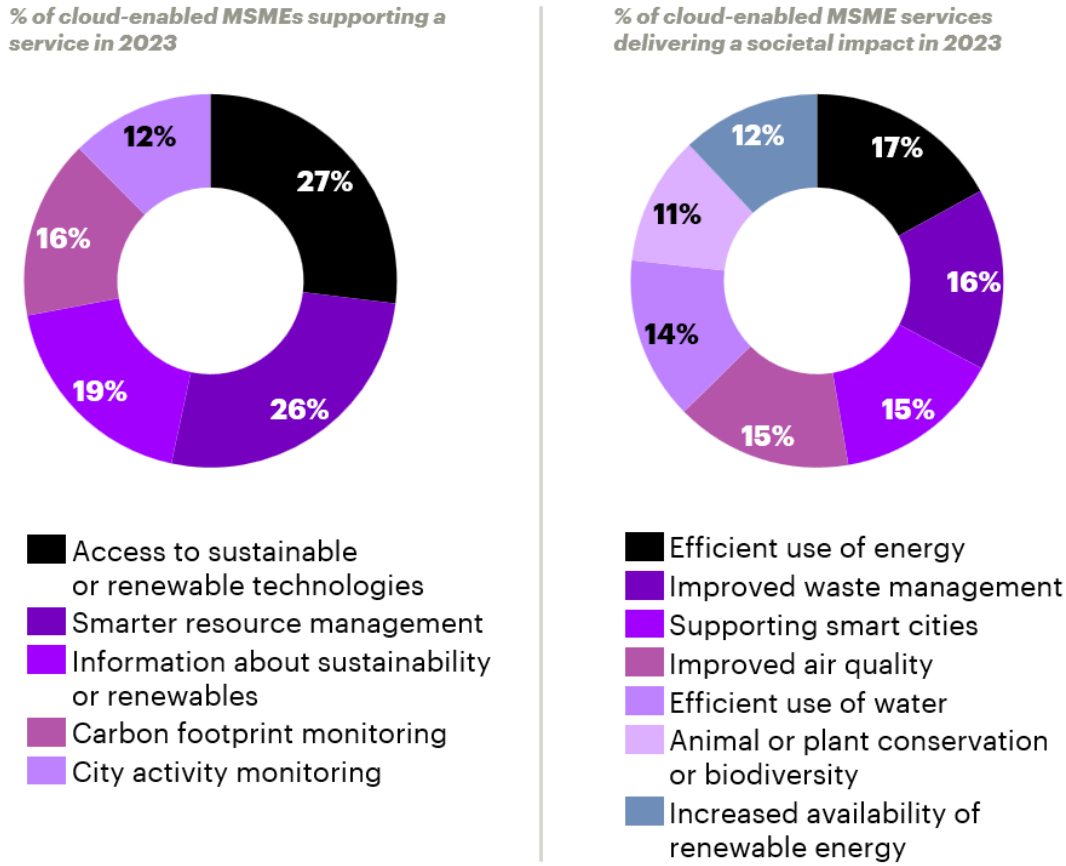
Jean-Simon Venne, Co-founder and CTO.

Cloud technology supplies the critical infrastructure that BrainBox AI needs as it collects large quantities of data and analyses it using artificial intelligence and deep learning methodologies. Cloud provides BrainBox AI with the ability to connect with buildings worldwide and to process the large volumes of data that they have collected and stored. With its support, BrainBox AI envisions an optimization of the energy grid that utilizes its AI technology to alleviate the current demand and strain that it is currently under, in favor of a more flexible grid that can produce electricity in line with the increased demand.

Source: Accenture interviews and research. BrainboxAI (2023), BrainBoxAI (2023) Unlocking energy efficiency in commercial buildings.

Cloud-based platforms and data analytics can help optimize energy consumption, identify renewable energy opportunities, and improve resource efficiency. MSMEs are already using cloud technology to offer a wide variety of services supporting sustainability practices, as shown in Figure 19. A data-driven approach to waste helps companies like the South Korea-based company Ecube Labs, which uses cloud-based data analytics to optimize garbage collection routes.[92] Working on the other side of society's waste problem is a Canadian MSME, Good Chemistry, that uses cloud-based AI and ML algorithms to help chemists accelerate materials innovations so that the physical goods produced can be made with more environmentally sustainable materials to begin with.[93]

Figure 19: Cloud-enabled MSME services and associated societal impacts in sustainability



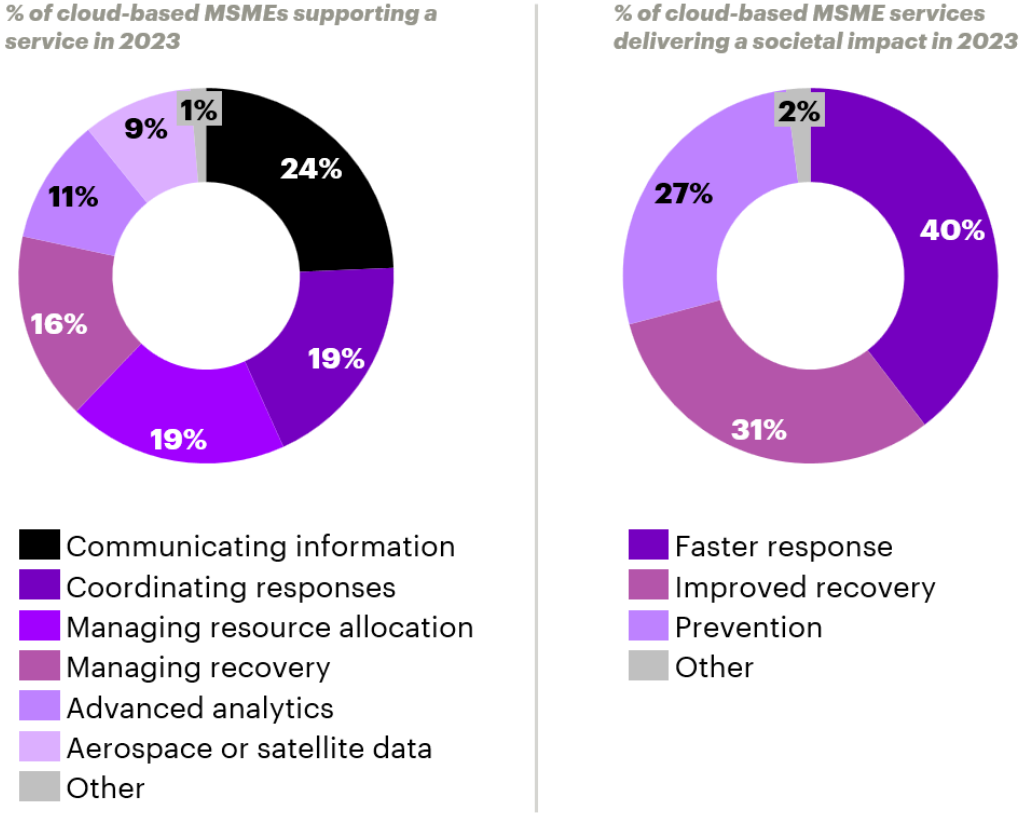
Source: Accenture societal impact survey (2023), n = 66. Respondents could select multiple answers.

