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Analysis of the Influence of the Application of Cloud Computing Technology on the Operational Efficiency of Technology Companies in Startup Companies in Jakarta

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ABSTRACT

The application of cloud computing technology has become the main solution for companies in managing computing resources efficiently, especially for technology startup companies that have limited resources. This study aims to analyze the influence of the application of cloud computing on the operational efficiency of technology startup companies in Jakarta. This study uses a qualitative approach with a case study method. The data was collected through in-depth interviews with CTOs, IT managers, and company owners, and was accompanied by questionnaires given to licensed employees at the seven startup companies that were the subjects of the study. In addition, direct observation of the company's operations is also carried out to obtain more in-depth data. The results show that the application of cloud computing has had a significant positive impact on reducing operational costs, with an average cost reduction of 20% to 45%. In addition, startups are also experiencing increased flexibility in technology scalability as well as employee time and productivity efficiency, especially in remote work scenarios. Although data security was initially a concern, most respondents were comfortable with the security standards implemented by cloud service providers. The conclusion of this study is that cloud computing is an effective solution to improve the operational efficiency of technology startup companies in Jakarta. In addition to being able to reduce costs, this technology also supports increased productivity and operational flexibility.

INTRODUCTION

In today's rapidly developing era of digitalization, technology is the main pillar in supporting efficiency and innovation in various industrial sectors (Erwin 2023). Information and communication technology (ICT) has changed the way companies operate, from traditional business models to a more dynamic and data-driven approach (Setiawan 2023). One of the technologies that has played an important role in this change is cloud computing (Rinaldi, 2019). This technology allows companies to access computing resources over the internet without having to manage large and expensive physical infrastructure. The application of cloud computing has been proven to help

companies optimize their operations in a more flexible, efficient, and economical way (Deni, 2023).

Cloud computing technology has become one of the main pillars in digital transformation in various industry sectors, including technology companies. For startup companies, especially in Jakarta, the application of cloud computing is a potential solution in facing increasingly complex operational challenges (Panjwani 2022). Cloud computing allows companies to access flexible, efficient, and affordable technology resources, so that they can support business growth quickly and effectively (Gunawan 2024).

In Indonesia, especially in Jakarta as an economic and technological center, startup companies face considerable challenges in terms of operations. These companies must be able to compete in a highly dynamic and rapidly evolving market. As relatively new companies, startups often operate with limited resources, both in terms of finance and technology infrastructure. Therefore, they need technological solutions that are not only efficient, but can also be adapted quickly according to the company's growth. One of the solutions that many startups in Jakarta consider is the application of cloud computing.

Specifically, the application of cloud computing in startup companies offers a number of advantages, such as reduced infrastructure costs, increased flexibility, and accelerated time to bring products or services to market (Yahya, 2023). Startups no longer need to spend a fortune to build and maintain physical servers or complex IT infrastructure. By utilizing cloud services, they can access computing resources as needed without having to make a large investment upfront (Wibowo, 2024). Additionally, cloud services allow startups to easily scale their operations according to business growth. This flexibility is very important considering the fast-growing nature of startups and always innovating.

According to RightScale's 2020 State of the Cloud report (Hu, Y. 2019), about 93% of companies worldwide have adopted cloud technology in some form, either through infrastructure services, platforms, or software (Infrastructure as a Service, Platform as a Service, Software as a Service). Cloud computing not only allows for a reduction in operational costs but also provides access to greater computing resources at a relatively low cost. This makes companies more agile in responding to market demands, increasing innovation, and providing faster service to customers. However, the application of cloud computing technology in various technology companies, especially startups in Jakarta, faces its own challenges. As the center of innovation and technology in Indonesia, Jakarta is an ideal city to learn how this technology is applied and its impact on the operational efficiency of startup companies (Rumetna, 2018). Startup companies, which often operate with limited resources, rely heavily on technology that is cost-effective and can scale up as the company grows. However, despite the significant increase in cloud computing adoption in Indonesia, there are local challenges such as data security, government regulations, and internet infrastructure that are still uneven across the region.

