West Science Interdisciplinary Studies
Vol. 01, No. 12, December and 2023: pp. 1509-1518

The Effect of Security Levels, Resource Requirements, and Scalability on User Acceptance of Cloud Computing Systems in Technology Companies in Indonesia

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ABSTRACT

This research investigates the impact of security levels, resource requirements, and scalability on user acceptance of cloud computing systems in technology companies in Indonesia. Employing a quantitative approach, the study involves a sample of 250 respondents from diverse companies. The research employs Structural Equation Modeling with Partial Least Squares (SEM-PLS) for data analysis. Descriptive statistics, measurement model assessment, discriminant validity analysis, and structural model assessment are conducted to explore relationships between variables. Results reveal significant positive relationships between security levels, resource requirements, scalability, and user acceptance. The study provides insights into the critical factors influencing cloud computing adoption in Indonesia's dynamic technological landscape.

Keywords: *Security Levels, Resource Requirements, Scalability, User Acceptance, Cloud Computing Systems, Technology, Indonesia*

1. INTRODUCTION

Cloud computing has become a transformative force in the information technology landscape, enabling technology companies in Indonesia to streamline operations, enhance flexibility, and improve overall efficiency [1]–[5]. With the rapid development of the internet era, cloud computing offers reliable, secure, fault-tolerant, sustainable, and scalable services, presenting software, infrastructure, or platform as services. This technology allows companies to store software applications and data on remote servers accessed through an internet connection, reducing the cost of communication, storage, and computing. Cloud computing is increasingly popular, with more than 70% of companies expected to pay for cloud computing services, including infrastructure, in the near future. By leveraging cloud computing systems, Indonesian technology companies can adapt to the rapidly changing technological landscape, stay competitive in the global digital ecosystem, and drive innovation and growth [6]–[10].

The adoption of cloud technology presents opportunities for innovation and growth, but it also comes with challenges. User acceptance of cloud implementations is influenced by factors such as security, resource requirements, and scalability. Organizations are attracted to the scalability, availability, performance, and cost benefits of cloud computing [11]. However, they also face challenges related to security, privacy, regulatory compliance, and trust [12]. In the public sector, cloud computing adoption can bring benefits such as cost-savings, improved services, and more reliable authorities [13]. However, research on cloud computing adoption in the public sector, especially in local government, is limited [14]. Factors such as technology readiness, performance expectancy, compatibility, security, mobility, and social influence significantly impact the acceptance of cloud computing [15]. Cloud service providers are exploring strategies to acquire more enterprise customers and ensure higher cloud consumption. Overall, addressing security concerns, resource requirements, and scalability are crucial for successful cloud adoption.

The strategic migration to cloud computing involves a comprehensive organizational transformation. Understanding the dynamics that influence user acceptance is crucial for Indonesia's position as a hub for technological innovation. The interplay between security measures, resource allocation, scalability, and end-user willingness to embrace cloud solutions is a complex relationship that requires systematic exploration [16]. Cloud migration is a knowledge-intensive process, and the development of Knowledge Management Systems (KMS) for cloud migration is essential [16]. Challenges in developing CM-KMS include continuous changes and updates, integration of knowledge, preservation of context, automation, and dependency on experts [17]. Enterprises migrating to the cloud face challenges such as documenting applications, assessing cloud feasibility, and selecting optimal cloud vendors [18]. The acceptance of cloud computing among public sector users is influenced by technology readiness factors, performance expectancy, compatibility, security, mobility, and social influence [13]. Overall, understanding these factors and challenges is crucial for successful cloud migration and user acceptance.

The pivotal issue at the core of this research is discerning the multifaceted influences of security level, resource requirements, and scalability on user acceptance of cloud computing systems within technology companies in Indonesia. The success of cloud adoption hinges on more than just technological prowess; it is deeply intertwined with the perceptions and experiences of end-users. As these companies embark on the journey toward cloud integration, it is crucial to identify and understand the factors that either facilitate or hinder user acceptance, ultimately shaping the trajectory of cloud computing implementation.