Cloud-enabled MSMEs are also utilizing cloud-based communication and collaboration tools, data storage, and backup solutions to enhance disaster preparedness, response, and recovery efforts.[94,95,96] First Street Foundation, based in the US, is using cloud to make modeled climate risk information public, in addition to sharing data with researchers and policymakers.[97] Cloud technologies are then being used to detect damage for clean-up efforts, and cloud-enabled analytics provided by companies like Rekor in the US help find routes for responders and

[92] Ecube Labs, (2023).
[93] Good Chemistry (2023).
[94] WMO (2022), Artificial Intelligence for Disaster Risk Reduction: Opportunities, challenges, and prospects.
[95] ITU (2020), A safer, more resilient world: Reducing disaster risks with AI.
[96] PNNL (2021), Disaster Response and Mitigation in an AI World.
[97] First Street Foundation, (2023), First Street Foundation Climate Risk Publicly Available Data.

aid.[98,99] Figure 20 highlights the work cloud-enabled MSMEs are already doing to support disaster response and prevention.

Figure 20: Cloud-enabled MSME services and associated societal impacts in disaster prevention and response



Source: Accenture societal impact survey (2023), n = 24. Respondents could select multiple answers.

In a cloud-enabled economy, MSMEs are expected to play a key role in benefiting society by helping organizations meet their sustainability objectives, along with supporting disaster preparation or response. By 2030, cloud-enabled MSMEs are expected to help more than 20% of businesses work towards their sustainability goals.[100] MSMEs could also help to prepare for and respond quicker to disasters such as floods, fires, hurricanes, typhoons, or cyclones, along with helping recovery by facilitating communication between those affected and first responders, enabling autonomous vehicles and drones to reach isolated regions, analyzing affected areas through satellite imagery, and coordinating response teams on the ground.[101] Going forward, 40% of cloud-enabled MSMEs providing disaster support are expected to be helping individuals and organizations respond quicker to disaster events.[102,103]

[98] World Economic Forum (2020), Natural disasters are increasing in frequency and ferocity. Here's how AI can come to the rescue.
[99] Rekor, (2023).
[100] Accenture societal impact survey (2023), n = 66.
[101] Accenture societal impact survey (2023), n = 24.
[102] Accenture societal impact survey (2023), n = 24.
[103] Based on the services that cloud-enabled MSMEs are currently delivering.

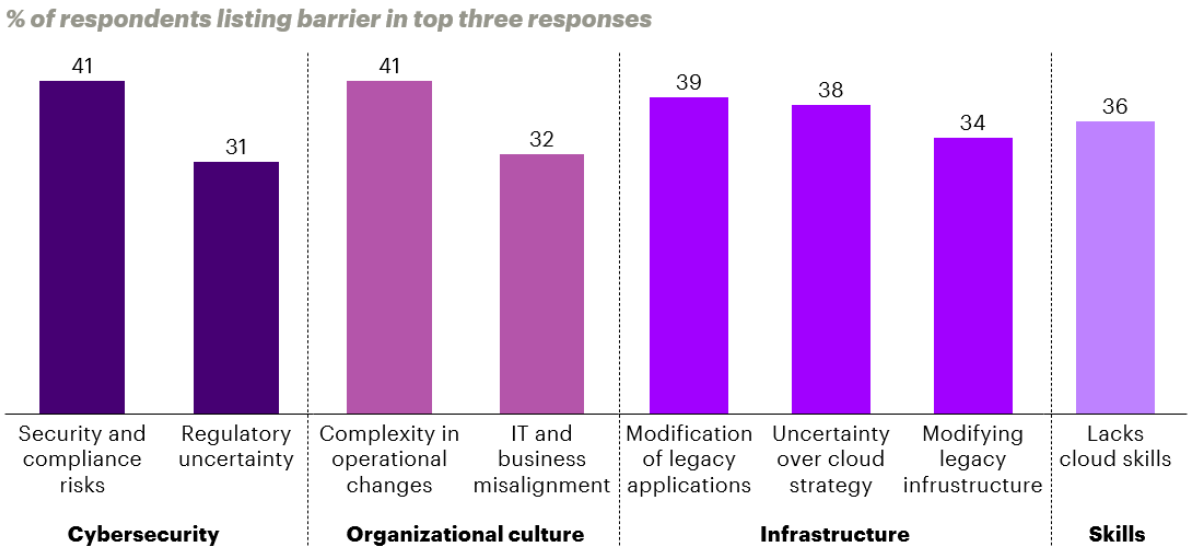
4 Achieving a cloud-enabled economy

The cloud-enabled economy offers significant potential in terms of both economic and societal impact. Coordinated action from industry and governments is required to unlock the opportunities of a cloud-enabled economy by 2030. This involves identifying the major barriers preventing MSMEs from increasing their utilization of cloud. MSMEs can then create clear cloud migration strategies that overcome these barriers at the firm-level. However, addressing these barriers at a structural level ultimately demands strong policy support from all levels of government. This chapter outlines the current barriers to cloud uptake, the steps MSMEs can take, and the policies that governments can introduce to increase cloud adoption.

4.1 Creating clear strategies to overcome firm-specific barriers to uptake

Strong growth in cloud adoption over the last decade has resulted in a boost of digital productivity, however there is still an opportunity for more MSMEs to capitalize further. To achieve this, MSMEs should focus on addressing the existing challenges in embracing cloud solutions. A recent survey by Accenture, revealed the four key persistent barriers to cloud adoption are cybersecurity, infrastructure (including software and hardware), organizational culture, and skills.[104]

Figure 21: Primary barriers to cloud uptake



Source: Accenture (2023). Survey responses from 2022, n = 800.

To address each of these complex challenges MSMEs should evaluate barriers at the firm level, to identify specific security, IT resources, organizational culture, and skills required to be successful. This will help MSMEs to develop holistic cloud solutions, optimized and scaled to improve performance, and reduce costs. Figure 22 provides an overview of the five key steps businesses can follow to achieve this, and how each of the four barriers are addressed along the process.

[104] Accenture (2023). The race to cloud: reaching the inflection point to long sought value.

