

Cloud Computing Adoption Using Toe Framework for Indonesia's Micro Small Medium Enterprises

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Abstract— Cloud computing is one of the pillars of the Industrial Revolution 4.0. Cloud computing provides ample benefits to companies such as mobility, ease of access, and enable collaboration. Nevertheless, the impact of cloud computing on the micro, small and medium enterprises (MSMEs) is not well established. This research aims to classify the factors affecting the acceptance of cloud computing in Indonesian MSMEs. A total of 135 participants participated in this analysis. The TOE Structure is used in this analysis. Methods of data collection using Google form. The details have been analysed with SPSS and SmartPLS. The findings demonstrated that top management encouragement and relative advantages have a positive impact on the adoption of cloud computing in MSMEs in Indonesia. In order to increase the adoption of cloud-based computing in Indonesia, cloud-based businesses need to concentrate on these two reasons so that MSMEs in Indonesia can embrace more cloud computing. Furthermore, the improvement of cloud computing adoption should come from government policy and incentives. Theoretically, this research helps to establish the TOE framework by providing empirical evidence. This research also explains that the TOE framework can help companies to understand critical domains that impact their businesses and which domain companies should focus.

Keywords— Cloud computing adoption; MSMEs in Indonesia; Top management support; Relative advantages; Industry revolution 4.0

I. INTRODUCTION

Cloud computing technology is an emerging topic in the literature. According to Gartner and Forrester, the cloud computing industry is projected to hit around USD200 billion in 2019. In the meantime, the Research Institute for the International Data Corporation (IDC) estimates that 60 per cent of all IT infrastructure investment and 60-70 per cent of applications, services, and technology expenditure in 2020 be cloud-based.

Cloud storage provides many advantages, including cost savings for businesses as there are only running expenses to be charged by businesses, environmentally friendly, and promoting business performance [1; 2; 3]. More data can also be stored in cloud storage than conventional operating systems. Cloud networking will only have more beneficial effects on corporate efficiency if it is successfully handled [4]. Many companies are using this technology and countries all over the world, owing to its tremendous advantages [5; 6]. Besides, cloud computing provides consistency in terms of both mobilities as employees can access anywhere with its supply chain partners [7; 8]. Companies also do not need to care about upgrading the applications, bugs and security

concerns as these benefits were managed by the service provider [9].

The Ministry of Communication and Computer Services is committed to promoting MSMEs use of cloud computing in Indonesia since, according to Rudiantara Minister of Communication and Technology [10], one of the future cloud computing industry adoptions is for MSMEs. Currently, roughly 55 million SMEs and MSMEs are active in separate sectors of industry. This business can continue to expand by about 5 per cent annually. However, there are no data available which precisely shows the number of cloud computing adopted by MSMEs in Indonesia. Rudiantara (2015) said the government would do three things to promote the use of cloud computing, namely, computers, networks, and apps (DNA).

Meanwhile, cloud computing is ideal for Indonesian MSMEs, as computing adoption improves cost savings and market efficiency. Cloud computing helps businesses to use new IT solutions without having to spend significantly in production and other tools [11]. To date, many businesses have invested a great deal of money on server, IT personnel, and capital investment that can be turned into operating

expenditure by leveraging cloud storage to make it more efficient.

PwC IT Outsourcing and Cloud Computing's 2015 survey of CIOs [10] and other senior management firms of 489 major businesses found that 77 per cent of businesses intend to move to cloud computing. Latest results, however, suggest that usage rates of cloud services in some developing countries are comparatively low [12; 13; 14]. In Indonesia, government and international corporations have been paying attention to cloud technologies. Although many are involved in switching, cloud infrastructure is still underdeveloped.

Besides the significant potential gains, cloud computing also raises several obstacles, including technical sophistication, safety threats, lack of auditing requirements and contracting concerns [4; 15]. Protection, the complexities of the subscription and application transfer process, which involved financial preparation, human resources management and ERP (Enterprise Resource Planning), security policies like government policies and industrial policies, a strategic partnership with companies, face an acceptance/rejection of technology decisions [4; 16; 17].

