

2023 Global Cloud Ecosystem



Preface

The “2023 Global Cloud Ecosystem” is an MIT Technology Review Insights report sponsored by Infosys. The report was created through in-depth secondary research and analysis, data from an MIT Technology Review Insights survey of 400 executives, and interviews with global experts on the global cloud economy. The report was written by Ross O’Brien, the editor was Michelle Brosnahan, and Nico Crepaldi was the producer. The research is editorially independent, and the views expressed are those of MIT Technology Review Insights.

We would like to thank the following individuals for providing their time and insights:

Anant Adya, Executive Vice President and Service Offering Head, Infosys

Mac Esmilla, Global CISO, World Vision

Giusella Finocchiaro, Chairperson of the Electronic Commerce Working Group, United Nations Commission on International Trade Law

Katherine McDermott, Executive Director of Digital Services, Service NSW

Daniela Proust, Senior Vice President and Head of Global Learning and Growth, Siemens

Raj Savoor, Vice President of Network Analytics and Automation, AT&T Labs

Miao Song, Global CIO, GLP

Sue-Lin Tin, Head of Technology, Pacific and Singapore, CBRE

About the survey

The survey that is the basis of this report was conducted by MIT Technology Review Insights during June 2023. All 400 respondents are executives in large organizations, including chief technology officers, chief information officers, chief data officers, vice presidents of data, vice presidents of technology, vice presidents of engineering, and director-level executives.

Geographically, the survey drew from four regions: North America, Europe, Asia Pacific, and Australia and New Zealand. Responses were distributed evenly among the four regions.

About one-third (32%) of the companies surveyed have revenue between \$10 billion and \$50 billion. Another third (32%) have revenue between \$1 billion and \$10 billion. Companies with revenue between \$500 million and \$1 billion make

up about one-quarter (23%) of respondents. Companies with revenue of more than \$50 billion make up 14% of respondents.

The industry sectors represented include advanced technology, IT and telecommunications, manufacturing, consumer goods and retail, health care, financial services, energy, travel, education, and professional services.

CONTENTS

01 Executive summary	4
02 The cloud is pervasive and essential	5
03 The business value of cloud computing	7
The cloud as a talent enabler	8
04 Data privacy, sovereignty, and governance	9
05 Cybersecurity is always a priority	10
06 Emerging cloud capabilities	12
5G depends on cloud.....	13
07 Toward a cloud-powered innovation economy	15
In Kuala Lumpur, cloud opportunities abound	16
08 North America: Building better in the cloud	17
09 Europe: The gold standard for responsible, sustainable cloud development	18
10 Asia: A rising cloud lifts all economies	19
11 Australia and New Zealand: The cloud as an innovation catalyst	20

01

Executive
summary

The cloud, fundamentally a tool for cost and resource efficiency, has long enabled companies and countries to organize around digital-first principles. It is an established capability that improves the bottom line for enterprises. However, maturity is lagging, and global standards are sorely needed.

Cloud capabilities play a crucial role in accelerating the global economy's next stage of digital transformation. Results from our 2023 Global Cloud Ecosystem survey of executives indicate there are two stages of cloud maturity globally: one where firms adopt cloud to achieve essential opex and capex cost reduction, and a second where firms link cloud investments to a positive business value. Respondents indicate the two are converging quickly.

The key findings are as follows:

- **Cloud helps the top and bottom line globally.**

Global technology market analyst firm Canalys estimates global cloud infrastructure services spending rose by 29% in 2022 to \$65.8 billion, and it expects the market to grow by 23% in 2023. More than eight out of 10 survey respondents report more cost efficiency due to cloud deployments. While establishing a link between cloud capabilities and top-line profitability is challenging, 82% say they are currently tracking cloud ROI, and 66% report positive ROI from cloud investments.

- **Cloud-centric organizations expect strong data governance (but don't always get it).**

Strong data privacy protection and governance is essential to accelerate cloud adoption. Perceptions of national data sovereignty and privacy frameworks vary, underscoring the lack of global standards. Most respondents decline to say their countries are leaders in the space, but more than two-thirds say they keep pace.

- **All in for zero-trust.** Some 86% of the survey respondents use zero-trust architecture. Primarily a public and hybrid cloud model that removes most instances of trust by default, zero trust has become a standard for cloud and AI. Cloud and AI draw from a broad data surface and generate rapid change, which presents new risks. Cloud, a requirement for growing AI and automation, also offers the breadth to identify and classify cloud assets with data cataloging, fast access, and visibility. This ensures asset risks are understood and prioritized. However, one-third of respondents do not routinely identify and classify cloud assets.

- **Sustainability in the cloud.** The cloud's primary function – scaling up computing resources – is a key enabler that mitigates compliance issues such as security; privacy; and environmental, social, and governance (ESG). More than half (54%) of respondents say they use cloud tools for ESG reporting and compliance, and a large number (51%) use cloud to enhance diversity, equity, and inclusion (DEI) compliance.

02

The cloud is pervasive and essential



MIT Technology Review Insights' 2023 Global Cloud Ecosystem survey shows the cloud is pervasive in digitally capable organizations, and continues to create value. Eight out of 10 respondents say cloud investments help trim costs and accelerate innovation (see Figure 1).

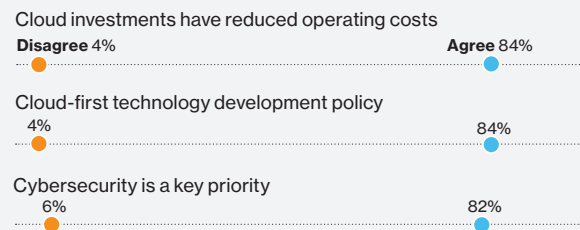
The cloud has become the dominant platform for IT deployment globally, increasingly in an uncertain economy. Global technology market analyst firm Canalis estimates global cloud infrastructure services spending rose by 29% in 2022 to \$65.8 billion. It expects the market to grow by 23% in 2023.¹ Global technology decision-makers see cloud as essential to ongoing digital transformation. Most respondents (82%) track the profitability of cloud investments (see Figure 2), and two-thirds report seeing positive return on cloud investments. Moreover, nearly 80% also believe the cloud has accelerated innovation in their organizations.