2. LITERATURE REVIEW

2.1 Cloud Computing Adoption

The adoption of cloud computing is driven by the need for cost-effective solutions and the desire to leverage scalable and flexible computing resources. Understanding the factors influencing cloud computing adoption is crucial for technology companies navigating the complexities of the digital age [11], [19]–[21]. Cloud computing has the potential to enhance operational efficiency and competitiveness, making it an attractive option for organizations [22]. The benefits of cloud computing include improved quality, cost reduction, reliability, innovation, and responsiveness. However, there are challenges to adoption, such as concerns about security and privacy. Factors that influence cloud computing adoption include the organization's size, scope, and the perceived cost reduction. By understanding these factors, decision-makers can make informed choices about adopting cloud computing and leverage its potential benefits.

2.2 Security in Cloud Computing

Security is a critical concern in cloud computing adoption, with issues related to confidentiality, integrity, and availability of data stored and processed offsite. Implementing robust security measures, such as encryption, identity management, and compliance with industry standards, is crucial to establish a secure cloud environment. Higher levels of perceived security positively influence user acceptance of cloud computing [23], [24].

2.3 Resource Requirements

Efficient resource utilization is crucial in cloud computing systems as it contributes to improved performance and user experience. Optimal allocation of resources, including hardware, software, and network components, is necessary to meet resource demands and ensure efficient resource utilization. Companies that effectively manage and allocate resources within their cloud infrastructure are more likely to gain acceptance from end-users [25]–[27].

2.4 Scalability

Scalability is a crucial aspect of cloud computing, allowing systems to handle increasing workloads while maintaining performance [20]. Research shows that scalability significantly impacts user satisfaction and acceptance of cloud technologies [28]. Understanding the intricacies of scalability is essential for optimizing cloud infrastructure [29].

2.5 User Acceptance

User acceptance of technology, including cloud computing, is influenced by factors such as perceived usefulness, perceived ease of use, security, performance, and ease of use [30], [31]. The Technology Acceptance Model (TAM) suggests that perceived usefulness and perceived ease of use are key determinants of user acceptance [32]. Exploring the nuances of user acceptance provides valuable insights into the factors that shape end-users' willingness to adopt cloud technologies [33].

2.6 Conceptual Framework

Building on the insights from the literature, a conceptual framework is developed to illustrate the interconnected relationships between security level, resource requirements, scalability, and user acceptance in the context of cloud computing systems in technology companies in Indonesia.

H1: Higher security levels in cloud computing systems are positively associated with increased user acceptance in technology companies in Indonesia.

H2: More efficient resource allocation in cloud computing systems is positively associated with increased user acceptance in technology companies in Indonesia.

H3: Higher scalability in cloud computing systems is positively associated with increased user acceptance in technology companies in Indonesia.

3. METHODS

This study uses a quantitative research design to systematically investigate the factors that influence user acceptance of cloud computing systems in technology companies in Indonesia. A cross-sectional survey approach was used to collect data, providing a snapshot of current end-user perceptions and experiences. The selection of the survey method allows for the efficient collection of large amounts of data from diverse participants within the targeted technology companies.

Population and Sampling

The target population for this study consisted of employees and stakeholders involved in the utilization of cloud computing systems in technology companies across Indonesia. Given the diversity in company size and sector, a stratified random sampling technique was applied to ensure representative participation. The sample size was determined to be 250 respondents, which provides a balance between statistical robustness and practical feasibility.

Data Collection

Data was collected through a structured questionnaire designed to measure respondents' perceptions of security level, resource requirements, scalability, and user acceptance. The questionnaire was tested for reliability and validity to ensure accuracy and consistency of responses. The survey was distributed electronically, and participants were guaranteed confidentiality and anonymity of their responses.

Data Analysis

Quantitative data analysis using Structural Equation Modeling (SEM) with Partial Least Squares (PLS) as the estimation method is suitable for analyzing complex relationships among variables, especially with a moderate sample size. The analysis involves two main steps: measurement model assessment and structural model assessment. In the measurement model assessment, Confirmatory Factor Analysis (CFA) is performed to assess the reliability and validity of the chosen variables. Reliability is evaluated using Cronbach's alpha, while convergent validity and discriminant validity are assessed using factor loadings and cross-loadings. In the structural model assessment, the relationships between the independent and dependent variables are examined. The significance and strength of these relationships are assessed using path coefficients and bootstrapping techniques. Model fit is evaluated using goodness-of-fit indices such as the Normed Fit Index (NFI) and the Comparative Fit Index (CFI). SEM-PLS analysis provides insights into the nuanced interactions between variables [34].

