The Impact of Cloud Computing on the Indonesian Economy

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pwc

Contents

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What is cloud computing and why is it important for the Indonesian economy?

Key takeaways from the study

- ❏ Indonesian companies are rapidly embracing the cloud to improve productivity, lower costs, and increase scalability in their journey to leverage digital technologies

- ❏ More than half of the small and medium businesses (SMB) surveyed saw a 20%+ revenue increase after adopting the cloud

- ❏ The majority (80%) of large enterprises surveyed indicated improving IT operation effectiveness as the top reason for adopting cloud technologies

- ❏ Talent shortage is the biggest challenge that large enterprises surveyed face in adopting and maximising the benefits from cloud computing

- ❏ We estimate that the adoption of cloud computing will improve Indonesia's GDP by about US$10.7 billion over the next five years

PwC Indonesia conducted this survey between March and August 2021. We received responses from 96 Indonesian companies, consisting of 81 small or medium businesses (SMB) and 15 large enterprises (LE)

Introduction

Cloud computing (often simply called "the Cloud"), allows companies who need computing resources to acquire them from the internet without having to build their own IT infrastructure in-house. Before cloud computing became commercially available in the market, companies that needed large and complex computing resources had to build their own data centers, purchase the network, hardware, and software, and hire skilled IT personnel to develop and run their computing systems. The cloud changed all that by offering these computing resources much like any other utilities, such as water or electricity.

This opens up access to all kinds of IT functionalities to a much broader audience, including to companies who would otherwise not be able to justify the amount of investment required. At the same time, through economies of scale, cloud computing also provides opportunities for companies who already have an established IT infrastructure to lower their IT costs and expand their IT capabilities more easily to meet the increasing business demand.

Companies in Indonesia have embraced cloud computing since its introduction, fuelled to a large extent by the pervasive use of mobile phones and social media by their customers. Cloud computing provides a quick path for companies to open digital channels to interact with these customers using the internet.

Moreover, when the COVID-19 pandemic hit, companies suddenly needed to find better ways for their employees to work from home, for their customers to order and receive services and products from anywhere, and for their suppliers and business partners to interact digitally to feed the company's supply chain. They quickly discovered that cloud services such as video conferencing, e-commerce, and social media-based marketing became an indispensable part of their operations. This situation drives an even faster adoption of cloud computing in Indonesia.

Cloud computing therefore plays a significant role in the Indonesian economy today. This study aims to provide insight into the impact of cloud technology on the Indonesian economy. This insight will be useful for businesses to reflect on how they can get more optimal benefits from their use of cloud technology. The insight could also be useful for cloud providers to have a better understanding of their customers' needs and also for public policy makers to identify ways to improve the overall economy through effective use of cloud computing.

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What is the Cloud?

The Cloud is not a single product or technology; it is a combination of multiple technology tools, commercial offerings, and delivery models, delivering computing services that can be accessed via the internet instead of residing in the company's own IT infrastructure. With the Cloud, companies can buy computing services and have them up and ready to use in a matter of minutes, rather than weeks or months that this would take otherwise. This lowers the barrier of entry, improves business flexibility, and saves significant costs.

Definition of cloud computing

US National Institute of Standards and Technology's (NIST) defines Cloud Computing as follows: "cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."
(NIST Special Publication 800-145).

Characteristics of the cloud

On-Demand Self-Service	The consumer can unilaterally provision and manage computing capabilities without requiring human interaction.
Metered Service	Providers and consumers can meter the units of computing capabilities utilised. (A unit could be defined as bandwidth, time, memory, seats, etc.)
Rapid Scaling	Computing capabilities can be quickly and automatically scaled up or down to meet business or consumer demand.
Resource Pooling	Computing resources are pooled to serve multiple consumers and are dynamically assigned and reassigned to consumers based on demand.
Broad Network Access	Computing capabilities are available over the network and can be accessed through different end-user devices.

Types of cloud services

Cloud services can also be categorised based on the type of computing technology that is offered as the service. The most complete type is Software as a Service (SaaS), whereby the customer can use the software via the internet using only simple end user devices such as a laptop or even a mobile phone. Examples of SaaS include video conferencing applications such as Zoom, MS Teams, and Webex. Examples of more complex SaaS examples include Salesforce, a Customer Relationship Management package sold as a cloud service.

The second type of cloud service, Platform as a Service (PaaS), is useful for companies that need to develop their own custom applications. Platforms include databases, development environments, and data analytics environments. Examples of PaaS include AWS, Google, and Azure.

The third type of cloud service, Infrastructure as a Service (IaaS), provides the fundamental infrastructure services. IaaS replaces the need for companies to have their own servers and data centers.

Software as a Service (SaaS)	SaaS is a software licensing and delivery model in which software is licensed on a subscription basis and is centrally hosted.
Platform as a Service (PaaS)	PaaS provides a platform allowing software developers to develop, run, and manage applications without maintaining technology infrastructure.
Infrastructure as a Service (IaaS)	IaaS provides customers with the capability to procure and use processing, storage, networks, and other fundamental computing resources easily

Cloud deployment models

Another important distinction of different cloud services is how and where each cloud technology is deployed and whether the resources are shared with multiple customers. A key indicator here is how much a company uses its own data center vs using the cloud provider's data center.

The diagram below illustrates the different deployment models. Each deployment model is explained further as follows:

1. Traditional IT. This is not considered a cloud, since cloud technologies are not used and therefore this model does not offer any of the six characteristics of cloud services.

2. Data center colocation. This is also still not considered a cloud, as this model still does not use cloud technologies. This model does exhibit a couple of the characteristics of a cloud, namely that it is a pooled resource and the service is likely to be metered to be charged to the customer

3. On-premises private cloud. In this model, the company applies cloud technologies to its privately owned IT infrastructure that is run in its own data center. This is the most complex model to be adopted by companies and is typically the most costly model, since it does not result in economies of scale, except if the company itself is very large.

4. Managed Private Cloud. In this model, the company purchases a cloud service from a provider but asks the cloud provider to dedicate certain resources only for the company's use. All characteristics of a cloud service are in place in this model except that resource pooling is limited.

5. Public cloud. When people talk about the cloud, this model is what they are usually referring to. In this model, the cloud provider manages all the computing infrastructure and sells the cloud service to its customers. The customer uses the cloud services according to the agreement and does not need to know how the underlying infrastructure is managed.

6. On-premises shared cloud. This model is an extension of the on-premises private cloud. The difference is that, in this model, the computing resources are shared with external parties outside of the company. Companies using this model may be charging their users, and therefore essentially become a cloud provider to their users.

7. Hybrid cloud. This is a deployment model that combines two or more of the models described above. A typical example might be the combination of an on-premises private cloud (model 3) and a public cloud model (model 5). This hybrid model is usually adopted to address some constraints that prevent the company from adopting only one deployment model.
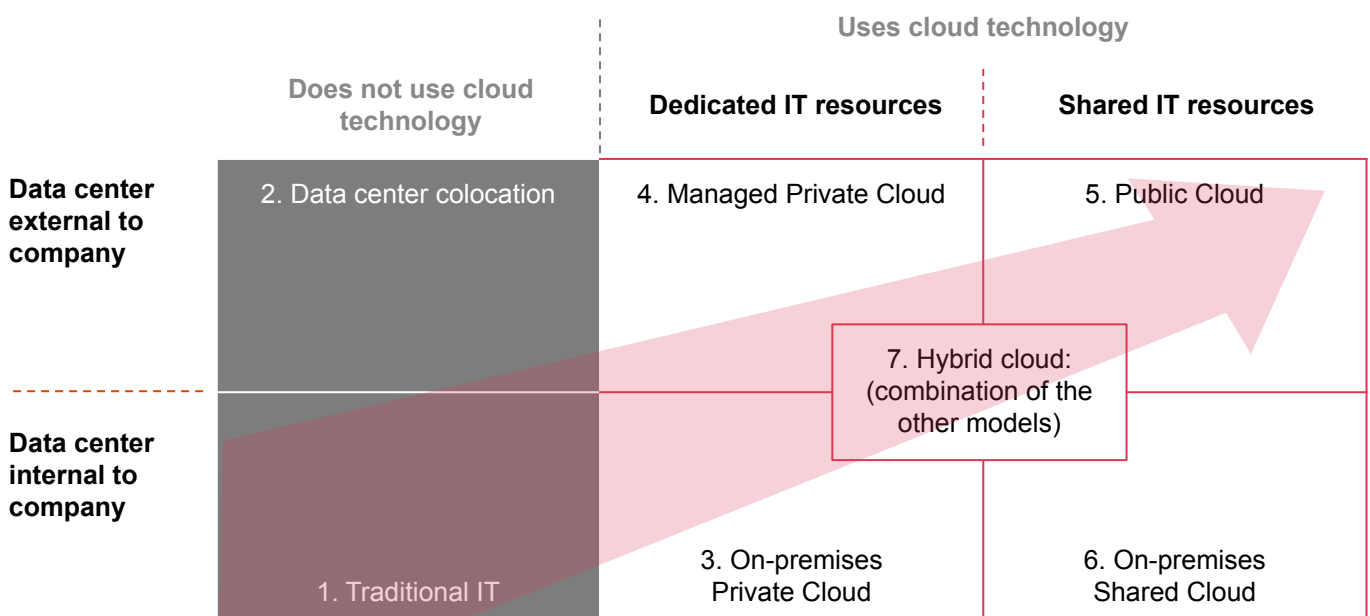
Figure 1: Cloud deployment model