Figure 22: Steps for MSMEs to adopt cloud

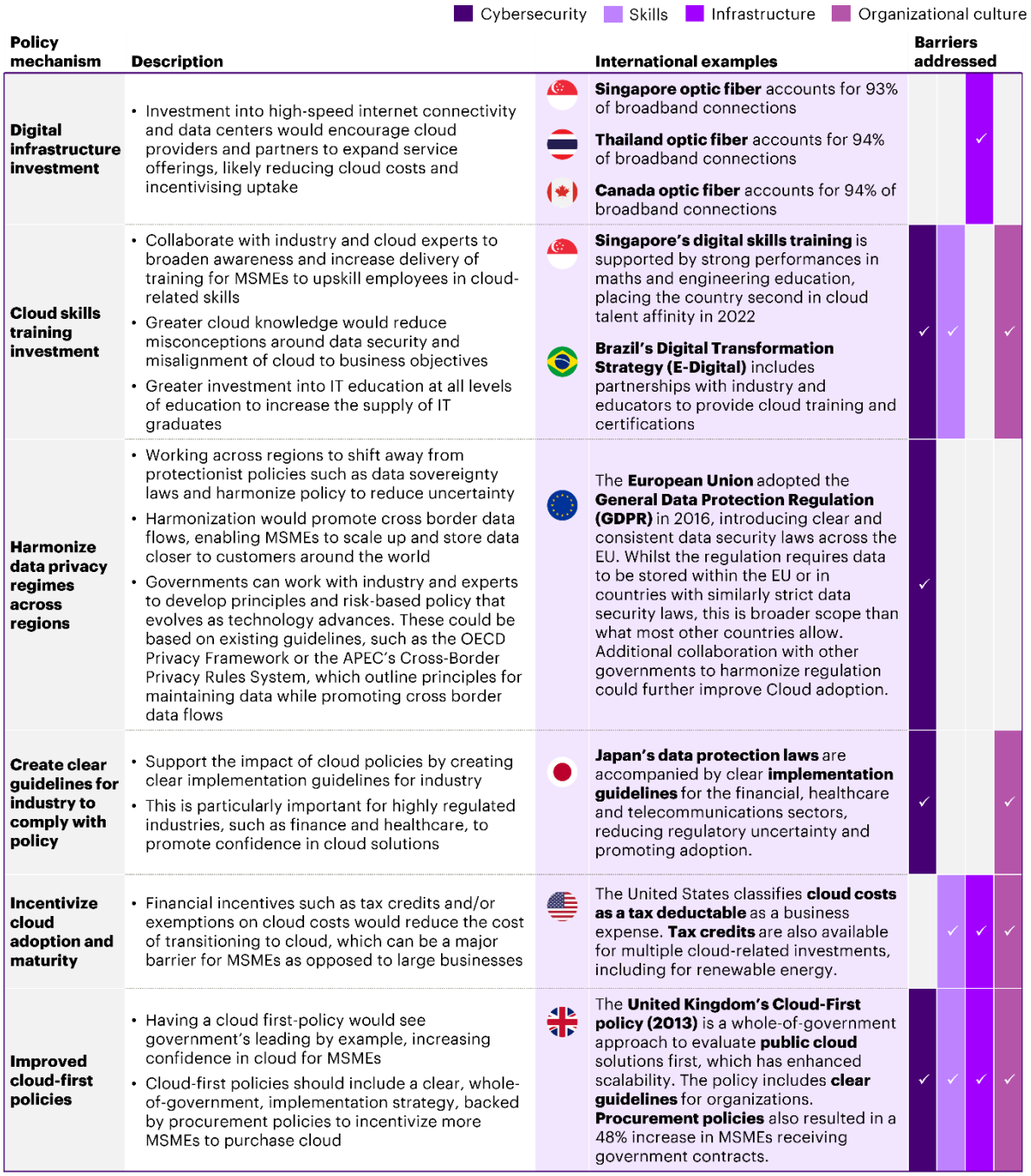
Steps	Description	Barriers addressed: Cybersecurity	Infrastructure	Skills	Organizational culture
1 Identify how cloud meet business needs	• Identify how cloud solutions can meet your goals • Identify a cloud partner that can help navigate the process • Examine case studies of how MSMEs have used cloud 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 cloud policies from governments and programs offered by industry to address firm-specific barriers and accelerate cloud maturity • This could include R&D tax credits from governments, or sponsorship programs for startups run by cloud providers such as AWS	✓	✓	✓	✓
3 Educate 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

As MSMEs act at the organizational level to increase their cloud adoption, strong government policy support is ultimately required to reduce these barriers to uptake at the country level. Policy support is particularly important for highly regulated social sectors such as finance and health, where the barriers to adoption can be much more prevalent. Having clear and practical guidelines to implement cloud in line with regulation is therefore particularly important for these industries to continue creating social impact. Addressing the structural barriers to adoption can be achieved through several mechanisms, including financial incentives and policy reforms. Figure 23 provides a brief overview of some policies that governments can consider to support MSMEs overcome barriers and increase their cloud adoption. Examples of global policy leaders also show how governments across the world have already introduced these policies to increase uptake.

Figure 23: Policy considerations for government to boost cloud adoption



Policy mechanism	Description	International examples	Barriers addressed
Digital infrastructure investment	• Investment into high-speed internet connectivity and data centers would encourage cloud providers and partners to expand service offerings, likely reducing cloud costs and incentivising uptake	**Singapore optic fiber** accounts for 93% of broadband connections **Thailand optic fiber** accounts for 94% of broadband connections **Canada optic fiber** accounts for 94% of broadband connections	Infrastructure
Cloud skills training investment	• Collaborate with industry and cloud experts to broaden awareness and increase delivery of training for MSMEs to upskill employees in cloud-related skills • Greater cloud knowledge would reduce misconceptions around data security and misalignment of cloud to business objectives • Greater investment into IT education at all levels of education to increase the supply of IT graduates	**Singapore's digital skills training** is supported by strong performances in maths and engineering education, placing the country second in cloud talent affinity in 2022 **Brazil's Digital Transformation Strategy (E-Digital)** includes partnerships with industry and educators to provide cloud training and certifications	Cybersecurity, Skills, Organizational culture
Harmonize data privacy regimes across regions	• Working across regions to shift away from protectionist policies such as data sovereignty laws and harmonize policy to reduce uncertainty • Harmonization would promote cross border data flows, enabling MSMEs to scale up and store data closer to customers around the world • Governments can work with industry and experts to develop principles and risk-based policy that evolves as technology advances. These could be based on existing guidelines, such as the OECD Privacy Framework or the APEC's Cross-Border Privacy Rules System, which outline principles for maintaining data while promoting cross border data flows	The **European Union** adopted the **General Data Protection Regulation (GDPR)** in 2016, introducing clear and consistent data security laws across the EU. Whilst the regulation requires data to be stored within the EU or in countries with similarly strict data security laws, this is broader scope than what most other countries allow. Additional collaboration with other governments to harmonize regulation could further improve Cloud adoption.	Cybersecurity
Create clear guidelines for industry to comply with policy	• Support the impact of cloud policies by creating clear implementation guidelines for industry • This is particularly important for highly regulated industries, such as finance and healthcare, to promote confidence in cloud solutions	**Japan's data protection laws** are accompanied by clear **implementation guidelines** for the financial, healthcare and telecommunications sectors, reducing regulatory uncertainty and promoting adoption.	Cybersecurity, Organizational culture
Incentivize cloud adoption and maturity	• Financial incentives such as tax credits and/or exemptions on cloud costs would reduce the cost of transitioning to cloud, which can be a major barrier for MSMEs as opposed to large businesses	The United States classifies **cloud costs as a tax deductable** as a business expense. **Tax credits** are also available for multiple cloud-related investments, including for renewable energy.	Skills, Infrastructure, Organizational culture
Improved cloud-first policies	• Having a cloud first-policy would see government's leading by example, increasing confidence in cloud for MSMEs • Cloud-first policies should include a clear, whole-of-government, implementation strategy, backed by procurement policies to incentivize more MSMEs to purchase cloud	The **United Kingdom's Cloud-First policy (2013)** is a whole-of-government approach to evaluate **public cloud** solutions first, which has enhanced scalability. The policy includes **clear guidelines** for organizations. **Procurement policies** also resulted in a 48% increase in MSMEs receiving government contracts.	Cybersecurity, Skills, Infrastructure, Organizational culture

Source: Gregory, M. A.,[105] Green, E.,[106] Lim, S.,[107] Statista,[108] Government of Canada,[109] Australian Government,[110] AlphaBeta,[111] MIT Technology Review,[112] Australian Government,[113], GDPR EU,[114] Delphix,[115] ATO,[116] Mcguire Sponsel,[117]Australian Government,[118] UK Government[119]