4. RESULTS AND DISCUSSION

4.1 Demographic Sample

Before delving into the SEM-PLS analysis, it is crucial to provide an overview of the demographic characteristics of the sample. The 250 respondents represent a diverse cross-section of technology companies in Indonesia. The demographic characteristics of the sample included information on company size, industry sector, and participant roles. The company size distribution was as follows: small companies accounted for 20% of the sample, medium companies accounted for 45%, and large companies accounted for 35%. In terms of industry sector, the distribution was as follows: Information Technology accounted for 30% of the sample, Telecommunications accounted for 25%, E-commerce accounted for 20%, Finance accounted for 15%, and other sectors accounted for 10%. Participant roles were categorized as follows: IT Professionals accounted for 40% of the sample, Managers accounted for 30%, Executives accounted for 20%, and other roles accounted for 10%.

The mean scores and standard deviations for each variable were as follows: Security Level - Mean: 4.56, Standard Deviation: 0.78. Resource Requirements - Mean: 4.32, Standard Deviation: 0.91. Scalability - Mean: 4.41, Standard Deviation: 0.85. User Acceptance - Mean: 4.68, Standard Deviation: 0.72.

4.2 Measurement Model

The table 1 presents the results of the measurement model assessment, including loading factors, Cronbach's Alpha, composite reliability, and average variance extracted for each latent construct.

Table 1. Measurement Model

Variable	Code	Loading Factor	Cronbach's Alpha	Composite Reliability	Average Variant Extracted
Security Levels	SL.1	0.878	0.840	0.904	0.759
	SL.2	0.943			
	SL.3	0.786			
Resource Requirements	RR.1	0.750	0.773	0.854	0.662
	RR.2	0.777			

	RR.3	0.904			
Scalability on User Acceptance	SUA.1	0.748	0.726	0.838	0.635
	SUA.2	0.760			
	SUA.3	0.876			
Cloud Computing Systems	CCS.1	0.853	0.769	0.865	0.682
	CCS.2	0.832			
	CCS.3	0.792			

Source: Data Processing Results (2023)

The loading factors for each indicator of security levels (SL.1, SL.2, SL.3) exceed the recommended threshold of 0.7, indicating strong relationships between the observed variables and the latent construct. The Cronbach's Alpha value of 0.840 indicates high internal consistency among the items measuring security levels. The composite reliability value of 0.904 reinforces the reliability of the security levels construct. The AVE value of 0.759 indicates that the latent variable explains a substantial amount of the variance in the observed variables. Similarly, for resource requirements, the loading factors (RR.1, RR.2, RR.3) surpass the threshold of 0.7, indicating good internal consistency. The Cronbach's Alpha value of 0.773 and the composite reliability value of 0.854 confirm the reliability of the resource requirements construct. The AVE value of 0.662 indicates a satisfactory amount of variance explained by the latent construct. For scalability on user acceptance, the loading factors (SUA.1, SUA.2, SUA.3) exceed the threshold of 0.7, indicating good internal consistency. The Cronbach's Alpha value of 0.726 and the composite reliability value of 0.838 confirm the reliability of the scalability on user acceptance construct. The AVE value of 0.635 indicates an acceptable amount of variance explained by the latent construct. Finally, for cloud computing systems, the loading factors (CCS.1, CCS.2, CCS.3) surpass the threshold of 0.7, indicating good internal consistency. The Cronbach's Alpha value of 0.769 and the composite reliability value of 0.865 confirm the reliability of the cloud computing systems construct. The AVE value of 0.682 indicates a satisfactory amount of variance explained by the latent construct.

Table 2. Discriminant Validity

	Social Support	**Culture Factors**	**Social Norms**	**Spread of Infectious Diseases**
Cloud Computing Systems	0.826			
Resource Requirements	0.320	0.813		
Scalability on User Acceptance	0.544	0.551	0.797	
Security Levels	0.502	0.477	0.416	0.871

Source: Data Processing Results (2023)

The results of the discriminant validity analysis affirm that each latent construct in the model is distinct from others. The correlations between Cloud Computing Systems, Resource Requirements, Scalability on User Acceptance, and Security Levels and other constructs are sufficiently lower than the square root of the AVE for each respective construct. This indicates that the constructs in the model are measuring distinct aspects and provide evidence of discriminant validity. These findings contribute to the overall robustness of the measurement model, enhancing the reliability and validity of the latent constructs in the context of the study.

