

THE STUDY OF CLOUD COMPUTING ON SERVICE INNOVATION
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ABSTRACT

Cloud computing brought a significant change to internet generation; it can feel the dramatic impact from the upstream of industry chain to consumers. This study is according to the service dominant logic and the characteristics of cloud computing, and attempt to explore the antecedents of cloud computing adoption for companies, and then make an impact on the service innovation performance. We proposed four construct that contain the relationship conditions between cloud computing suppliers are reliability and compatibility, and the customer orientation and cost plan to themselves. After the measure value of PLS path model, we found that reliability, compatibility, and cost have significant impact on cloud computing adoption. We expect this study will provide to cloud computing providers as a reference, and have a broad understanding with the cognition of their consumers.

Keywords: cloud computing, service-dominant (S-D) logic, service innovation, mediating effect

1. INTRODUCTION

1.1 Research Background and Motivations

High-tech industry in Taiwan has developed more than twenty years; especially the information technology industry that is one of the important roles in global supply chain. However, cloud computing creates a new wave of competitive situation. Cloud computing offers challenges and opportunities to this industry that how to enhance competitiveness form hardware manufacturing transition to brand, profits, and soft power. Although cloud computing is not a new technology, it stirs up software and service-based new competition and it will reshape the value chain of IT industry. The most opportunity for developing cloud computing is the innovation of software and application service, it can build through the existing hardware manufacturing strength and foundation, and form the low-cost and differentiation strategy to improve their margins and output value.

Cloud computing allows computer technology to be easily accessed as a service over Internet or via a private network from any location, so that computer technology, software program, and data can be available when and where the users need them. Market Research Company Gartner predict that by 2012, there will be 80% of the 1,000 large enterprises of "Fortune" will adopt the cloud computing service which become one major part of IT application environments. This research would like to discuss that the adoption situation of cloud computing service in Taiwan. Attempt to find out the critical impact

factors that affect the adoption intention of enterprises. And examines antecedents and consequences of the adoption level of cloud computing.

1.2 Research objectives

Based on the background and motivations above mentioned, we tend to explore the following objectives: (1) clarifying the cloud computing adoption antecedents and the interorganizational relationship; (2) exploring the relationship between cloud computing adoption and service innovation performance; (3) examining the mediating effect among adoption antecedents and service innovation performance.

2. LITERATURE REVIEW

The critical discuss point in our research is the antecedents of information technology adoption. Therefore, we can separate two parts in information technology generally, one is individual level and another is firm level. In individual level, researchers always discuss the reasons, which would affect users to adopt, such as the support of organization, characteristics of system, and satisfaction of users. In firm level, scholars often research which reasons will affect whole organizations cognitive to the antecedents of information technology adoption, such as, whether a new information technology can increase operating value, create competitive advantage, enhance core competence and improve the misunderstanding of department or organization. In addition, in this study, we discuss the IT adoption that just focuses on firm level. In addition, we will discuss the influence of service innovation for company itself after adopting cloud computing.

2.1 Cloud Computing

The term "cloud computing" has caught fire and is used in a variety of contexts in advertising and the media. The related researches of cloud computing are rare recently, one of the research team that proposed some opinions (1) the positioning of cloud computing of computing systems, (2) distinguish the difference of cloud computing, utility computing, and grid computing, (3) interpret the framework of cloud computing for market orientation, (4) development-related issue of cloud computing from service level agreement, (5) display the research about global cloud exchange market, (6) compare the existing cloud computing platforms, (7) compare the performance differences of Aneka cloud computing, high performance computing (HPC), and internet-based service, (8) understand global cloud exchange market from the service quality viewpoint, (9) propose the subjects about third party

partners in cloud storage service.

Lyde and Gilbert [6] address that cloud computing could make continuously cost down and improve efficiency, but it has some legal and practice risk probably, such as data protection act, confidentiality, and database right. In addition to, about the cost benefit, "usage-based pricing" is hours purchased via cloud computing can be distributed non-uniformly in time, and have no questions of software update for users that enhance the efficiency of resource use [4].

This study measures the extent of cloud computing are according to following three categories. The Commerce Department's National Institute of Standards and Technology (NIST, 2010) has attempted to provide structure to the cloud computing conversation with some helpful definitions. NIST defines three basic types of service models for cloud computing:

1. *Infrastructure as a Service (IaaS)*, involving the provisioning of fundamental computer resources (e.g., processing, storage, networks);
2. *Platform as a Service (PaaS)*, involving the provision to users of the capability to deploy onto the cloud infrastructure applications created by the user with provider-supported programming languages and tools; and
3. *Software as a Service (SaaS)*, involving access to a provider's software applications running on a cloud infrastructure.

In this research, cloud computing will defined as that companies get computing capability, storage space, software application, and data which through internet from a huge data center of cloud computing service supplier through internet [12].

2.2 IT Adoption

Because of the rapid development of information technology, most of companies introduce the IT for enterprise reengineering to maintain or improve competitive advantage. Literature in the field of information management has been widely appreciated that the adoption of information technology can help companies to create competitive advantage [13]. Information technology is a very broad concept, in this study; information technology is defined according to Straub and Wetherbe [19] as "IT is a new technology which involves hardware, software, database, and communication, and adds the new concept of information system application, such as CAD/CAM. Organization introduces information technology that often also regarded as a kind of organizational innovation.