Regulators and government bodies continue to work on policy structures and cybersecurity frameworks required to cultivate critical cloud resources. While there is notable progress, respondents indicate that in many economies, more work is required on enabling laws around data privacy, secure critical infrastructure and blockchain, and the ethics and legality of AI use. Confidence in government is mixed: a fraction of respondents feels their country lags global efforts

Figure 1: The cloud is pervasive

Respondents were asked to rate the extent of their agreement with the following statements.

The totals of the "agree" and "disagree" data show that cloud technology has permeated industry.

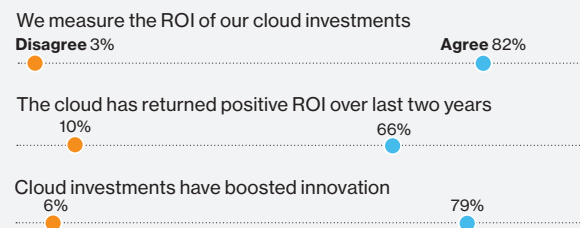


Source: MIT Technology Review Insights survey, 2023

Figure 2: The cloud will be essential

Respondents were asked to rate the extent of their agreement with the following statements.

The totals of the "agree" and "disagree" data shows that cloud technology has become an integrated part of business operations and innovation.



Source: MIT Technology Review Insights survey, 2023

(see Figure 3); however, only about one-third say their country is a global leader.

Respondents in some regions see pockets of cloud leadership. The four regions examined in this research show distinctive results.

North America seeks differentiation and efficiency from cloud. It leads the globe in cloud adoption, and respondents link cloud investment to business value here more than anywhere else. Cloud transformation here exceeds global peers: nearly all (93%) measure cloud ROI (versus 82% globally) and 76% find positive ROI from cloud assets (versus 66% globally).

Europe is the gold standard for sustainable cloud. Europe's cloud advantage is its use of digital platforms to drive social and environmental sustainability. Since 2020, the European Commission has mandated Green Public Procurement criteria for government acquisition of cloud services,² and in March 2022, it put forward a set of recommendations based on a study of how to best implement cloud resources across the EU in line with the Union's goal of establishing climate-neutral computing resources by 2030.³ Unsurprisingly, Europe also leads in using cloud for carbon emissions reporting, as 42% of respondents report using cloud for Scope 1 and Scope 2 emissions, and more than one-third use cloud for Scope 3.

Asia has a wide variety of digital economies at different maturity levels. Most respondents (86%) say cloud reduces technology costs. And although Asia is committed to bottom-line cloud efficiency, it trails the rest of the regions in ROI tracking, with 53% reporting positive ROI. Cloud is essential for ensuring Asia's industrial productivity and development goals.

Figure 3: Global cloud leaders and laggards

Respondents were asked to rate how their country ranks in global efforts to bolster cybersecurity capabilities, build 5G infrastructure, and develop generative AI on a scale ranging from leaders to laggards.

The data below highlights both ends of the spectrum, showing an increasingly positive sentiment in global organizational performance.

Data privacy and laws and regulation

Laggards 2% Leaders 37%

Blockchain and digital ledger tech

6% 35%

Hardening financial service critical infrastructure

2% 44%

5G mobile infrastructure

3% 32%

Generative artificial intelligence

5% 39%

Source: MIT Technology Review Insights survey, 2023

Some 84% of respondents from Australia and New Zealand (ANZ) see cloud as an innovation catalyst – more than respondents from any other region. Governments in ANZ create policy frameworks that grow cloud economies and digital transformation, an important driver for cloud adoption. ANZ respondents have the highest cloud-first posture of any region (89%). From a global view, the cloud is less mature in ANZ, and respondents have the lowest confidence in government data privacy and data sovereignty efforts.

“Technology teams can leverage cloud to drive automation at every level. Once upon a time, one administrator would manage 150 to 200 virtual machines. When you go to cloud, it is one to 10,000 or 12,000.”

Anant Adya, Executive Vice President and Service Offering Head, Infosys

03

The business value of cloud computing

Cost savings are a well-established first driver of cloud investments. More than eight of 10 survey respondents say cloud deployments produce more cost efficiency. Cloud has demonstrated that it improves the bottom line (see Figure 4). And most respondents globally are committed to technology development strategies that begin with cloud.

But our survey also reveals that most technology decision-makers are trying to leverage their cloud resources to grow and transform operations as well. “In 2020, when we launched our cloud brand, Cobalt, it was all about taking cost out,” says Anant Adya, executive vice president and service offering head, Infosys.

“Everybody was moving to cloud to get out of data centers and modernize their legacy infrastructure to achieve IT efficiency.”

As the global economy worked its way out of pandemic shutdowns, Adya explains, “businesses started to redefine their cloud narratives to focus on business outcomes.” Adya now sees two cloud approaches evolving simultaneously. “One is to leverage cloud to save and optimize your cost. The second, which more and more businesses are choosing, is to use the cloud to grow and disrupt their market segment or industry,” he says.

A majority of respondents (82%) say they measure the success of these cloud investments by determining ROI

Figure 4: Cloud is good for business culture

Survey responses show that cloud investments reduce costs and bolster innovation.

	Overall	North America	Asia	Australia/ New Zealand	Europe
Cloud investments have reduced operating costs	84%	82%	86%	84%	84%
Cloud investments have boosted innovation at our company	79%	79%	79%	83%	76%
We have a cloud-first technology development policy	84%	85%	75%	89%	87%

Source: MIT Technology Review Insights survey, 2023

(see Figure 5). At the same time, only two-thirds (66%) report positive ROI in the last two years. Challenges remain for firms in mapping cloud spend to business-line profitability. Flexera, a cloud cost-management firm, estimates in its 2023 survey that for the first time in a decade, cost management exceeds security as technology decision-makers' top concern. Flexera's survey also indicates 68% of firms are deploying FinOps – a cloud management discipline that allows organizations to increase the business value of cloud investments – to ensure cloud investments deliver top-line gains.⁴

There are two distinct stages of cloud maturity globally: one where firms adopt cloud to achieve essential opex and capex cost reduction, and a second where firms link investments to a positive business value. Respondents indicate the two are converging quickly. Cloud-based capabilities beyond resource optimization are leveraged across business units and shared functions, such as talent management, where training and development tools play a growing role to identify skill gaps and align learning programs with strategy.

