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The Context of Cloud Computing/Services Adoption in Business: A Systematic Review with Activity Theory perspective

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Completed Research Paper

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Abstract

Cloud computing has been established as a prominent research topic with the rise of a ubiquitous provision of computing resources over the last decade. According to literature review, previous studies are found focusing on the technical issue mostly; however, accompanying with the cloud service developing progress, there are a wide range of applications for adopting cloud computing/services and without an overall comprehension. This study aims to proposed a conceptual framework to systematically explore the activities and elements related to cloud computing/services adoption in business. The research framework is found useful for understanding the context of cloud computing and services and the preliminary findings are helpful to further explore the related activities and relationships behind on cloud computing/services adoption in business.

Keywords: Cloud computing services, Activity theory, TOE framework

Introduction

Over the last decade, the evolution of Internet has enabled the information and communication technologies (ICTs) rapid growth and broaden application. Both industrial and academia has increasingly focused on enterprise transformational developments brought by ICTs. Cloud computing, one of the ICTs appeared based on the Internet and information technology (IT) industry revolution, has been seen as the critical strategy technology and the digital transformation enabler in next few years. It is indeed a technology and business composite issue.

Gartner annual report identified cloud computing as top 1 strategic technology since 2011 presented the potential for significant impact on the enterprise. Logic Monitor survey also indicated that 83% of enterprise workloads will be hosted on the cloud by 2020 (Columbus 2018). International Data Corporation (IDC) predicted total cloud IT infrastructure investment in 2018 was $57.2 billion, reflecting a 21.3% increase over the previous year. The apparent exponential growth of deploying cloud environment and increasing industry focus have displayed the irreversible trend of the cloud computing/services adoption and application. In its first decade, cloud computing was itself a disruption. Today it serves as the foundation for other disruptive trends including the Internet of Things, artificial intelligence and digital business.

Cloud computing/services have revolutionized traditional IT delivery (P.-F. Hsu et al. 2014) with its essential characteristics including on-demand self-service, broad network access, resource pooling, rapid elasticity, measured service (Mell and Grance 2011). With these characteristics, organizations need only low cost to achieve the effectiveness of the original information system infrastructure (Dixit and Sharma 2015; Marston et al. 2011). On the other hand, the reduction in in-house ICT sunk costs and the lower risks associated with developing new ICT-related or supported projects (Ross and Blumenstein 2015) has become the chances for entrepreneurs; therefore, facilitate the famous tech unicorn (Carey 2016) such as Dropbox, Airbnb, Spotify, Uber etc.

Forrester predicted that cloud computing/services would radically accelerate enterprise digital transformation. After powering small and medium business success and giving disruptive companies the tools and technologies, they needed to compete head on with the world's largest firms in the last decade, cloud has the great potential to drive significant enterprise change in the very firms being disrupted by innovative startups (Bartoletti 2018). Under the significant enterprise digital transformation trend, numerous studies have mentioned that cloud computing is also considered as the next generation IT and can enhance firms' agility (Bhattacherjee and Park 2014; Choudhary and Vithayathil 2013; Marston et al. 2011; Son et al. 2014). On the human, organization, and technology point of view, the empirical study of Liu et al. (2018) discuss the relevance between cloud infrastructure capability and organizational agility, then conclude the result that firms must focus on organizational factors rather than technical factors in a cloud computing/services environment.

Forrester report states that "Cloud computing has moved past its self-centered teenage years to become a turbocharged engine powering digital transformation around the world" (Edwards 2018). Cloud computing has been established as a prominent research topic with the rise of a ubiquitous provision of computing resources over the past years. However, many researchers focus exclusively on the technical aspects of cloud computing, thereby neglecting the business opportunities and potentials cloud computing/services can offer (Leimeister et al. 2010; Marston et al. 2011). Senyo et al. (2018) also noted that the attention to the cloud computing/services related articles have now moved from technical issues to business issues. Using web crawler with Python, this study searched the key word "cloud computing" and "cloud services" through Google scholar engine on Jan 4th 2019 and found out that only 11% was discussing on the business perspective. Apparently, there are still an obvious research gap from technology to business application.