II. LITERATURE REVIEW

In cloud computing adoption, TOE System was used [4]. This research uses the TOE paradigm as it offers a compelling theoretical context for analysing the variables involved in the use of cloud computing. The TOE has three contexts, technical, operational, and environmental. Factors in each case differ from one analysis to another. Figure 1 displays the proposed structure and consists of 11 dimensions as follows:

1. *Relative Advantage*

The relative advantage is the consistency of the level to which cloud computing can deliver business advantages [18]. The advantages of innovation are responsiveness, cost performance, scalability, durability, and interoperability [4]. The relative benefit is that an invention can transform a traditional method to performance-based [19]. It can be inferred that the relative advantage is the degree to which innovation can offer the business many advantages to boost its efficiency concerning previous innovations.

2. *Complexity*

Complexity is the degree of quality at which invention is difficult to recognise and use for enterprises [7]. Companies will resist creativity if the business is too complicated and comparatively new [4]. It can also be inferred that the challenge of the invention used by the organisation is uncertainty.

3. *Compatibility*

The degree to which creativity blends with a company's technical systems, procedures and processes can be calculated in terms of compatibility [20]. The main question is how creativity is integrated or in line with existing market practises [4]. It can also be inferred that the degree of convergence of innovation with technical technology should be sufficient.

4. *Privacy Concern*

Security issues involve security attacks and occurrences in which businesses destroy information such as documents, personal records, and other confidential data [21]. Cloud computing companies can protect their corporate data more efficiently. The protection of services, data centres and media are classified as part of security. Security concerns can be concluded as the degree of business faith in cloud computing services in the protection of confidential company information.

5. *Vendor Lock-in*

The lock-in point refers to a company's willingness to move to a new distributor due to costs or technological challenges [22]. The supplier lock-in is a situation in which consumers of a commodity rely on one supplier and cannot move without a significant charge and a long period to another supplier [23]. It can, therefore, be inferred that vendor lock-in is a situation whereby businesses find it difficult to move due to cost and technical considerations to other vendors.

6. *Top Management Support*

Top management refers to the mindset of top management in favour of the related technologies and the extent of funding for implementation [25]. Support for upper management is one of the most significant aspects of sustaining and supplementing the tools required for implementing emerging technologies. Top management plays the primary position since the implementation of creativity requires resource integration and re-engineering of business structures that only top management can promote [4]. Top management support is also a prerequisite where top management encourages the company's acceptance of creativity.

7. *Organization Readiness*

Business readiness refers to the availability of company services required for technological implementation [25]. A company's preparation covers cloud computing platform infrastructure, finance, information technology and human resources. Technology architecture is referring to innovation-enhancing operating systems, technological networks, system applications and database systems [4]. Business Preparation is the company's degree of financial and technical readiness to innovate.

8. *Competitive Pressure*

Competitive pressure refers to the degree to which an organisation reacts with competing competitors' pressure [4]. Companies must use emerging technology to maintain a strategic lead over their rivals. Competitive pressure means the extent to which an organisation reacts to the pressure of a rival and complies with industry requirements.

9. *Government Support*

Help from the government is an initiative and opportunity from the government to encourage adoption [26]. It was suggested that the government can increase the adoption of cloud computing by creating a profitable business and corporate tax regulations. It can also be inferred that government funding is a government strategy that impacts the acceptance by businesses of innovation.

10. Business Partner Pressure

Business associates are one of the things that will decide a company’s performance. In order to promote data sharing and exchange, organisations must implement technologies which are comparable and compliant with their collaborators [4]. This pressure comes from manufacturers or other cloud-based partners. In this way, companies should be motivated to use this technology [27].

11. Regulatory Policies

Judicial protection applies to government regulations for the supervision of the technology industry [26]. The expanded use of technologies raises the urgency to deal with legal concerns relating to privacy and data security [21]. It is different from government regulation as a policy is more focused on the industry-wide effect.