Figure 5: Cloud investment pays off

Survey responses show that companies not only are measuring and tracking cloud investment ROI, but those investments have returned a positive ROI in the past two years.

	Overall	North America	Asia	Australia/ New Zealand	Europe
My company tracks its cloud technology investments and measures their ROI	82%	93%	76%	79%	79%
Cloud investments have returned a positive ROI in the past 24 months	66%	76%	53%	63%	74%

Source: MIT Technology Review Insights survey, 2023

The cloud as a talent enabler

Part of cloud ROI shows in global hunger for digital literacy skills – particularly cloud capabilities. Talent cultivation is crucial for remaining cloud-competitive. Cloud is a critical asset to bring these skills to bear, and it is one that is sorely needed in every economy: recent analysis by Microsoft in Australia and New Zealand (ANZ) estimates that public cloud adoption will create more than 700,000 specialized jobs in ANZ alone by 2026.⁵

Daniela Proust, senior vice president and head of global learning and growth at Siemens,

says “cloud technology is enabling us to provide completely new personalized learning experiences at scale to our people.”⁶

Platform-based learning ecosystems deliver new opportunities to help companies manage development and retention. “We can see what people are interested in, what they actually learn or don’t learn. We can see what skills are on the horizon for specific communities, such as digital talent, and we can match the right learning opportunities for each member,” Proust says.

Proust says Siemens leverages cloud through its strategic framework, NextWork, which enables highly personalized upskilling at scale and targeted strategic learning interventions. “It allows us to see areas of major workforce transformation and do targeted workforce transformation analysis, then match relevant learning interventions to an individual’s development path,” she says.

Hear more of this conversation with Daniela Proust on MIT Technology Review’s Business Lab podcast, “Building the necessary skills for digital transformation.”



04 Data privacy, sovereignty, and governance

A strong stance on data privacy protection and governance is essential for economies promoting cloud adoption. Rapid cloudification of IT resources and proliferation of data assets across multiple clouds can make enforcing data governance difficult. The cloud's flexible, API-forward environment enhances the power and capabilities of data management tools: cloud-based tools make it easier to build and deploy powerful ID and access management (IAM), for instance, which enhances data security and data privacy capabilities.

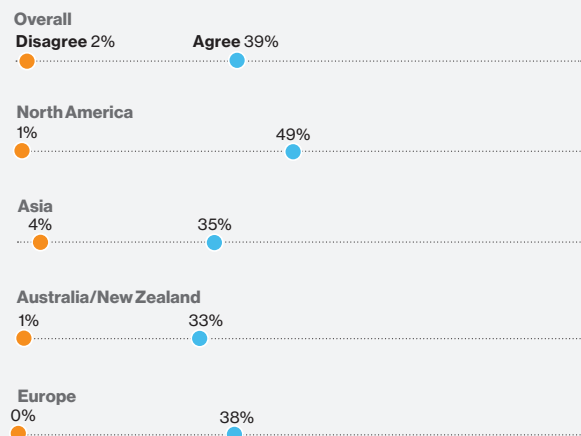
Most respondents do not see their countries as leaders in data privacy or data sovereignty (see Figure 6), though more than two-thirds believe their country keeps pace. Respondents in some large digital technology economies – the U.S. and China, in particular – are more likely to identify themselves as leaders. But perceptions of national data sovereignty and privacy frameworks vary, underscoring the lack of harmonized global standards.

Miao Song, global CIO of real estate conglomerate GLP, says, “global companies need to adopt a multiregional asset location policy to reflect the current geopolitical reality that all countries and regions are increasing their efforts to develop more enforceable data sovereignty regulations.” In a recent survey by cloud software firm Nutanix in Australia, data sovereignty emerged as the top driver of infrastructure decisions, which is beginning to cause some organizations to repatriate cloud assets.⁷

Figure 6: Data management leadership is maturing

Survey responses show that respondents feel companies in their countries are supporting data sovereignty laws and regulations.

My country leads in global efforts to support data sovereignty laws and regulations.



Source: MIT Technology Review Insights survey, 2023

05

Cybersecurity is always a priority



Public and hybrid cloud assets raise cybersecurity concerns and increase threat surfaces, and AI tools are being used to improve the predictability of attacks. As cloud helps AI and automation capabilities mature, AI algorithm development is accelerated with the scale that cloud compute provides. These cloud-produced AI tools provide more accurate and predictive security tools, such as service-provider and enterprise endpoint incursion and anomaly detection, which improve data cataloging, access, and visibility. These tools are emerging rapidly: in June 2023, U.S. networking technology giant Cisco launched a security-service edge (SSE) solution which uses generative AI tools in its cloud capabilities to streamline security operations for cloud service providers.⁸

Several survey indicators say cloud decision-makers have robust security postures. Nearly all respondents (95%) say they have formal processes to assess and

“Global cloud providers will always have security roadmaps that are much more intense and advanced than you will have, so you tap into advancements in security capabilities that you might not have the ability to invest in yourself.”

Mac Esmilla, Global CISO, World Vision

“Cloud migration is not strategic; it’s organic. It’s just the most agile way of meeting customer needs.”

Katherine McDermott, Executive Director of Digital Services, Service NSW

benchmark security in the cloud (see Figure 7). Most (86%) employ zero-trust architecture, which has gained broad acceptance as a check against the risks around AI, because of the large amounts of data it draws on and the rapid changes it tends to generate.⁹

Mac Esmilla, Singapore-based global CISO for global nonprofit World Vision, oversees security for cloud-based IT operations in 125 countries, many of them emerging economies. Zero-trust architecture, he says, provides an important support structure for security policies, particularly over disparate network environments. “Acceptable use policy becomes an organizational culture, and one that you cannot enforce and cannot monitor is no good,” he says.