The urgency of this research lies in the fact that in an era of fierce business competition, startups must be able to achieve operational efficiency to survive and thrive. With the increasing adoption of cloud computing in various industries, it is important to understand how this technology can be optimized in a local context, such as in Jakarta. In addition, the COVID-19 pandemic has also accelerated the need for companies to switch to digital solutions, including cloud computing, to maintain business continuity amid uncertain economic challenges.

Suryani, N. (2018) "The Effect of Cloud Computing on the Operational Cost Efficiency of Startup Companies in Indonesia." This study examines the impact of the application of cloud computing on reducing operational costs for technology startups in Indonesia. The study shows that using the cloud can lower costs by up to 40% through reduced infrastructure requirements and physical IT services.

Pratama, H. (2019) "Cloud Computing as a Strategic Tool for Enhancing Innovation in Startup Companies." This research focuses on how cloud computing enhances innovation in startup companies through the flexibility it offers. The study found that cloud adoption allows companies to accelerate time-to-market with reduced technology barriers.

Wang, Y., & He, L. (2020) "The Impact of Cloud Computing on Operational Efficiency in Small and Medium-sized Enterprises (SMEs)." Contents: This study examines the impact of the use of cloud computing on operational efficiency in small and medium enterprises (SMEs). The study found that companies that use this technology experience an increase in productivity and efficiency of up to 35%.

This research has several outstanding novelties. First, in terms of local contexts, most previous studies have focused more on international contexts or national scales. This research makes a new contribution by analyzing the impact of cloud computing on the operational efficiency of startups in Jakarta, a city that has unique characteristics as a center of technology growth in Indonesia. Second, the focus of this research on technology startup companies is also a differentiating aspect. Although the benefits of cloud computing have been widely discussed in the context of SMEs or large enterprises, this research specifically highlights the operational challenges faced by technology startups, which are different from more established companies. Third, this study not only explores the positive impact of cloud computing but also examines the local obstacles that startups face in adopting the technology in Jakarta, such as infrastructure and regulatory issues, which have often been overlooked in previous studies.

Thus, this research not only complements the existing literature, but also offers a new perspective on the application of *cloud* technology in the context of technology startup companies in Jakarta.

The purpose of this study is to analyze the influence of the application of *cloud computing* on the operational efficiency of startup technology companies in Jakarta. In addition, this study aims to identify the obstacles that startups face in adopting the technology and provide recommendations on how to optimize its implementation.

The benefits of this research are expected to provide practical insights for technology startups in Jakarta in adopting *cloud computing* to improve their operational efficiency. In addition, the results of this research can also provide input for the government and investors in supporting the adoption of *cloud technology* in the startup sector.

The implications of this research include theoretical contributions in information technology literature as well as practical contributions for startup companies and the government in formulating more effective technology development strategies in Jakarta. Thus, this research is expected to provide in-depth insight into the role of cloud computing in supporting the operational efficiency of technology startup companies in Jakarta and contribute to the development of technology adoption strategies in the future.

Method

This study uses a qualitative approach to analyze the influence of the application of cloud computing on the operational efficiency of technology startup companies in Jakarta. The qualitative approach was chosen because this research aims to understand the phenomenon in depth and extract insights from the subjective experience of startup business people related to the application of cloud technology.

Research Design

The research design used is a case study. The case study allows researchers to explore in depth the process of cloud computing adoption in a startup environment in Jakarta, as well as its impact on the company's operational efficiency. This research uses an exploratory design, where researchers seek to dig up information and a broad understanding of how cloud computing is implemented and how startups use it to achieve efficiency.