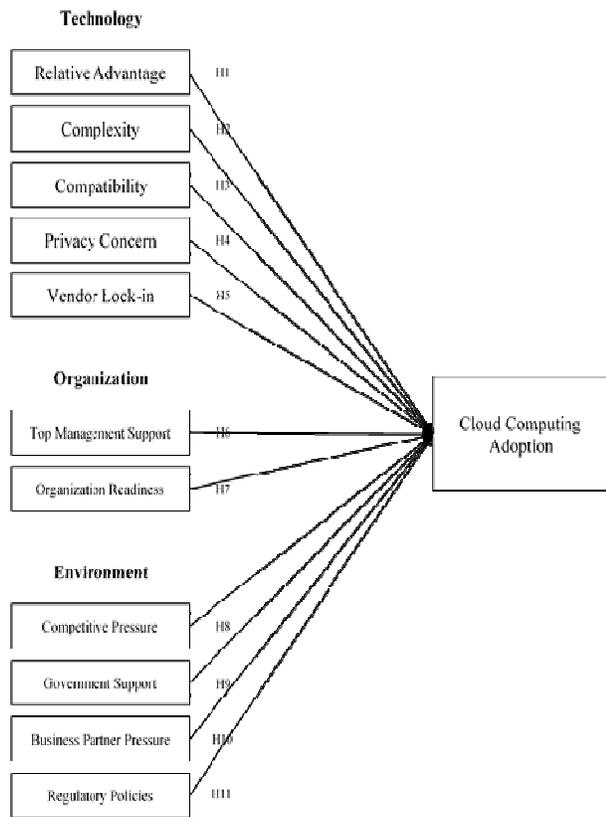


Fig 1: Proposed framework

Variable Operationalisation

The questionnaire was adapted from research by [4]. Table 1 shows the operationalisation of the variables from this study:

TABLE 1
MEASUREMENT ITEMS

Variables	Dimension	Indicator
Technology	Relative Advantage	CC already or if implemented can reduce costs to the company
		CC has been or if implemented can increase the efficiency of business operations at the company
		CC has or if implemented can accelerate business processes in the company

Complexity	CC already or if implemented can improve the relationship with the company’s customers
	CC has or if implemented can improve relationships with business partners (vendors and customers) in the company
	CC is easy to implement in companies
	CC is easy for employees to understand in the company
	CC is trusted by employees at the company
Compatibility	CC requires a high level of expertise for companies to implement
	CC fits into the organisation culture in the company
	CC matches the organisation value in the company
Organisation	CC fits into the work habits of the company
	Companies are concerned about data leaks in the use of CC
	Privacy Concern
	Companies are concerned about storing data on CC
	Vendor Lock-in
Environment	The company found it difficult to switch to another CC
	Top Management interested in adopting CC
	Top Management Support
	Top management supports CC adoption
	Top management knows the advantages that can be obtained from CC adoption
Environment	Companies are financially ready to undertake CC adoption
	Organisation Readiness
	The technology commonly used in companies is ripe for CC adoption
	Competitive Pressure
	Competitor companies influence the company’s decision to adopt CC
Environment	Pressure from the industrial sector influenced the company’s decision to adopt CC
	Business Partner Pressure
	Your business partners (vendors and customers) influence the company to adopt CC
	Government Support
	The government supports CC adoption
Regulatory Policy	The government sponsors CC workshops and conferences
	Law in Indonesia provides legal protection in the use of CC
	Indonesian laws and regulations facilitate the use of CC

Adopted from [4]

III. METHODOLOGY

This research collects data through an online questionnaire of Google Form. The questionnaires were circulated through the social media feature Facebook, LINE and WhatsApp of MSMEs managers in Indonesia. There are no database available recording MSMEs in Indonesia. Thus, the sampling technique used to help to answer the research objective is through convenient sampling. Data processing took place between 2 May and 31 May 2020. The number of samples was 178, but only 135 samples were valid for this analysis.

SPSS is used for authenticity and reliability checking and for having a respondent’s profile. Data are classified by the demographic of business, age of business, the number of employees, business-as-Service (SaaS) applications, business-as-used Platform (PaaS) and the Business-as-used Infrastructure (IaaS). SmartPLS is used to assess the relationship between hypotheses on MSMEs cloud

computing adoption in Indonesia. The internal model study is performed at this point with a path coefficient test, determinant coefficient (R^2), t-test, effect size (f^2) and predictive relevance (Q^2) using blindfolding.

IV. RESULT

From 135 respondents, 81 per cent live in Java Island and 19 per cent outside Java Island. 53 per cent of MSMEs operate for 3-10 years, 30 per cent operate less than 3 years, but 17 per cent operate for more than 10 years. Furthermore, 53 per cent engaged in manufacturing, 38 per cent in services and 9 per cent in trading where these companies have 46 per cent with 5-19 employees, 34 per cent with less than 5 employees and 20 per cent with 20-99 employees. Interestingly, 92 per cent companies have used SaaS, 35 per cent have used PaaS, and 30 per cent have used IaaS.