Take a deeper review on previous researches, most of researchers discussed on the adoption factors and intention of cloud computing/services (C.-L. Hsu & Lin 2016; Gangwar et al. 2015; Gutierrez et al. 2015; Lian et al. 2014; Loukis et al. 2017; Low et al. 2011; Mangula et al. 2014; Oliveira et al. 2014; P.-F. Hsu et al. 2014; Tehrani and Shirazi 2014); however, there are a wide range of applications for adopting cloud computing/services and without complete interpretation and definition. Therefore this research purposes are as following: (1) To understand the cloud computing/services adoption situation from systematic literature review in business perspective; (2) To explore the activities and elements which should be involved in the adoption of cloud computing/services scenarios with theoretical framework.

Literature Review

Cloud Computing/Services

Since cloud computing is an evolving paradigm (Mell and Grance 2011), there is no specification of the definition and scope of cloud computing/services. Youseff et al. (2008) were the first who tried to provide a comprehensive understanding of cloud computing and regard cloud computing as a "collection of many old and few new concepts in several research fields like Service-Oriented Architectures (SOA), distributed and grid computing as well as Virtualization" (Youseff et al. 2008). Leimeister et al. (2010) organize the related work and provide the description "cloud computing is an IT deployment model, based on virtualization, where resources, in terms of infrastructure, applications and data are deployed via the internet as a distributed service by one or several service providers. These services are scalable on demand and can be priced on a pay-per-use basis." (Leimeister et al. 2010) Later on, National Institute of Standards and Technology (NIST) release the cloud computing definition

document, and define as "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics (on-demand self-service, broad network access, resource pooling, rapid elasticity, measured service), three service models (software as a service, platform as a service, infrastructure as a service), and four deployment models (private cloud, community cloud, public cloud, hybrid cloud)." (Mell and Grance 2011) The NIST definition has been broaden adopted by scholars and become the reference for further research.

According to Senyo et al. (2018) and Yang and Tate (2012) review, the cloud computing/services related topic can distinguish into four categories: technology issues, business issues, conceptualizing cloud computing, and domains and applications. There are no articles related to cloud computing were published before 2007 as the term was coined by industry practitioners in 2006. Technological issues (88 articles) and conceptualizing cloud computing (48 articles) were the most published categories during Yang and Tate (2012) investigation from 2008 to 2011, and the business issues were the least published with only 28 articles. Senyo et al. (2018) review the articles from 2009 to 2015, and find out the result that technological issues (135 articles) are still in the lead of cloud computing/services related researches. Business issues (91 articles) are in the follow and focused on the socio-technical aspect of cloud computing/services such as adoption, cost, privacy, legislation, and ethics. Most studies within the business issues focused more on cloud computing/services adoption, this result is as same as Yang and Tate (2012) previous work. As the apparent trend, cloud computing/services related studies are still growing. The future research direction has turn from technology development to business and application such as the critical adoption factors, privacy and security, and the relevance between cloud computing/services adoption and enterprise performance. Therefore, this study follows this direction and concentrates on the situation and performance after adoption and focus on the enterprises that have adopted cloud computing/services for their information systems.

Activity Theory

The original concept of activity theory is source from Vygotsky's Cultural-Historical Theory which proposed the interaction between human (Subject) and the world (Object) is via tool in 1920s (Miettinen et al. 2009). Leont'ev (1978) expanded the original concept and proposed the concept of "activity". It is cultural-historical activity theory as known as the first-generation activity theory. Engeström (1987) considered that the human activities are composited with four sub-activity systems including production, consumption, exchange, and distraction; therefore, added community, the division of labour, and rules to construct the theoretical framework of the second-generation activity theory. In second-generation activity theory, contradiction has become the core analysis item, because of the three intermediate paths expanding from the first-generation activity theory. Those three paths are (1) the subject and the object are mediated by the tool unit; (2) the community and the subject are mediated by the rules; (3) the community and the object are mediated by the division of labour. Besides, other additional lines may have secondary mediating relationships (Georg et al. 2015). Therefore, in order to present the complex mediational structure of activities, triangle analysis structure is used to highlight the contradiction in activities (Cole and Engeström 1993), and also become the basis for the development and transformation of activity system. Engeström then developed the third-generation of activity theory as a conceptualize tool to understand the dialogue, multiple perspectives, and interactions of more than two activity system networks with common object and practices (Allen et al. 2013; Engeström 1999), and induced the transformation of activity system and the interaction with other activities. On the situation perspective, the description framework includes subject, object, the tools, and language related items and focuses on the analysis between activity elements and interaction process (White et al. 2016). Activity analysis across multiple domains helps to understand complex work and social activities (Karanasios et al. 2015) and to explore complex process relationships in activities. It is now the founding theory for understanding the changes and developments in work and social activities (Karanasios and Allen 2018).