Location and Subject of Research

This research was carried out in Jakarta, which is known as the center of the technology startup ecosystem in Indonesia. Startups that are the subject of the study are selected based on the following criteria:

1. It is based in Jakarta and has been operating for at least two years.
2. Using cloud computing technology as part of their technology infrastructure.
3. Engaged in the technology sector that utilizes the cloud to support operations, product development, or services.
4. The subject of the study involved 5 to 7 technology startup companies that met the above criteria. The respondents interviewed in this study are information technology (IT) managers, CTO (Chief Technology Officer), or startup owners who are responsible for the application of cloud computing technology.

Research Instruments

The research instruments used in this qualitative approach are:

1. Semi-structured interview guide: This guide is designed to explore the subject's experience regarding cloud computing adoption, the obstacles faced, and the perceived impact on operational efficiency. The questions in the interview are structured flexibly to allow the researcher to dig deeper when needed.
2. Documentation: Researchers also collect secondary data in the form of internal documentation of startups, such as annual reports, reports on the use of cloud technology, and operational efficiency data before and after the adoption of this technology.

Data Collection Techniques

The data collection technique in this study involves several stages as follows:

1. In-depth interviews: Semi-structured interviews are conducted directly or through online media (video calls) to respondents. This interview focuses on their experiences related to the application of cloud computing, the benefits they feel, and the obstacles faced in daily operations. These interviews were recorded, then transcribed for further analysis.
2. Participatory observation: Researchers also conduct participatory observations on several startups that allow researchers to be involved in the day-to-day operational activities of the company, especially those related to the use of cloud computing. This

is done to gain a deeper understanding of the implementation of the technology in the field.

3. Documentation: Collection of secondary data from company documents, such as technology usage progress reports, financial reports, and operational performance data before and after the implementation of cloud computing. This data is used to support the results of interviews and observations.

Data Analysis Techniques

Data collected from interviews, observations, and documentation were analyzed using thematic analysis methods. The analysis process involves the following steps:

1. Data transcription: All interview and observation data are transcribed to facilitate the analysis process.
2. Data coding: Researchers identify key themes or patterns that emerge from the data. These codes are then organized into categories relevant to the research objectives.
3. Theme analysis: The researcher connected these themes with the research objective to answer the question of how cloud computing affects the operational efficiency of startups in Jakarta.
4. Data interpretation: The analyzed data is then interpreted to produce relevant findings, both in the form of positive impacts, constraints, and potential optimization of the application of cloud computing in technology startups.

RESULTS AND DISCUSSION

General Description of Respondents

This research involves seven technology startup companies operating in Jakarta. Each company operates in various technology sectors, such as fintech, e-commerce, mobile applications, and educational platforms. All companies have been adopting cloud computing technology for more than a year. Respondents in this study involved Chief Technology Officer (CTO), IT managers, and several company owners who are responsible for decision-making related to the application of cloud computing. In addition, 30 licensed employees from various divisions were also involved in filling out questionnaires to broaden their perspectives on operational impact.

Table 1 Respondent's Company Profile

Company	Field	Number of Employees	Long Cloud Deployment	Cloud Services
Company A	Fintech	15	2 years	Amazon Web Services (AWS)
Company B	E-commerce	25	1.5 years	Google Cloud
Company C	Mobile Apps	10	3 years	Microsoft Azure
Company D	Education Platform	35	2.5 years	AWS
Company E	Fintech	40	1 year	Google Cloud
Company F	E-commerce	50	2 years	Microsoft Azure

Company G	Mobile Apps	20	3 years	AWS
Company D	Education Platform	35	2.5 years	AWS
Company E	Fintech	40	1 year	Google Cloud
Company F	E-commerce	50	2 years	Microsoft Azure
Company G	Mobile Apps	20	3 years	AWS

These companies vary in size, with the number of employees ranging from 10 to 50 people. They use various cloud service providers such as Amazon Web Services (AWS), Google Cloud, and Microsoft Azure.