[105] Gregory, M. A. (2022), What's next for the National Broadband Network? Labor and the Coalition's plans compared.
[106] Green, E. (2022), Huge plan to fix Australia's NBN to be announced in Albanese's federal budget.
[107] Lim, S. (2019), The city of the future: What will a full-fiber broadband city look like.
[108] Statista (2021), Share of fiber optic internet connection in Thailand from the 3rd quarter of 2019 to the 2nd quarter of 2021.
[109] Government of Canada (2023), High-speed Internet for all Canadians.
[110] Australian Government (2013), The National Cloud Computing Strategy .
[111] AlphaBeta (2021), Unlocking APAC's Digital Potential: Changing Digital Skills Needs and Policy Approaches.
[112] MIT Technology Review (2022), Global Cloud Ecosystem Index 2022.
[113] Australian Government (2023), Rights and protections – Privacy.
[114] GDPR EU (n.d.), What is GDPR, the EU's new data protection law.
[115] Delphix (2020), The Japan Act on the Protection of Personal Information Explained.
[116] ATO (2022), Small Business Technology Investment Boost and Small Business Skills and Training Boost.
[117] Mcguire Sponsel (2020), Calculating cloud computing expenses.
[118] Australian Government (2021), Secure Cloud Strategy.
[119] UK Government (2022), Government Cloud First policy.

Appendix A: Economic modelling

A novel econometric model was used to estimate the economic contribution associated with MSMEs adopting cloud technology. Section A.1 of this Appendix describes the theoretical model underpinning the empirical model, before A.2 describes the data, specification of results of the econometric model.

A.1 Theorizing the economic impact of cloud

This section of Appendix A describes the firm-level decision to invest in cloud using a theoretical model of a firm. This model formulates the firm's decision to invest in cloud and how this investment impacts the firm's production process and profit levels. This conceptualization forms the basis for the empirical approach to estimating the aggregate economic impact described in Chapter 2. The framework presented in Section A.1 is underpinned by a mathematical model which has been excluded for brevity.

This model considers a market to produce a certain product or service where firms are free to enter and exit as required. To enter the market, however, potential firms must invest a certain level of capital to obtain the initial IT resources required to compete. Some of these resources, such as software and hardware, can be either provided internally at an upfront, fixed cost or, alternatively, can be outsourced to the cloud for an ongoing fee. The extent to which cloud can be adopted differs by firm, by industry, and by country. The other inputs to production are simplified as labor, capital, and other intermediate goods.[120] Intermediate goods refer to products or services used by firms in the production of other goods or services (also known as producer goods or semi-finished goods), such as cloud.

The more the firm chooses to utilize the cloud, the lower the initial investment required, but the higher the volume and cost of intermediate goods.[121] This condition implies that there is an optimal amount of investment in cloud which varies by firm. The decision to invest in cloud also impacts the firm's choice of labor, since cloud has the option to supplement as well as complement different tasks in the production process. Therefore, labor is described as two types of employment, those that are impacted by cloud and those that are not. The model also includes a parameter that considers the general efficiency improvement in firm operations resulting from the adoption of cloud. This efficiency parameter will also be firm, industry, and country specific.

Depending on the industry and country, each firm optimizes their adoption of cloud such that the firm's profit is maximized given the costs of the various inputs (capital, labor, other intermediate inputs, and cloud). For certain firms, the adoption of cloud will greatly improve the underlying production process, boosting profitability whereas others will see fewer benefits. In some instances, higher profit margins, combined with lower initial investment costs, will result in more firms entering the market. Cloud impacts firms differently depending on:

[120] This model uses a modified Cobb-Douglas function to summarize a firms production function. More information can be found in Appendix A.
[121] The model assumes that, in most cases, the cost of cloud as an intermediate good will be less than the cost of capital of developing the capability in-house.

- the importance of cloud in complementing cloud labor and substituting other types of non-cloud labor
- the substitutability of initial investment costs to the cloud
- the impact of cloud on general, firm-level productivity; and
- the importance of cloud as an intermediate good in the firm's production.

These impacts are simplified and generalized to make them applicable across firms, industries, and countries. The true impact of cloud may be more nuanced, although the value of this model comes from the simplicity in framing the firm-level decision to invest in cloud.

A.2 Econometric modelling

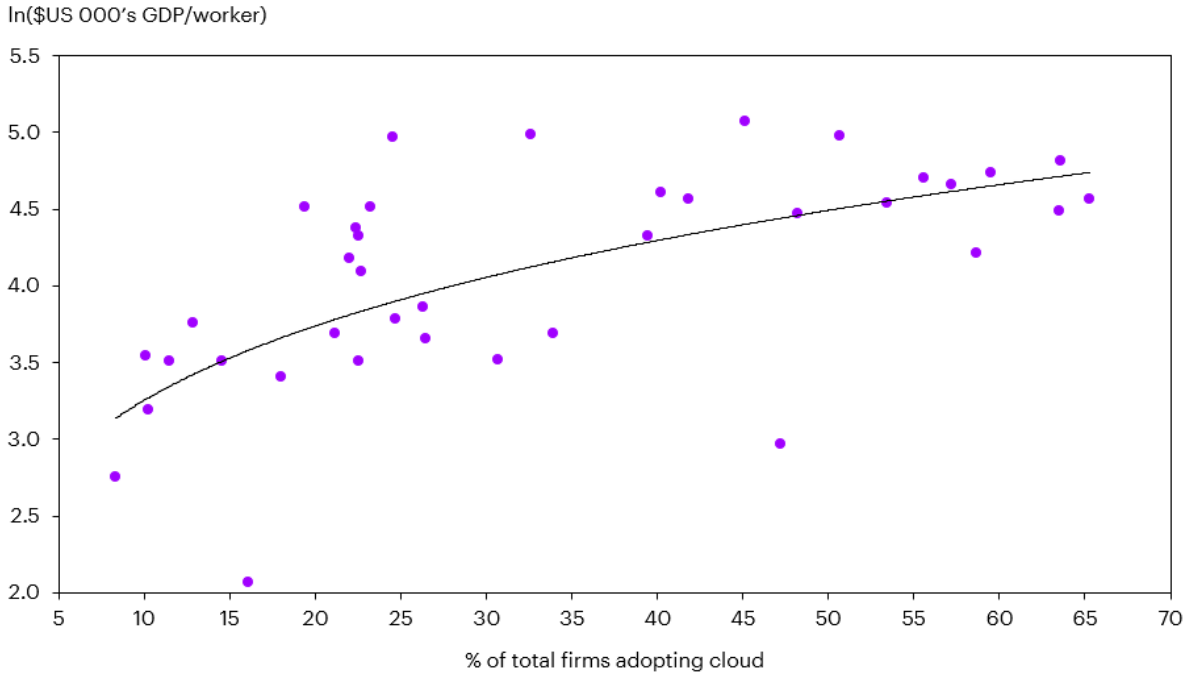
To estimate the macroeconomic impact of the firm-level decision to adopt cloud, an empirical model was developed based on publicly available datasets. These datasets include the World Bank and the Conference Board Total Economy Database, which details the gross domestic product (GDP) in USD, capital (*K*) and labor (*L*) stock by country and year.[122,123]

As the largest publicly available, time series dataset, the OECD ICT statistics were used to calculate the cloud adoption intensity of 32 countries by year.[124] Using the theoretical model outlined above, this model tested how changes in cloud corresponded to changing levels of GDP, controlling for the other primary factors of production (capital and labor).