	Does not use cloud technology	Uses cloud technology	
		Dedicated IT resources	Shared IT resources
Data center external to company	2. Data center colocation	4. Managed Private Cloud	5. Public Cloud
		7. Hybrid cloud: (combination of the other models)	
Data center internal to company	1. Traditional IT	3. On-premises Private Cloud	6. On-premises Shared Cloud

Figure 2: Characteristics of each cloud deployment model

|	1 Traditional	2 Co-location	3 On-premises private cloud	4 Managed Private cloud	5 Public cloud	6 On-premises shared cloud
On-demand self-service	✘	✘	✔	✔	✔	✔
Metered service	✘	some	✔	✔	✔	✔
Rapid scaling	✘	✘	✔	✔	✔	✔
Resource pooling	✘	some	✘	some	✔	some
Broad network access	✘	✘	✘	✔	✔	limited

Which cloud deployment model is right for you?

There is no single answer that works for all situations. Companies with different backgrounds will answer this differently depending on their situation. A new start-up would very likely start with the public cloud model, as it requires the least amount of setup time and likely also the lowest cost. A company with a large existing IT infrastructure base will have a more complex decision as the migration to the cloud could be very complex and there might be some technological or even regulatory constraints to consider. These cases will require in-depth analysis and careful planning to map out how cloud computing will be adopted by the company.

In general, it could be said that the benefits of cloud computing would potentially be the highest in the Public Cloud model because this allows for the maximum economies of scale. On the other hand, services delivered using the Public Cloud will have a high level of built-in standard features, and therefore they would typically be less customisable than the other models.

Underlying technologies used in cloud computing

There are a number of key technologies used in cloud computing to achieve its flexibility and scalability. A key technology is **virtualisation** whereby computing hardware can be emulated using software. Another key technology is **automatic provisioning**. This allows the cloud system to allocate more hardware resources automatically when needed. System **monitoring and metering** is integral to the system as a way for the cloud provider to make sure they meet the required service level agreement and charge their customers according to the actual resource usage. To optimise the use of computing resources, the system uses **load balancing** to distribute demand across available resources. A more sophisticated cloud technology that could be in use is **bursting**, whereby a cloud system can be configured to extend its network and use resources from different locations automatically when required without disrupting the service to the customer. Cloud providers continue to innovate and expand their technologies to offer even more reliable and secure cloud services to their customers that are easy to use and at an affordable price.
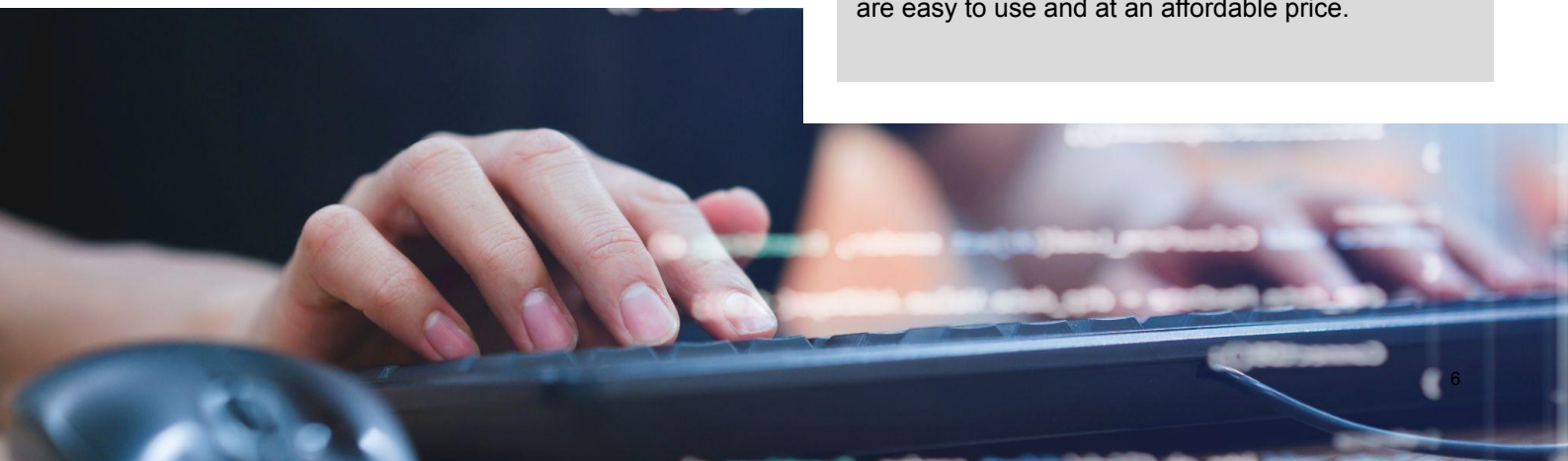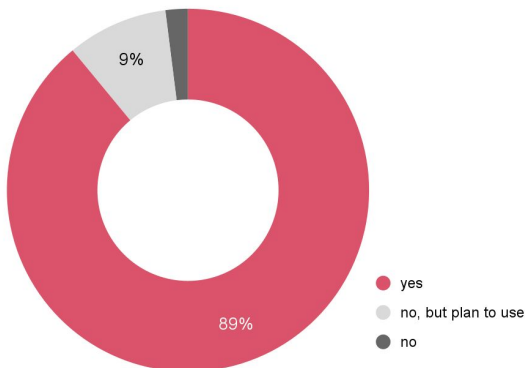
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Adoption of cloud computing in Indonesia

80%+

of respondents are currently using some form of cloud computing

Our survey revealed that cloud computing is used by the vast majority of respondents. Among the small and medium businesses, 89% of respondents are actively using cloud services, with 9% more planning to use it in the near future (see figure 3)

Among large enterprises, 80% of respondents are already using cloud technology, 11% are planning to use it this year and the remaining 7% plan to use it in the next three years (see figure 4). However, among those who are currently using cloud computing, in general this seems to represent only a relatively small part of their computing resources as only 7% of the large enterprise respondents have currently allocated cloud computing at more than 20% of their IT budget (see figure 5)
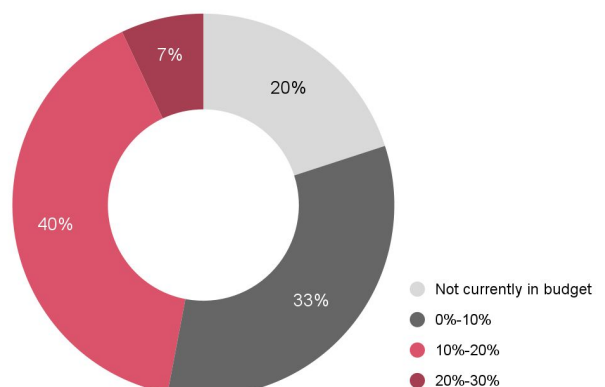
Figure 3: Cloud adoption in Small and Medium Businesses

Q: Do you currently use cloud services?

9%

89%

- yes
- no, but plan to use
- no

Figure 4: Cloud adoption in large enterprises

Q: What is your current adoption level of cloud services?

7%
13%
20%
60%

- Plan in 3 yr
- Plan this year
- Some cloud
- Mostly cloud
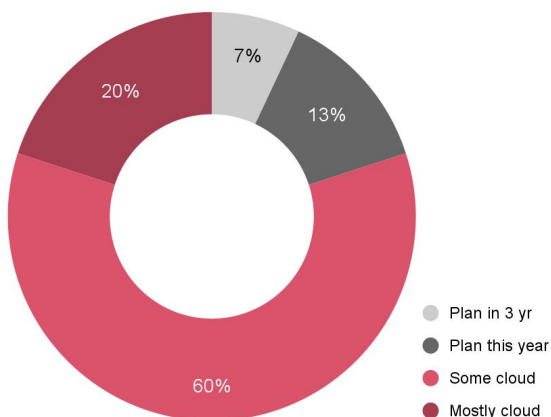
Figure 5: Allocated IT budget cost for cloud services for large enterprises

Q: How much cost is allocated from annual IT budget for cloud services?