Reviewing the related issues of activity theory, activity theory is mainly applied to issues such as education, information technology and organization. The discussion in the field of information technology has recently increased (Allen et al. 2013), focusing on human-machine interface (HMI) and system construction issues. These can help the system design or development personnel to summarize and analyze the service processes and activity elements implied by the system, and then design a process-oriented information system and related applications.

Since activity theory is not a methodology, it provides a philosophical framework for studying human reality, including various forms in which individuals and society are interconnected (Jonassen 2000). After reviewing the IS related issues recently, and combining the foregoing description with the activity theory literatures, this study uses the second-generation framework with the subject, the object, the tools, the community, the rules, and the division of labor in the activity theory.

Methodology

This paper makes a systematic review of cloud computing/services literature on the adoption factors. A systematic review, inspired by (Bakker 2010; Crossan and Apaydin 2010), was preferred as the approach to recap the literature, as it is replicable, transparent and provides a clear structure for the literature selection process. The scope of this review was delimited to empirical research papers on cloud computing/services adoption. Also, only papers published in peer-reviewed empirical journals written in English were included, as they were presumed to provide the most suitable coverage on the issue studied. The literature selection process involved several stages, as depicted in Figure 1. Each stage had a purpose to either increase or decrease the number of relevant articles.

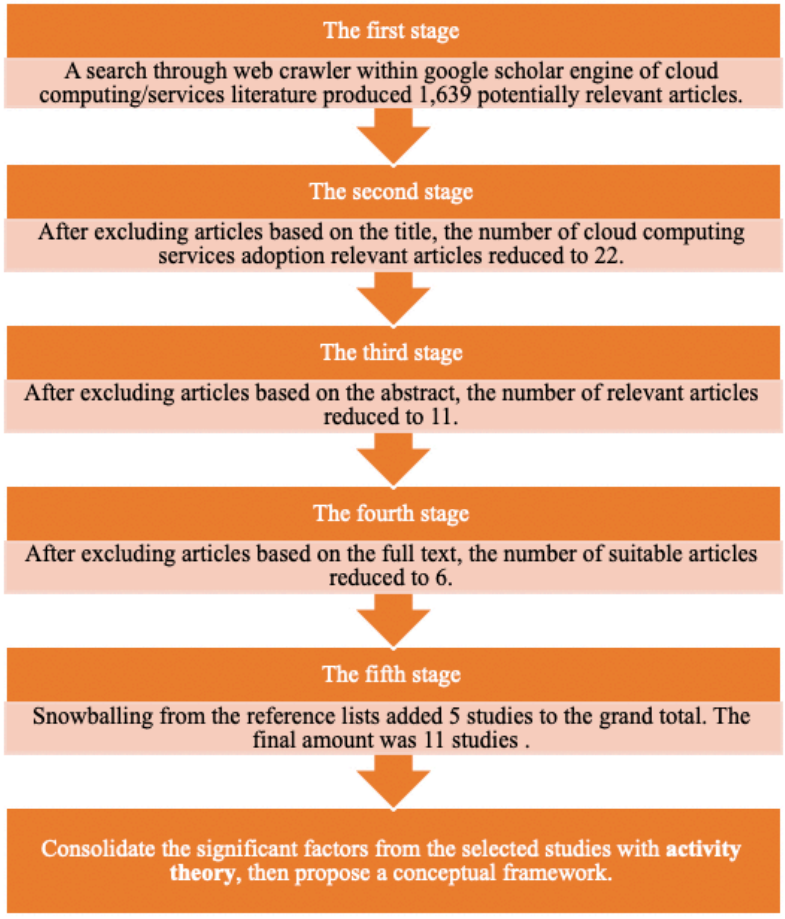

Figure 1. The Literature Selection Process (Source: this research)