Key Findings from Interviews with Management

The results of interviews with CTO and IT managers revealed several key findings related to the impact of cloud computing on startup operations. All respondents stated that the implementation of this technology has a positive impact, especially in terms of cost efficiency, scalability, and operational flexibility.

a. Reduced Operational Costs

All companies reported a significant decrease in operating costs after the adoption of cloud computing. Before using the cloud, companies had to spend a lot of money to purchase, maintain, and update physical infrastructure such as servers. By switching to cloud services, the costs associated with maintenance and hardware purchases can be minimized. For example, Company A recorded a 30% reduction in costs in the first year after cloud adoption.

b. Scalability and Flexibility

Startup companies report that one of the main advantages of cloud computing is the ability to increase or decrease server capacity as needed. Respondents from Companies B and C highlighted that when demand for their applications increases dramatically, they can increase capacity without having to make a large investment in physical infrastructure. This flexibility is crucial in ensuring operations continue to run smoothly amid a surge in demand.

c. Data Security

Data security is one of the company's initial concerns before adopting cloud computing. However, over time, most companies are more comfortable with the security provided by cloud service providers. These companies feel confident because cloud service providers already have international security certifications, such as ISO 27001 and PCI DSS, which ensure data protection.

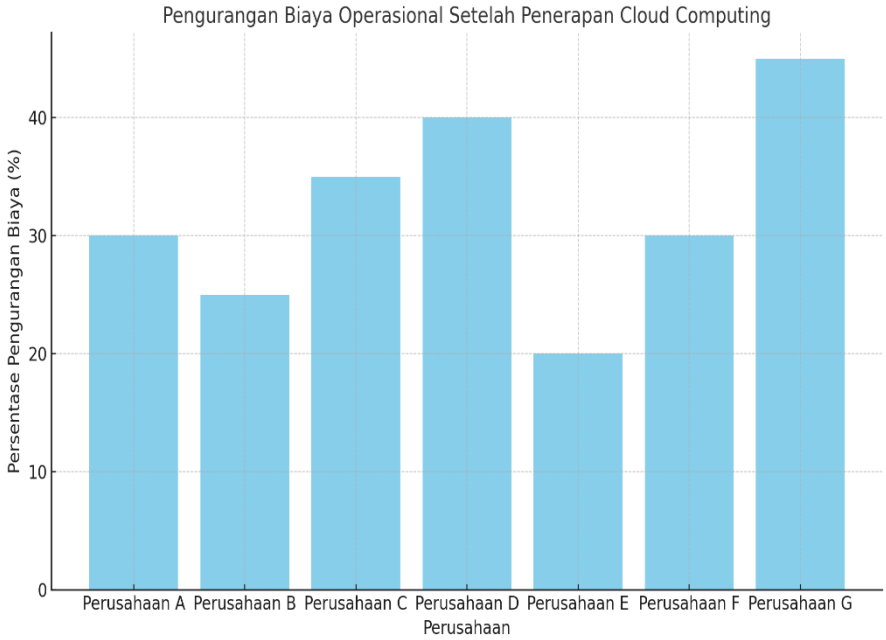

Figure 1. Reduction in Operational Costs After the Implementation of Cloud Computing

Table 2 Key Findings from Interviews with Management

Aspects	Findings
Cost Reduction	Operational costs reduced by an average of 30-40%
Scalability	Ability to increase server capacity in minutes, especially during spikes in demand
Data Security	Trust in *cloud* providers is increasing, with internationally recognized security

Findings from the Licensed Employee Questionnaire

A total of 30 employees from 7 startup companies filled out a questionnaire regarding the impact of *cloud computing* on their daily work. The findings from the questionnaire reveal several important aspects:

a. Time Efficiency and Productivity

As many as 80% of respondents stated that the implementation of *cloud computing* has improved their time efficiency. Previously, limited access to data and applications was often an obstacle, especially when working outside the office. However, with *the cloud*, employees can access applications and data more quickly from multiple locations.

b. Ease of Remote Working

As many as 75% of employees report that *cloud computing* makes it easier for them to work remotely. This has been especially beneficial during the COVID-19 pandemic, where most employees have had to work from home. Fast and secure access to company data allows employees to stay productive even when not in the office.

