JEMSI: Jurnal Ekonomi Manajemen Sistem Informasi
E-ISSN: 2686-5238
P-ISSN: 2686-4916
https://dinastirev.org/JEMSI dinasti.info@gmail.com +62 811 7404 455
DOI: https://doi.org/10.38035/jemsi.v6i3

Navigating the Cloud: Analysis of Product Deployment Timeline on Cloud Infrastructure for E-Commerce: A Case Study at Company X

Kusuma Asdani[1], Endroyono Endroyono[2]
[1]Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia, danny.asdani@gmail.com
[2]Institut Teknologi Sepuluh Nopember, Surabaya, Indonesia, endroyono@ee.its.ac.id

Corresponding Author: danny.asdani@gmail.com[1]

Abstract: This study seeks to analyze the factors affecting the efficiency of product launch timelines within the cloud infrastructure at Company X, which operates in the e-commerce sector. The primary issue identified is the prolonged product launch process, attributed to technical and operational challenges as well as inadequate team coordination. A review of the literature suggests that process automation through tools such as Terraform and Jenkins could enhance launch efficiency. This research utilizes a qualitative approach with thematic analysis to investigate various obstacles, including application compatibility issues, configuration errors, skills deficiencies within the team, and reliance on manual processes. The findings indicate that automation has the potential to reduce launch times by up to 50%, thereby significantly enhancing overall work efficiency. Nevertheless, challenges such as insufficient team training in automation tools and weak interdepartmental coordination were also noted. Recommendations include the implementation of comprehensive automation strategies, the development of training programs to improve team competencies, and the adoption of more effective cost management practices. This study contributes empirical insights within the e-commerce context and presents practical solutions aimed at improving product launch efficiency in cloud infrastructure.

Keyword: Deployment Cloud, Timeline Efficiency, E-Commerce, Automation, Thematic Analysis, Ost management

INTRODUCTION

Over recent years, cloud technology has emerged as one of the most transformative innovations in information technology. Its adoption extends beyond large corporations, increasingly becoming the backbone for e-commerce enterprises seeking scalable and efficient infrastructure solutions. Due to its innovative potential coupled with minimal resource demands, cloud technology serves as a strategic tool for e-commerce firms aiming to establish themselves in competitive markets. However, transitioning data storage from desktop-based systems to cloud platforms remains a significant challenge.

A critical concern is optimizing the timeline for deploying products on cloud infrastructure to ensure swift and efficient delivery to end users. In highly competitive ecosystems, delays in deployment can result in lost market opportunities and diminished competitiveness. Deployment on platforms such as AWS, GCP, or Azure often involves intricate infrastructure configurations. Such complexity, coupled with challenges in capacity planning and scalability forecasting, can slow deployment processes. Additionally, limited technical expertise and resource constraints within teams pose significant hurdles, impeding integration and increasing the risk of failures.

Operational costs associated with cloud services necessitate careful management, especially for firms with tight budgets. Inefficient deployment processes may escalate expenses, threatening operational sustainability. Thus, understanding the factors impacting deployment timelines is critical for optimizing cloud-based infrastructure in e-commerce services.

The imperative for swift product delivery in e-commerce underscores the need for time-efficient operations in today's dynamic and competitive business landscape. Despite the growing familiarity with cloud computing, its full potential remains underutilized, particularly as a collaborative automation tool.

This study aims to analyze key factors influencing product delivery efficiency and delays in e-commerce services. By addressing these factors, firms can develop strategies to enhance product launch speeds, ensuring a competitive edge in the market. The research provides in-depth insights into deployment efficiency factors within cloud infrastructure for e-commerce firms, addressing a relatively underexplored topic in prior literature.

By focusing on deployment timeline optimization, this study fills a gap in the literature, offering concrete strategies and practical recommendations to overcome common obstacles in cloud-based deployments. These findings contribute not only to academic discourse on deployment efficiency but also serve as a guide for enhancing e-commerce product deployment speed and effectiveness.

METHOD

This study adopts a qualitative approach using a case study method to analyze the factors affecting the efficiency of product deployment timelines in cloud infrastructure within e-commerce companies. The case study focuses on several e-commerce firms that utilize cloud services such as AWS, GCP, or Azure as their primary infrastructure platforms. Additionally, in-depth interviews were conducted with technical teams, project managers, and other relevant stakeholders within the companies. The research subjects consisted of informants who were directly involved, well-informed, and capable of providing detailed insights into the research topic.

This descriptive-analytical research employs thematic analysis to examine variables influencing product deployment timelines in the cloud infrastructure of e-commerce services. Drawing on previous studies, this method facilitates the qualitative measurement of specific variables to gain a deeper understanding of the context and dynamics impacting the deployment process.

To identify patterns and discrepancies in cloud infrastructure deployment, the analysis compares data from various sources. It further aids in uncovering the components that influence the efficiency of deployment timelines.

