Adoption of Cloud Business Intelligence in Indonesia's Financial Services Sector

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Abstract. Business Intelligent (BI) tools adopted in many companies as an effort to develop new strategies and survive in the rapid changes and agility situation. New horizons emerged with the implementation of the BI concept using "Cloud Computing". The leading IT companies compete to develop BI cloud-based services (cloud BI). This study aimed to determine the factors influencing manager decision to adopt cloud BI in Indonesia's financial service sector, using the diffusion of innovation (DOI) model and technology organization environment (TOE) framework. The research also obtains prediction of the cloud BI marketing trend in Indonesia. The survey conducted with 30 participants at the senior management level in Indonesia's financial services sector. The findings reveal, the adoption rate of cloud BI in Indonesia financial service sector still very low. Only 3.4% of firms have implemented cloud BI, while 10% not considering the cloud BI adoption. The results of this research can be used by vendors to develop cloud BI tools that fit into the customer's need. It is also very useful for marketers to know the characteristics and demographics of cloud BI users. For regulators, this research illustrates how and what drives regulators to make policies that can encourage companies to use the latest technology.

Keywords: Cloud business intelligence · Cloud BI · DOI framework · TOE framework

1 Introduction

In the current world situation, the decision-making process has become more complicated in the last few decades, caused by the unpredictable situation of world change related to markets, competition, and technology. It is stated that a critical component of an organization's success is the capability to capitalize on all available information and knowledge [1]. Each organization has tended to become more scalable, flexible and intelligent, using new BI solutions [2]. The superior solutions accomplished by integrating different big data platforms to achieve the compatibility with any existing BI solutions [3]. Business intelligence (BI) has grown as main of the solution to provide companies with crucial information. The BI tools help the decision-making process in all

level of management to ensure sustainability and generate value for shareholders [4]. In many cases, the implementation of traditional BI is considered complex, expensive, and inflexible. On the other side of the coin, cloud computing nowadays is the new buzzword in the ICT industry [5]. Cloud computing has made BI tools more accessible [6]. The integrating cloud computing and BI technologies generated the cloud BI [7]. The main benefits driven by this model are business agility with lower costs, which allows organizations to respond quickly and effectively to the constantly changing business environment [8]. However, currently, there is still a serious lack of conceptualization in the cloud BI area. The cloud BI implementation strategy still needs to be investigated [9]. Since then, there are many obstacles for companies adopting this new technology.

This research will investigate the adoption of cloud BI according to an empirical study in Indonesia's financial services sector. The objectives of the research are investigating the factors that influence the decision of managers when adopting the cloud BI and predicting its marketing trend in Indonesia's financial services sectors.

2 Literature Review

2.1 Definition and Benefits of Cloud Business Intelligence

Cloud BI represents a way for reporting and analysis solutions to be developed, installed, and consumed more easily due to its lower cost and easier deployment [10]. Many leading IT providers developed cloud-based BI tools as a solution to create a more accessible and accessible solution in BI (see Fig. 1).
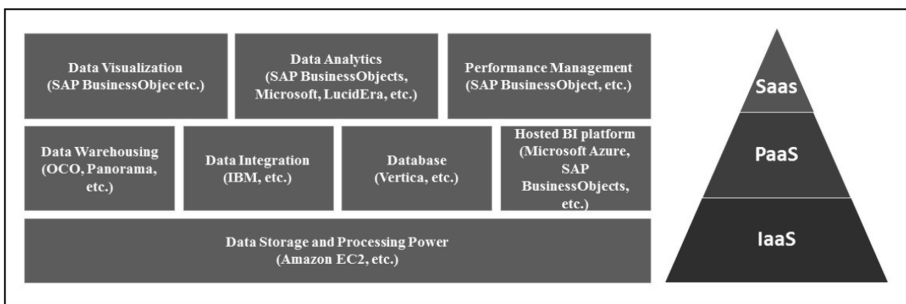

Fig. 1. Cloud BI, Source: Infosys Research.

Nowadays, the popularity of cloud BI solutions are gradually increase among businesses, as many businesses are realizing the benefits of data analytics [11].