Perception of Data Security

As many as 70% of employees feel secure with the *cloud* services their company uses. Despite this, 30% of employees still express concerns regarding potential data leaks.

Table 3 Results of Employee Questionnaire on the Use of Cloud Computing

Assessed Aspects	Positive Percentage	Neutral/Negative Percentage
Time Efficiency and Productivity	80%	20%
Ease of Remote Work	75%	25%
Data Security	70%	30%

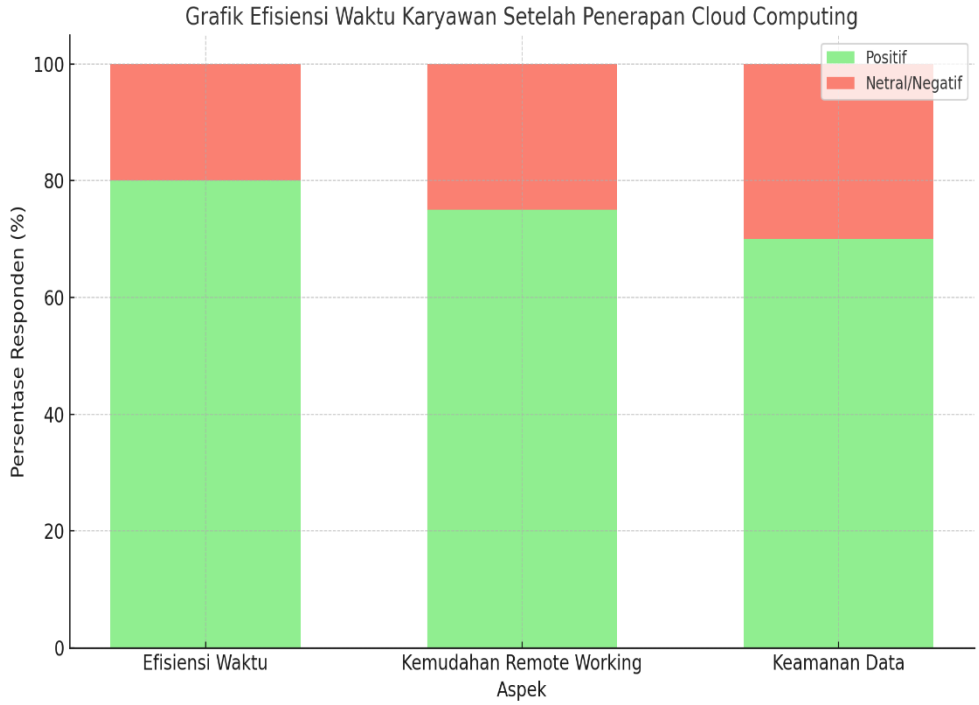

Figure 2 Graph of Employee Time Efficiency After the Implementation of Cloud Computing

Observation Results

Observations were made on two companies (Company A and Company D) to see firsthand how *cloud computing* is used in daily operations. The observation results show that *cloud computing* has been well integrated in the operations of these companies.

a. Integration of Cloud Services with Operations

In Company A, AWS services are used to store financial transaction data in real-time. Finance teams and app developers have fast and secure access to this data, which minimizes the risk of data loss and speeds up decision-making.

b. Using the Cloud for Product Development

At Company D, application developers utilize *cloud computing* to run test applications before launching them to the public. This allows them to test various features quickly without the need for a large investment in physical infrastructure.

Visualization of Findings

Here is a visualization of some of the main findings of this study:

a. Reduction of Operational Costs After the Implementation of Cloud Computing

The graph below shows the percentage reduction in operational costs in seven startup companies after using *cloud computing*. The company reported a reduction in fees between 20% to 45%.