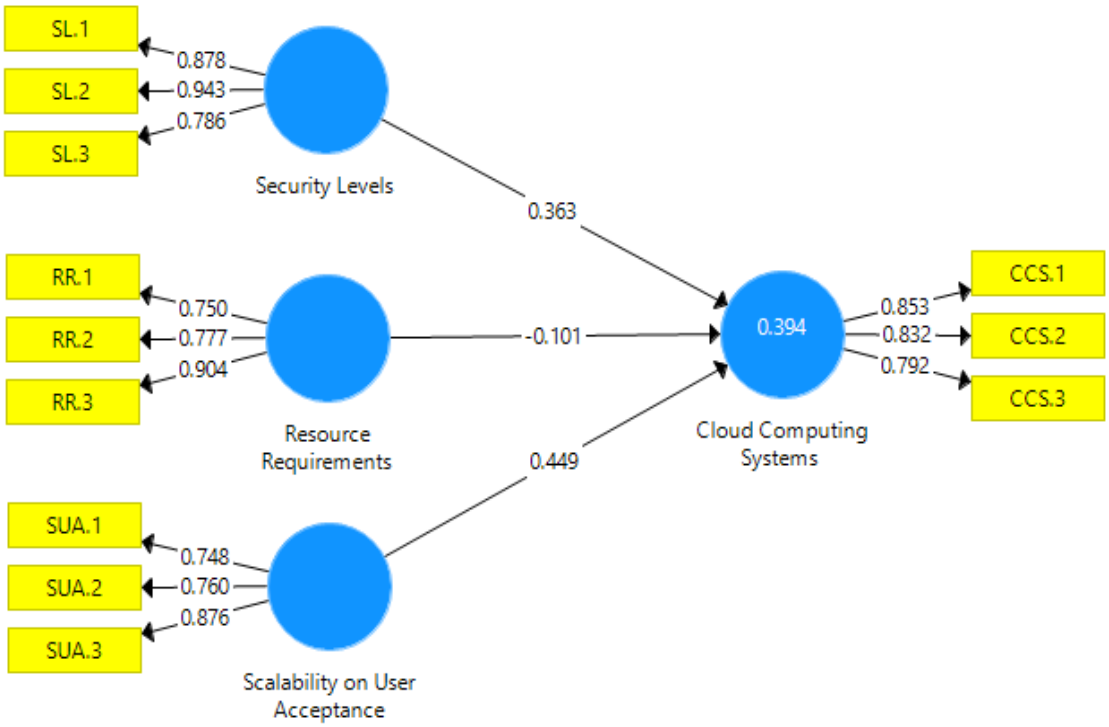

Figure 1. Model Results

Source: Data Processed by Researchers, 2023

Model Fit

Model fit indices provide insights into how well the proposed model fits the observed data. The table presents the fit indices for both the Saturated Model (a model with perfect fit) and the Estimated Model, allowing for an assessment of the goodness of fit.

Table 4. Model Fit Results Test

	Saturated Model	Estimated Model
SRMR	0.02	0.102
d_ULS	0.814	0.814
d_G	0.325	0.325
Chi-Square	234.793	234.793
NFI	0.661	0.661

Source: Process Data Analys (2023)

The SRMR, d_ULS, d_G, Chi-Square, and NFI fit indices were evaluated for the Saturated Model and the Estimated Model. Both models had an SRMR of 0.102, indicating a good fit. The d_ULS values were identical at 0.814, suggesting a close approximation of the estimated model to the saturated model. The d_G values were also identical at 0.325, indicating a good fit. The Chi-Square values for both models were 234.793, which is non-significant in typical SEM, suggesting a good fit. The NFI values for both models were 0.661, indicating a lower fit but should be interpreted alongside other fit indices.

