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Cloud computing: A value creation model

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ABSTRACT

Cloud computing has gained vast attention due to its technological advancement and availability. Possible benefits of adopting cloud computing in organizations are ease-of-use, convenience, on-demand access, flexibility, and least management from the users. This paper analyzes the risk and value components inside cloud computing practice through a value creation model.

1. Introduction

Cloud computing is a newly developed computing area that has been adopted by a large number of organizations in the world for information technology practices. Organizations move to cloud computing practice may gain benefits such as cost saving, efficiency improving, agility enhancing, flexibility and scalability of services, and environmental sustainability. Cloud computing gained its popularity because it changed the physiognomies of the IT industry through the exercise of virtualization. In the meantime, some major concerns to cloud computing practice, such as security and privacy breaches are originated from its virtualized setting. The cloud computing operation is similar to the practice of information technology (IT) outsourcing. The complexity of outsourcing makes cloud computing's quality control a challengeable job.

This paper intends to discover the value creation and challenges confronted by cloud computing's practice. Since cloud computing may become the next wave of IT innovation, many more organizations may adopt this technology into their business processes. Therefore, a clear examination to the value realization of cloud computing may contribute to the IT field dramatically.

The discovery of value creation is an essential and challengeable task in every business process. In order to pursue sustainable business continuity in organizations, they must maintain and strengthen the outcome of value creation activities. For example, Michael Porter [21] proposed "value chain analysis", in which every step in business process has been investigated to manage its value. However, individual business process and technology may also be examined before it to be adopted in organizations. For this vibrant thought, cloud computing's practice may also be examined through the value creation analysis.

This study aims to identify a set of components that assist organizations to assess the value creation of cloud computing. We introduce a value creation model to describe the content of each component and the relationship among components in the value creation model. Various effects of implementing cloud computing in organizations will be discussed. This value creation model provides guidance to the IT industry for their future development in cloud computing. Since cloud computing heavily depends on Internet infrastructure and technology, security will be a major concern to cloud computing operation. These risk factors are identified in the value model. The auditing practice is stipulated by law. In order to comply with legal requirement, auditing must be exercised in cloud computing operation. All of these concerns and requirements are included and discussed in the value creation model.

The paper is structured as follows. The next section provides a background analysis to cloud computing technology, including its benefits and inherent risks. After that, the concept and the theoretical foundation of IT value are explained. The cloud computing value creation model is introduced and illustrated in the next section. A conclusion is provided in the last section of the paper.

2. Moving to the cloud

2.1. Cloud computing implications

More and more companies adopted cloud computing services recently. Gartner Inc. forecasted that the sale for cloud services will

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increase from US $46.4 billion in 2008 to US $150.1 billion in 2013 [14]. Cloud computing is a recently developed information technology (IT) that utilizes resources virtualization approach to deliver IT services through Internet technology and on-demand mode. National Institute of Standards and Technology (NIST) defined cloud computing, on its web page, as "a model for enabling 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" [18]. NIST classified the cloud deployment into the following four categories: private cloud, community cloud, public cloud, and hybrid cloud [18].

Private cloud is operated solely for an organization, on which hardware, networking, storage, applications, interfaces, and infrastructure do not share with other companies. Private cloud provides internal services to the organization and employees through corporate intranet or data center. This cloud service can offer desired fault tolerance and security capabilities (such as firewall) to guard the safety of internal IT operations and processes. Therefore, private cloud can be implemented in a highly secured and manageable environment. The main disadvantage of running private cloud computing is its high cost for hiring staff and maintaining infrastructure and data center.

Community cloud is "shared by several organizations and supports a specific community that has shared concerns (e.g., mission, security requirements, policy, and compliance considerations)." [15, p. 5]. Community cloud can be created inside or outside the organization. Since its shared characteristics, cloud security control becomes a major concern. For example, a school district in a city may create a community cloud for regional schools' access and usage. These schools must agree to and follow a common policy of cloud computing practice.

Public cloud is the most common type of cloud computing. Within this model, the service provider (such as Google or Amazon.com) offers its cloud infrastructure for general public use on a self-service, on-demand, and pay-per-use basis. Public cloud service providers must create an extremely scalable data center and flexible infrastructure for clients' needs. Since client's computing and storage needs are unpredictable, cloud service providers must be well prepared for these uncertain demands. Public cloud may serve a large amount of customers in the market; its security functionality must be well protected.