RESULTS AND DISCUSSION

In the context of this research, a total of 20 core questions were systematically designed to explore various aspects influencing the efficiency of product deployment timelines. These questions encompass topics such as timeline efficiency, technical challenges, the role of

automation tools, team collaboration, and cost management, all of which aim to provide comprehensive insights into the challenges and opportunities faced by e-commerce companies in leveraging cloud infrastructure for product deployment. The questions cover a wide range of topics, from deployment duration and the use of automation tools to technical and operational barriers, all designed to offer a holistic understanding of the challenges and opportunities in the deployment process.

Thematic analysis, employed as the data analysis technique, draws upon the collected data to formulate five key themes, as outlined in Table 1.

Table 1. Summary Table of Main Themes

No	Main Theme	Description
1	Efficiency Timeline	This theme covers factors that affect the duration of deployment, including barriers and efforts to accelerate the process..
2	Technical Barriers	It includes technical constraints such as application compatibility, manual validation, and configuration complexity that affect the efficiency of deployment.
3	Automation Technology	It describes the role of automation tools such as CI/CD pipelines, Jenkins, and Terraform in enhancing the speed and efficiency of deployment.
4	Team Collaboration	This theme covers communication barriers, coordination between teams, and the role of project management in the deployment process.
5	Cost Management	It covers cloud cost management, budget challenges, and their impact on the deployment process.

Based on information obtained from respondents, the average time required to complete the product deployment process is approximately 5–7 days. This duration is significantly influenced by the complexity of the application being deployed and the specific cloud configuration requirements to support the infrastructure. While this timeline is relatively efficient for e-commerce standards, several key challenges continue to hinder the smoothness of the deployment process.

One common obstacle is the lack of full automation, leaving certain tasks to be performed manually, including final configuration validation. Additionally, issues with the compatibility of legacy applications with new cloud services frequently arise, often requiring code adjustments or even architectural changes, which increase deployment time and complexity.

On the other hand, the use of automation technologies such as Terraform for infrastructure provisioning and Jenkins for CI/CD pipelines has proven to significantly accelerate the deployment process. However, the implementation of these technologies is not always seamless, as it requires a higher level of technical expertise within the team to maximize their potential. This indicates that while automation technology offers numerous benefits, additional efforts are needed in the form of team training and reduced reliance on manual processes to achieve greater efficiency in deployment timelines.

Respondents also emphasized the critical importance of team collaboration and effective cost management as two key aspects in addressing various operational challenges encountered during the product launch process. Strong collaboration between technical teams, business teams, and project management is deemed essential to ensure that each stage of the launch proceeds according to plan and targets. However, communication and coordination barriers often arise, particularly when team priorities are misaligned.

In addition, effective cost management is vital for sustaining the launch process, especially for e-commerce companies operating on limited budgets. By utilizing tools such as AWS Cost Explorer, companies can directly monitor expenditures and identify areas for cost reduction, thereby enabling more efficient resource allocation. If both factors are well-managed, companies can reduce operational risks, accelerate launch timelines, and improve overall efficiency. The findings of this study include the following:

a. Efficiency Timeline Deployment

Table 1. Efficiency Timeline Deployment

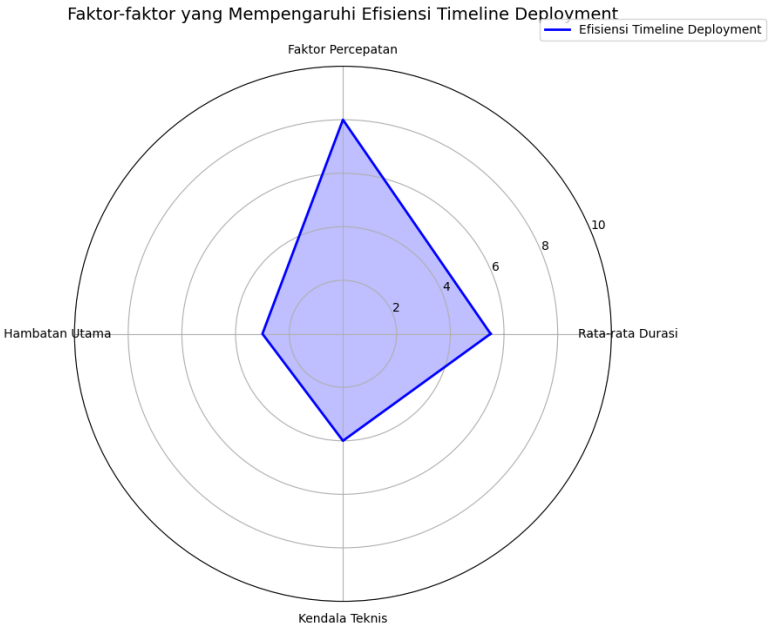
Aspect	Description	Impact on the Timeline
Average Duration	Product deployment takes 5-7 days, depending on the complexity of the application.	The timeline is quite efficient for modern applications.
Accelarion Factors	The use of CI/CD pipeline, Terraform, and Jenkins accelerates provisioning and integration.	Reduces time and the risk of configuration errors.
Main Barriers	Manual validation at several stages of deployment.	Significantly extends the deployment time.
Technical Obstacles	Lack of technical skills within the team to fully leverage automation..	Dependence on inefficient manual processes.

