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Cloud Migration Analysis for Core System Infrastructure in Financial Services: Study Case PT. XYZ

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Abstract

Currently, cloud computing adoption is being utilized in the financial sector for its flexibility and innovative technologies. This study assesses PT XYZ's readiness to migrate its core systems to a cloud environment, which is crucial for maintaining competitive agility and robustness in Indonesia's financial services sector. Focusing on the diffusion of innovations (DOI) model and the technology-organization-environment (TOE) framework, the research examines ten factors influencing PT XYZ's migration strategy. The analysis identifies challenges related to PT XYZ's aging on-premises infrastructure, including server procurement delays and maintenance issues, which impact operational efficiency. Through semi-structured interviews with key IT personnel, this study explores perceptions of the benefits and challenges of cloud computing, as well as regulatory compliance, aiming to guide PT XYZ toward a successful cloud migration that ensures continuity, compliance, and enhanced operational capabilities. The findings contribute to understanding the relative advantages, such as cost savings and security concerns, complexity, compatibility, technology readiness, top management support, firm size, competitive pressure, and regulatory factors. PT XYZ's decision to migrate aligns with all the factors for cloud computing adoption, with the relative advantage, complexity, compatibility, technological readiness, and top management support being high impacts on the migration decision, while regulatory compliance presents a challenge for the financial services industry in Indonesia].

A. Introduction

In financial services industry, technological agility and robust infrastructure are crucial for maintaining a competitive advantage and ensuring seamless operation[1]. Cloud computing, with its promise of scalability, cost efficiency, and operational flexibility, has become a strategic imperative for organizations looking to modernize their IT landscapes [2]. Recent research highlights the strategic benefits of cloud computing in financial services, emphasizing improvements in data handling and security, which are crucial in this sector [3].

As one of the financial services industry in Indonesia, PT XYZ is currently facing several challenges with its existing IT infrastructure. The company operates on a hybrid model with customer-facing applications already migrated to the cloud, while the core systems remain on-premises. These core systems are nearing the end of their lifecycle, with an expiration deadline by the end of 2024, posing significant operational risks. Research indicates that operational inefficiencies such as long server procurement times and inflexibility in scaling resources can severely hinder an organization's adaptability and responsiveness to market and regulatory changes [4]. Other issue related to these on-premise infrastructure are server procurement delays, scalability issues, and system maintenance downtime. Cloud solutions can significantly reduce capital expenditures on physical infrastructure and enhance operational efficiency through scalability and flexibility [5].

To analyze the cloud computing adoption for PT XYZ's core system, various theoretical frameworks have been research to assess the adoption and use of new technologies. Among these are the technology-organization-environment framework combine with Diffusion of Innovations model (TOE-DOI), the Unified Theory of Acceptance and Use of Technology (UTAUT), and the Technology Acceptance Model (TAM).

The TOE framework assesses three broad dimensions that influence technology adoption within an organization: technological, organizational, and environmental factors [6]. It is particularly useful for examining how these multiple dimensions interact to affect technology implementation decisions. Combined with DOI model, complements TOE by focusing on how innovations spread within an organization or social system, considering factors such as an innovation's relative advantage, compatibility, complexity, trialability, and observability [7]. UTAUT aims to explain user intentions to use a technology and subsequent usage behavior, integrating elements like performance expectancy, effort expectancy, social influence, and facilitating conditions [8]. Similarly, TAM focuses on two primary determinants—perceived ease of use and perceived usefulness—to predict user acceptance and usage behavior of a technology [9].

For the specific context of PT XYZ, a financial services company in Indonesia considering cloud computing adoption, the TOE-DOI framework was chosen over UTAUT and TAM. This decision was driven by the framework's comprehensive nature, which is well-suited to address the complex interplay of factors in an organizational setting [10]. The TOE-DOI framework not only considers the technological aspects of cloud adoption but also integrates critical organizational factors such as internal readiness, management support, and structural considerations, alongside environmental influences including regulatory frameworks and competitive pressures [11]. Such a multi-dimensional approach is

essential in the financial sector where external regulations significantly impact technological deployments [12]. In contrast, while UTAUT and TAM provide robust models for understanding individual adoption and usage, they do not as extensively cover the organizational and environmental contexts which are crucial for understanding adoption in PT XYZ condition [13].