2.2 Empirical Cloud BI Research in Indonesia Financial Sector

Financial Services Authority (*Otoritas Jasa Keuangan* - OJK) stated, there are 115 commercial banks, 137 insurance companies, 172 Multi finance, and 63 Fintech operated in Indonesia (OJK Report, June 2018). Prior studies have performed to

explore the adoption of Business Intelligence and cloud BI in many sectors, including financial institutions around the world. However, no empirical study research has been conducted on the adoption of BI and the cloud BI in Indonesia's financial sector. Limited access to and regulation of privacy and data security are the barriers for the academy to conduct an empirical study on the financial service in Indonesia. With respect to data privacy and customer safety of commercial banks, POJK 38 issued by OJK contains the Regulation number 38/POJK.03/2016 of the financial services authority on the implementation of the use of the risk management of the information technology of the commercial bank. Indonesia Government through the Ministry of Communication and Informatics issued PP82 on the government regulation of the Republic of Indonesia number 82/2012 on "Management of electronic systems and transactions".

2.3   DOI Framework

The DOI framework built principally on the characteristics of the technology and the perceptions of the users on the implementation of innovation strategy. According to Rogers [13], the diffusion of Innovation (DOI) theory and the adoption rate of innovations were impacted by five factors: (1) compatibility, (2) the relative advantage, (3) observability, (4) complexity, and (5) trialability [12]. Rogers further explains that complexity has a negative impact related to the rate of adoption, trialability, relative advantage, observability, and compatibility are usually positively related with the rate of adoption. The DOI Framework proposed by Rogers is illustrated in Fig. 2.
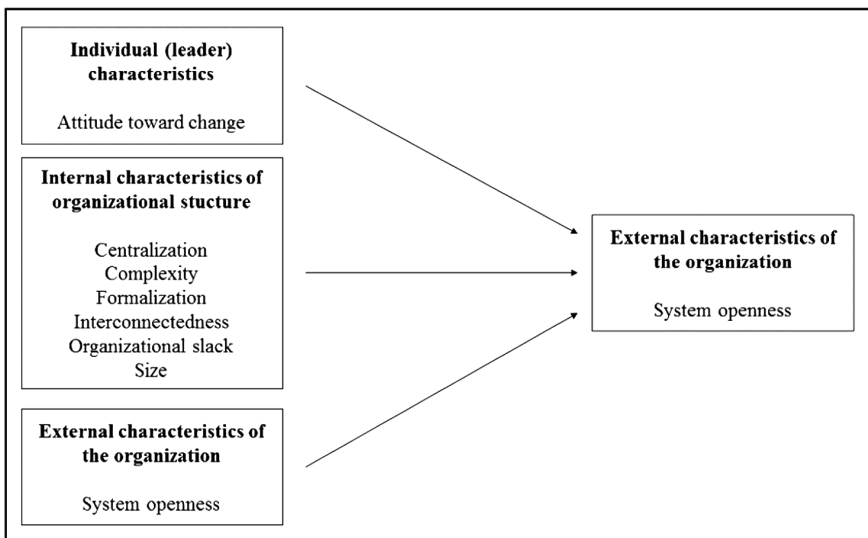

Fig. 2. Diffusion of innovations [13].

2.4   TOE Framework

Oliveira and Martins [13] advised the TOE framework to define the process of innovation in the context of a company. Figure 3 illustrated the TOE framework [13]. Based on this framework, the process of adopting technological innovation is influenced by three aspects of the context of a company:

- Technological context describes the internal and external technologies related to the organization; both the technologies that are already in use in the company and those that are available in the market but that is not currently in use. These technologies can include equipment or practice.
- The organizational context defines as the resources and the characteristics of the company, for example, size and management structure.
- Environmental context, which refers to the area in which a company conducts its business; It may be related to surrounding elements, such as industry, competitors and the presence of technology service providers.
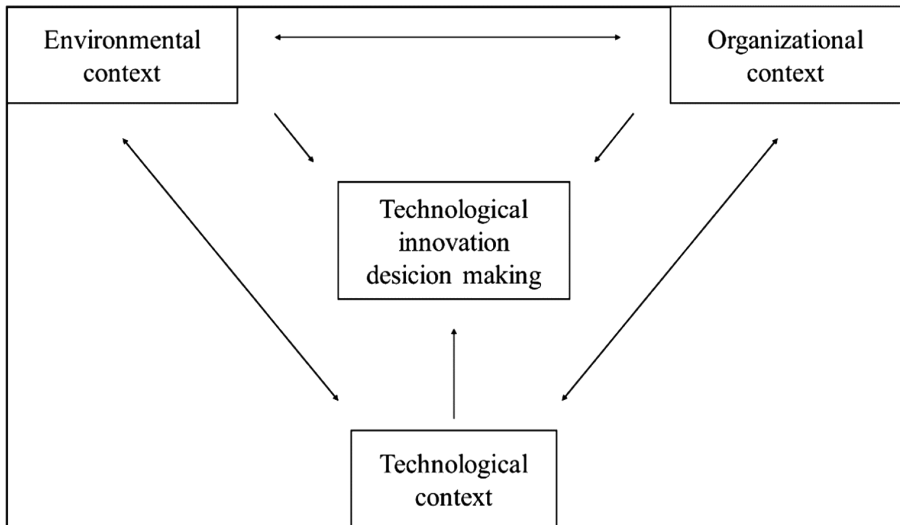