Based on the information in Table 2, the product deployment process typically takes around 5-7 days. This is considered quite efficient, especially for applications with medium to high complexity. This duration indicates that the company has a well-organized deployment system, supported by adequate technology. One of the key factors driving this efficiency is the use of automation technologies, such as CI/CD pipelines, Terraform, and Jenkins. These tools not only speed up the provisioning of cloud infrastructure but also facilitate better application integration. With automation, many manual tasks that previously consumed significant time can now be performed automatically, reducing the risk of configuration errors and speeding up execution time. Additionally, automation allows teams to focus more on other strategic tasks, ultimately enhancing overall efficiency. However, to maximize the use of these tools, sufficient technical expertise from the technical team is still required to ensure proper implementation that aligns with the organization's needs.

However, there are several obstacles preventing the achievement of maximum efficiency, one of which is the manual validation process still required at certain critical stages of deployment. While manual validation is essential for maintaining quality, it is time-consuming and one of the primary causes of delays. This issue is further complicated by the lack of technical skills among some team members, making it difficult for them to effectively leverage automation technologies. As a result, there is still dependence on slow, inefficient, and error-prone manual processes.

From the analysis, it is clear that while the deployment process is currently fairly efficient, there are many opportunities for improvement. One solution could be to adopt full automation to replace manual validation, which would speed up deployment time without compromising quality. Additionally, it is important to improve the technical skills of the team through training focused on automation technologies. This way, the company can reduce reliance on manual processes, speed up deployment times, and save time and resources in the long run.

For clarity, a visualization image is included to provide a better overview of efforts to improve efficiency in the deployment timeline and how these solutions could be strategically applied in the future.



Picture 1. ***Visualisasi faktor pengaruh timeline deployment***

Chart Explanation :

1. Average Duration (Score: 5.5)
   Based on the analysis, the average time required for the deployment process is at a moderate efficiency level, approximately 5-7 days. This duration is considered quite good for applications with medium to high complexity, as the deployment process involves several technical stages such as infrastructure provisioning, application integration, and final validation. However, there is still an opportunity to improve efficiency so that this time can be shortened by optimizing the existing processes.
2. Accelaration Factors (Score: 8)
   Automation technologies such as CI/CD pipelines, Terraform, and various other tools play a significant role in accelerating the deployment process. With automation, manual tasks such as infrastructure provisioning and application integration can be performed automatically. This not only speeds up the process but also reduces the likelihood of errors that could cause delays. These tools help the company respond more quickly and efficiently to market demands.
3. Main Barriers (Score: 3)
   One of the main challenges faced is the manual validation process, which has a significant negative impact on time efficiency. Although this validation process is crucial for maintaining quality, it is time-consuming and often causes delays. By still relying on manual validation at several critical stages, the full potential for efficiency that could be achieved through complete automation has not yet been realized.
4. Technical Barriers (Score: 4)
   The limited technical capabilities among team members and the high complexity of configurations remain significant issues in the deployment process. Technical teams often struggle to fully leverage automation technologies, resulting in some tasks still being carried out manually. Additionally, the complex initial configuration often requires more time, which impacts the overall duration of the deployment process.

This radar chart shows that acceleration factors (automation) are the main strength, while manual validation and technical constraints are key areas for improvement.

b. Technical Barriers

Table 2. Technical Barriers on Deployment

Hambatan Teknis	Description	Impact on Deployment Timeline
Application Compatibility	Difficulties in integrating legacy applications with new cloud services.	Requires additional time to refactor code, causing delays
Missconfiguration	Errors occurring during provisioning or cloud infrastructure integration.	Requires revalidation and debugging, which extends the deployment time.
Manual Process	Configuration validation and integration that are still done manually.	Increases the risk of technical errors and takes longer.
Lack of Skill on Team	The technical team is not yet fully skilled in optimally utilizing automation.	Dependency on manual processes reduces deployment efficiency

Based on Table 3, there are several key technical obstacles encountered when deploying products on the e-commerce company's cloud infrastructure. These obstacles include application compatibility issues, configuration errors, remaining manual processes, and the lack of technical knowledge among team members. One of the most common challenges is application compatibility, particularly when legacy applications need to be integrated with new cloud services. This process often requires code adjustments or even changes to the application architecture, which not only extends the time required but also increases the overall complexity of the work. This constraint is a major cause of delays in deployment schedules, as the team must allocate additional resources to handle compatibility issues.