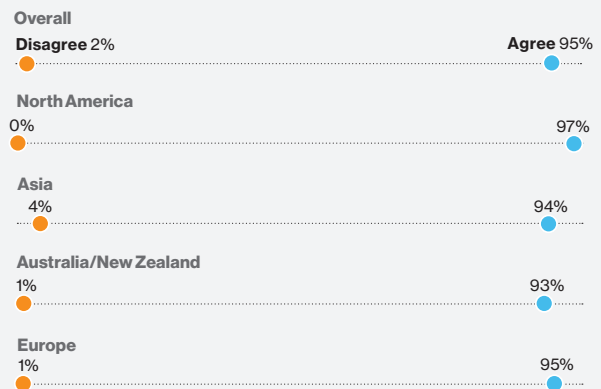
Esmilla says cloud-based resources help organizations secure assets in three ways. “One, shared accountability. Two, global cloud providers will always have security roadmaps that are much more intense and advanced than you will have, so you tap into advancements in security capabilities that you might not have the ability to invest in yourself,” he says.

The third is with digital security talent management. “If you build everything by yourself on-premises, how many subject matter experts will you need to hire,” he says, “in every market, at price points your organization allows you to invest in?” Rather than replicating talent in every node of the organization, “sometimes you just need a good contract manager or vendor-relationship manager. The cloud vendor helps operationalize security management,” he says. While Esmilla acknowledges increased vendor reliance increases third-party risk, he emphasizes, “it’s still shared risk.”

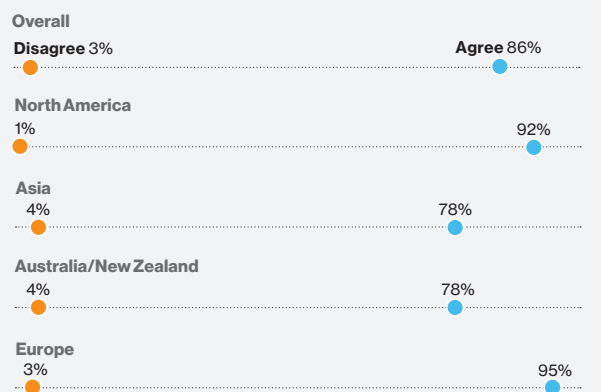
Figure 7: Cybersecurity vigilance

Survey responses show respondents feel their companies have effective, formal cloud asset security processes, and support zero-trust data policies.

Cloud assets are secured by processes that are formally assessed and benchmarked.



We have zero-trust data access policies for cloud-based resources.



Source: MIT Technology Review Insights survey, 2023

06

Emerging cloud capabilities



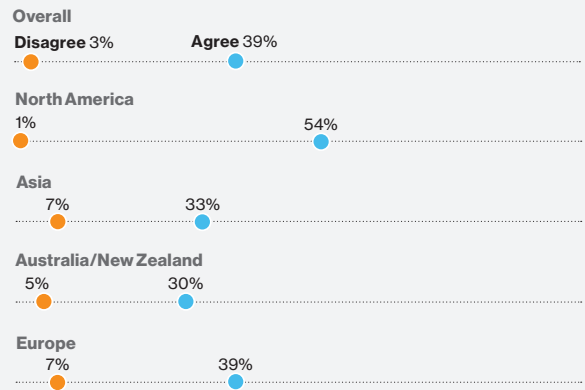
Cloud-dense markets drive wider transformation and underpin digital innovation. Digital companies depend on cloud-hosted SaaS and AI resources to innovate and compete. APIs developed in the cloud can increase automation of IT resources; this increases speed and efficiency, and allows organization around digital principles. More process automation and faster access to customer data drives business transformation, which helps reach customers and constituents – mobile app-based digital natives – with the speed and service level they expect.

The cloud empowers data management at scale, and allows cost-effective management of large data sets. As the global cloud ecosystem matures, and more and richer applications and computing resources become

Figure 8: Perceived generative AI leadership

Global survey responses show most don't see their home countries as leaders in developing generative AI.

My nation leads global efforts to develop generative AI.



Source: MIT Technology Review Insights survey, 2023

available, cloud will be a place for large language models (LLMs), developing machine learning (ML), and process automation. The cloud is essential for AI, an emerging capability where 39% of respondents say their nation is a leader (see Figure 8). “Cloud and AI go hand in hand,” Adya says. “When you look at the engineering, testing, and training required to deliver AI products at speed and at scale, you will need cloud. The amount of compute, storage, and network required is so intensive, most firms just do not have the time and money to build those infrastructure landscapes within their data-center footprint,” he says.

Cloud adoption creates a virtuous cycle in rich and poor countries. Cloud capabilities will grow as national infrastructure initiatives continue to develop 5G, fiber, and edge computing. As end users increasingly use broadband-rich networks to leverage cloud applications, they will speed up network capabilities; this virtuous cycle is particularly evident in mobile broadband markets. Less cloud-dense markets can draw on global resources and build core national infrastructure, and access the skills digital economies need.

The cloud's biggest value – scaling up computing resources efficiently and flexibly – is a key enabler of digital innovation. This can mitigate challenging issues in security, privacy, and ESG compliance (see sidebar). More than half of respondents (54%) indicate they use cloud-based tools for ESG reporting and compliance (see Figure 9). A similar percentage – 51% – use cloud to enhance DEI in talent management, to support data-driven insights into DEI initiatives. Comparable to how cloud-based tools help firms analyze carbon impact

5G depends on cloud

5G is essential to cloud. Raj Savor, vice president of network analytics and automation applications at AT&T Labs, says that as immersive experiences like high-definition video, social media apps, augmented reality, and virtual reality become more common, so will the importance of performance capabilities such as lower latencies, less jitter, and lower variability.