This study is designed to evaluate PT XYZ's readiness for migrating its core systems to a cloud environment, given its current hybrid infrastructure and impending system expiration. It aims to identify and analyze the technological, organizational, and environmental factors that influence PT XYZ's cloud migration strategy using the Technology-Organization-Environment (TOE) framework and the Diffusion of Innovation (DOI) model. These frameworks have been shown to effectively examine IT adoption dynamics in sectors characterized by stringent security and compliance requirements [14].

Through the analysis of PT XYZ's readiness and the factors impacting its cloud adoption, the research aims to study the transition to the cloud, ensuring continuity, compliance, and security within PT XYZ current infrastructure. The strategic benefits of cloud computing extend beyond mere cost efficient, offering enhanced capabilities in service delivery speed and scalability, which are essential in the fast-evolving financial sector [15].

B. Research Method

The strategic perspective of this research underscores a readiness assessment for cloud adoption in healthcare, focusing on organizational, technological, and regulatory facets. It provides a comprehensive framework for evaluating readiness across various dimensions, presenting a robust methodology that could be adapted by PT XYZ. This multi-dimensional approach is key in identifying specific needs and potential obstacles in cloud adoption within regulated industries such as finance, suggesting that PT XYZ could benefit from a similar in-depth evaluation to facilitate a smooth transition to cloud infrastructure [16].

This report discusses the challenges associated with migrating to cloud services while maintaining compliance with stringent regulatory standards in the financial industry. It highlights the essential need for financial institutions to implement cloud solutions that not only enhance operational efficiency but also conform to both international and local regulations. The document serves as a relevant example for PT XYZ by demonstrating how other financial institutions address the dual challenges of technological upgrades and compliance. The focus on secure, compliant cloud migrations mirrors PT XYZ's requirements for data centers located within Indonesia and adherence to ISO27001 standards, recommending that PT XYZ should prioritize these factors in its cloud strategy [17].

Research by Indriasari et al. examines the low adoption rate of cloud-based Business Intelligence (BI) tools in Indonesia's financial sector, identifying key influencing factors through the DOI and TOE frameworks. The study points out significant hesitations among financial firms due to the complexities and security concerns associated with cloud BI solutions. It reveals that, despite recognized benefits like cost savings and enhanced business agility, only a minority of firms have adopted cloud BI technologies. This reluctance is mainly due to perceived risks and insufficient regulatory support, crucial in the highly regulated financial sector.

This context is pertinent to PT XYZ's situation, emphasizing the need to address these concerns to promote cloud adoption [18].

Alshdadi et al.'s research evaluates the readiness of higher education institutions in Saudi Arabia for cloud migration by developing and validating the Cloud Migration Readiness Assessment (CMRA) instrument. The analysis not only assesses technological readiness but also organizational and environmental readiness, advocating for a holistic approach to cloud migration. The findings suggest that while some universities are technologically prepared for cloud migration, they may lack organizational readiness or encounter environmental challenges. This situation underscores the need for PT XYZ to adopt a comprehensive assessment tool like the CMRA, ensuring all readiness aspects are evaluated before transitioning to the cloud. The study stresses the importance of considering organizational and environmental factors, which are often overlooked despite their critical role in the successful adoption of cloud services in sensitive sectors like financial services [19].

Another paper proposes a model for cloud computing adoption in the oil sector, which, despite its industry-specific focus, provides valuable insights for the financial services industry. It examines the impact of external pressures, such as market competition and regulatory environments, on the adoption process. For PT XYZ, this model highlights the significance of considering external factors in their decision-making process. The research suggests that, similar to the oil sector, the financial services sector could benefit from a tailored adoption strategy that addresses unique industry challenges, particularly in a regulatory-intensive environment like Indonesia [20].

An additional study investigates the adoption of cloud-based accounting systems within the Jordanian financial sector, exploring specific drivers and barriers to cloud adoption in a closely regulated industry. It provides insights into the technological efficiencies, cost benefits, and compliance challenges faced by financial institutions. The findings underscore the importance of regulatory compliance and strategic alignment of cloud technologies with business objectives, resonating with PT XYZ's scenario where regulatory concerns and business continuity are paramount. This research also highlights the potential for cloud solutions to improve operational efficiencies and scalability, which are crucial for PT XYZ as it transitions its core systems to the cloud [21].

The collective insights from these studies highlight the complexity of cloud adoption in regulated sectors, emphasizing the need for a comprehensive, strategic approach that encompasses technological, organizational, and regulatory readiness. For PT XYZ, these narratives suggest the importance of not only preparing the technological infrastructure but also ensuring alignment with regulatory requirements and gaining organizational support. This multifaceted preparation is essential for overcoming the barriers to cloud adoption and leveraging the full potential of cloud computing to enhance operational efficiencies in the financial sector.