In first stage, using Python web crawler to search "cloud computing" and "cloud service" through Google Scholar Engine in December 2018. The result included the first hundred page with total 1,825

articles, then excluded the same articles from two key words, the number of initial articles was reduced to 1,639. In second stage, the articles were excluded based on titles, and reserve the article title which included "adoption". After article title limitation, the number of relevant articles was reduced to 22. The third stage put all the remaining articles under abstract examination. Based on key information of the papers, the excluding articles in this stage are the study which cloud computing/services are not adopted by enterprise or focus on the technical issues. There were 11 articles remained in this stage. The fourth stage review full texts with all remaining articles. There are 5 empirical studies used the qualitative methodology which did not identify the significant factors in the result; therefore, excluded in this stage and remained 6 articles. In the fifth stage, reference lists of the remaining articles were searched to find key articles which were not recovered during the earlier stages in the literature selection process. Snowballing increased the number of relevant articles to 11, which was the final number of the included studies.

The remaining articles used either TAM, TOE, DOI or combining framework to generalize the adoption factors; therefore, this study first consolidates the significant factors in TOE framework and illustrate each factor definition in these studies. Later on, integrate those factors with activity theory perspective and propose the conceptual framework with the activities and elements related to cloud computing/services adoption.

Results & Discussion

In result, Technology Acceptance Model (TAM) was used to the initial empirical firm level research in cloud computing/services adoption (King and He 2006). Focus on the usefulness and ease of use as possible determinants of cloud computing/services usage intention and adoption. Wu (2011) then developed an explorative model for SaaS adoption factors which includes classical TAM factors and its extensions, and additionally specific factors for cloud computing/services (security and trust). Gupta et al. (2013) make an extension and develop a five-factor model of the inclination of small and medium firms to use cloud computing/services, including ease of use, cost reduction, security and privacy reliability, support of collaboration and data sharing, and service provider reliability as independent variables.

Later on, cloud computing/services adoption empirical research start to use the Technology, Organization and Environment (TOE) theory of technological innovation adoption (Baker 2012) as its main theoretical foundation, which includes more types of adoption factors. In Senyo et al. (2018) review, TOE is also the most used research framework. TOE factors are divided into three main types: technological factors (perceived technological characteristics of cloud computing/services), organizational factors (firm internal characteristics) and environmental factors (characteristics of firm's external environment). In order to examine the technological factors, previous studies adopt Diffusion of Innovation (DOI) theory (Rogers 2010) to define with five critical characteristics of innovation which are the degree of relative advantage, compatibility, complexity, trialability and observability.

Summarizing, the empirical studies from previous systematic review that investigate the factors determining cloud computing/services adoption at firm level, particularly a series of firm characteristics, are shown in Table 1. (the factors found to have statistically significant effect on cloud computing/services adoption are shown in bold).

Table 1. Previous Empirical Studies Examining the Effects of Firm Characteristics on Cloud Computing/Services Adoption

Study	Technological factors	Organizational factors	Environmental factors	Country/Industry
(Low et al. 2011)	**Relative advantage (+)**, Compatibility, Complexity	**Top management support (+)**, **Firm size (+)**, Technology readiness	**Competitive pressure (+)**, **Trading partner pressure (+)**	Taiwanese high-tech firms