7%
20%
40%
33%

- Not currently in budget
- 0%-10%
- 10%-20%
- 20%-30%

Figure 6: Types of cloud services adopted in small and medium Businesses

Q1: What types of cloud services have you used to support your business?

Q2: What additional cloud services have you added to support your business after your business started operation?

Q3: What type of cloud services you plan to add in the future to support your business?
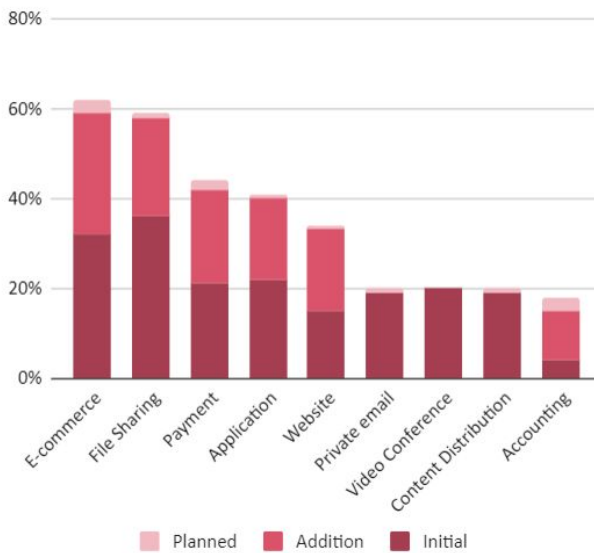
Our survey found that small and medium business respondents use a variety of cloud solutions. 60% of them use an e-commerce cloud service. This may be explained by the fact that e-commerce was the primary sales channel during the COVID-19 pandemic. File sharing solutions have almost the same level of usage at slightly less than 60%.

Next in terms of popularity we see payment solutions, office productivity applications and websites which were used by around 40% of respondents. From the survey we also found that around half of the respondents only started to use the above cloud solutions after they had been operating for some time. This illustrates that these small and medium businesses managed to adopt cloud computing and change their operations while they were operational.

There were also a few solutions used by only about 20% of the respondents. This includes private email, video conferencing, content distribution and accounting.

Figure 7: Types of cloud service models adopted in large enterprises

Q: What types of cloud service model do you currently use in your organization?

Q: What types of cloud service model do you plan to use in your organisation in the future?
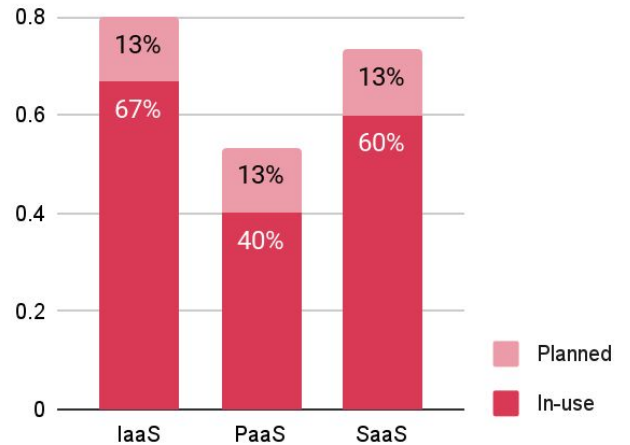

For large enterprises, we asked about which cloud service models they are using. Some companies are using more than one cloud service model, including IaaS, PaaS, and SaaS. From these three cloud service models, 67% of large enterprise respondents are using IaaS, followed by SaaS at 60% and lastly PaaS at 40%. This indicates that cloud in large enterprises is used more for capacity expansion (main use case of IaaS) and ready made solutions (main use case of SaaS) than for software development (main use case of PaaS).

Figure 8: Reasons to adopt cloud technology for Small and Medium Business

Q: Why do you use cloud services?
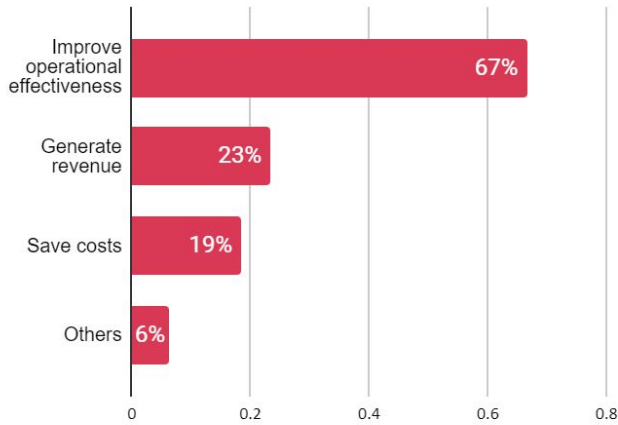
The survey also asked about the reason businesses adopted cloud computing. 67% of the small and medium businesses respondents stated that improving operational effectiveness was their reason to adopt cloud computing. Revenue generation was the next popular response at 23%, while 19% stated that cost saving was their reason.

Figure 9: Reasons to adopt cloud technology for large enterprises

Q: What were your reasons for adopting cloud computing?
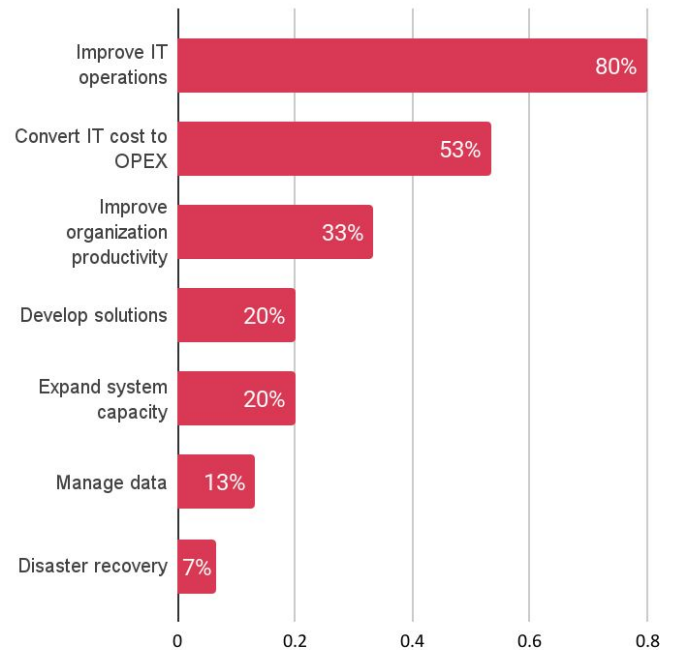
The most common reason for cloud adoption for large enterprises was to improve IT operational effectiveness (80%). The second most common reason was to convert the IT cost model from capital investment to operational costs (53%), followed by improving productivity (33%). Some of these companies are currently using the Cloud for disaster recovery (around 7%).
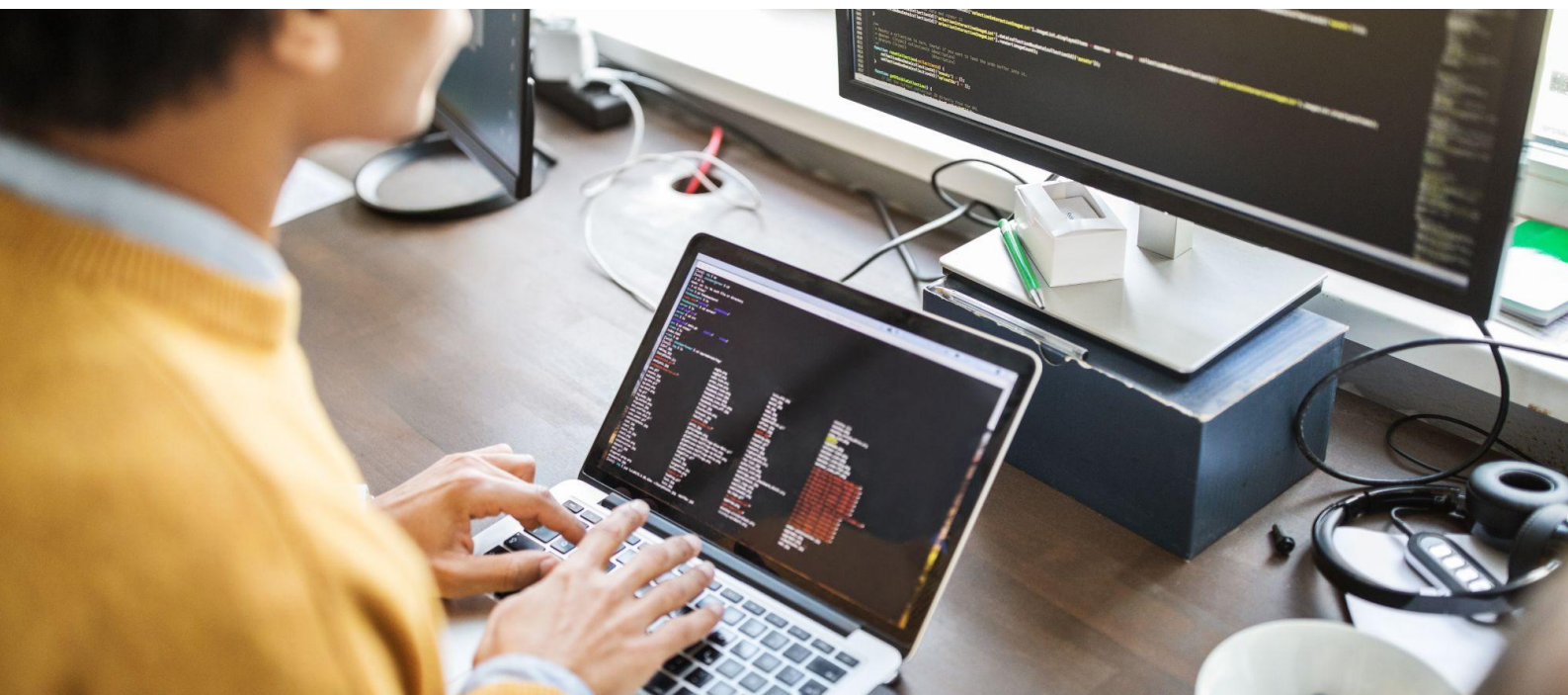
Benefits of cloud computing for businesses