Fig. 3. TOE framework [13].

The TOE framework already adopted in a variety of Information System (IS) adoption settings including open systems, ERP, E-Commerce, and Cloud Computing [14].

2.5   Conceptual Model and Hypothesis

In this era, the complexity of the new technology adoption required people to combined more than one theoretical model to achieve a better understanding of IT/IS adoption phenomenon.

In this research, we assume that the DOI-TOE framework developed by Oliveira [15] is suitable to be adapted to describe the variable relationship of the implementation of cloud BI to the financial service sector in Indonesia. We use the framework and conduct an empirical study to find out the factors that influence BI's cloud adoption. The integrative research model is shown in Fig. 4.
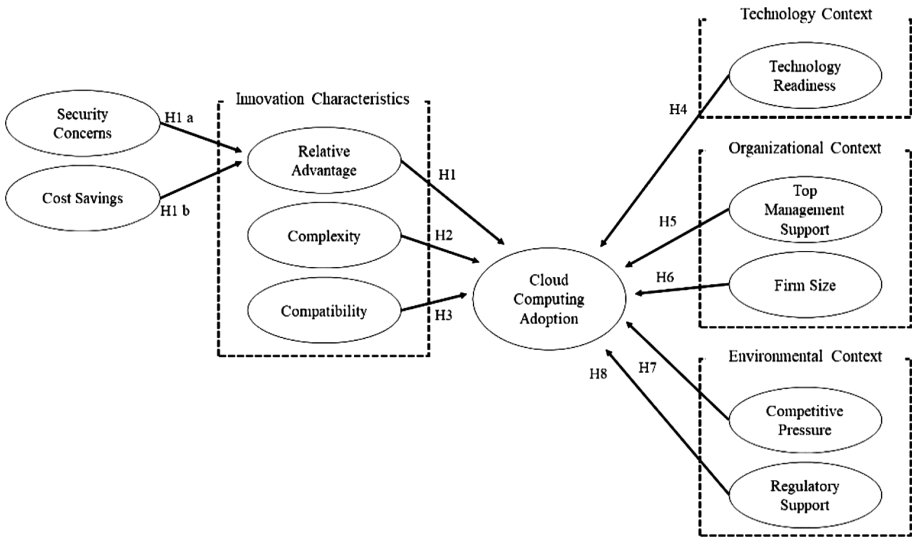

Fig. 4. Conceptual model [15]

Previous literature proposed by Oliviera [15] has revealed hypothesis and listed in the Table 1.

Table 1. Hypothesis

H#	Hypothesis
H1a	Security and privacy concerns will negatively influence relative advantage of cloud BI adoption
H1b	Cost saving will positively influence relative advantage of cloud BI adoption
H1	Relative advantage will positively influence cloud BI adoption
H2	Complexity will negatively influence cloud BI adoption
H3	Compatibility will positively influence cloud BI adoption
H4	Technology readiness will positively influence cloud BI adoption
H5	Top management support will positively influence cloud BI adoption
H6	Firm size will positively influence cloud BI adoption
H7	Competitive pressure will positively influence cloud BI adoption
H8	Regulatory support will positively support cloud BI adoption

3   Research Methods

3.1   Research Design

The research conducted is employed two research methods: interviews and the questionnaires. The purpose of research, methods, and participants of the research is illustrated in Table 2.