In addition, configuration errors that occur during provisioning or integration stages also pose significant barriers. Although automation tools like Terraform have helped reduce the risk of errors, some configurations are still done manually, which increases the likelihood of technical mistakes. These errors require time for revisions and debugging, ultimately extending the deployment time. This challenge highlights that, while cloud infrastructure offers high flexibility and scalability, the success of its implementation heavily relies on the team's ability to address emerging technical challenges.

Even though automation tools like Terraform have proven to reduce technical errors, there are still some steps in the configuration process that must be done manually. These manual processes often require revalidation and debugging, which not only add complexity but also prolong the time needed to complete the deployment. The validation and integration stages, which could be accelerated with full automation, instead become major obstacles due to reliance on manual tasks. This process is not only slower than automation but also increases the risk of technical errors, which ultimately impacts the efficiency of the overall deployment timeline.

The issue is further exacerbated by the limited technical expertise among team members in utilizing automation technologies effectively. Many of them are not familiar with how tools like Terraform, Jenkins, or CI/CD pipelines work, leading them to prefer manual methods, which are inherently less efficient. This limitation emphasizes the importance of technical training to enable the team to optimally leverage automation technologies, which will not only improve efficiency but also reduce the risk of technical errors during the deployment process.

The delays caused by manual processes, largely due to a lack of technical training, directly slow down the deployment process and hinder the company's ability to achieve faster timelines. These obstacles highlight the need for a more targeted strategic approach to address the technical and operational issues that obstruct the deployment process. One step that can be taken is to provide additional training for the technical team to enhance their ability to use automation tools like Terraform and Jenkins. This training aims to ensure that the team can fully optimize automation technologies, reducing dependency on manual processes.

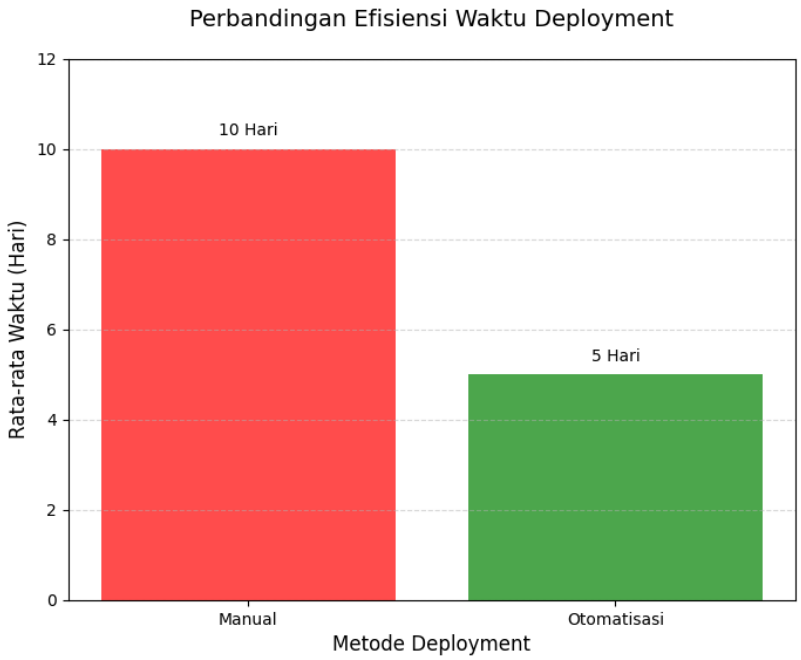
Additionally, adopting full automation at every stage of the deployment process becomes a crucial solution to improve overall efficiency. By reducing manual processes, the company can not only accelerate the deployment timeline but also minimize the risk of errors that often arise from manual validation or improper configurations. This approach will have a significant impact, not only in terms of time efficiency but also in the company's ability to remain competitive in an increasingly dynamic market. Through these steps, the company is expected to improve the overall deployment efficiency, making the process faster, more reliable, and resource-efficient.

c. Role of Automation Technologies

Automation technology has become a key factor in improving the efficiency of product deployment schedules within cloud infrastructure. According to interview results, tools like Terraform and Jenkins play a significant role in accelerating the deployment process by reducing time-consuming manual work. Terraform is used for automatic infrastructure provisioning, enabling technical teams to define configurations more consistently and reduce the risk of errors.

On the other hand, Jenkins is a CI/CD pipeline tool that allows integration and testing to be done automatically before deployment. As a result, it speeds up the process and enhances product quality. Although automation has brought many benefits, its implementation still faces challenges. One of the main challenges is the lack of technical skills among some team members, preventing them from fully utilizing these tools.

Additionally, the complexity of the initial configuration of automation tools often presents an obstacle. The setup process for Terraform and Jenkins requires time and expertise, especially when teams need to integrate these tools with existing systems. Overall, the use of automation technologies like Terraform and Jenkins has proven effective in reducing deployment time and improving operational efficiency. However, to maximize the benefits, further training for technical teams is required, along with better documentation for initial configurations. For a comparison of deployment time efficiency, the Bar Chart below can be referenced.