Study	Technological factors	Organizational factors	Environmental factors	Country/Industry
(Alshamaila et al. 2013)	**Relative advantage (+)**, **Uncertainty (-)**, **Geo-restriction (-)**, **Compatibility (+)**, **Complexity (-)**, **Trailability (+)**	**Size (-)**, **Top manage support (+)**, **Innovativeness (+)**, **Prior IT experience (+)**	**Market scope (+)**, **Supplier computing support (+)**, Competitive pressure, **Industry (+)**	UK information technology, education, financial, legal, retail, and service firms
(Gupta et al. 2013)	**Cost reduction (+)**, **Ease of use (+)**, **Security and privacy (+)**	Sharing and collaboration	Service provider reliability	Indian, Singapore, Malaysia, USA firms
(P.-F. Hsu et al. 2014)	**Perceived benefits (+)**, **Business concerns (+)**	**IT capability (+)**	External pressure	Taiwan ese manufacturing and service firms
(Mangula et al. 2014)	Relative advantage, **Compatibility (+)**, **Complexity (-)**, Trialability, **Observability (+)**	Organization readiness, Top management support	Market pressure, **Market competition (+)**, Vendor marketing effort, Trust on vendor, **Government support (+)**	Indonesian firms
(Lian et al. 2014)	**Data security (+)**, Complexity, **Compatibility (+)**, Costs	Relative advantage, **Top manager's support (+)**, **Adequate resource (+)**, Benefits	Government policy, **Perceived industry pressure (+)**	Taiwanese hospitals
(Oliveira et al. 2014)	**Relative advantage (+)**, **Complexity (-)**, Compatibility, **Technology readiness (+)**	**Top management support (+)**, **Firm size (+)**	Competitive pressure, Regulatory support	Portuguese manufacturing and services firms
(Gutierrez et al. 2015)	Relative advantage, **Complexity (-)**, Compatibility	Top management support, Firm size, **Technological readiness (+)**	**Competitive pressure (+)**, **Trading partners pressure (+)**	UK firms
(Gangwar et al. 2015)	**Relative advantage (+)**, **Compatibility (+)**, **Complexity (-)**	**Organizational readiness (+)**, **Top management commitment (+)**, **Training/education (+)**	**Competitive pressure (+)**, **CC services provides' support (+)**	Indian information technology firms
(C.-L. Hsu and Lin 2016)	**Relative advantage (+)**, Ease of use, Compatibility, Trialability, **Observability (+)**, **Security (+)**	Firm size, Global scope, **Financial costs (+)**, **Satisfaction with existing IS (-)**	**Competition intensity (+)**, Regulatory environment	Taiwanese firms
(Loukis et al. 2017)	**Degree of sophistication of firm's ICT infrastructure (+)**	**Adoption of ICT investment reduction strategy (+)**, Adoption of an innovation-oriented	Price competition, Quality competition	European countries (Germany, Spain, France, Italy, UK, Poland)

Study	Technological factors	Organizational factors	Environmental factors	Country/Industry
		strategy, **Employment of specialized ICT personnel (+)**, Sufficiency of ICT skills of firm's employees, **Previous experience of ICT outsourcing (+)**, Size		manufacturing firms

Refers to previous studies of cloud computing/services adoption, this study consolidates the determinants of cloud computing/services adoption in previous section using TOE framework in Table 2., this study describes those critical factors as the following:

Table 2. The Classification of Cloud Computing/Services Adoption Factors

TOE framework	Classification	Factors
Technological factors	DOI	Relative advantage, Compatibility, Complexity, Trialability, Observability
	TAM	Ease of use, Perceived benefits
	Business concerns	Security and privacy, Uncertainty, Geo-restriction
	Sophisticated ICT infrastructure	Degree of sophistication of firm's ICT infrastructure
Organizational factors	Tangible resource	Firm size, Financial costs
	Intangible resource	IT capability, Organizational readiness, Prior IT experience (satisfaction of existing IS, outsourcing), Specialized ICT personnel, ICT investment reduction strategy
	Human resource	Top management support/commitment, Innovativeness, Training/education
Environmental factors	Market	Market scope
	Industry	Industry
	Stakeholders	Competitor pressure, Trading partner pressure, Supplier computing support, Government support

1. Technological factors are classifying into DOI factors, TAM factors, Business concerns factors, and degree of sophistication of firm's ICT infrastructure.

(1) DOI factors: Relative advantage is defined as the degree to which innovation is perceived by potential adopters as providing greater benefits than the current practices. Compatibility is defined as the degree to which innovation is perceived to be consistent with existing values, current needs, and previous experience of potential adopters. Complexity is defined as the extent to which an innovation is perceived as difficult to understand and use. Trailability is the degree to which an innovation may be experimented with on a limited basis. Observability is the degree to which an innovation may be experimented with on a limited basis (Rogers 1995). Besides from complexity, other factors have positive effect on the cloud computing/services adoption (Alshamaila et al. 2013; C.-L. Hsu and Lin 2016; Gangwar et al. 2015; Gutierrez et al. 2015; Lian et al. 2014; Low et al. 2011; Mangula et al. 2014; Oliveira et al. 2014).