Table 5. Coefficient Model

	R Square	Q2
Cloud Computing Systems	0.394	0.379

Source: Data Processing Results (2023)

R Square (R^2) and Q^2 are key metrics in Structural Equation Modeling (SEM) that provide insights into the explanatory power and predictive relevance of the model. R Square (R^2) measures the proportion of variance in the dependent variable that is explained by the independent variables in the model. For Cloud Computing Systems, an R^2 of 0.394 indicates that approximately 39.4% of the variability in Cloud Computing Systems can be explained by the independent variables included in the model. Q^2 (Cross-validated R Square) assesses the predictive relevance of the model by comparing the model's predictions to the predictions made by a null model. A Q^2 of 0.379 for Cloud Computing Systems implies that the model has good predictive relevance, suggesting that the included latent variables contribute meaningfully to predicting the variance in Cloud Computing Systems beyond what would be predicted by a null model.

Structural Model

The core of the analysis lies in understanding the relationships between the independent variables (Security Levels, Resource Requirements, Scalability on User Acceptance) and the dependent variable (Cloud Computing Systems). Table 5 presents the results of the structural model assessment.

Table 5. Hypothesis Testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
Resource Requirements -> Cloud Computing Systems	0.301	0.378	0.093	3.087	0.003
Scalability on User Acceptance -> Cloud Computing Systems	0.449	0.456	0.083	5.404	0.000
Security Levels -> Cloud Computing Systems	0.363	0.350	0.102	3.573	0.000

Source: Process Data Analysis (2023)

The structural model results demonstrate that all three independent variables—Resource Requirements, Scalability on User Acceptance, and Security Levels—have statistically significant positive relationships with the dependent variable, Cloud Computing Systems. The effect sizes and T statistics provide insights into the strength and significance of these relationships. These findings support the hypotheses formulated in the study and indicate that optimizing Resource Requirements, enhancing Scalability on User Acceptance, and bolstering Security Levels can positively influence the adoption and effectiveness of Cloud Computing Systems in the context of the study.

1) Resource Requirements -> Cloud Computing Systems: The positive effect size (0.301) and statistically significant T statistics (3.087, p = 0.003) indicate a significant positive relationship. As Resource Requirements increase, there is a significant positive impact on Cloud Computing Systems.
2) Scalability on User Acceptance -> Cloud Computing Systems: The substantial effect size (0.449) and highly significant T statistics (5.404, p = 0.000) reveal a strong positive relationship. As Scalability on User Acceptance increases, there is a substantial positive effect on Cloud Computing Systems.
3) Security Levels -> Cloud Computing Systems: The positive effect size (0.363) and statistically significant T statistics (3.573, p = 0.000) signify a significant positive

relationship. As Security Levels increase, there is a significant positive impact on Cloud Computing Systems.

Discussion

Companies in Indonesia that prioritize robust security measures, efficient resource allocation, and scalable systems are more likely to experience positive user acceptance and successful cloud computing implementations [35]. The development of information technology is fast-paced, and the use of information technology is necessary to support business processes and increase productivity [36]. The integration of IoT and cloud computing technologies in Indonesia's finance and accounting sectors has immense potential for growth and development [37]. Strategies to monetize personal data, such as innovative credit scoring, have created opportunities for business innovation in Indonesia [38]. Government agencies in Indonesia must manage digital apps to support public service operations and administration, and application portfolio management (APM) can help in this regard [39]. The development and advancement of information and communication technologies have led to major changes in industry and the labor system in Indonesia, and improving digital skills in the workforce should be a top priority for the government.

Implications and Practical Significance

The findings carry significant implications for technology companies in Indonesia. Emphasizing security, optimizing resource allocation, and prioritizing scalability are pivotal considerations for organizations aiming to maximize user acceptance of cloud computing systems.

Limitations and Future Research

While the study provides valuable insights, certain limitations should be acknowledged. The focus on specific dimensions of cloud computing adoption and the context-specific nature of the findings may limit generalizability. Future research could explore additional variables and expand the study to different industries and geographical regions for a more comprehensive understanding.

CONCLUSION

In conclusion, this study sheds light on key determinants influencing the user acceptance of cloud computing systems in technology companies within the Indonesian context. The empirical analysis, supported by robust statistical methods, demonstrates that security levels, resource requirements, and scalability significantly impact user acceptance. These findings contribute valuable insights for technology companies seeking to optimize their cloud computing systems. The emphasis on security measures, efficient resource allocation, and scalability emerges as pivotal considerations for organizations navigating the evolving digital landscape in Indonesia. Acknowledging limitations and paving the way for future research, this study provides a foundation for strategic decision-making, fostering successful cloud computing implementations and enhancing user satisfaction in the Indonesian technology sector.

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