To evaluate PT XYZ's current situation regarding the migration of their core system from on-premise to cloud, interviews were conducted with key IT members at PT XYZ. The question items were based on published literature that assesses cloud computing adoption specifically in the manufacturing and services industries

[22]. The combination of the TOE framework and DOI models from the previous study provides a comprehensive theoretical basis for analyzing the complex interplay of technological, organizational, and environmental factors that influence cloud adoption decisions in the company. While the results of the previous study show that relative advantage, complexity, technological readiness, top management support, and firm size are the most influential factors for PT XYZ's industry to adopt cloud computing, this case study will also discuss all ten factors in the hypothesis to verify the relevancy of other factors to the industry and the location of the case study.

To be consistent with previous studies, the topics for each question will be based on the ten factors shown in Table I. Each factor will also be related to other factors and lead to the cloud computing adoption strategy and decision. This qualitative research design approach will focus on semi-structured interviews to explore a deeper understanding of related strategies that can be related to the factors. The interview guide will include questions about perceptions of cloud migration benefits, challenges, strategies, and regulatory compliance. Thematic analysis will be used to analyze the interview transcripts [23]. This method is ideal for identifying themes related to the TOE and DOI factors and allows for a detailed exploration of how each factor impacts the cloud migration strategy at PT XYZ.

Table 1. Cloud Adoption Factors DOI-TOE Framework

Factors	Direct Impact	Relation
Cost Savings	Relative Advantage	Positive
Security Concerns	Relative Advantage	Negative
Relative Advantage	Cloud Computing Adoption	Positive
Complexity	Cloud Computing Adoption	Negative
Compatibility	Cloud Computing Adoption	Positive
Technology Readiness	Cloud Computing Adoption	Positive
Top Management Support	Cloud Computing Adoption	Positive
Firm Size	Cloud Computing Adoption	Positive
Competitive Pressure	Cloud Computing Adoption	Positive
Regulatory Support	Cloud Computing Adoption	Positive

This questions builds upon prior research that examines cloud adoption through the TOE framework and DOI model from previous study [22]. It identifies PT XYZ's result from all factors that has direct and indirect influence on cloud computing adoption. This study will conclude which factors has high influence for the decision of core system migration to cloud, especially for financial services industry in Indonesia.

C. Result and Discussion

Interviews have been conducted in August 2024 with IT Division Head and IT Architect Department Head in PT XYZ. The questions were based on the TOE-DOI framework, which was formulated into ten factors impacting the decision for cloud computing adoption [22].

1) Cost Savings (TOE)

The reduction of current expenditure makes a major role for company to migrate or adopt the cloud computing. While PT XYZ recognizes potential cost savings from cloud adoption, particularly through a microservices architecture, the initial financial outlay and ongoing costs associated with a lift-and-shift strategy are considerable. This makes a company needs to build new architecture and systems to accomplished full utility of cloud benefits. The evaluation of cost savings through the lens of the TOE framework reveals a complex assessment of financial impacts, influencing the organization's approach to cloud adoption.

2) Security Concerns (TOE)

Information security is one of the factor that negatively impact to cloud technology adoption through relative advantage. While cloud is backed with their security standards, the integrity and data sovereignty will be a part of Indonesian's financial industry sector. The security is one of the important factor in PT XYZ's cloud migration strategy. Ensuring compliance with ISO 27001 and other security standards is crucial and aligns with the TOE framework's environmental context, where external regulatory and security standards influence organizational approaches to technology adoption.

3) Relative Advantage (DOI)

The significant advantages PT XYZ perceives in cloud computing, such as scalability and reduced maintenance, underscore the DOI's emphasis on relative advantage. This aligns with the TOE framework by showing how technological advancements directly benefit organizational efficiency and agility. However, while scalability and reliability are appealing, the company recognizes the high costs associated with migrating their monolithic systems to the cloud, giving a nuanced perspective on cloud computing's relative advantages. This result has the same relation as the TOE-DOI model factor for cloud computing adoption, which is relative advantage in PT XYZ is positively impact the decision for migration their core system from on-premise to cloud.