(2) TAM factors: Ease of use is defined as the degree to which an individual believes that using a cloud service would be free of effort (C.-L. Hsu and Lin 2016). Perceived benefits are refer to the operational and strategic benefits a firm can expected to receive from cloud computing (P.-F. Hsu et al. 2014). Both ease of use and perceived benefits have positive effect on the cloud computing/services adoption (Gupta et al. 2013; P.-F. Hsu et al. 2014).

(3) Business concerns factors: Security and privacy in organizations concerns are about having their own control than any other serious issue (Gupta et al. 2013), data security is one of the critical key variables (Lian et al. 2014). Uncertainty is the short lifetime of a new innovation may often lead to some degree of uncertainty. Geo-restriction is identified as the enterprises concern about the geolocation which their data is stored (Alshamaila et al. 2013). Better security and privacy control has positive effect on the cloud computing/services adoption (Gupta et al. 2013; Lian et al. 2014); however, the uncertainty and geo-restriction of cloud computing/services have negative effect (Alshamaila et al. 2013).

(4) Degree of sophistication of firm's ICT infrastructure: Cloud computing/services are valuable to firms with highly sophisticated ICT infrastructures, since it enables them to reduce their high ICT operations, support, and maintenance costs (Loukis et al. 2017). Therefore, the higher the sophistication of firm's ICT infrastructure, the higher the intension to adopt cloud computing/services.

2. Organizational factors are classifying into tangible resource factors, intangible resource factors, and human resource factors with resource based theory (RBT) perspective.

(1) Tangible resource factors: Firm size is a controversial factor. Previous studies agreed that large firms tend to adopt more innovations, largely due to their greater flexibility and ability to survive failures (Low et al. 2011; Pan and Jang 2008; Zhu et al. 2004). However, small firms can be more innovative and have flexibility to response to the quick changes. The coordination which needs in IT adoption may be relatively easier to achieve in small firms (Damanpour 1992; Jambekar and Pelc 2002; Premkumar 2003). Cloud computing/services pay-as-you-go basis lead to the lower financial costs including set-up, operations, management, maintenance, and training (Armbrust et al. 2010; Sultan 2011). In summarize, lower financial costs have positive effect on the adoption of cloud computing/services. Firm size affects the adoption, but the relevant should be further discussed.

(2) Intangible resource factors: IT capability consists IT resources and IT employees (Bharadwaj 2000). IT resources refer to the firm's annual budget for its IT department to install, maintain, and upgrade the company's information systems. The number of IT employees is an indicator to determine whether a firm has sufficient IT employees to support daily operations; perform installation, maintenance and upgrades; and handle emergencies (P.-F. Hsu et al. 2014). Organizational readiness has been described into three dimensions including managers perception and evaluation of the degree to their organization awareness, resources, commitment, and governance to adopt IT (Tan et al. 2007); financial readiness (financial resources for cloud computing implementation and for ongoing expenses during usage); technological readiness (infrastructure and human resources for cloud computing usage and management) (Musawa and Wahab 2012; Oliveira and Martins 2010). Prior IT experience includes satisfaction of existing IS and outsourcing experience. The satisfaction level with existing systems affect firms' motivation to change (C.-L. Hsu and Lin 2016). Cloud computing is a type of ICT outsourcing (Benlian and Hess 2011), firm's personnel has previous experience and skills concerning any type of ICT outsourcing can be useful for the adoption (Loukis et al. 2017). Specialized ICT personnel has been identified as the critical importance human capital for ICT-related innovation whose technical and business knowledge and skills can be quite useful for the adoption and adaption to the cloud computing/services (Willcocks 2013). ICT investment reduction strategy is the firm adopt a greater or lesser degree strategies of investment reduction due to unfavorable economic conditions (e.g., overall recession or sectoral economic problems). Cloud computing/services costs can transform the ICT capital investments to operating expenses to cope with this problem (Marston et al. 2011; Venters and Whitley 2012). Excluding the satisfaction of existing IS, all the others organizational intangible resource factors have positive effect on cloud computing/services adoption.