Picture 2. ***visualisasi peran teknologi otomatisasi***

This bar chart shows that deployment with automation can reduce the time by up to half compared to manual methods. This visualization illustrates that automation not only increases efficiency but also reduces the risk of human errors.

d. Team Collaboration

Table 3. Obstacles and Solution for Team Collaboration

Aspect of Collaboration	Description of Obstacles	Potential Solution
Clear Communication	Information shared between teams is often unclear, leading to miscommunication.	The use of collaboration tools such as Slack helps to accelerate cross-team communication.
Responsiveness Between Teams	The team is often slow to respond to requests or inquiries from other teams.	Setting up an internal SLA (Service Level Agreement) to speed up response times.
Usage Tool for Collaboration	Collaboration tools such as Jira or Slack have not been fully adopted in the workflow.	Implementing collaboration tools integrated with the deployment process.
Alignment of Priorities	Missalignment of targets between the technical team and the business team often leads to conflict.	Regular meetings to align priorities and targets between teams

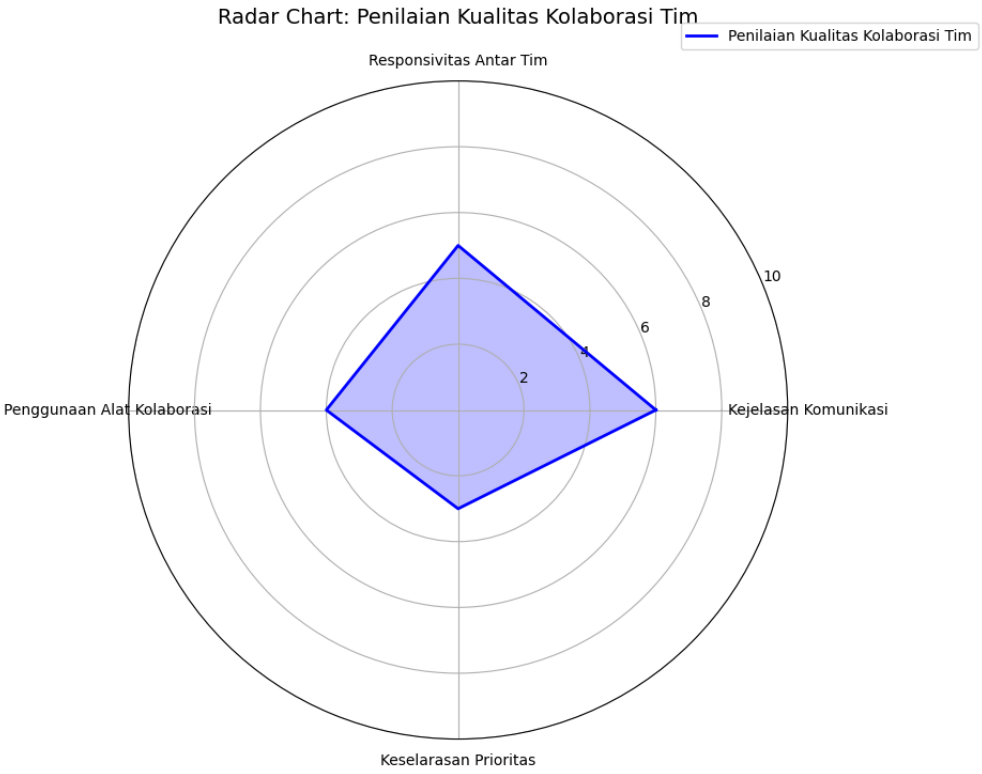
Referring to Table 4, the difficulties in team collaboration can be seen across four aspects: clarity of communication, responsiveness between teams, use of collaboration tools, and alignment of priorities. These aspects highlight the main barriers within the team collaboration process.

In some cases, team members are not sufficiently specific or detailed. An example of this is decision-making being hindered due to communication breakdowns. A solution to this

issue is improving communication by using tools like Slack, where teams can communicate in real-time across departments and also document ongoing discussions for future reference.

Responsiveness between teams is also a challenge, particularly when there are urgent requests from other teams that are not addressed quickly. In this case, the company could introduce internal SLAs (Service Level Agreements) to ensure that all requests or inquiries are handled within a set time frame. The underutilization of collaboration tools, such as Jira or Slack, further exacerbates coordination issues between teams. These tools are integrated into the deployment workflow and facilitate task tracking and progress monitoring, reducing the likelihood of mistakes.

The final aspect is alignment of priorities, where, for example, the business team's goals may not align with the technical team's conditions. This can be addressed by holding regular meetings between both parties to establish priorities, reducing conflicts, and improving deployment process efficiency. For a clearer visualization of the team collaboration quality assessment, please refer to the chart below.



Picture 3. Visualitation Collaboration between Team

This radar chart indicates that the average communication quality score between teams is still below the optimal level expected. One area that requires significant attention is the alignment of priorities between the technical and business teams, which often causes miscommunication and inefficiency. Additionally, the underutilization of collaboration tools presents a significant weakness in the communication process. The absence of integrated tools to facilitate collaboration, such as Slack or Jira, increases the risk of misinformation or missing important details during the deployment process.