“Experience-intensive smartphone apps are raising the demand for security and reliability,” Savor says. “A personal device is basically an extension of our persona; protection of the data in the device becomes equally important over the network channel.”

Savor further explains, “these high demands can really [only] be met with a 5G network architecture. 5G brings cloud-native application platforms closer to the network edge. This architecture allows for more automation and AI tools as users expect to use more applications in the cloud whether they are in a public venue, their home, or a connected car driving in a smart city. Cloud-native economies and network infrastructure need to enable seamless transitions.”

Hear more of this conversation with Raj Savor on MIT Technology Review's Business Lab podcast, “Building tomorrow's telecommunications network today.”





“Most new tools that calculate carbon footprint or measure sustainability impact today are built in the cloud.”

Miao Song, Global CIO, GLP

data to enhance sustainable development, cloud analytics can be deployed by hiring and developing teams to enhance equity in employment and advancement.

Sustainability in the cloud

Cloud-based analytics helps companies organize and report on ESG metrics, and provides a clearer picture of carbon emissions. Social and governance metrics are less mature than environmental metrics and remain less well understood. ESG reporting requirements are becoming more stringent as customers and stakeholders demand more data. The cloud can be part of the solution as a platform to collect, analyze, and share.

“Most new tools that calculate carbon footprint or measure sustainability impact today are built in the cloud,” Song says. “The cloud is the only way to roll out assets fast and cost effectively.” Carbon emissions projects, which involve complex, multi-site data integration to deploy networks of IoT-based sensors, are well-suited to cloud, she says.

Cloud can also be a platform to operate sustainably, but Song cautions that the cloud is only part of the equation. CIOs should look broadly at aligning digital transformation with sustainability goals, contributing to firmwide efforts, she says.

Figure 9: Prioritizing cloud-based resources to enable ESG activities

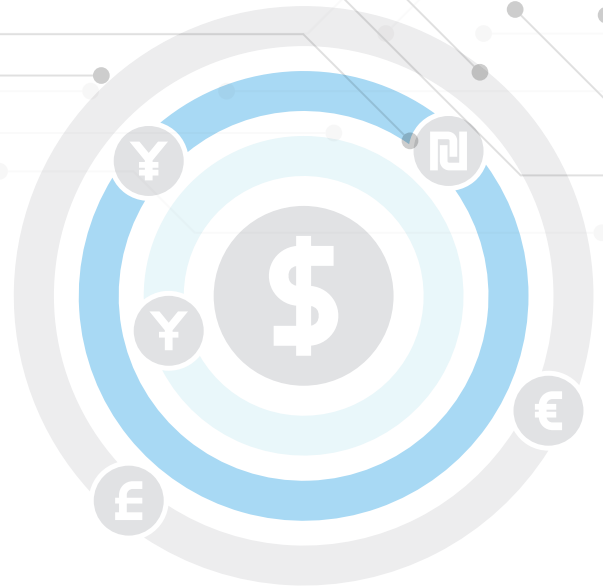
In the last two years, my company has prioritized cloud-based resources for the following:

	Overall	North America	Asia	Australia/ New Zealand	Europe
ESG compliance reporting	54%	52%	62%	52%	52%
Energy monitoring and management solutions	47%	54%	47%	45%	42%
Scope 1 and 2 carbon emissions accounting tools	35%	39%	33%	27%	42%
Scope 3 carbon emissions accounting tools	30%	31%	28%	26%	35%

Source: MIT Technology Review Insights survey, 2023

07

Toward a cloud-powered innovation economy



Technology decision-makers expect a lot from the cloud. Cloud computing and cloud-hosted applications are essential for scaling digital resources while reducing costs, delivering differentiated experiences, and accelerating leading-edge innovation. Cloud capabilities enable fast, cost-effective computing at scale.

Overwhelmingly and comprehensively, the cloud fulfills all these expectations, respondents say. Moreover, from emerging to advanced economies, most believe the cloud is a fundamental building block for digital economic development. Respondents believe cloud powers development of analytics, puts process automation into operation more quickly, and enhances capabilities of data management and data security tools. “Cloud deployments are done in a very standardized and disciplined fashion, and this means the number of support resources required have been significantly reduced,” says Adya. “Technology teams can leverage cloud to drive automation at every level. Once upon a time, one administrator would manage 150 to 200 virtual

machines. When you go to cloud, it is one to 10,000 or 12,000,” he says.

As cloud technology becomes ubiquitous, it also spreads the knowledge and availability of security practices that address its increased threat surface, with more accurate and predictable security tools. Cloud eases deployment of ID and access management (IAM) to enhance data security and data privacy capabilities. As less-developed economies access the cloud, they can also access global talent and experience. As most respondents indicate, the cloud enables them to be more carbon-efficient and meet ESG standards.

Most respondents see a lack of leadership around governance, but most also feel assured their nations are at least keeping pace. Perceptions of national data sovereignty and privacy frameworks, which vary, call out for effective global standards.

Bottom-line efficiency and top-line innovation mean cloud computing is fast facilitating further innovation: AI, blockchain, and other technologies will define the

next stage of global economic productivity. Cloud maturity is approaching, as its ability to reduce costs and show positive business value increasingly converge.

Our survey data shows there is no single path toward convergence. There are correlations between cloud economy policy and infrastructure maturity, and the ability of participants to realize returns from cloud investments. Few respondents consider their country a leader in maintaining strong data regulatory environments and in cyber-resilient critical digital infrastructure (with the exception of Canada and China). In more mature cloud economies, respondents from companies with competency in at least one cloud ecosystem seem to be able to see positive ROI. Strong policy and platform infrastructure – regulatory clarity and pro-data governments – are also linked to cloud ROI for respondents (France, Germany, and the U.S. rank highly). In some cases, well-managed cyber-resilient and secure network environments are also catalysts for positive cloud ROI (particularly in India).