For the results of the path coefficient, the t-test was carried out with the one-tailed test with significance level used was 0.05, the t-test was carried out to determine the significance of a variable, and according to the t-test value, it was significant if it was greater than the critical value of 1.645. The effect size test can predict a specific variable against other variables in the structural model. The effect size value, which has a limit of 0.02, means a small effect, 0.15 means a moderate effect, and 0.35 means a considerable influence. Meanwhile, a value below 0.02 means that it does not affect the structural model [28]. The results of hypothesis testing are shown in Table 2.

All hypotheses were rejected except for relative advantage and top management. The determinant coefficient (R^2) is used to assess to what degree the model can describe the dependent variables. The determinant meaning coefficient itself is between zero and one. The statistic of 44 per cent indicates that cloud computing adoptions have been affected by technological dimensions, organisational dimensions, and environmental dimensions.

Testing of predictive relevance using blindfolding method is conducted to check the accuracy of the hypothesis decision. This test is used to show that some variables used in a model have statistical associations with other variables in the model. The value of more than zero in Q^2 [28] means that the model has predictive significance, while zero indicates that the model has no predictive relevance. The predictive relevance value is 0.309, which can be inferred that the model is of predictive relevance.

TABLE 2
RESULT OF HYPOTHESES TESTING

Path	β	T value	f^2	Significance
H1 Relative Advantage -> CC Adoption	0.166	1.654	0.024	Significant
H2 Complexity -> CC Adoption	-0.003	0.028	0	unsignificant
H3 Compatibility -> CC Adoption	-0.106	1.302	0.009	unsignificant
H4 Privacy Concern -> CC Adoption	0.045	0.504	0.003	unsignificant
H5 Vendor Lock-in -> CC Adoption	0.032	0.323	0.001	unsignificant
H6 Top Management Support -> CC Adoption	0.526	5.011	0.231	Significant
H7 Organizational Readiness -> CC Adoption	-0.044	0.464	0.002	unsignificant

Hypothesis	Path	β	T value	f^2	Significance
H8	Adoption Competitive Pressure -> CC Adoption	-0.003	0.022	0	unsignificant
H9	Business Partner Pressure -> CC Adoption	0.09	0.937	0.006	unsignificant
H10	Government Support -> CC Adoption	0.024	0.171	0	unsignificant
H11	Regulatory Policy -> CC Adoption	0.007	0.065	0	unsignificant

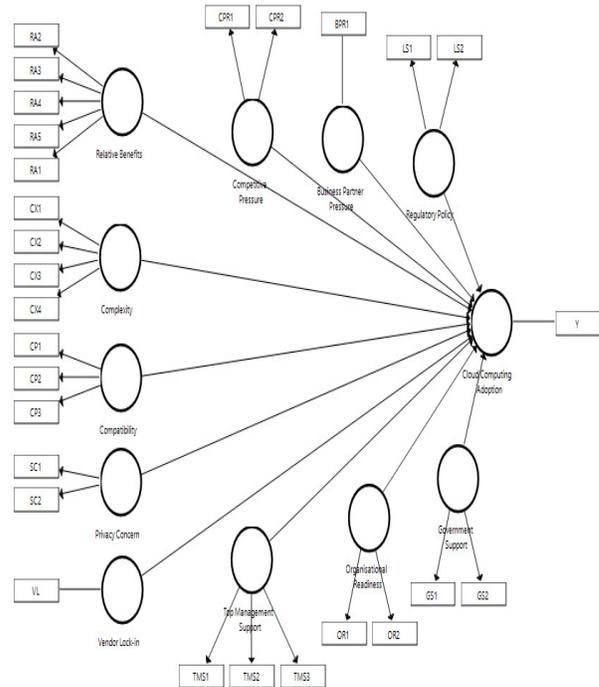


Fig 2: Convergent validity based on SmartPLS

V. DISCUSSION

Results of the report suggest a significant positive impact on cloud computing adoption, as a result of studies by [29] and [30]. Much of the respondents agreed with the advantages that cloud computing would bring. This research reveals that 93 per cent of respondents have taken advantage of cloud computing, 71 per cent agree that cloud computing can reduce business costs, 84 per cent accept that cloud computing can increase operational efficiency, 85 per cent agree that cloud computing can speed up business transactions, and 83 per cent accept that cloud computing can enhance business relationships with clients MSMEs in Indonesia.