The potential benefits of cloud computing as a utility service for computing resources are clear, and our survey provides an insight into the specific benefits that are expected or have been realised by Indonesian companies. We will discuss first the top line (revenue) benefits of cloud computing before going into the cost saving benefits.

Revenue impact of the Cloud on the small and medium business segment

Respondents from the Small Medium Business segment reported that a significant portion of the their revenue was positively impacted by their use of cloud computing. In fact, 84% of the SMB respondents who are currently using the Cloud say that they saw a revenue increase of 20% or more attributable to the use of cloud computing (figure 10)

Further breakdown of this number shows that the revenue increase varies based on the type of industry in which they operate. The highest reported revenue improvement came from the business services sector while the lowest came from wholesale and retail trades (see figure 11).
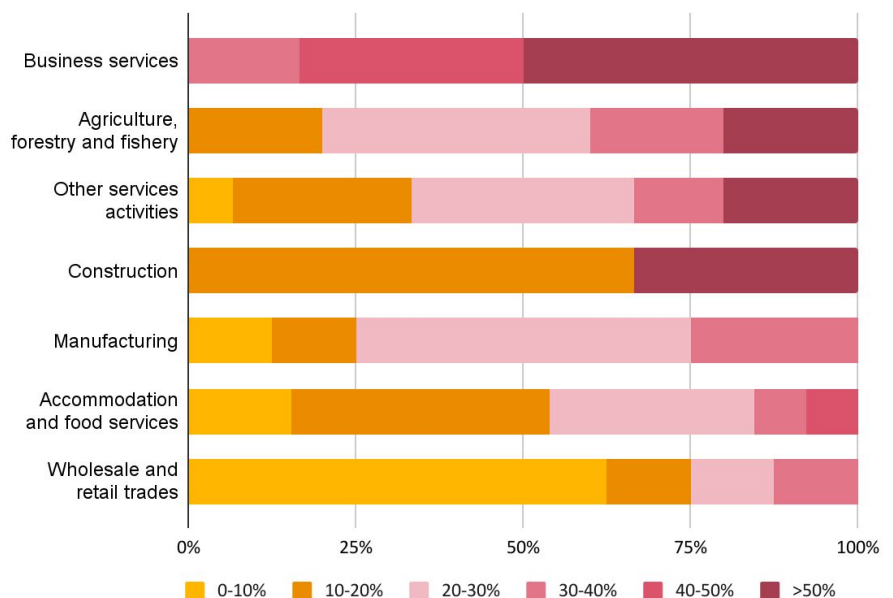
Figure 10: Revenue improvement by using cloud for SMB

Q: How much is the increase in your income / turnover from the use of the cloud service?

Legend:
- 0%-10%
- 10%-20%
- 20%-30%
- 30%-40%
- 40%-50%
- >50%
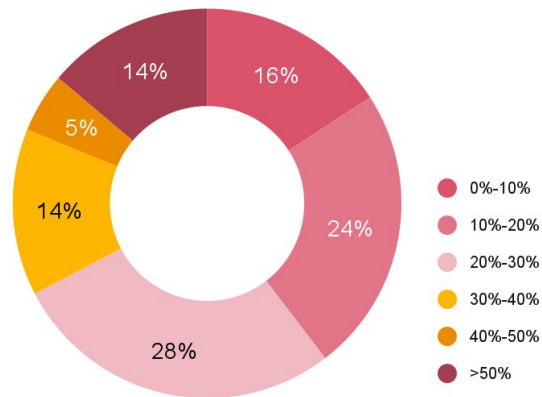
Figure 11: Revenue increase by adopting cloud service for SMB based on industry

Q: How much revenue increase do you get from using the selected cloud service?

Legend:
- 0-10%
- 10-20%
- 20-30%
- 30-40%
- 40-50%
- >50%

Figure 12: The benefits of cloud computing for large enterprises

Q: To what extent do you agree/disagree with the statements regarding the benefits of cloud

	Strongly disagree	Somewhat Disagree	Neutral	Somewhat agree	Strongly agree
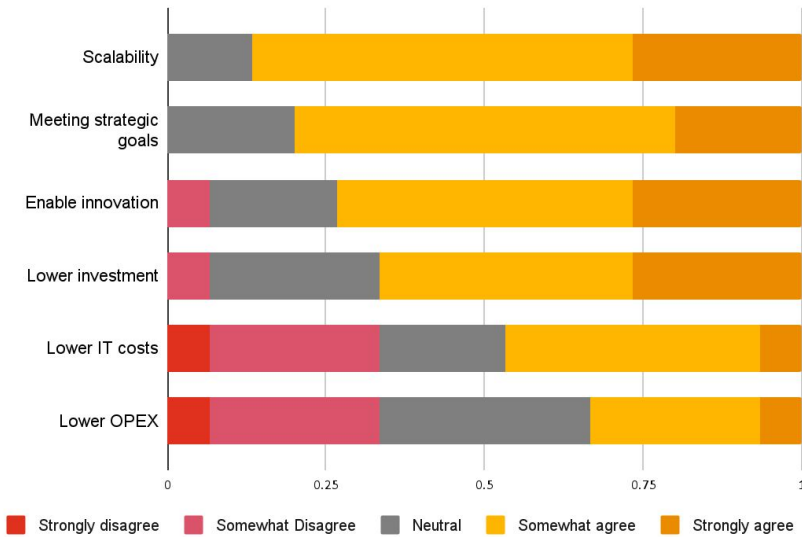
Figure 13: Productivity benefit of cloud for large enterprises

Q: Is there any increase in your productivity after using the cloud?
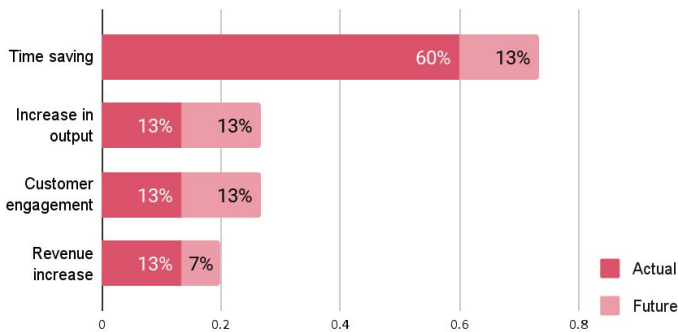
Potential benefits of cloud for large enterprises

Large enterprise respondents expect the benefits to be delivered through the Cloud's ability to scale up or down quickly in response to the market dynamics. This in turn enables companies to foster innovation, allowing experimentation and listening better to their customers. All of these can be done without a significant upfront IT investment.