Inspection of the data revealed that there is a non-linear relationship between cloud adoption and GDP/worker, whereby an increase in cloud adoption increases productivity at a diminishing rate (see curvature of line in Figure A.1). Diminishing returns are a common feature of technological innovation and reflect the fact that early adopters tend to be firms who have the most to gain from adopting cloud.

[122] The Conference Board (2022), Total Economy Database.
[123] World bank (2021), GDP (current US$).
[124] OECD (2022), ICT Access and Usage by Businesses.

Figure A.1: Relationship between productivity and cloud adoption by country, 2019



Note: Only 38 of the 190 observations are shown, since this chart only includes one year of data
Source: OECD, World Bank, The Conference Board

To capture this relationship, the model uses a non-linear, fixed effect regression model to estimate the increase in productivity by increasing cloud adoption, holding the ratio of capital to labor constant. The non-linear parameter (0.3) was selected as this provided the best fit of the data. Log transformations of the ratios of GDP and labor (GDP/E), and capital and labor (K/E) were adopted to improve the normality of distribution of these variables. Fixed effects (including controls for each country and year) were included to capture unobserved differences between countries and between years. The final specification is included below.

$$\ln(GDP/E_{i,t}) = \alpha_i + \gamma_t + \beta_0 \left(C_{i,t}\right)^{0.3} + \beta_1 \ln(K/E_{i,t}) + \epsilon_{i,t}$$

where:
C = % of firms adopting cloud
i = country, n=38 countries
t = year, n=2014-19
α_i = Country fixed effects
γ_t = Time fixed effects

The regression model calculated robust standard errors to obtain unbiased standard errors of under heteroscedasticity. Data from 2020 and 2021 was excluded from the regression based on unavailability of data, as well as to minimize the abnormality caused by the COVID-19 pandemic which saw a sharp increase in cloud adoption while a sharp decline in economic activity (lower GDP).

A.2.1 Results

Using these model specifications, we estimated a statistically significant positive relationship between cloud adoption and productivity at the 95% confidence level.

Table A.1: Model specifications and results

Variable	Coefficient
$C^{0.3}$	0.0225** (0.0099)
ln(K/E)	0.5930*** (0.0755)
Time fixed effects	Yes
Country fixed effects	Yes
Adjusted R-squared	0.9511
N	190

*** 1% significance level, ** 5% significance level, *10% significance level.
Standard errors in parentheses.

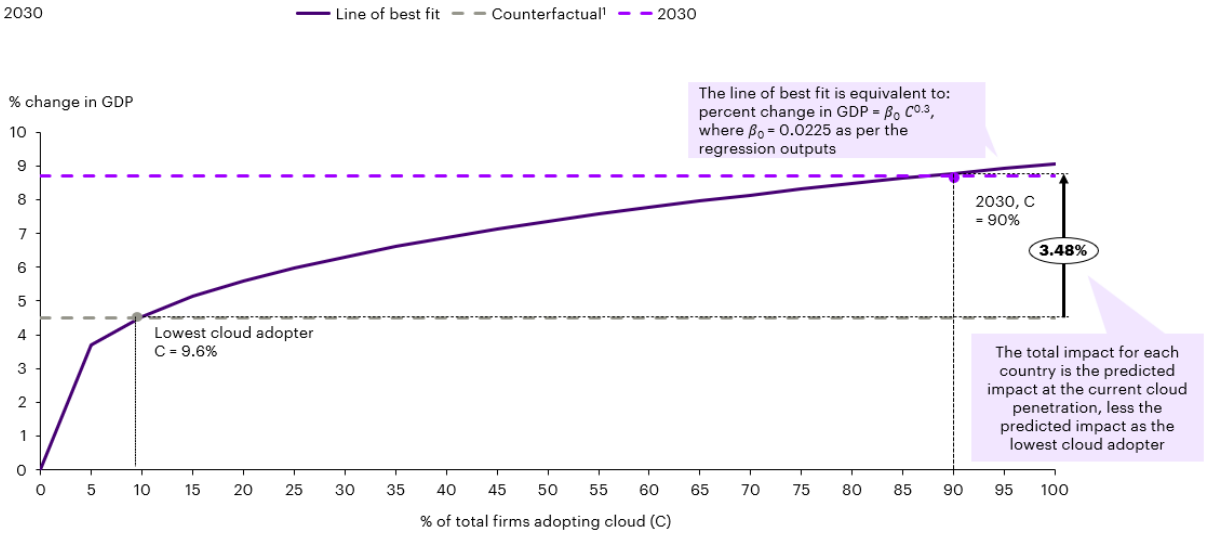
Based on this relationship, the productivity impact of cloud adoption was estimated across the 12 countries by comparing to a lower bound counterfactual. The counterfactual selected was the lowest available cloud adoption rate in the OECD data in 2019 (9.8%). The reason for doing this is twofold:

1. In 2021 (base year for the model), it is unlikely that any country has 0% cloud adoption, making it a reasonably unrealistic counterfactual.
2. Econometric models are not good at extrapolating findings beyond the upper and lower data range for which there is no data to base the estimation.

To then estimate the impact in a cloud-enabled economy, the upper bound was selected to determine what the impact of cloud be under a scenario of full adoption, based on conservative assumption. The upper bound was based on a literature review of publications which forecast a basic level of cloud adoption for approximately 90% of all businesses by 2030.[125,126] Several countries have experienced similar growths in their cloud adoption over a similar timeframe. For example, Australia and Canada have seen a 52.7 and 43.4 percentage point rise in cloud adoption over the last seven years.[127] With broadband adoption forecasted to grow significantly in India (almost four times growth from 2022 to 2030) and Indonesia (about six times growth from 2022 to 2030).[128]

[125] David Smith and Dennis Smith (2022), "The future of cloud computing in 2027: From technology to business innovation".
[126] Laurence Goasduff (2021), "Gartner says cloud will be the centerpiece of new digital experience".
[127] OECD (2022), ICT Access and Usage by Businesses.
[128] Ray Le Maistre (2022), India to be second-largest fibre broadband market by 2030: Point Topic.

Figure A.2: Estimating the total impact of cloud



Source: Accenture analysis, OECD

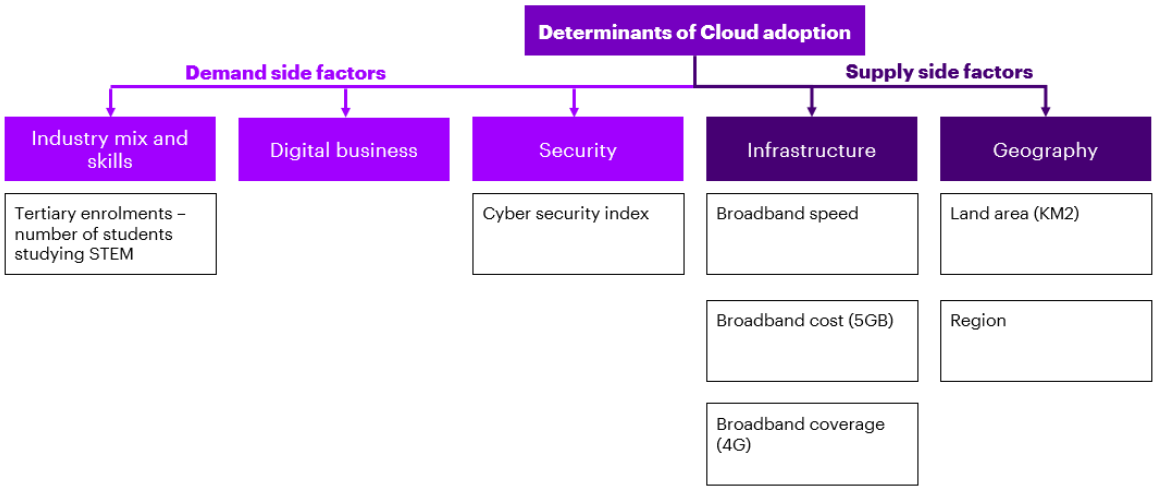
To estimate the proportion of this impact attributable to MSMEs adopting cloud, we weighted each countries total impact by the percentage of Gross Value Added (GVA) attributable to MSMEs compared to total firms. Similarly, results at the industry level were estimated by the industry contribution to GVA at the country level.[129]