To improve the scores in both of these areas, it is recommended to implement modern, fully integrated collaboration tools within the company's workflow. Tools like Slack can be used to facilitate real-time communication, while Jira can help with project management, task tracking, and assigning responsibilities between teams. Additionally, the company should

establish shared priorities through regular meetings between the technical and business teams to align goals and ensure there are no conflicts in expectations or targets. By implementing these solutions, it is expected that communication quality between teams will improve significantly, thereby supporting efficiency and the overall success of the deployment timeline.

e. Cost Management

Table 4. Distributed Cost Management

Cost Category	Decription	Percentage
Cloud Infrastructure	Main costs for servers, storage, networking, and cloud capacity used in deployment.	50%
Automation Tools	Costs for using tools like Terraform and Jenkins to enhance deployment efficiency.	30%
Additional Cost	Additional costs such as troubleshooting, debugging, and manual validation at various stages.	20%

Based on Table 5, it is evident that the cost of product deployment on cloud infrastructure is dominated by the infrastructure itself, contributing 50% of the total expenditure. This cost includes the procurement of servers, storage, and networking, which are crucial for supporting the deployment process. This infrastructure serves as the foundation for the company to run its applications and services effectively, but it also requires a substantial investment, especially if the company needs high scalability to handle workload spikes.

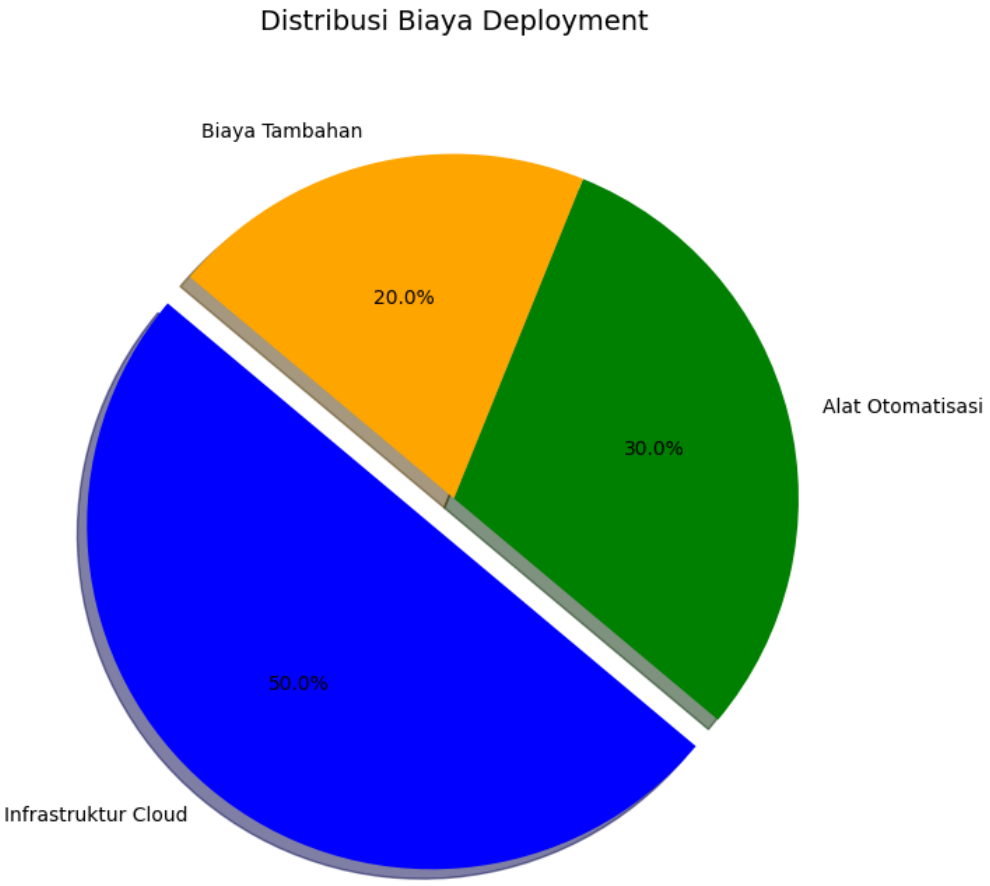
Next, automation tools such as Terraform and Jenkins account for approximately 30% of the total costs. While these tools significantly help in improving deployment efficiency by reducing manual time and errors, they also require a considerable investment, both in terms of licensing costs and operational expenses. Despite being costly, using automation tools is considered a smart investment due to the substantial benefits in reducing deployment time and enhancing operational quality.

Another component is incidental expenses, which make up 20% of the total cost. These expenses arise from troubleshooting, debugging, and manual validation. These costs typically occur when facing technical issues or unforeseen errors during deployment. While smaller compared to the other components, these incidental costs can rise dramatically if serious technical problems occur, such as major configuration errors or system integration failures.