Observing the links between perceived domestic technology leadership and an organization's ability to innovate with the cloud, we see a broadly similar set of findings emerge. More respondents report high levels of innovation from countries that excel in cloud-critical technologies such as AI and edge computing. Japan, the U.S., and Canada rank highly. Outliers include many European respondents who feel their countries do not lead in development of AI or next-generation computing; however, many respondents still extract value from cloud investments. Europeans, conscious about a lack of domestic cloud technology development, feel their regulatory and business environment cultivates a cloud-friendly ecosystem.

While all cloud economies need to perform effectively – with clear regulatory environments, digitally minded business environments, and robust broadband networks – the survey finds markets with excellence in at least one critical cloud competency can create overall momentum. Those that develop one competency with speed and agility usually see positive feedback that encourages development of others. The network effects of cloud economics lets firms seize immediate gains such as process efficiency and cost savings, which can quickly scale into broader-reaching value creation.

In Kuala Lumpur, cloud opportunities abound

Microsoft's "Bersama Malaysia" initiative, launched in 2021, is a commitment to invest \$1 billion over five years to establish the country's first data-center region in Greater Kuala Lumpur and to provide cloud services. Microsoft is partnering with Malaysian government agencies and local companies; it has a global commitment to shift to 100% renewable energy by 2025, which will include having power purchase agreements for green energy contracted for all the carbon-emitting electricity consumed by its data centers, buildings, and campuses.

At the Bersama Malaysia Microsoft Cloud Summit 2022, Malaysian global energy company National Petroleum Unlimited, known as Petronas, announced it uses Azure-supported AI tools for productivity, asset maintenance, and safety for its fossil fuel operations. It aims to accelerate AI adoption to increase effectiveness throughout its energy value chain, and is opening an **AI center of excellence** in partnership with Microsoft and others.

The Kuala Lumpur government has sought to increase green opportunities, including its smart **City Brain** governance system. It uses Alibaba Cloud's computing systems to optimize traffic flow and emergency services, and to detect traffic problems and accidents. It is the first city outside China to use the system. The cloud system will enable AI to integrate video and image recognition, data mining, and machine learning with big data. Alibaba opened the first global public cloud platform in the country in 2017.

Google Cloud Platform (GCP) announced plans to launch new operations in Malaysia and Thailand in August 2022. The new operations, plus another in New Zealand, join **35 global cloud facilities** in 20 countries for the company, with nine more in development. GCP offers infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) to organizations worldwide.

08

North America: Building better in the cloud



NORTH AMERICA

100%

security frameworks, and nearly all (92%) employ zero-trust architecture.

Source: MIT Technology Review Insights survey, 2023

U.S. respondents self-identify as cloud security leaders: fully 100% say they use cloud security frameworks, and nearly all (92%) employ zero-trust architecture.

North America leads the global survey in cloud adoption and linking cloud investment to business value. The U.S. is more confident than global peers in its leadership across many attributes for robust infrastructure and policy that support cloud development. Governments here identify a competitive cloud economy as an important component of economic rejuvenation. The U.S. government (the world's single largest buyer of technology services) is diversifying cloud procurement practices to increase competition.¹⁰

North American respondents clearly build better businesses in the cloud than their global peers. Almost all (93%) measure cloud ROI (versus 82% globally), and 76% see positive ROI from cloud (versus 66% globally). Respondents in Canada and Mexico are more likely to consider development paths cloud-first, underscoring the importance of technology deployment. Economic headwinds are impacting investment agendas; McKinsey research from 2023 notes that although cloud migration continues to grow, the rate of migrations has slowed in the face of rising costs and data privacy and latency issues.¹¹

U.S. and Canada respondents show the highest engagement in data privacy, data sovereignty, and

security efforts, and in technologies like blockchain. Blockchain has synergies with cloud, and is increasingly used in data management for identity management and authentication. Blockchain peer networks, such as the Interplanetary File System, are developing cloud storage.¹²

U.S. respondents self-identify as cloud security leaders: fully 100% say they use cloud security frameworks, and nearly all (92%) employ zero-trust architecture. U.S. cybersecurity and data sovereignty efforts, however, can lead to clashes – particularly with China. A years-long technology cold war with China spilled into the cloud economy in April 2023, as U.S. lawmakers sought to sanction Chinese cloud providers on national security grounds.¹³

Cloud adoption is also accelerated by policy action in North America. The U.S. Inflation Reduction Act (the largest climate stimulus package to date) channels investment to energy transition, industrial automation, and smart infrastructure – all dependent on cloud. Most respondents (72%) in North America deploy cloud-based process automation, and more than half have ESG reporting and energy management tools in the cloud. U.S. respondents, more than any others, believe they lead global efforts in next-generation technologies, particularly AI (54%).

09

Europe: The gold standard for responsible, sustainable cloud development

Europe's cloud advantage is its ability to use digital platforms to drive regional social and environmental sustainability. European respondents report slightly lower business value visibility in cloud operations (79%) than the global average. Reported operational cost reductions (84%) track the global average, although surprisingly, only 56% of German respondents saw bottom-line improvements (perhaps an indication of the leanness of operations in that efficiency-focused economy). European technology decision-makers have a cloud-first development stance (87%), better than peers globally, led by the U.K. and Nordic countries.

The EU is the global gold standard for data privacy management and policy creation. Data management is in sharp focus in the EU, and many respondents here (43%) say their nation is a data privacy leader. Businesses headquartered here capitalize on the EU's GDPR environmental regulation and the robust regulatory environment. This creates competitive advantage for cloud-centric sectors like health care, manufacturing, aerospace, and financial services.

Giusella Finocchiaro, chairperson of the Electronic Commerce working group at the UN Commission on International Trade Law (UNCITRAL), says GDPR's chief merit is that it "drives attention to the value of personal data, and this could potentially create a global standard." It is, she says, a catalyst for data regulation innovation on



EUROPE

87%

European technology decision-makers have a cloud-first development stance (87%), better than peers globally, led by the U.K. and Nordic countries.

Source: MIT Technology Review Insights survey, 2023

nonpersonal data as well, and for "finding a way, at an international level, to build bridges between different data protection systems."