Many of the large enterprise respondents also saw that cloud computing would potentially lower IT costs and overall OPEX, but cost saving is not seen as the main benefit targeted by companies in the large enterprise segment as cost saving benefits ranked lower compared to scalability, meeting strategic goals, and innovation. We will discuss further the cost saving benefits on the next page.

In terms of productivity benefits, most respondents (80%) agreed that cloud computing could deliver significant time saving. The Cloud's key characteristics of rapid scaling and on-demand self-service reduce the time needed to acquire and implement the IT infrastructure and that significantly speeds up their time to market. Other productivity benefits cited by respondents included increased output, improved customer engagement and increased revenue.

CASE STUDY

A company in ride-sharing business processes millions of transactions daily using cloud computing

Situation:
As an online digital transportation platform, the company needs to be able to process millions of requests daily and process the demand for services within seconds.

Cloud based solution:
Cloud computing enables massive parallel processing of the requests for a quick turnaround
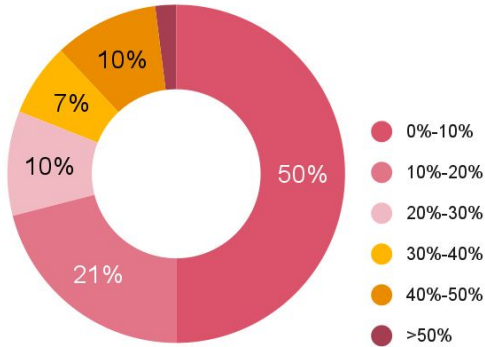
Benefits:
➔ Ability to process data in parallel for real-time transaction processing
➔ Scalability of the system to grow with the business
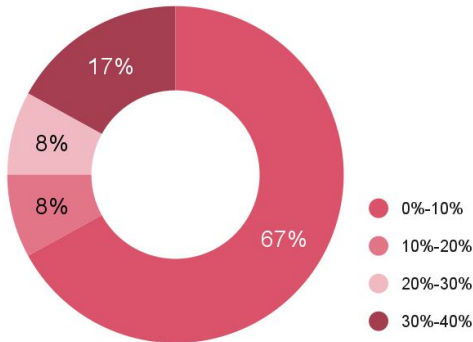
Case study courtesy of AWS

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Figure 14: Cost saving impact of cloud for SMB

Q: How much is the decrease in operating costs from using cloud services?

- 0%-10% — 50%
- 10%-20% — 21%
- 20%-30% — 10%
- 30%-40% — 7%
- 40%-50% — 10%
- >50%

Figure 14: Cost saving impact of cloud for large enterprises

Q: How much is the estimated cost saving that you get by implementing cloud services?

- 0%-10% — 67%
- 10%-20% — 8%
- 20%-30% — 8%
- 30%-40% — 17%

Cost saving benefits from cloud computing

Adopting cloud computing will typically result in a direct saving on the cost for IT hardware and software. This is mainly because by using the Cloud companies do not have to buy extra capacity upfront to account for planned growth and/or to handle the peak load of the system. Adopting the Cloud will also reduce the cost of internal IT support staff because some of the functions of the internal IT support will be replaced by the cloud provider. The cost saving may also extend beyond IT and into the business side.

In the survey we asked the respondents about how much cost saving they have seen by adopting cloud computing. About 50% of SMB respondents who are currently using cloud computing said that they gained cost savings of more than 10% (see figure 14). It is interesting to note that 19% of them state an even higher cost saving of 30% or more.

Respondents from the large enterprise segment stated a more modest cost saving impact compared to the SMB segment. In this segment only 33% of current cloud users obtained cost savings of more than 10%. This is consistent with the earlier question about cost savings as a potential benefit whereby 30% of these respondents disagreed that cloud computing would result in reduced overall costs.

Nevertheless, the survey does confirm that companies are seeing cost saving from the use of cloud computing, especially in the SMB segment.

Potential use cases of cloud computing for the large enterprise segment

The survey asked for more details on how the respondents saw the opportunity of using the Cloud. 70% of the respondents said that their organizations were considering using the Cloud for Big Data and analytics.

More than 40% of respondents believe they could use cloud computing in the area of non-core systems, with more than 30% specifically in CRM and Marketing and close to 30% for ERP (Enterprise Resource Planning)

During the COVID-19 pandemic, the need for online collaboration has increased significantly, 40% of respondents saw opportunities to use the Cloud for collaboration purposes and 20% of respondents saw opportunities to use it for office automation.

The respondents saw more opportunities to adopt cloud services for their non-core systems compared to their core systems. The non-core systems are often less complex and therefore easier to migrate to the Cloud compared to the core system. Companies may also consider it is less risky to put non-core systems in the Cloud until they get more experience in using the Cloud.

An observation from the survey is that many respondents saw an opportunity to adopt SaaS solutions such as ERP, CRM, collaboration, office automation, and collaboration. SaaS solutions in general can simplify the IT solution life cycle from the ideation phase until the operations and maintenance phase.

Figure 16: Opportunity for cloud services

Q: What kind of IT services do you see as most suitable for your organisation to be migrated to the Cloud environment?
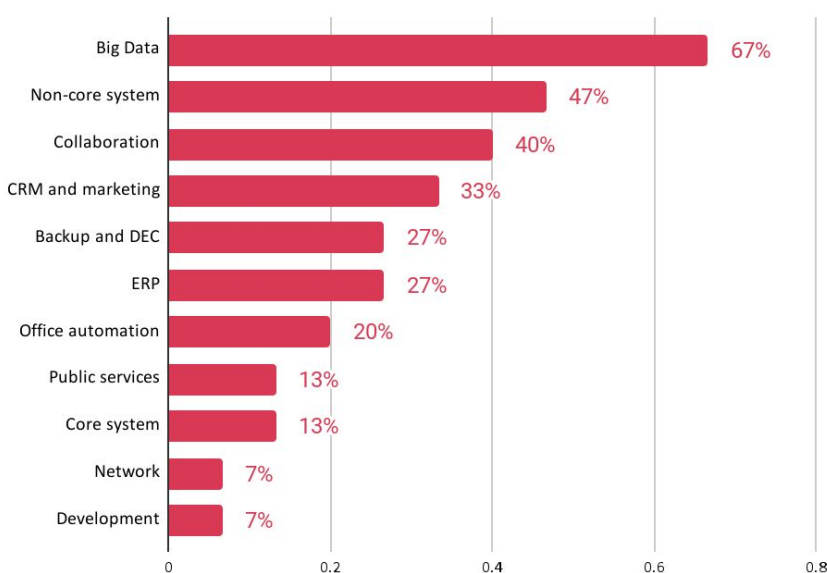
CASE STUDY

A provincial government in Indonesia uses Cloud Computing to coordinate COVID-19 response

Situation:
Lack of adequate infrastructure made it difficult to collect and analyse data to make decisions in planning and coordinating a COVID-19 pandemic response in the province.

Cloud based solution:
Developed a cloud-based application with more than 35 features, such as virus spread data collection and mapping, hospital bed availability, and vaccine distribution.

Benefits:
➔ Ability to reach citizens in remote areas digitally in real time.
➔ Better quality data for developing insights, making decisions, and coordination.
➔ Rapid and continuous development of the application.
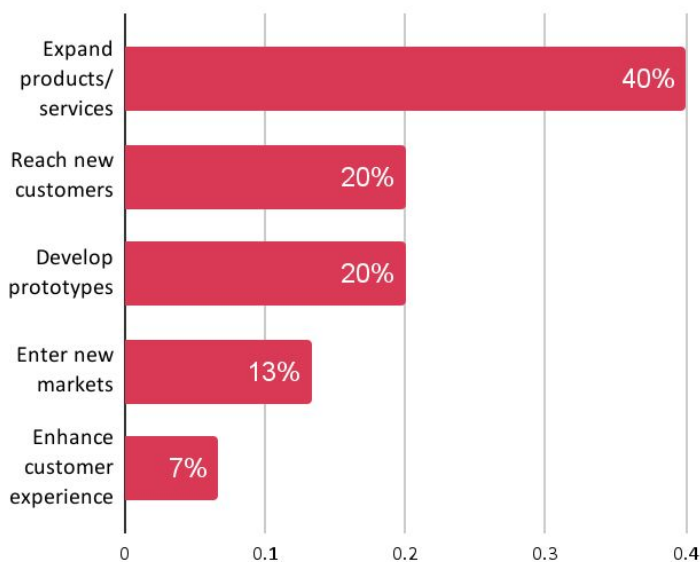
Case study courtesy of AWS

Innovation

Innovation is a significant competitive agenda for most organisations in the current digital era. The COVID-19 pandemic is forcing most companies to innovate and adopt digital technologies faster. The Cloud's ability to provide computing resources very quickly allows companies to experiment with ideas without having to spend much time in preparing the required infrastructure. If the idea does not work well, they can simply stop the Cloud services, thereby avoiding further costs. On the other hand, if the idea does work, they can scale up the IT infrastructure quickly to rollout the solution to a large number of users.