Table 2. Research design

Purpose of research	Research methods	Research group
Previous theories considering cloud BI. Gaining new insights of the cloud BI market trend	Interviews	Study case. Participants: 2 CIO
Ranking the importance of key adoption factors	Questionnaire	CIO or Head of IT of 30 financial firms (banking, insurance Multi finance, Fin-tech)

3.2   Data Collection and Analysis

To identify the variables in Cloud BI adoption, interviews are performed and used as the main method in the data collection. The first draft of the questionnaire was an experiment with two participants from different companies. The personal interview with the Director of Information Technology (CIO) in the two firms were involved in the adoption decision-making process of cloud BI.

The interviews are performed for one hour. Interview questions included (1) the background of the company, (2) BI, cloud computing, and the cloud BI implementation, and (3) the impact of the factors in the cloud BI adoption.

After conducting a face-to-face interview, the next step is conducted a survey. We distributed questionnaires to CIOs of 30 financial service firms in Indonesia. Adoption is generally measured on the Likert scale. In the questionnaire, we used a 5-point Likert scale to measure the degree of adoption. 26 questions were asked in the survey. The questions measure 10 variables represented in the research model.

3.3   Validity and Reliability

The operational measures applied in this investigation were taken from prior work. Statistic software is exercised to run multiple tests. The validity and reliability tests are used to ensure that the measurements were accurate. The results of the Cronbach's scores were used to evaluate the reliability of the items constructed. We eliminate questions that have low reliability. After eliminating CP1 and FS2, all the constructs have a high-reliability value >0.6 as shown in the Table 3.

Table 3. Cronbach's α score for each factor DOI-TOE framework

Factors	Factor code	Item/question no. (questioner)	Cronbach's α score
Security concerns	SC	SC1, SC2, SC3	0.927
Cost savings	CS	CS1, C2, CS3	0.703
Relative advantage	RA	RA1, RA2, RA3	0.778
Complexity	CX	CX1, CX2	0.795
Compatibility	CM	CM1, CM2, CM3	0.691
Technology readiness	TR	TR1, TR2, TR3	0.774
Top management support	TS	TS1,TS2,TS3	0.751
Firm size	FS	FS2	1.000
Competitive pressure	CP	CP1	1.000
Regulatory support	RS	RS1, RS2	1.000
Cloud BI adoption	CBI		1.000

4   Finding and Dicussion

4.1   Survey Result Discussion

A prototype questionnaire had been floated in November 2018. The survey conducted in 10 days, with 30 participants at the senior management level (Chief or Head of Division) in Indonesia's financial services sector, including (1) Banking, (2) Insurance, (3) Multi finance, (4) Fintech, and (5) Securitas. Most participants are from banking firms that have annual revenues more than IDR 50 Billion. Currently, most Indonesian financial firms have implemented Business Intelligence. 76.7% of firms have implemented BI, and 23% of firms not yet implemented BI. Most of the firms also have adopted cloud computing for a particular type of services. Total 56.7% of firms have implemented cloud computing, and 43.3% of firms have not yet implemented cloud computing. Figure 5 illustrated cloud BI features that appropriate to financial service firms in Indonesia.
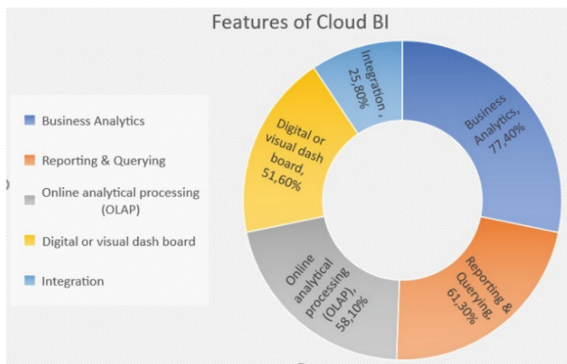

Fig. 5. Features of Cloud BI.