This cost distribution shows that, although automation has reduced reliance on manual tasks, there are still opportunities to save more by enhancing operational efficiency and better managing technical risks. With the right strategy, companies can optimize their expenditures, allocate resources more effectively, and improve overall deployment efficiency.

The cost distribution also highlights the importance of implementing more efficient strategies in managing cloud infrastructure. By maximizing the use of cloud resources like servers, storage, and networking, companies can reduce the costs that make up the largest portion of their expenditures. Additionally, reducing extra costs through automation at every stage of deployment is a strategic step that can significantly lower total spending. The use of automation not only reduces dependence on time-consuming and costly manual validation processes but also helps avoid unexpected expenditures that often arise from technical issues or operational mistakes.

For a clearer illustration, the cost distribution of deployment is shown in the following chart, which displays the proportion of each cost component, including cloud infrastructure, automation tools, and incidental costs. By understanding these distribution patterns, companies can design better strategies for managing expenditures, prioritizing investments, and improving operational efficiency in the future.



Picture 4. Visualitation Cost Management

This pie chart demonstrates that achieving better cost efficiency in the deployment process requires strategic management of cloud infrastructure to be a top priority. Cloud infrastructure, which accounts for the largest portion of total expenditure, requires a more planned approach to optimize the use of resources such as servers, storage, and networking. Actions like adjusting capacity to match actual needs and leveraging options like reserved instances or spot instances can help reduce costs without compromising performance.

Additionally, reducing extra costs through the full implementation of automation is another crucial strategy that can significantly lower operational expenses. By replacing time-consuming and resource-draining manual processes with automation at every stage of deployment, companies can minimize the risk of technical errors and reduce the need for debugging or troubleshooting, which often drives up costs.

By applying these strategies, companies can not only allocate their budgets more efficiently but also support faster, more reliable, and resource-efficient deployment processes. Ultimately, this will help companies enhance their competitiveness in a dynamic and ever-changing market.

f. Discussion

The findings of this research provide relevant insights into the context of product deployment into cloud infrastructure, particularly for e-commerce companies. The data analysis highlights the importance of deployment time efficiency, technical barriers, automation integration levels, teamwork, and cost management as interrelated aspects of the deployment process. It is important to note that these findings align with several previous studies while also contributing additional value by addressing existing research gaps. The results of the discussion will be elaborated below.

1. Comparison With Previous Research

   Although previous research has discussed deployment efficiency in terms of automation, flexibility, and scalability of cloud services, this study's milestone lies in identifying specific technical barriers. In most cases, previous research has focused on general problems or challenges— for example, studies on the use of DevOps and CI/CD pipelines have demonstrated that automation can reduce deployment time by more than 50%. However, many of these technical barriers have not received the comprehensive attention they deserve in earlier studies. Similarly, team collaboration and cost management are particular aspects of this research. Typically, research does not focus on these areas, especially in the context of e-commerce.

2. Filed Up Gap Research

   This research fills the research gap by providing a more specific focus on the technical and operational challenges associated with the deployment process in e-commerce companies. Unlike previous studies that primarily focused on technology or systems in a more defined or general sense, this study emphasizes technology as an integrated system within the broader operational context as seen below :

   a) Analyzing the unique factors faced by e-commerce companies, such as dynamic market demands and the pressure to release products quickly.
   b) Identifying operational barriers, such as miscommunication between teams and limitations in technical expertise.
   c) Providing practical recommendations to address cost issues and improve deployment timeline efficiency. With a focus on e-commerce companies, this research not only adds theoretical insights but also offers relevant guidance for the sector.

CONCLUSION

This study identifies five primary factors—deployment efficiency, technical challenges, automation technology, team collaboration, and cost management—that influence product deployment within cloud infrastructure. Deployment efficiency, with an average timeline of 5-7 days, hinges on automation and technical proficiency. Challenges such as legacy system compatibility and configuration errors remain significant barriers. Automation tools like Terraform and Jenkins expedite deployment, although their effectiveness is constrained by team expertise. Effective team collaboration and strategic cost management are crucial for mitigating operational delays and optimizing deployment timelines.

These findings advance existing literature on cloud deployment efficiency, particularly within the e-commerce domain, by addressing specific technical and operational barriers. This research bridges existing gaps by providing actionable recommendations for improving deployment efficiency and competitive positioning in dynamic markets.

This study focuses solely on analyzing the product deployment process within the cloud infrastructure of e-commerce businesses. Other sectors, such as education or fintech, are not included within the scope of this research. Future studies could explore different industries beyond e-commerce and examine the use of cloud services other than Amazon Web Services (AWS), Google Cloud Platform (GCP), and Microsoft Azure.

REFERENCE

Armbrust *et al.*, "A view of cloud computing," *Commun. ACM*, vol. 53, no. 4, pp. 50–58, 2010, doi: 10.1145/1721654.1721672.