When we drilled down further on where in the innovation agenda cloud computing could help their organisation, 40% of respondents believed it was helping them to expand their products and services, another 20% are using the Cloud to reach new customers and 15% to enter new markets.

Figure 17: How cloud fosters innovation

Q: In what ways does cloud help to encourage innovation within your organisation?

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Economic value and other social impacts of cloud computing

Productivity benefits of the Cloud

At a business level, the use of cloud computing supports improvements in productivity, through cost or time reductions, or enabling staff to work more efficiently. For example, by streamlining analysis, information sharing and data management across teams and offices.

> Time savings were seen as the main productivity benefit of cloud by survey respondents, and over half also agreed that use of cloud computing lowers IT investment.

Quantifying the economic value of productivity improvements

This analysis leverages recent research by A. Yusuf, commissioned by the Asian Development Bank, on the effect of new and disruptive technologies on the Indonesian economy.[1] The research uses a recursive-dynamic multi-regional computable general equilibrium and applies sector-specific labour productivity shocks to the model, representing the effect of the new technological changes on the economy.

The model shows that an increase in labour productivity not only improves sector value-added (by producing the same amount of output for less cost), but also tends to increase the level of output. The extent of output expansion varies from sector to sector and depends on the sensitivity of demand to price changes. Output will expand significantly where demand is sensitive to a price reduction (achieved through more efficient use of resources), maintaining or increasing the demand for labour - i.e. negating the need for labour force reductions.

Attribution to the use of cloud computing

Overall, Yusuf found that Indonesia would experience a net gain to economic output and employment through the adoption of disruptive technologies, amounting to around 0.5% in additional GDP growth per year. However, to isolate the impact of cloud services adoption alone, we consider the level of investment in cloud services in Indonesia, relative to other forms of new investment in disruptive technologies.

It is estimated that around 12.5% per year on average of all new IT investment is in cloud technology.[2] It is assumed that this proportion will remain fairly constant, as total investment in new IT increases.

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1. Yusuf, Arief Anshory. 2020. "The Effect of New Technologies on the Indonesian Economy: An Economy-Wide Assessment". CSIS Working Paper.

2. Based on the results of this survey, as well as the findings of Frost & Sullivan 2018, Digital Market Overview: Indonesia

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Overall, it is estimated that the cumulative productivity benefit to the Indonesian economy of cloud adoption will be US$10.7 billion over the next five years (2021 - 2025).

Figure 18: Estimated future GDP uplift due to the adoption of cloud computing in Indonesia, Real terms, USD billion

	2021	2022	2023	2024	2025	Subtotal
	1.0	1.6	2.1	2.7	3.4	10.7
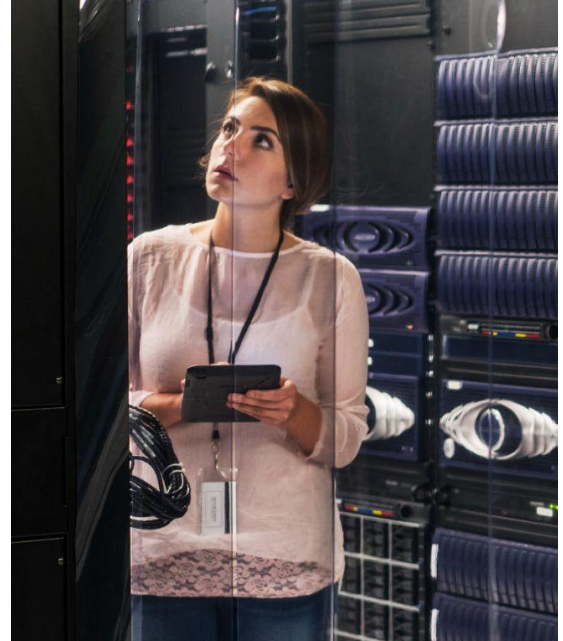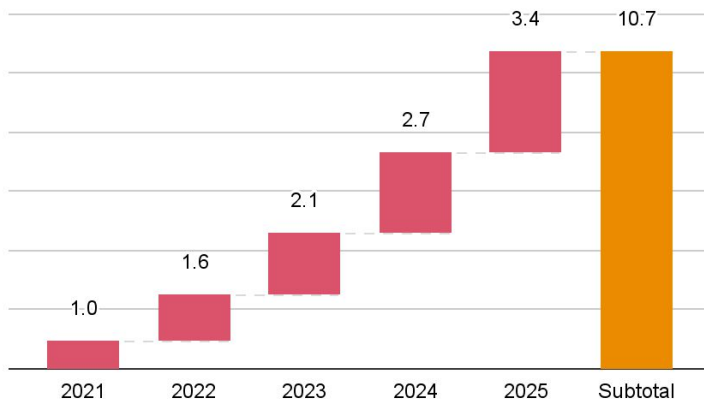
Implications for jobs

With technological advances, like robotization and automation, has come uncertainty regarding the impact on jobs, particularly in capital intensive sectors like manufacturing. The research in this space is still emerging, however there appears to be a growing consensus that although many existing jobs will be at risk of potential displacement, technological advancement provides the opportunity for workers to shift out of manual and routine jobs, and leads to greater wealth generation and employment over the longer term.[3]

Yusuf's research supports the view that technological adoption by companies is necessarily labour-displacing and that it often transforms tasks, jobs and skills, leading to higher innovation and output overall. In terms of the Cloud in particular, the survey findings suggest that it is indeed an enabler of greater productivity within workplaces, rather than replacing the underlying tasks of workers that it is designed to support.

Impact of cloud adoption on sustainability

Computing data centers use a lot of energy not only to power the servers and IT equipment, but also for air conditioning, redundant power, lighting, building operations, etc. A data center for a medium sized bank for example typically needs about 250 to 500 kilowatts of electricity. The increasing demand for computing power also means that these data centers need more power as they add more computing resources.

Data center efficiency

Efficiency of data centers is measured by a widely accepted standard called Power Usage Effectiveness (PUE). The formula to calculate PUE is as follows:

$$PUE = \frac{\text{Total facility power consumption}}{\text{IT equipment power consumption}}$$

Traditional data centers run by companies in Indonesia have PUE between 1.8 and 2.5. In contrast, data centers run by global cloud providers run in the 1.1 to 1.5 range, or sometimes even lower.

PUE	Level of efficiency
3.0	Very inefficient
2.5	Inefficient
2.0	Average
1.5	Efficient
1.2	Very efficient

Large scale adoption of cloud computing is expected to result in energy savings due to consolidation of computing resources from individual data centers to the cloud provider's data centers that are run more efficiently at a higher utilization rate. Study by 451 Research [4] estimated an 80% energy savings from migrating business applications from on-premises facilities to the Cloud in Asia Pacific. Carbon footprint will be further reduced as cloud providers utilise more renewable energy.

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3. See for example: PwC 2018, *Will robots really steal our jobs? An international analysis of the potential long term impact of automation*
4. 451 Research July 2021, *The carbon reduction opportunity of moving to the cloud for APAC*

5 Realising the full potential of cloud computing

Challenges in adopting cloud computing

What are the barriers to companies realising the potential benefits of cloud computing? Our survey provides indications of different challenges SMBs and large enterprises have to overcome in adopting cloud computing.

Small and medium business challenges

SMBs typically do not have substantial internal IT resources in-house so they are more dependent on the out-of-the-box services that cloud providers offer. Naturally, SMBs expect that cloud services can be used easily and reliably as they might not have substantial time and resources to customise the services or ask for support from cloud service providers to troubleshoot issues.

Usability

Features must be easy to use with the end-user experience in mind. 20% of respondents see that finding appropriate service offerings that meet their exact uses and needs are a key challenge for them to adopt the services.

Support

Only about 10% of the SMB respondents cited support as a key challenge. This might be driven by the expectation that cloud services should work reliably all the time and be easy to use. These users do not expect to have to make a call to request support to resolve issues.