A.2.2 Imputation of missing cloud data

The OECD database has the most comprehensive data covering current and historic adoption of cloud. However, some of the focus countries are not included in the OECD dataset, namely Brazil, India, Indonesia, and Singapore. To estimate the economic impact of cloud in these economies, cloud adoption rates were imputed based on known datapoints that are correlated with cloud adoption. Imputation was conducted using an econometric equation that ultimately estimated cloud adoption in a country, based on other observable datapoints. To determine the factors that lead to cloud adoption, a framework of supply and demand side factors affecting cloud adoption was established (see Figure A.3).

[129] Where the contribution to GVA was not availiable, industry government spending as a % of GVA was used.

Figure A.3: Cloud adoption determination framework



Note: Framework is not exhaustive.
Source: Accenture

The final list of variables, their sources and definitions are included in Table A.2.

Table A.3: Table of data used in imputation

Variable	Definition	Source
4G coverage	Percent of population covered by 4G networks	GSMA Intelligence
Tertiary enrolment	Percentage of population enrolling in tertiary education	UNDP/UNESCO
Cyber score	ITU Global cyber security index score	ITU
5G price	Cost of 5GB data (% of monthly GDP/Capita)	Tarifica
Download speed	Average download speeds for Mobile broadband	Ookla
Area (KM^2)	Land area in square kilometers	World Bank

Source: GSMA Intelligence, World Bank.

Using this data, the regression is performed on the known values of cloud using the below specification. $X_{i,t}$ represents the control variables denoted with subscripts, to reflect that these variables change by country (i) and time (t). Only *Area (KM^2)* does not change over time so does not have a (t) subscript (and is included separately to other controls in the equation). To account for potentially unobserved effects by time and geographic region, the model includes region (γ_r) and time (α_t) fixed effects. Country fixed effects are not included as country fixed effects absorb the explanatory power of the other control variables.

$$Cloud\ adoption\ (\%)_{i,t} = \beta_0 + \beta X_{i,t} + \beta_2 Area_i + \alpha_t + \gamma_r + e$$

The results of the regression are included below in Table A.3.

Table A.4: Regression outputs – cloud adoption imputation

Variable	Coefficients
Intercept	-4.8*** (0.70)
4G coverage	0.01 (0.01)
Tertiary enrolment	0.01* (0.00)
Cyber score	0.01** (0.00)
5G price	0.03*** (0.00)
Download speed	0.01*** (0.00)
Log (Area^2)	0.02 (0.03)
Time fixed effects	Yes
Regional fixed effects	Yes
Country fixed effects	No
R-squared	0.53
N	268

*** 1% significance level, ** 5% significance level, * 10% significance level.
Standard errors in parentheses.

A.3 Cloud-enabled MSME employment estimates

This research estimates the number of employees working in MSMEs that are expected to use cloud in a cloud-enabled economy by 2030. This exercise involved extrapolating World Bank country-level employment forecasts outwards to 2030, based on existing projections and then multiplying by a cloud-enabled MSME employment ratio. Table A.4 outlines the data and sources used for this calculation.

Table A.5: Employment estimates

	Employment forecasts	Industry share	MSME share
Description	The World bank produces forecasts for employment to 2024. For years beyond, the 10-year average compounding growth rate was used bring the rates forward to 2030.	The share of GDP attributable to each industry. This was used to estimate the distribution of employment since industry level employment was not available.	The share of GDP attributable to MSMEs as opposed to large businesses. This was used to estimate the share of employment attributable MSMEs since employment was not available by business size.
Source	World Bank	OECD, World Bank, Statista, NZ Government, Global Economy	OECD

Sources included in table.

Appendix B: Survey and consultation

B.1 External panel survey

B.1.1 Sampling

In May and June 2023, a global cloud survey was fielded by the provider Dynata to better understand business leaders' perspectives on the societal impacts of cloud by 2030. The survey involved paneling a random sample of 562 executives/technology officers from MSMEs across the 12 in-focus countries (Australia, Brazil, Canada, France, India, Indonesia, Japan, South Korea, New Zealand, Singapore and the United Kingdom) and the five sectors being considered (Finance, Education, Healthcare, Agriculture and Sustainability). Data was collected through detailed online surveys conducted between May and June 2023.

Table B.1: Sample sizes by industry

Sector	Sample
Finance	188
Education	186
Healthcare	171
Agriculture	105
Sustainability	66

Source: Accenture societal impact survey

Table B.2: Summary of survey questions

Section	Purpose	Types of questions
Screening questions	Identify businesses that are relevant to this study and gain high-level statistics about the types of businesses using cloud	• Country • Industry • Employee count
Cloud questions	Generate insights about how cloud is used currently and how it may be used to create societal impacts into the future	• Use of technologies supported by cloud • Benefits of cloud for the business • Technologies supported by cloud likely to create the most societal impacts in 2030
Societal impact questions	Identify the types of products and services provided to a particular industry and learn about how those services create societal impacts	• Types of customers in an industry • Products and services provided to an industry • Societal impacts created in an industry • Potential industry wide Cloud usage in 2030
Projected growth	Quantify the number of customers currently reached and the medium-term customer growth rate	• Customers in an industry • Expected customer growth rate in an industry

Source: Accenture

B.2 Consultations

In addition to survey analysis, this report (and accompanying country reports) features a series of case studies to provide qualitative insights into the use and societal impact of cloud among MSMEs. These case studies provide real, firm-level examples of cloud to substantiate the research and modelling. These conversations took place with 12 AWS customers from across the focus countries and industries.

B.2.1 Sampling

Similar to the survey, the candidates for case study interviews were selected from within the AWS customer network. Each candidate was nominated by AWS client leads from the respective regions and then reviewed by the Accenture project team for their suitability to the scope of research. A full list of MSME consultees is included below in Table B.2.