Budiono, S. K. Lau, and W. J. Tibben, "Cloud computing adoption for e-commerce in developing countries: Contributing factors and its implication for Indonesia," *Proc. 22nd Pacific Asia Conf. Inf. Syst. - Oppor. Challenges Digit. Soc. Are We Ready?, PACIS*, 2021.

Budiono, S. K. Lau, and W. J. Tibben, "Cloud Computing and E-commerce Adoption in Indonesia: Mind the Gaps," *Proceeding - 2018 Int. Conf. ICT Rural Dev. Rural Dev. through ICT Concept, Des. Implic. IC-ICTRuDEv 2018*, pp. 48–53, 2021, doi: 10.1109/ICICTR.2018.8706853.

Christiani, "Peluang dan Tantangan Penerapan Cloud Computing (Komputasi Awan) Sebagai Solusi Automasi Kerjasama Antar Perpustakaan," *Anuva*, vol. 2, no. 1, p. 43, 2018, doi: 10.14710/anuva.2.1.43-53.

Creswell, V. L. P. Clark, and V. L. Plano Clark, *Designing and conducting mixed methods*, vol. 2nd. 2007. [Online]. Available: http://scholar.google.com/scholar?hl=en&btnG=Search&q=intitle:Designing+and+conducting+mixed+methods+research#0%5Cnhttp://doi.wiley.com/10.1111/j.1753-6405.2007.00096.x

Diaby and B. B. Rad, "Cloud Computing: A review of the Concepts and Deployment Models," *Int. J. Inf. Technol. Comput. Sci.*, vol. 9, no. 6, pp. 50–58, 2017, doi: 10.5815/ijitcs.2017.06.07.

Dhika, T. Akhirina, D. Mustari, and F. Destiawati, "Pemanfaatan Teknologi Cloud Computing sebagai Media Penyimpanan Data," *J. PkM Pengabdi. Kpd. Masy.*, vol. 2, no. 03, p. 221, 2019, doi: 10.30998/jurnalpkm.v2i03.3144.

Fransisca and Y. Yunus, "Validitas Pengembangan Media Pembelajaran Blended Learning Berbasis Cloud Computing Tingkat Sekolah Menengah Atas Kota Padang," *Pros. Semin. Nas. Ris. Inf. Sci.*, vol. 1, p. 103, 2019, doi: doi: 10.30645/senaris.v1i0.13.

Lwakatare *et al.*, "DevOps in practice: A multiple case study of five companies," *Inf. Softw. Technol.*, vol. 114, pp. 217–230, 2019, doi: 10.1016/j.infsof.2019.06.010.

Nzanzu *et al.*, "Monitoring and resource management taxonomy in interconnected cloud infrastructures: a survey," *Telkomnika (Telecommunication Comput. Electron. Control.*, vol. 20, no. 2, pp. 279–295, 2022, doi: 10.12928/TELKOMNIKA.v20i2.20503.

NIST, "NIST SP 500-292: NIST Cloud Computing Reference Architecture," *NIST Spec. Publ.*, p. 35, 2011, [Online]. Available: https://pmt-eu.hosted.exlibrisgroup.com/permalink/f/gvehrt/TN_cdi_ieee_primary_6012797

Ramsari and A. Ginanjar, "Implementasi Infrastruktur Server Berbasis Cloud Computing Untuk Web Service Berbasis Teknologi Google Cloud Platform," *Conf. Senat. STT Adisutjipto Yogyakarta*, vol. 7, 2022, doi: 10.28989/senatik.v7i0.472.

Riungu-Kalliosaari, S. Mäkinen, L. E. Lwakatare, J. Tiihonen, and T. Männistö, "DevOps Adoption Benefits and Challenges in Practice: A Case Study BT - Product-Focused Software Process Improvement," P. Abrahamsson, A. Jedlitschka, A. Nguyen Duc, M. Felderer, S. Amasaki, and T. Mikkonen, Eds., Cham: Springer International Publishing, 2016, pp. 590–597.

Serrador and J. K. Pinto, "Does Agile work? — A quantitative analysis of agile project success," *Int. J. Proj. Manag.*, vol. 33, no. 5, pp. 1040–1051, Jul. 2015, doi: 10.1016/J.IJPROMAN.2015.01.006.

Tomarchio, D. Calcaterra, and G. Di Modica, "Cloud resource orchestration in the multi-cloud landscape: a systematic review of existing frameworks," *J. Cloud Comput.*, vol. 9, no.

1, 2020, doi: 10.1186/s13677-020-00194-7.
YOANDA, N. Nurmalasari, and T. Hidayat, “Rancang Bangun Chatbot Untuk Meningkatkan Pelayanan Customer Pada Aplikasi Traveloka,” *J. Teknol. Sist. Inf.*, vol. 3, no. 2, pp. 337–352, 2022, doi: 10.35957/jtsi.v3i2.2706.