Cost

Almost 20% of SMB respondents said that the cost of the Cloud is a challenge for them. SMBs are generally very pragmatic and practical. They correlate the overall cost of the services with direct benefits that they gain whether from practicality, time-saving or increase in revenue / sales.

Figure 19: Challenges in adopting cloud for SMB

Q: What are the concerns or challenges that you face when adopting the Cloud service?
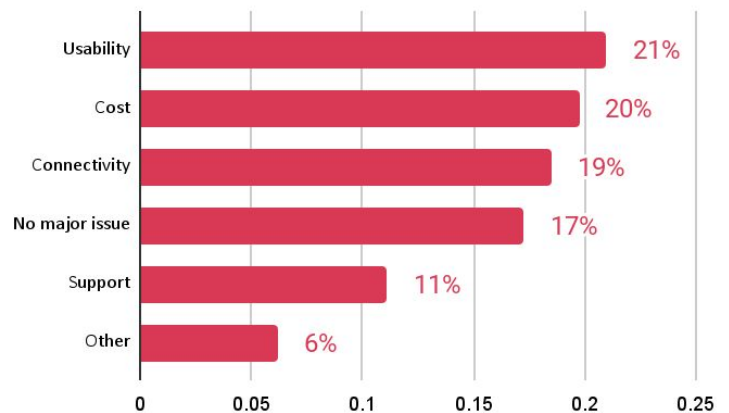
Connectivity

The stability and availability of sufficient bandwidth of network connectivity is a key factor for SMBs to be able to use cloud services. SMBs might lack the expertise to troubleshoot connectivity issues and pinpoint the appropriate solution (e.g. device issues, telecommunication issues or cloud service providers issues). When they experience issues with connectivity and accessibility, they might resort to not using the services at all.

Large enterprise business challenges

Large enterprises have typically invested in their own IT resources. They have substantial IT resources deployed in-house, third party vendors that support them and many existing legacy applications that are vital to support their business operations. These factors result in a different set of challenges compared to the SMBs. Actions required to overcome these challenges will be discussed later in this paper

Talent availability

The majority of large enterprises cited talent availability as a key challenge. Cloud platforms and technology are relatively new and their IT resources are not yet familiar and experienced enough with managing the public cloud platforms.

Implementation cost

Although companies are aware of the potential benefits of using cloud services in the long run, they have concerns over initial implementation costs, which include developing new applications that use the Cloud platforms' capabilities, migrating the data and services to new cloud platforms and the potential risks associated with the migration.

Legacy integration

Most large enterprises already have their critical business operations supported by applications running on top of legacy technology. Many of the legacy systems are based on proprietary technologies for which integration might be a hurdle to overcome, especially for integrating with new applications or services running on top of cloud platforms. If integration is not feasible, enterprises might choose not to adopt the Cloud services.

Figure 20: Challenges in adopting cloud for Large Enterprises

Q: What are the major concerns or challenges of implementing cloud in your organisation?
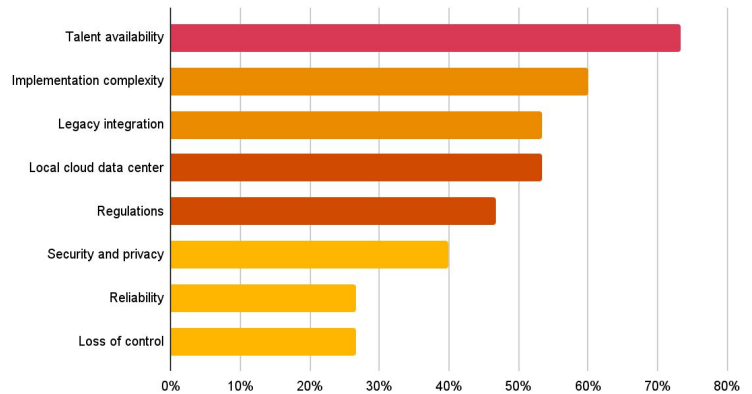
Availability of local data centers and uncertainty over regulation

Some large enterprises, especially those within the government or certain regulated industries such as banking need to comply with applicable government regulations related to data residency within the Indonesian national border. This explains the challenges cited by respondents around availability of local data centers and the perceived uncertainty over regulations

In addition, many of the respondents have concerns about having secure / private network connectivity to their existing on-premises environments. They think the local presence of a data center from a cloud provider could address the issue by having a dedicated physical network link between the Cloud provider's data center and their own data center.

Security, privacy, reliability, and control

Large enterprises generally have more concerns regarding security and privacy compared to small and medium businesses. They have internal policies related to security and privacy, and have established a set of well-defined controls and procedures to consistently monitor and manage the issues.

Cloud services need to comply with the company's internal policies and standards. Any non-compliance with those policies and standards might be a barrier to those planning to adopt cloud computing.

Talent: a key to success in adopting cloud computing

The survey indicates that having the right talent is key for companies to be able to take advantage of the full benefit that cloud computing has to offer. It starts with the ability for the business leaders to understand the potential benefits of cloud computing to engage customers better, innovate the business and operating model, increase revenue, and reduce costs.

For companies that already have significant in-house IT infrastructure, the journey to adopt cloud computing is more complex. These companies need to have the right talent to develop the future technology architecture incorporating cloud computing, planning the path to adopt cloud computing, and implementing the plan amidst constant change in technology. The skills in cloud platform management are cited as the biggest gap for large enterprises.

To overcome this, companies need the right skills, knowledge about the Cloud platform, including how to configure its features to meet the business needs, and integration with the existing IT infrastructure.

Successful business depends on having high-quality data and the ability to extract insights from the data. Skills in data management, data programming, and data migration are therefore key requirements.

The effectiveness of cloud computing also depends on good management of the underlying network resources, therefore skills in network management are also important to have.

These skills can be developed in-house by training the existing IT staff, by recruiting new talent, and/or utilising third party resources. While all three strategies are important, most of the respondents (53%) stated that training their existing IT staff is their primary method to close the skills gap in adopting cloud computing.
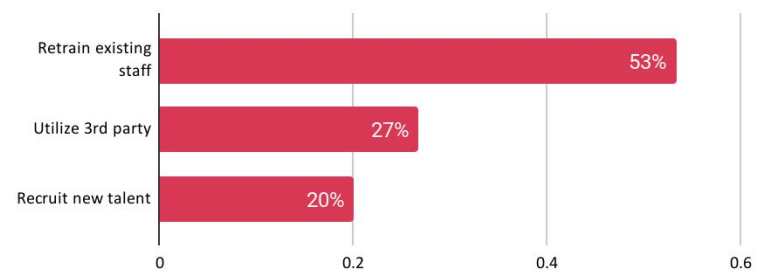
Figure 21: Key skill gaps for cloud adoption for Large Enterprise

Q: Which of the following skills do you think are important in supporting cloud adoption/acceleration in your organisation?
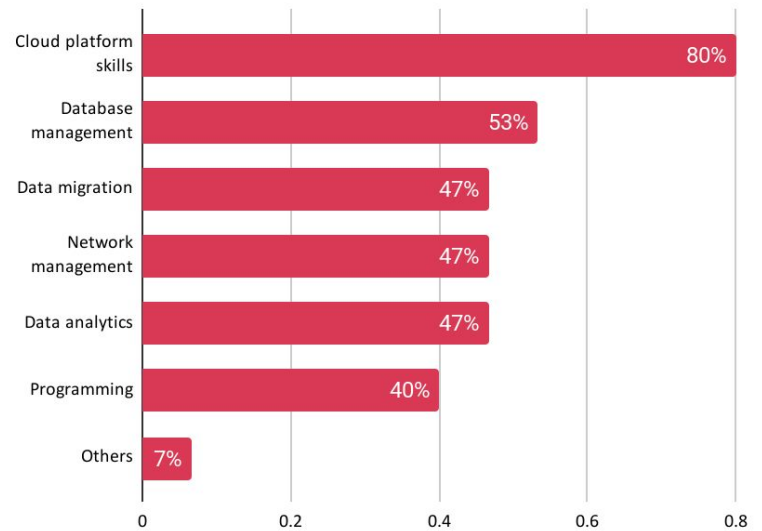
Figure 22: Talent fulfillment for cloud adoption for Large Enterprise

Q: How will you fulfill the need for talent during the cloud development and maintenance phase?

Indonesian regulations related to the use of the Cloud

The Indonesian government has long realised the importance of cloud technology to the economy and there are a number of regulations related to cloud computing. These regulations mostly concern the data residency, as opposed to the actual use of cloud computing. However since the cloud computing model fundamentally consolidates computing resources globally for economies of scale, the issue of where the cloud provider's data center resides has become interlinked with the data residency issue.