Figure 3 Graph of Operational Cost Reduction in Startup Companies

b. Increased Time Efficiency and Employee Productivity

Here is a graph that illustrates the improvement in time efficiency and employee productivity based on the results of the questionnaire.

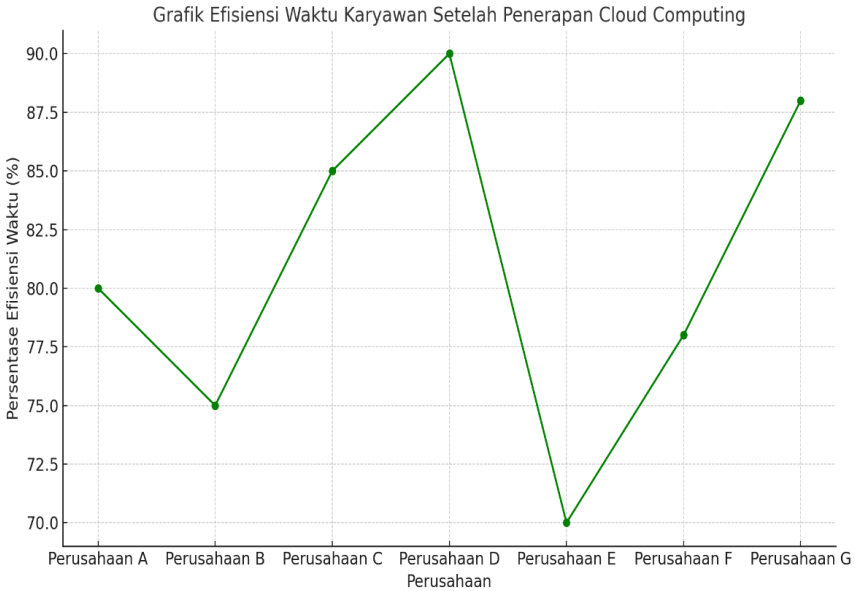

Figure 4 Graph of Employee Time Efficiency After the Implementation of Cloud Computing

The results of this study show that the application of cloud computing significantly improves operational efficiency in technology startup companies in Jakarta. Reduced costs, flexibility in scalability, and faster and more secure access to data are some of the key benefits that companies are seeking. From an employee's perspective, cloud computing helps improve productivity and efficiency, especially in remote work scenarios. However, concerns about data security are still an issue for a small percentage of respondents, although the majority believe that cloud service providers have taken adequate security measures.

This research provides a clear view of the benefits of cloud computing in improving startup operations, but also highlights the importance of continuing to pay attention to the security and governance aspects of the technology used.

CONCLUSION

This research reveals that the application of cloud computing has had a significant impact on the operational efficiency of technology startup companies in Jakarta. One of the key findings was a considerable reduction in operating costs, where the company reported a reduction of between 20% to 45%. This is possible because cloud computing eliminates the need for expensive physical infrastructure, such as servers and other hardware, which previously depleted a company's budget.

Additionally, the flexibility and scalability offered by cloud computing allow startup companies to quickly adjust their computing resources as needed. This flexibility provides great advantages, especially in dynamic markets that often require rapid changes in technological capacity without large investments. From the employee side, the application of cloud computing also has a positive impact on time efficiency and productivity. As many as 80% of employee respondents reported that they felt an increase in efficiency at work, mainly due to faster access to data and applications. In addition, cloud computing has also been very helpful in supporting remote work systems, with 75% of employees stating that this technology makes it easier for them to work effectively from home, especially during the COVID-19 pandemic.

Overall, this study shows that cloud computing is an effective solution to reduce costs, improve operational efficiency, and support productivity, especially in the context of technology startup companies. However, companies still need to pay attention to data security and cloud infrastructure governance so that the benefits obtained can be fully optimized. This research provides valuable insights into how cloud technology is adopted and utilized by startup companies in Jakarta, as well as the challenges faced during the implementation process.

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