Table B.2: Summary of consultation participants

	Company	Country (HQ)	Industry
1	Areete	India	Agriculture
2	Akrivia Health	United Kingdom	Healthcare
3	atama plus	Japan	Education
4	BrainBox AI	Canada	Sustainability
5	EcubeLabs	Korea	Sustainability
6	Education Perfect	New Zealand	Education
7	eFishery	Indonesia	Agriculture
8	Osara Health (formerly Cancer Aid)	Australia	Healthcare
9	Serious Games Asia	Singapore	Education
10	Sub-K	India	Finance
11	Telescope Health	United States	Healthcare
12	Tetsuyu Health	Singapore	Healthcare
13	Trust Science	Canada	Finance
14	Wakke Class	Brazil	Education

Source: Accenture

B.2.2 Method

Each consultation was hosted by the Accenture project team and ran for between 45 minutes to an hour with a senior leader within each MSME. An AWS client representative was present for each consultation, although these representatives did not ask questions. Clients were invited to speak candidly and were not asked about their relationship with AWS, the products or services they purchased, or any other type of question that might be perceived as favorable to AWS. Consultees were also reminded that they did not need to answer any questions they did not wish to. A summary of the types of questions asked to consultees is included below in Table B.3.

Table B.3 Summary of consultation questions

Section	Purpose	Types of questions
Screening questions	Identify businesses that are relevant to this study and gain high-level statistics about the types of businesses using cloud	• Country • Industry • Employee count
Cloud questions	Obtain detailed information about how cloud is used currently and how it may be used to create societal impacts into the future	• Use of technologies supported by cloud • Benefits of cloud for the business
Societal impact questions	Produce nuanced examples about the products or services provided to a particular industry, and illustrate how those services create societal impacts	• Types of customers in an industry • Products and services provided to an industry • Societal impacts created in an industry
Quantitative questions	Quantify the reach of businesses and the scale of societal impacts created	• Customers in an industry • Customers receiving particular societal impacts

Source: Accenture

Appendix C: Market sizing estimates

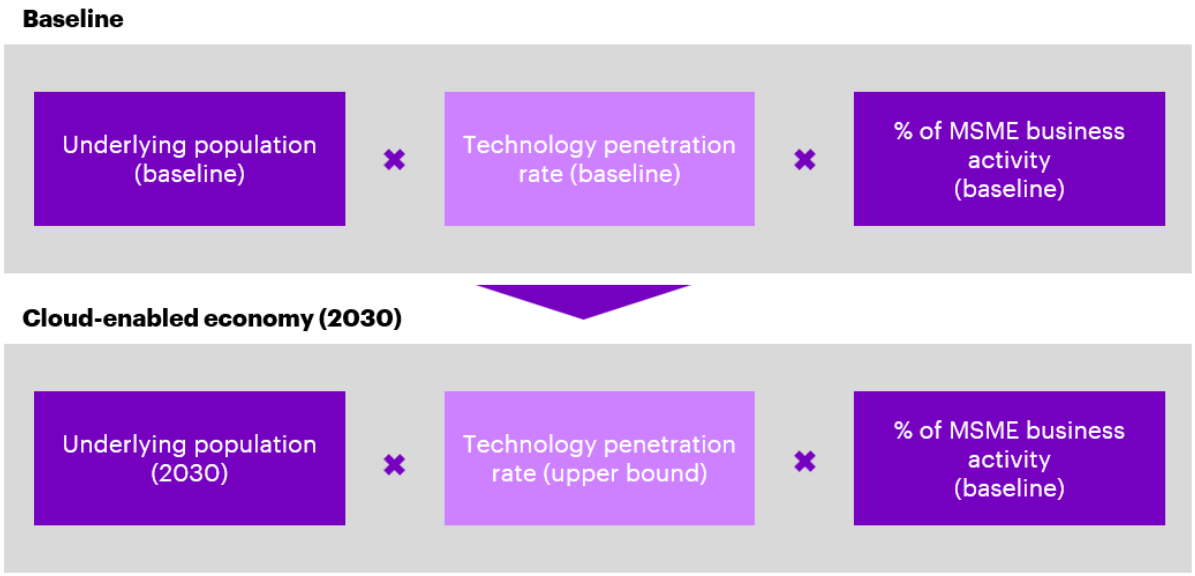
This Appendix outlines the method and sources for developing the market sizing estimates used in Chapter 3. These estimates use a range of data sources combined to quantify the reach and impact of cloud on a particular social outcome under a cloud-enabled economy in 2030.

C.1 Method

The market sizing of different outcomes follows a consistent calculation approach shown in Figure C.1. Each estimate involves estimating a baseline (2023) consisting of an underlying population (i.e. patients, students, farms), a cloud technology penetration rate (i.e. the proportion of the population using the relevant technology supported by cloud) and the share of the technology that can be attributed to MSMEs (the share of MSME activity).

Forecasting the future of these outcomes is precarious due to the rapidly changing technology landscape which they operate in. Instead of forecasting what the future looks like for specific technologies, this method assumes that the technology of the future already exists, but it is unevenly distributed between countries. Therefore, the cloud-enabled economy estimates involve updating baseline populations and adjusting the technology penetration rate to the level of the current market leader. This is shown in Figure C.1.

Figure C.1 Method for estimating industry-level societal outcomes



Source: Accenture

The remainder of this Appendix outlines the specific metrics and sources used to reach the main market sizing estimates.

C.1.1 Use of cloud for telehealth

To size the impact of the services that MSMEs are expected to provide to the healthcare industry under a cloud-enabled economy, the methodology determines the number of teleconsultations that are likely to be supported by MSME cloud services in 2030, as shown in Table C.1.

Table C.1 Estimated 2030 usage of telehealth from MSMEs

Estimation	Metric	Source
The number of teleconsultations in 2030 likely to be supported by MSMEs using cloud	The number of teleconsultations per person in 2020	The OECD, the World Bank, company information, and other research.[130,131,132,133,134,135,136,137,138,139,140,141,142,143,144]
	Projected population in 2030	The World Bank forecasts.[145]
	Proportion of teleconsultations expected to use cloud, based on the highest values from 2020	Government affiliated and other organizations, and academic articles. [146,147,148,149,150,151,152]
	Proportion of cloud services expected to be from MSMEs	The OECD share of GDP from MSMEs. [153]

Source: Included in table

[130] OECD (2023), The COVID-19 Pandemic and the Future of Telemedicine.
[131] Saúde Digital Brasil (2023), Research shows that 33% of the country's doctors performed teleconsultations in 2022.
[132] World Bank (2020), Physicians (per 1,000 people).
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[135] OECD (2021), Health Care Utilization.
[136] Agustina et al. (2019), Universal health coverage in Indonesia: concept, progress, and challenges.
[137] World Bank (2020), Indonesia High-frequency Monitoring of Covid-19 Impacts, Round 4.
[138] Practo (2020), How India accessed healthcare in the last three months.
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[141] Atmore & Stokes (2020), Turning on a dime-pre- and post-COVID-19 consultation patterns in an urban general practice.
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[143] RCGP (2021), The future role of remote consultations & patient 'triage'.
[144] ASPE (2021), Medicare Beneficiaries' Use of Telehealth in 2020: Trends by Beneficiary Characteristics and Location.
[145] World Bank (2022), Population estimates and projections.
[146] The University of Queensland Centre for Online Health (2022), Telehealth and coronavirus: Medicare Benefits Schedule (MBS) activity in Australia.
[147] VisionFlex (2021), To telehealth via video, or not to telehealth via video, that is the question.
[148] Canada Health Infoway (2021), 2021 National Survey of Canadian Physicians.
[149] Sakakibara et al. (2022), Emergency Visits and Hospitalization After Chat Message, Voice Call, or Video Call for Telehealth in Obstetrics and Gynecology Using Telehealth Service User Data in Japan: Cross-sectional Study.
[150] Kim et al. (2022), Experience With and Awareness of Telemedicine Among Korean Outpatients During the COVID-19 Pandemic.
[151] Rodriguez & Betancourt (2021), Differences in the Use of Telephone and Video Telemedicine Visits During the COVID-19 Pandemic.
[152]Sachs et al. (2021), Disparities in telephone and video telehealth engagement during the COVID-19 pandemic.
[153] OECD (2020), SDBS Structural Business Statistics (ISIC Rev. 4).