The EU has the highest levels of cloud security practices, evidenced by its executive commitment to security (85%), and implementation of zero-trust architecture (95%). Only a few countries (Germany and Spain, in particular) do not indicate widespread use of zero trust.

This region has an advanced posture on supply chain accountability for carbon impact. The EU leads in legislation and investment in smart cities, low-carbon transportation, mobility, and renewable energy. Cloud-based analytics and process control resources are critical for autonomous and automated energy and transport systems, and seven of 10 respondents rely on cloud to enable process automation. Cloud-based energy management solutions are employed by many (42%) respondents – a figure likely to rise as the EU's Fit for 55 initiative propels organizations to reduce carbon footprints 55% by 2030. Europe is a clear leader in using cloud for carbon emissions reporting, with 42% using cloud tools for Scope 1 and Scope 2 emissions, and more than a third using cloud to track Scope 3.

10 Asia: A rising cloud lifts all economies

The cloud is increasingly important in Asia, across its variety of digital economies and maturity levels. Emerging and advanced countries can access cost-effective cloud-based technology at speed and scale. In survey responses, 86% say cloud reduces technology costs, the highest among all regions (though Hong Kong, at 67%, is an interesting outlier). Respondents report the lowest ROI tracking globally, and little more than half (53%) see positive ROI.

Cloud-aspirational Asian governments hope to catalyze economy-wide adoption. Singapore is working toward a cloud-first economy (as are over 70% of Singaporean survey respondents): in May 2023, the government announced plans to invest 30% of its IT budget (U.S. \$2.45 billion) on cloud-based applications from commercial vendors.¹⁴ India Stack, another ambitious multi-stakeholder effort, builds on the Indian government's investment in digital identity and payment infrastructure.¹⁵ Indian survey respondents report high confidence in their cloud deployment as a result: 71% report positive ROI from cloud investments, 93% say they've saved money with the cloud, and 86% report an innovation boost from their cloud capabilities. These results are higher than the global average, as well as their Asian peers.

Respondents from large Asian cloud markets say they lead in data privacy and sovereignty efforts; Chinese respondents (57%) rank their country as a leader. Sue-Lin Tin, head of technology for Pacific and Singapore at CBRE, points to difficult situations with data sovereignty in its public sector, which sometimes complicate access to



ASIA

85%

In Asia, 85% of interviewees say cloud reduces technology costs, the highest among all regions.

Source: MIT Technology Review Insights survey, 2023

resources. “We are still trying to work out whether this is an application issue or a data privacy and access issue – but probably the latter,” she said.

Asia reports low levels of zero-trust architecture, and adoption varies: it is highest in India, a market dependent on international technology and software services, and lowest in Korea and Hong Kong. Regionally, “there are not more security considerations, they are just different,” says Tin. “We now have to stand up a lot of our own applications in many third-party environments, and that creates a lot more gates for us to consider,” she says.

As Asia's production centers integrate into global supply chains, they become more sensitive to ESG compliance. Asian respondents report the highest levels (62%) of ESG reporting. China, with policy links between technology adoption and energy conservation and sustainability, is the single-highest ranked for using cloud for ESG. Japan and India also rank highly.

Asia is home to the world's largest numbers of digital consumers, and to its most important manufacturing hubs. This is traditionally led by China, but Southeast Asia is catching up; significantly, Malaysia and Singapore report the highest levels of cloud-enabled process automation adoption. The cloud is essential for serving these customers and ensuring industrial productivity keeps pace with development goals.

Australia and New Zealand: The cloud as an innovation catalyst

Australia and New Zealand (ANZ) are at pivotal junctures. This region creates responsive policy frameworks to help cloud economies grow and accelerate digital transformation. Enterprises are integrating cloud into day-to-day operations, and see cloud as a catalyst for digital transformation.

The cloud is less mature here than globally – only 63% see positive ROI in cloud investment. ANZ respondents have the highest cloud-first posture of any region (89%). Australia's department of finance has been cloud-first for more than a decade, to make information and communications technology purchases, which are reevaluated for security posture every three or four years. New Zealand has had a cloud-first stance since 2012; in June 2023, it shifted development policy to increase use of domestic cloud infrastructure and services, and to focus on data sovereignty for indigenous communities.¹⁶

Government cloud deployment and investment is an important driver for cloud adoption in ANZ. “The Australian government sees the cloud's potential in enabling contemporary ways of working,” says Katherine McDermott, executive director for digital services at Australian government agency Service NSW. She says Australia's largest state is on a decade-long journey to create a one-stop shop for digital citizen services, developed in the cloud. “Cloud migration is not strategic; it's organic. It's just the most agile way of meeting



AUSTRALIA AND NEW ZEALAND

84% In ANZ, 84% of respondents – more than in any other region – report cloud investments have directly contributed to innovation at their organization.

Source: MIT Technology Review Insights survey, 2023

customer needs,” she says. This belief is underscored by the fact that 84% of ANZ respondents – more so than any other region – report that cloud investments have directly contributed to innovation at their organization.

ANZ's cloud-centricity does come with challenges, cybersecurity in particular. The region has suffered from many high-profile data breaches in recent years, impacting banks, telcos, and health-care providers. Respondents there have the lowest confidence in government data privacy and data sovereignty efforts, and lower-than-average opinions of efforts to harden critical network and financial infrastructure. In response, Australia aims to be a cybersecurity leader. It has redoubled efforts to use digital tools and regulations to safeguard personal data and digital transactions, and is overhauling cybersecurity law. Respondents report low executive prioritization for cloud security, however, and low implementation of zero trust.

Though ANZ respondents see cloud as a catalyst for IT innovation, they report the lowest confidence (30%) in cloud support for AI development. This tracks with global averages in use of cloud for ESG reporting and energy use management (52% and 45%), but only about one quarter currently tracks Scope 1, Scope 2, or Scope 3 emissions using cloud.