The functional areas of cloud BI are illustrated in Fig. 6. The result of the survey represents the adoption rate of cloud BI in Indonesia's financial service sector still very low. Only 3.4% of firms have implemented Cloud BI, while 10% not considering Cloud BI adoption. The future of cloud BI is still promising, most the firms have a positive perspective of cloud BI integration soon. 60% of firms will adopt BI between 1–2 years, while 13.3% of firms will adopt more than 1 year, and 13.3% of firms will adopt less than 1 year.
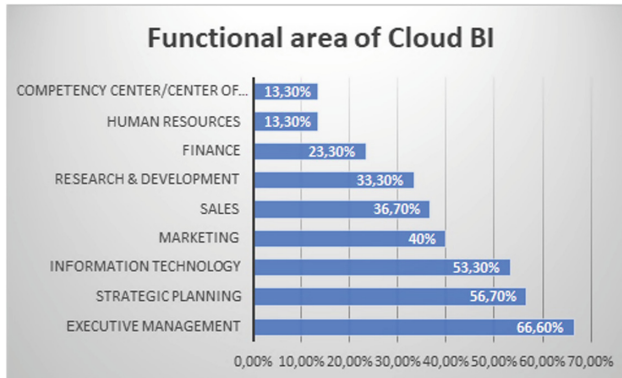

Fig. 6. Functional areas of Cloud BI.

We perform identification and validation of ten factors through data analysis, and the result is as follow. Table 4 shows the estimated coefficients and statistics calculation for each variable path.

Table 4. The estimated coefficients and statistics

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	P Values	Sign Level
RA → CBI	−0.556	−0.530	0.186	2.990	0.003	S
SC → RA	0.337	0.305	0.194	1.733	0.084	NS
CS → RA	0.767	0.751	0.085	8.975	0.000	S
CM → CBI	0.117	0.077	0.361	0.323	0.747	NS
CX → CBI	0.275	0.257	0.230	1.194	0.233	NS
TR → CBI	0.335	0.334	0.407	0.823	0.411	NS
TS → CBI	0.114	0.169	0.250	0.456	0.649	NS
FS → CBI	−0.194	−0.172	0.205	0.948	0.344	NS
CP → CBI	0.307	0.298	0.178	1.726	0.085	NS
RS → CBI	0.097	0.099	0.209	0.464	0.643	NS

NS=Not significant; S=Significant;

The t test deliberated is to test whether the independent variables partially have a significant effect on the dependent variable. The variable is significant if p-values < 0.05. We found two paths: RA $\rightarrow$ CBI and CS $\rightarrow$ RA have p-values < 0.05. The summary result from the Table 4 can be clarified as follows:

- Cost savings have a positive and significant effect on the relative advantage, because t value $= 8.975 > 1.96$, making high-cost savings, the higher relative advantage, and vice versa.
- Relative advantages have a positive and significant effect on the cloud BI adoption, because of t value $= 2.990 > 1.96$, making high-relative advantage, the higher cloud BI adoption rate, and vice versa.
- Security concerns have not significant effect on relative advantage, because of t value $= 1.733 < 1.96$, making high-security concern, the lower relative advantage, and vice versa.
- Complexity has not significant effect on cloud BI, because of t value $= 1.194 < 1.96$, making high-complexity, the lower cloud BI adoption, and vice versa.
- Compatibility, firm size, technology readiness, competitive pressure, top management support and regulatory support are not statistically significant.

5   Conclusion and Recommendation

Recommendations based on the findings of research provide an overview of cloud BI's acceptance in Indonesia's financial service sector. The results of this research can be used by application designers to create applications that focus on user needs. IT engineers can produce an application with better functions and designs. Vendors can use this as a marketing trend data. So that they can see the priority of problems encountered on the cloud BI adoption. Thus, vendors can focus on existing problems, developing applications, and roll out new versions. This research is very useful for marketers to know the characteristics and demographics and types of BI cloud user companies in the financial services sector.

For regulators, this research illustrates how and what drives regulators to make policies that can encourage companies to use the latest technology, but still focus on high levels of privacy and security. The implementation of Information Technology or Information Technology able to encourage companies to achieve high performance and ultimately be able to improve Indonesia's economy on a macro basis. The government can find out what problems the company faces in adopting a technology, especially the cloud BI. So that companies, especially the financial services sector in Indonesia can increase efficiency by using cloud BI. Development of a policy plan can use this research to identify gap areas and implement policies that are in line with technological developments.

In the end, the company can analyze the problems and issues faced. Cloud BI implementation is part of the implementation strategy plan and system integration with cloud computing. As part of the IT infrastructure strategy that is more integrated and efficient.

Further research is needed with a greater number of participants, besides requires empirical research that focuses on cloud BI integration strategy with traditional BI and infrastructure in the company.

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