(3) Human resource factors: Top management support/commitment is a critical factor on adoption of new technologies for creating a supportive atmosphere and providing adequate resources (Wang and Noe 2010). When the complexity and sophistication of technologies increase, the vision and commitment provided by top management can create a positive environment for innovation (Kim and Lee 2007); therefore, plays an important role on integration of resources and reengineering of processes during cloud computing/services implementation. Innovativeness means the openness to new technologies, and often links to the human characteristics of the decision maker such as CEO, CIO (Marcati et al. 2008) while deciding to adopt the new technologies. Training is described as a degree of

a company instructs its employees in using a tool (Schillewaert et al. 2005). An organization needs to train and educate its employees before the implementation to reduce employees' anxiety and stress about the use and to provide motivation and better understanding about cloud computing/services benefits for their tasks (Gangwar et al. 2015). These three factors have positive effect on cloud computing/services adoption.

3. Environment factors are classifying into market, industry, and stakeholders.

(1) Market: Market scope is identified as the horizontal extent of a company's operations (Zhu et al. 2003). The growth of enterprises may start from local, national to international. When firms expand their market reach, they incur inventory holding costs and search costs (for instance, searching for consumers, trading partners and distributors) (Chopra and Meindl 2001). Therefore, adopting cloud computing/services are expected to decrease external costs and make them less location dependent.

(2) Perceived industry pressure: The implementation of national system from government may lead to the intensity in industry competition. These competitive pressures will force firms to adopt new IS quickly to provide better services and increase strategic advantages typically in hospitalize and financial industry. Previous studies also confirm the fact that business competition significantly affects firms to adopt new IS (Hsiao et al. 2009; Lian et al. 2014).

(3) Stakeholders: Competitor pressure refers to the intensity and pressure levels from the competitors in the same industry (Laforet 2011; Oliveira and Martins 2010; To and Ngai 2006). The experience of intense competition has been seen as an important determinant of IT adoption (Zhu et al. 2004). Firms gain benefits from cloud computing/services adoption with better understanding of market visibility, greater operation efficiency, and more accurate data collection (Gutierrez et al. 2015). Trading partner is which firms rely on for their IT design and implementation tasks (Low et al. 2011; Pan and Jang 2008). Empirical studies have suggested that trading partner pressure is an important determinant for cloud computing/services adoption and use (Gutierrez et al. 2015; Low et al. 2011). The linkage of supplier support and client's adoption decision was discussed in the previous researches (Woodside and Biemans 2005). Supplier activities can significantly influence adoption decisions (Alshamaila et al. 2013) and identify the importance of activities such as targeting and communication in order to reduce the perceived risk from the potential customer (Frambach and Schillewaert 2002). Government support may give from several ways such as issuing regulations for protecting data security and confidentiality (Pudjianto et al. 2011), issuing policies to lowering bandwidth cost and hardware/software procurement tax (Zhu et al. 2006), and improving national IT infrastructure (Kurnia and Peng 2010), providing incentives and financial support (Kraemer and King 2006) as well as by adopting cloud computing/services within government institutions (Pudjianto et al. 2011). Several studies have proved that government support is a critical influencer in innovation adoption (Mangula et al. 2014; Molla and Licker 2005). Among the stakeholder factors, they all have positive effect on cloud computing/services adoption.

To describe the elements which are included in the adoption of cloud computing/services, this study uses the framework of activity theory proposed by Engeström (1999), and refers to the eight-step model (Eight-Step-Model) proposed by Mwanza (2001), which is clarified by eight open-ended questions. (1) Activity of interest: "What sort of activity does this study interest in?" The adopting cloud computing/services situation of enterprise; (2) Objective of activity: "Why is this activity taking place?" The cloud computing/services have been broaden applied to enterprises, the purpose is to explore the elements and activities in adoption situation; (3) Subjects in this activity: "Who is involved in carrying out this activity?" The enterprises which have adopt cloud computing/services; (4) Tools mediating the activity: "By what means are the subjects carrying out this activity?" Cloud computing/services including SaaS, PaaS, and IaaS and the technological factors of cloud computing/services including relative advantage, compatibility, complexity, trialability, observability, ease of use, perceived benefits, security and privacy, uncertainty, geo-restriction; (5) Rules and regulations: "Are there any cultural norms, rules or regulations governing the performance of this activity?" The external factors such as industry regulation and government policy and the internal factors such as the enterprise market scope and the sophistication of firm's current ICT infrastructure; (6) Division of labour: "Who is responsible for what, when carrying out this activity and how are the roles organized?" Top management,

specialized ICT personnel and non-ICT employees' capability, readiness, innovativeness and prior IT experience effects the adoption and also human resource training/education which are all the organizational factors; (7) Community: "What is the environment in which this activity is carried out?" The activity is carried out with several stakeholders including competitor, trading partner, supplier and government; (8) Outcome: "What is the desired outcome from carrying this activity?" The benefit after adopting cloud computing/services such as the increasing digitalization, the organizational agility, and etc.