4) Complexity (DOI)

Complexity of existing system is a unique factor that negatively impacts cloud migration. PT XYZ experiences high complexity in integrating cloud solutions, particularly due to the tightly coupled nature of its existing systems. This complexity, identified in the DOI as a barrier to innovation adoption, is evident in company's cautious approach to cloud migration. This reflects the TOE's technological context, where the existing tech infrastructure significantly influences new technology adoption strategies.

5) Compatibility (DOI)

In the TOE-DOI model, business capability and compatibility are fundamental factors that determine the migration to cloud computing. A single incompatibility can significantly alter the entire architecture of the system, requiring organizational efforts to adapt. Thus, the compatibility of cloud technologies with PT XYZ's existing Microsoft-based infrastructure highlights the importance of aligning new technologies with existing organizational practices. This directly supports the DOI's compatibility factor and is reinforced by the TOE framework, which considers organizational context as a crucial element in the adoption of new technologies.

6) Technology Readiness (TOE)

PT XYZ's current technological state, primarily its monolithic architecture, presents challenges to cloud adoption, emphasizing the TOE's focus on technological context. PT XYZ's readiness for cloud adoption involves necessary upgrades, highlighting how technological preparedness impacts the organization's ability to leverage new technologies effectively.

7) Top Management Support (DOI and TOE)

Management support is crucial for cloud migration due to their contribution of resources, comprehensive integration, and the business process re-engineering process. The active role of PT XYZ's management in assessing and supporting cloud initiatives illustrates the critical impact of top management support, a factor acknowledged by both DOI and TOE frameworks. Core system migration is a significant decision that impacts the entire company's business processes. PT XYZ shows their management's commitment to this project by dedicating a team to ensure a smooth transition. This organizational context within the TOE framework is vital for securing resources and aligning technological innovation with strategic business goals.

8) Firm Size (TOE)

The size of a company positively influences the adoption of new technology, such as cloud computing. As a company in the financial services sector operating for over ten years, PT XYZ is one of the competitive companies in the industry in Indonesia. PT XYZ's dedicated team for cloud migration reflects its resource allocation capability, influenced by the firm's size. This supports the TOE framework's organizational context, suggesting that larger organizations may have better capabilities to manage the complexities associated with technological innovations like cloud computing.

9) Competitive Pressure (TOE)

While competitive pressure is often a significant driver for adopting new technologies, PT XYZ's decision-making process reveals that this factor is more complex compared to other assessments of technology benefits and challenges. The adoption of cloud computing enables the company to adopt a more aggressive approach to innovation in technology and applications. However, determining whether this argument has a significant influence depends on the company itself. This divergence from typical TOE framework analyses indicates that internal factors may outweigh external competitive pressures in PT XYZ's strategic decision-making.

10) Regulatory Support (TOE)

The Indonesia Financial Services Authority (OJK) is the official governance regulatory for financial services and banking industry in Indonesia. Adhering to regulatory requirements, especially those mandated by OJK for data localization, significantly shapes PT XYZ's cloud strategies. Additionally, the new law for Personal Data Protection (PDP), which will be officially enforced in October 2024 [24], highlight that the personal data must be a concern for every financial services industry in Indonesia. This regulatory environment component of the TOE framework critically influences PT XYZ's operational strategies in cloud adoption, underscoring the need for compliance with local data sovereignty laws.

D. Conclusion

The adoption of cloud computing, using the TOE-DOI framework, proves to be relevant in the financial services sector in Indonesia. Six factors appear to have

significant influence on cloud computing adoption from PT XYZ's perspective, one of which is different from the previous study, and one additional factor proved to be highly influential. The most significant influences in this case study are relative advantage, complexity, compatibility, technological readiness, top management support, and regulatory support.

From PT XYZ's view, a complex interplay of internal readiness, external pressures, and strategic management decisions influences cloud adoption. Cost and compatibility are two important factors in determining whether the cloud infrastructure is ready to be adopted, impacting the relative advantage factor. Top management support also plays an important role in enabling an organization to migrate its infrastructure to the cloud. The company's core system condition determines whether the current technology is ready to get the most benefit from adopting a cloud environment. As a financial services company in Indonesia, PT XYZ must also pay close attention to strict local regulations, which are prone to changes. For further research, investigating the weight of these factors could provide a clearer understanding of their implications and enhance the discussion of cloud migration readiness.

For future studies, further plausible explanations on how the cloud adoption can impact the business. It might also be interesting to conduct similar studies across different countries or regions to compare whether the different regulation will have different impact on cloud adoption.

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F. References

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