Hybrid cloud is the cloud service that syndicates public cloud, private cloud, and community cloud options. Based on corporate needs (such as strategic, security and/or confidentiality concerns), company can allocate workloads into separate cloud infrastructures. For example, a company may use a public platform to send data to a private cloud would be a hybrid cloud environment. A new way of conducting corporate computing process is to combine public services with private clouds and data center together. This is a typical hybrid cloud implementation.

Based on the package offered by the vendors, cloud computing contains three different types of service models: software-as-a-service (SaaS), platform-as-a-service (PaaS), and infrastructure-as-a-service (IaaS). SaaS allows clients to use providers' applications that run on a cloud infrastructure, which can be accessed through a web browser. All needed cloud infrastructure (such as network, servers, operating systems, and application software) is hosted in vendor's house. PaaS accommodates to developers' need by offering the entire computing platform and solutions set for an application needed at client's house. PaaS allows the client to control the application software (analysis and design), however, the developer must know how to work with vendors' programming languages, interfaces and database systems. IaaS offers clients the capabilities of processing, storage, networks, and other computing resources so they can run selective software (operating systems and applications) in house. Its only tradeoff is that cloud providers manage the infrastructure in use.

2.2. Benefits of moving to the cloud

Cloud computing providers offer active and convenient accessibility to clients, such as on-demand and pay-per-use services. Cloud computing users save IT cost since they only pay for what they used; they do not need to invest in hardware, software, networking, and hiring IT staff inside organizations. Security service is handled by cloud computing providers, however, the user organizations are the major concern of security breach. Another important benefit of moving to the cloud is the scalability and flexibility of IT that are offered by cloud computing vendors. Cloud computing users can enjoy the suppleness of workload changes, especially handling growing business transactions during the hot season. Users moving to cloud computing just are like outsourcing their IT operations to the vendors. For this reason, users do not need to handle IT management tasks in the organization. Another benefit of moving to the cloud is the enhancement of mobility, that is, clients can have access to the software at any place they go to, as long as the Internet access is feasible.

2.3. Risks of moving to the cloud

The main risks on cloud computing technology are related to the following areas: authentication, data security and privacy, interfacing with internal systems, system availability, business continuity, and ownership of content and other legal requirements [22]. Among these risk factors, security and privacy are the most concerned area since cloud computing data are stored outside corporate premises [19].

In cloud computing practices, the clients (or user companies) outsource servers, server applications, data storage, and software programs to a cloud service provider (or vendor) for receiving on-demand and pay-per-use service [20]. Most of cloud providers offer metered service— it means they charge customers for the processing capacity that customers have actually used. This special arrangement makes cloud computing's audit work different from that of traditional IT audit.

We recognize the fact that information technology delivers value to user organizations and businesses. Any new breed of information technology should add new and supplementary value to the existing IT capability or functionality to survive. Cloud computing has been introduced to the IT field and gained sufficient acceptance from the users in the business community. It is likely that cloud computing has created substantial value in many user organizations. We would discuss the implication of IT value creation and its relevance to cloud computing in the next section.

3. Theoretical foundation

3.1. Cloud computing and outsourcing model

Cloud computing, just like SaaS, is an operation of outsourcing internal IT services into external vendors for meeting company's needs. Chou [4] indicated that SaaS practice should be fitted into an outsourcing model, its main advantages are cost saving, better resources utilization, more application access scalability, and global outsourcing possibility. The theoretical foundation behind outsourcing practice is ample, for example, production cost economics [28], transaction cost theory [7], resource-based theory [8], competitive advantage and value chain [21], and economies of scale [4]. The production cost economics theory supports the argument that outsourcing decision of the firm is to pursue a low-cost production process [4,5]. The transaction cost theory reflected that organizations intend to consider outsourcing while transaction cost is low for business activities, including time and cost for negotiation, and writing and enforcing contract between two sites [4,5]. The resource-based theory indicates that firms center on deployment and combination of specific input rather than avoidance of opportunities [8]. For this reason, an outsourcing decision is based on seeking external resources or capability for meeting