About MIT Technology Review Insights

MIT Technology Review Insights is the custom publishing division of *MIT Technology Review*, the world's longest-running technology magazine, backed by the world's foremost technology institution—producing live events and research on the leading technology and business challenges of the day. Insights conducts qualitative and quantitative research and analysis in the U.S. and abroad and publishes a wide variety of content, including articles, reports, infographics, videos, and podcasts. And through its growing MIT Technology Review **Global Insights Panel**, Insights has unparalleled access to senior-level executives, innovators, and thought leaders worldwide for surveys and in-depth interviews.

About the partner

Infosys Cobalt is a set of services, solutions, and platforms that acts as a force multiplier for cloud-powered enterprise transformation. It offers 35,000 cloud assets and over 300 industry cloud solution blueprints. Infosys Cobalt helps businesses redesign the enterprise, from the core, and also build new cloud-first capabilities to create seamless experiences in public, private and hybrid cloud, across PaaS, SaaS, and IaaS landscapes. With Infosys Cobalt's community leverage, enterprises can rapidly launch solutions and create business models to meet changing market needs while complying with the most stringent global, regional and industry regulatory and security standards. For insights from industry leaders across the globe on how cloud and cloud-enabled technologies are helping organizations move from cloud chaos to clarity, see **The cloud hub: From cloud chaos to clarity**. For more details on Infosys Cobalt, visit us at infy.com/infosyscobalt.

Footnotes

1. "Worldwide cloud service spend to grow by 23% in 2023," (press release), Canalys, February 8, 2023, <https://www.canalys.com/newsroom/global-cloud-services-Q4-2022>.
2. Nicholas Dodd, et al., "Development of the EU Green Public Procurement (GPP) Criteria for Data Centres, Server Rooms and Cloud Services," European Commission's Joint Research Centre, 2020, <https://publications.jrc.ec.europa.eu/repository/handle/JRC118558>.
3. Valentijn Bilsen, et al., "Study on Greening Cloud Computing and Electronic Communications Services and Networks: Towards Climate Neutrality by 2050," Directorate-General for Communications Networks, Content and Technology, March 22, 2022, <https://digital-strategy.ec.europa.eu/en/library/study-greening-cloud-computing-and-electronic-communications-services-and-networks-towards-climate>.
4. "2023 State of the Cloud Report," Flexera, 2023, <https://info.flexera.com/CM-REPORT-State-of-the-Cloud>.
5. Linus Lai and Louise Francis, "Public Cloud Services Opportunities and Dividends to the Australian and New Zealand Economies," IDC, November 2022, https://news.microsoft.com/wp-content/uploads/prod/sites/66/2023/04/IDC-WP_MSFT_FINAL_17.04.pdf.
6. "Building the necessary skills for digital transformation," MIT Technology Review Business Lab podcast, June 15, 2022, technologyreview.com/2022/06/15/1052869/building-the-necessary-skills-for-digital-transformation/.
7. Aaron Tan, "Data sovereignty and security driving hybrid IT adoption in Australia," ComputerWeekly.com, June 21, 2023, <https://www.computerweekly.com/news/366542399/Data-sovereignty-security-driving-hybrid-IT-adoption-in-Australia>.
8. "Cisco Shows Breakthrough Innovation Towards AI-First Security Cloud," (press release), Cisco Systems, June 6, 2023, <https://newsroom.cisco.com/c/r/newsroom/en/us/a/y/2023/m06/cisco-shows-breakthrough-innovation-towards-ai-first-security-cloud.html>.
9. Phil Laplante and Jeffrey Voas, "Zero-Trust Artificial Intelligence?" in *Computer*, vol. 55, no. 02, pp. 10-12, February 2022, <https://www.computer.org/csdl/magazine/co/2022/02/09714079/1AZLISNNVik>.
10. Lindsay Clark, "Oracle, Microsoft barely compete for a quarter of their US Federal contracts," *The Register*, February 1, 2023, https://www.theregister.com/2023/02/01/oracle_microsoft_us_government/.
11. "McKinsey Technology Trends Outlook 2023," McKinsey, July 20, 2023, <https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/the-top-trends-in-tech#new-and-notable>.
12. Lachlan Keller, "Blockchain developers have taken a decentralized interest in cloud storage – will it shake up the industry?," *Forkast*, February 9, 2023, <https://forkast.news/blockchain-developers-decentralized-interest-storage/>.
13. Dashveenjit Kaur, "US Senators are urging Biden to sanction Chinese cloud firms, including Huawei and Alibaba," *Tech Wire Asia*, April 27, 2023, <https://techwireasia.com/2023/04/us-senators-are-urging-biden-to-sanction-chinese-cloud-firms-including-huawei-and-alibaba/>.
14. Eileen Yu, "Singapore focuses ICT spend on cloud applications," *ZDNET*, May 25, 2023, <https://www.zdnet.com/article/singapore-focuses-ict-spend-on-cloud-applications/>.
15. Benjamin Parkin, John Reed, and Jyotsna Singh, "The India Stack: opening the digital marketplace to the masses," *Financial Times*, April 20, 2023, <https://www.ft.com/content/cf75a136-c6c7-49d0-8c1c-89e046b8a170>.
16. Marc Daalder, "Govt quietly resets rules for public sector cloud use," *Newsroom*, June 14, 2023, <https://www.newsroom.co.nz/govt-quietly-resets-rules-for-public-sector-cloud-use>.

Illustrations

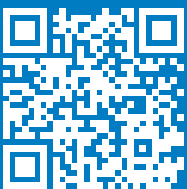
Cover and spot art assembled by Chandra Tallman Design with images from Adobe Stock and The Noun Project.

While every effort has been taken to verify the accuracy of this information, MIT Technology Review Insights cannot accept any responsibility or liability for reliance by any person on this report or any of the information, opinions, or conclusions set out in this report.

© Copyright MIT Technology Review Insights, 2023. All rights reserved.



Learn how Infosys Cobalt can accelerate your business
with cloud services, solutions and platforms.



www.technologyreview.com/thecloudhub

Infosys
cobalt



MIT Technology Review Insights

www.technologyreview.com

insights@technologyreview.com