The six elements were summarized and explored to establish the relevant factors that should be involved in the adoption of cloud computing/services in Figure 2.

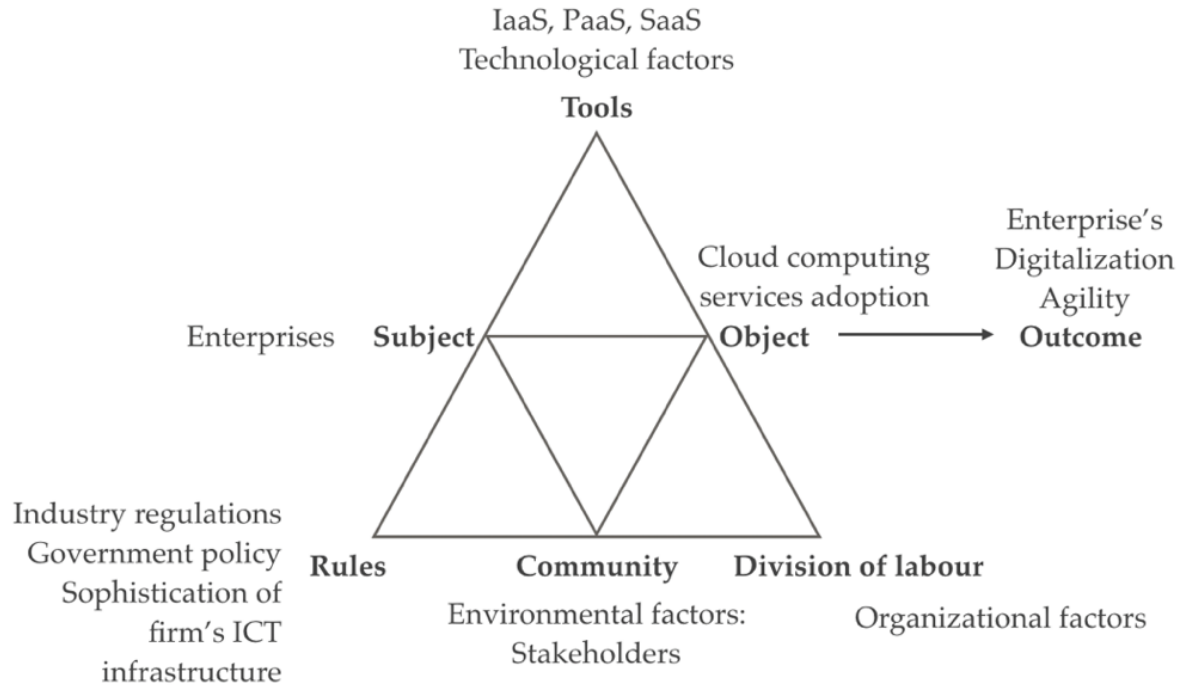

Figure 2. Modified Research Model

Conclusion

To response to the research purpose, this study first reviewed the literature gap between technology and business aspects through systematic process. Then summarized the critical adoption factors through TOE framework and proposed a cloud computing/services adoption situation framework with activity theory perspective. From this study, while the subject enterprise adopting cloud computing/services, the intermediation of tools, rules, community, and division of labor affect the object. Comparing to the previous studies on adoption, the conceptualize framework provided in this study propose an overall discussion and may become the basis for discussing outcome and performance in further research to enrich the studies in cloud computing/services field. However, there are some limitations. First, each of adoption factors play important role in the adoption situation, but the relevant between factors should be further discussed. Second, an overall discussion cloud not display the results in specific conditions such as the differences of country, industry, and firm size etc. Therefore, future research could be conducted on the relevance between factors inside the framework and might be beneficial to examine the outcome after adopting cloud computing/services.

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