C.1.2 Use of cloud for online learning

To size the impact of the services that MSMEs are expected to provide to the education industry under a cloud-enabled economy, the methodology determines the amount of school students and adults that are likely to engage in online learning using MSME cloud services in 2030, as shown in Table C.2.

Table C.2 Estimated 2030 usage of online learning from MSMEs

Estimation	Metric	Source
The number of school students in 2030 likely to engage in online learning supported by MSMEs using cloud	Expected number of students in 2030	The World Bank forecasts.[154,155,156]
	Proportion of students expected to use learning apps or websites regularly in 2030, based on the highest values out of the 12 countries in 2020	The OECD, the World Bank, company information, along with government affiliated and other organizations.[157,158,159,160,161,162,163,164,165,166,167,168,169]
	Proportion of cloud services expected to be from MSMEs	The OECD.[170]
The number of adults in 2030 likely to be engage in online learning supported by MSMEs using cloud	Expected number of adults in 2030	The World Bank forecasts.[171]
	Proportion of adults expected to engage in online courses in 2030, based on the highest values out of the 12 countries in 2020	The OECD and government affiliated national statistics.[172,173]
	Proportion of cloud services expected to be from MSMEs	The OECD share of GDP from MSMEs.[174]

Source: Included in table

[154] World Bank (2022), Primary education, pupils.
[155] World Bank (2022), Secondary education, pupils.
[156] World Bank (2022), Population estimates and projections.
[157] OECD (2021), 21st-Century Readers: Developing Literacy Skills in a Digital World, Table B.6.14.
[158] Statistics Canada (2021), Selected online activities by gender, age group and highest certificate, diploma or degree completed.
[159] Udemy (2020), Online Education Steps Up: What the world is learning (from home).
[160] Cluey (2021), 2021 Annual Report.

C.1.3 Use of cloud for precision agriculture in farms

To size the impact of the services that MSMEs are expected to provide to the agricultural industry under a cloud-enabled economy, the methodology determines the number of farms that are likely to used precision agriculture technologies from MSMEs, as shown in Table C.3.

Table C.3 Estimated 2030 usage of precision agriculture from MSMEs

Estimation	Metric	Source
The number of farms in 2030 likely to use precision agriculture technology supported by MSMEs	Expected number of farms in 2030	The FAO and government affiliated national statistics.[175,176,177,178,179]
	Proportion of farms likely to use precision agriculture, based on the highest global values currently	The OECD[180]
	Proportion of cloud services expected to be from MSMEs	The OECD share of GDP from MSMEs.[181]

Source: Included in table

[161] Folha De S.Paulo (2021), Education startups innovate in public schools and peripheries.
[162] OECD (2020), The potential of online learning for adults: Early lessons from the COVID-19 crisis
[163] World Bank (2020), EdTech in Indonesia- Ready for Take-Off?
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[167] Business Wire (2020), EdTech Leader, Mathpresso Announces 7 Million Monthly Active Users in over 50 Countries.
[168] World Bank (2020), Indonesia High-frequency Monitoring of Covid-19 Impacts, Round 4.
[169] UNICEF (2020), Rapid Assessment of Learning During School Closures in the Context of Covid
[170] OECD (2020), SDBS Structural Business Statistics (ISIC Rev. 4).
[171] World Bank (2022), Population estimates and projections.
[172] OECD (2021), ICT Access and Usage by Households and Individuals.
[173] ABS (2022), Work-Related Training and Adult Learning, Australia.
[174] OECD (2020), SDBS Structural Business Statistics (ISIC Rev. 4).
[175] FAOSTAT (2023), Structural Data from agricultural censuses.
[176] Censo Agro 2017 (2017), Establishments.
[177] Eurostat (2020), Farms and farmland in the European Union – statistics.
[178] Singstat (2021), Agriculture, Animal Production and Fisheries, Licensed Local Food Farms.
[179] UK Government (2020), Agriculture in the United Kingdom 2020.
[180] OECD (2022), The digitalisation of agriculture: A literature review and emerging policy issues.
[181] OECD (2020), SDBS Structural Business Statistics (ISIC Rev. 4).

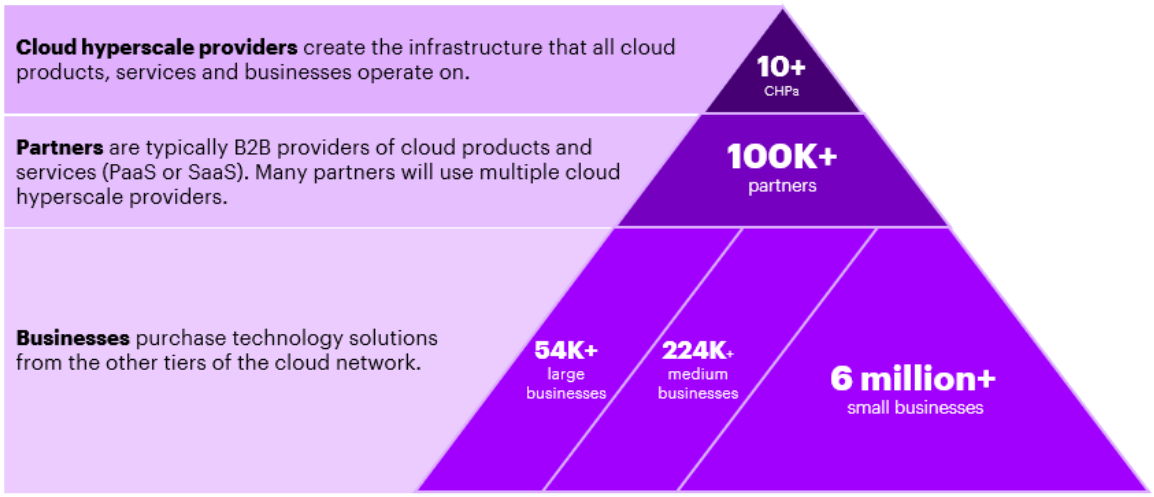
Appendix D: Supplementary materials

D.1: The cloud network

As a result of this growth, a large and growing network of interconnected businesses, ranging from startups to large multinationals, has gradually developed around cloud, with participants sharing cloud as the common foundation underpinning their operations (see Figure D.1). Global cloud providers deliver the IT resources that unlocks a network of at least six million business globally, 98% of which are MSMEs.[182] This has helped enable new business models, supporting MSMEs to access global markets, increase their revenue, cost efficiency, and productivity, and deliver greater impact across the community.

Figure D.1: Scale of the cloud network

Number of firms, EU, UK and US and Brazil, 2021



Note: Number of firms globally is much larger, although data is not readily available.
Source: Statista, AWS, OECD, The Census Bureau, Accenture analysis

[182] Amazon Web Services (AWS), Microsoft Azure, Google Cloud, Alibaba, and IBM are the top 5 CSPs, holding 74% of the market share combined

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