Cloud infrastructure is in line with findings from Low et al. (2011), [29], [30], and [4]. The finding has significant effects on top management. Most respondents agreed that Top Management promotes the use of cloud services. According to [4], this is most likely caused by local cultural dynamics where industry players appear to follow the corporate hierarchy and have had a strong effect on business decisions, including the decision to take cloud storage.

Cloud adoption is not significantly influenced by organisational readiness. The findings suggest that the effect on cloud adoption of market dynamics is not significant. Cloud computing adoption has no substantial impact on

business partner pressure. The cloud computers adoption Regulatory Framework has no considerable influence. Complexity has no significant effect on cloud computing adoption. Compatibility has no significant effect on cloud computing adoption. Privacy concern has no significant effect on Cloud Computing Adoption. Vendor lock-in has no significant effect on cloud computing adoption. The results are similar to the result of studies by [29], [30], and [31].

Of the 135 respondents in this study, only 39 per cent agreed that pressure from external parties (i.e. competitors, industry conditions, business partners) influenced the company's decision to adopt Cloud Computing. This result shows that MSMEs in Indonesia do not care about the pressure of external factors on their decision to adopt cloud computing. Only 40 per cent of respondents agree that the government supports cloud computing adoption and Indonesian laws facilitate the use of cloud computing. This result shows that the government in Indonesia still pays less attention to the cloud computing sector. This finding implies that most MSMEs in Indonesia adopt cloud computing based on internal needs and relative advantages.

Regarding the TOE framework, the result suggested practical policy improvement to the company, industry, and the Indonesian government. However, in terms of theoretical contribution, the result is still lacking clarity on the adoption of cloud computing. The reason for the unclear finding is due to the adoption of cloud computing in Indonesia is still limited among MSME. Therefore, an improvement in the TOE framework by investigating the critical success factors are recommended.

CONCLUSIONS

The goal of this research is to understand the cloud adoption factors among Indonesian MSMEs. Based on the findings, it is still a long way from MSMEs in Indonesia to incorporate cloud computing in the company entirely. The result indicates that MSMEs administrators thoroughly appreciated the advantages of cloud technologies in their business. Besides, there is proof of support from top management or the ability of the top management to embrace cloud computing. Nevertheless, government funding, business policy and competition pressure are not visible based on the outcome. The results indicate that the Indonesian administration has a crucial role to play in overseeing and enforcing policies to foster competition for MSMEs in the sector.

The supply chain of MSMEs, on the other hand, must also be strengthened. There is a severe lack of pressure from the supplier, networking with mutual associates and readiness of the supply chain network. The findings indicate that MSME managers must concentrate on establishing a supply chain partnership to boost efficiency. This supply chain efficiency would improve the use of Industrial Revolution 4.0 technologies, such as cloud computing.

This study is not without limitation. The crucial limitation is the data collection schedule, which was obtained during the Covid-19 pandemic and the economic downturn. Therefore, future study should concentrate on data obtained at the end of Covid-19.

Future research

The scope of research can be applied to all Indonesian business participants or reduced to areas of business such as cuisine, manufacturing, and education. Add other variables or add moderating variables from the literature. The TOE framework has several drawbacks, which can be strengthened by incorporating the TOE into other frameworks, including TAM, DoI and TPB.

Cloud computing will also expand the customer base of organisation programmes, as the study findings suggest that these considerations influence the decision to implement cloud computing substantially. In comparison, MSME players who have not used cloud computing will attempt to use commonly used cloud computing, such as Google Apps and Microsoft 365. Cloud Computing enables business operations to be effective, to accelerate business processes, to improve customer relationships, and to improve business connections (sellers and customers).

SMEs using SaaS Cloud Computing should try using IaaS and PaaS in cloud computing that other member countries, for example, Google App Engine, the Amazon Web Service, Salesforce, and Alibaba Cloud, have trusted. It is because it is efficient, prices are lowered, and market efficiency is improved.

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