The survey indicates that about half of the respondents are concerned about what they perceive as uncertainty over regulations and whether the cloud provider's data center is located in the country. This corresponds to another finding from the survey that 80% of respondents considered the local presence of cloud providers to be either important or very important.

The most important Indonesian regulation regarding data residency is Government Regulation no.71/2019, which governs the implementation of electronic systems and transactions. It defines two types of electronic system operators: the public domain, which includes the Indonesian government, and the private domain, which includes the private sector. The state-owned enterprises are defined as part of the private domain.
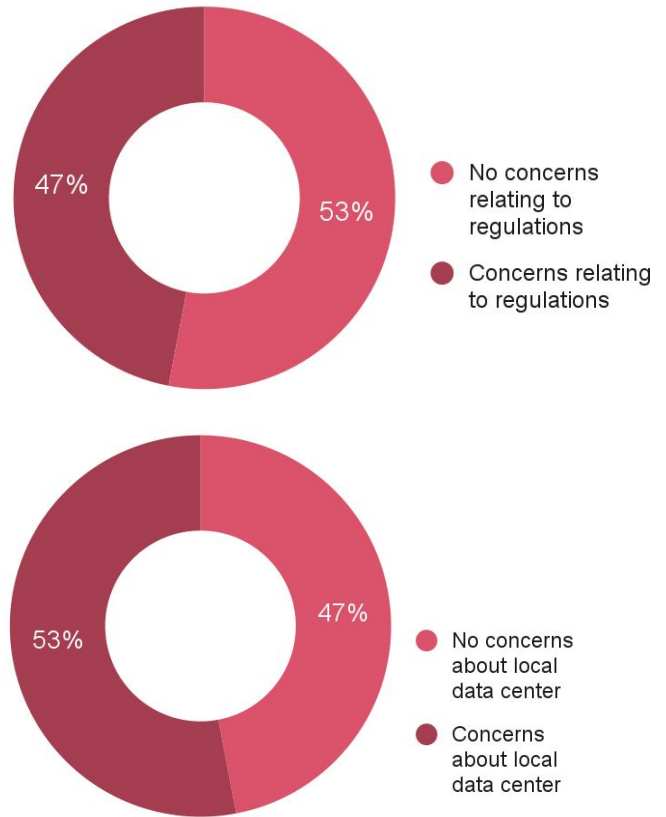
According to this regulation, for operators in the public domain, systems and data must be operated, processed, and stored within the Indonesian national geographical boundary. Exceptions to this need approval from the relevant Ministry.

This limitation does not apply to operators in the private domain, who are in general free to store data anywhere. However, there is an exception to the private domain for companies in regulated industries such as the financial services sector. The regulator in these industries may pass further regulations regarding data residency applicable to companies in that particular industry.

For the Financial Services industry, the related regulation on data residency is governed in chapter 21, POJK 13/No.03/2020 for the banking Industry and chapter 23, POJK 4/No.05/2021 for the non-banking financial services Industry passed by the OJK (Indonesian Financial Services Authority). These chapters state that financial services organisations must locate their Data Center and Disaster Recovery Center in Indonesia. An exception to this is possible through an approval process by the OJK.

Figure 23: Challenges in adopting cloud for Large Enterprise

Q: What are the major concerns or challenges of implementing cloud in your organisation?

- 53% No concerns relating to regulations
- 47% Concerns relating to regulations

- 47% No concerns about local data center
- 53% Concerns about local data center

Figure 24: The importance of the cloud provider's local presence

Q: How important is local presence of the cloud provider?

- 13% Not important
- 7% Neutral
- 33% Important
- 47% Very Important
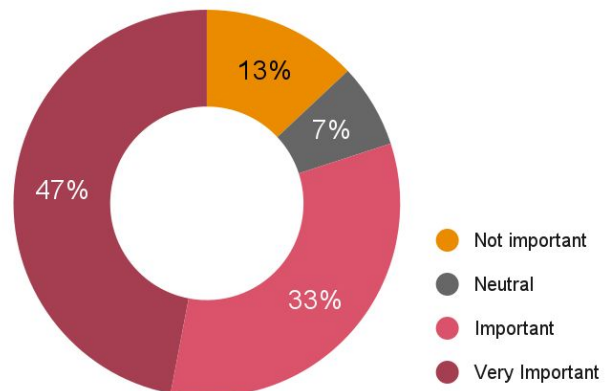
Moving forward with the Cloud

What should companies do to realise the full benefits that cloud computing has to offer? Taking insight from the survey findings, we recognise six actions for companies to take in their cloud adoption journey to maximize the benefits of cloud computing. These six actions address the business, technology, and people aspects of cloud computing adoption.

1. BUSINESS: Establish clear objectives

Companies should start their journey by defining what business benefits they are targeting by using cloud computing. As our survey indicates, while the Cloud can save costs, there are other potentially larger benefits of cloud computing. Business benefits can be gained from the Cloud's inherent ability for rapid scaling up and down with no upfront investment. This could results in faster time to market and increased innovation.

Identifying and quantifying the target benefits at the start of the cloud adoption journey help companies make the business decision to justify the cost for implementing cloud computing. Along the way, the achievement of these business benefits should be monitored to see if there are any adjustments required..

2. BUSINESS: Build trust

Security, data privacy, and compliance are all important elements to build trust from all stakeholders.

IT infrastructure operated by cloud providers needs to comply with a very stringent security standard, therefore they typically have better security features than most IT infrastructure run privately by companies today. However, system security is only as strong as its weakest link. As the security risk profile of cloud computing is different from on-premises systems, companies moving to the Cloud need to assess all the risks, develop governance and control framework to mitigate the risks, and perform tests to ensure that the business is adequately protected.

Companies also need to understand the regulations that are applicable to them including data residency, data privacy and protection. These aspects must be addressed in the design and implementation of a cloud-based solution.

Figure 25: Realizing the full potential of cloud computing

3. TECHNOLOGY: Adopt a *cloud-first* mindset

Using the utility analogy, people building houses today would be thinking first about getting the electricity company to supply the electricity instead of installing their own generators. Similarly companies today should first think about getting their computing needs from the Cloud rather than building their own IT infrastructure. This *cloud-first* mindset is natural for small and medium businesses, but can be difficult for large enterprises with existing significant non-cloud IT infrastructure. However, due to quick advances in IT, systems typically need major upgrades every 3 years or so. Switching to the Cloud may make a lot of sense during one of these technology refresh cycles. Seeing business challenges through a pre-Cloud lens can blind a company to potential business opportunities of cloud-based platforms.

4. TECHNOLOGY: Be agile

PwC's Global Crisis 2021 survey [5] found that 87% of companies are now adapting their strategy to respond nimbly to major interruptions and implement changes. Cloud computing helps companies achieve the agility required to survive and even thrive in an unpredictable market.

This also mean that the cloud adoption journey itself needs to be agile. Companies need to start with envisioning the grand design but develop the adoption roadmap as a series of small steps and iterations. It is important to be prepared to revisit agreed-upon paths to determine if better options are available along the way.

For example a company's initial plan might be to get an IaaS (infrastructure as a service) from the Cloud and migrate the legacy application to the IaaS environment. The company then finds out that there is a SaaS (software as a service) offering that can provide all the functionalities that they need. The company should consider adopting the SaaS instead. In cloud computing you only pay for what you are using, such a move is easier to make since the company did not make a large initial investment previously.

5. PEOPLE: Reimagine the end-user experience

Adopting cloud computing often means changing the way users do their work. For instance, most cloud based applications nowadays can be accessed through mobile phones. This could be a big change for users who are used to have access to the company's internal applications only from their office desktop computers.

This change is an opportunity not only to improve the user experience, but also to gain staff members' support in making the change stick. Involve the users early to have them co-design and innovate on how the cloud can benefit them.

6. PEOPLE: Invest in talent

Lastly, but perhaps most importantly as the survey indicates, cloud adoption requires a significant shift in IT skills for companies with complex IT needs. Building an integrated business solution from various cloud-based components requires a different skill from developing standalone custom solutions in traditional IT environments.

Companies will require a combination of reskilling and new hires, as well as getting help from third-party specialists. They need to develop their talent strategy to invest in the required skills during the beginning stages of the Cloud transformation but also consider that adopting the Cloud will shift a number of roles currently performed in-house to their cloud provider.

5. PwC March 2021, *PwC Global Crisis Survey 2021 - Building resilience for the future*

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