Based on the model of Kwon and Zmud [22], "adopt" is defined as a resource investment decisions that in order to meet the changes required. It has to determine hardware and software investment in equipment and personnel appointment system at this stage. So it might easily lead to failure and waste of corporate resources, if they failed to consider in detail for the important factors,

put huge amounts of money and introduce the information technology. Ryan and Gross [32] defined adopt as the first use. Lionberger [22] thought that adopt is decided to use a new thing, but not bound to continue to use. Rogers [30] considered adopt is a decision that continued to use and use an innovation thing.

Because IT adoption has occurred over time, firms may have decided to use it for different reasons. For example, firms that adopted early may have recognized the benefits sooner, and may have seen the IT as a way to gain competitive advantage. However, theory indicates that, as time goes by, an organizing vision or focal community idea for the application of IT in organizations' is formed [13]. As a larger number of firms adopt a technology, the technology becomes legitimized, and rather than asking "why do it", firms begin to ask "who is doing it" and "why do it". Later adopters may place less emphasis on perceived benefits and compatibility of the technology and develop a IT largely in order not to be left behind other firms in their industry. Because IT adoption has occurred over time, firms may have decided to use it for different reasons. For example, firms that adopted early may have recognized the benefits sooner, and may have seen the IT as a way to gain competitive advantage. However, theory indicates that, as time goes by, an organizing vision or focal community idea for the application of IT in organizations' is formed.

2.3 Service Dominant Logic (S-D Logic)

Service dominant logic provides a new service-centric concept that is customer oriented and relational [34]. Although this transforming viewpoint of marketing, Vargo and Lusch exhibited that the firm should emphasizes on the intangible resource, mutual relationship and co-creating value to transform marketing concept. Furthermore, service offering has replaced of the tangible offering to become the basis of value exchange.

The discrimination between product and service getting more and more blurred. Since value is always co-created with and determined by the customer (value-in-use), it cannot be embedded in the manufacturing process. The comprehension of customer is easily influenced by additional service, and not only by the product itself which they bought. Ever since a product or service of what customers really pay for is the value of service provided, the company needs to change their positioning view form producer to customer.

Vargo and Lusch [34,35] used nine foundational premises (FPs) to present their emerging dominant logic. Furthermore, they address the foundational premises (FPs) of S-D logic inform a "competing through service" strategy from G-D logic and thus allow for the development of nine derivative propositions addressing competing through service [33]. Their overall theme is

that applied collaboration and knowledge are the key drivers for firms to more successfully compete through service. To complete this successfully, the firm must view external environment, partner, and customers as operand resources. Most importantly, at the beginning of FP1, Vargo and Lusch [34] claim that “the application of specialized skills and knowledge is the fundamental unit of exchange,” which means the resources are the main factor for the firm to create new value and competitive advantage. Additionally, resources can be separated to “operand resource” and “operant resource” [34, 35]. Operant resource can be defined as “resources on which an operation or act is performed to produce an effect,” on the contrary, operand resources as “which are employed to act on operand resources.” That is to say, operand resource becomes the ingredient of operant resource which is the main factor of firm’s competitive advantage.

Even the great OEM supplier of notebook and server in Taiwan — Quanta have claimed that they are service industry, no longer manufacturing industry. Lusch and Vargo [34] had suggested that service should not be defined as in or out of the boundary of manufacturing activities. In contrast, the role of service economic activities is achieving importance in the world, many manufacturing companies inform the position to view themselves as a service provider, and regard the intangibility of product as something to enlarge the value of product. What is more, the definition of service refers to the application of specialized competences (knowledge and skills) through deeds, processes, and performances of the benefit of another entity or the entity itself [34].

In addition, the role of skills and knowledge are more important in the value creating process. In the S-D logic, knowledge and skills belong to operant resource. Compare to operand resource, they usually are intangible and invisible. Company uses their operant resources to provides direct service for customer and in return, customers use more their own operant resources to act with the resources which provided by the company in the process. Thus, all the values are integration of operant resources regardless it is invested from company or customers.

Base on the discussion above, we realized another point of service-dominant logic is the role of customers. In the proportions of Vargo and Lusch [34], they mentioned about that company should view their customers as a co-producer instead of value receivers. Traditionally, price represents the value of product (value-in change), however, in S-D logic, the value that customers received is created by themselves (value-in-use).

Based on S-D logic, company needs to change its view of value creation. Company can only make value propositions [34], and what they need to do is involving the operant resources they collected and reassemble the value.

According to above mentioned, we can understand that operant resources play a very important role in

service-dominant logic, and they suggested company can acquire more resources both from inter- and out of organization. Nevertheless, previous researches mentioned a little about the impact on the role of capability within service-dominant logic. Therefore, we are going to develop our study based on this theory and focus more on the role of operant resources that is antecedents of IT adoption. And considerate that a firm whether according to the concept of operand resources to adopt cloud computing.

2.4 Service

We all know that there are four important features, involving intangibility, inseparability, heterogeneity, and perish ability [23]. Compared to the usual tangible product, service is dynamic and performs through gathering continual events and steps during a period. Biner also suggested the importance of service experiences. They mentioned that all of the employees in the company should focus on the same purpose—create an integrated, memorable and enjoyable customer experience.

The definition of services is no longer the activities beside the manufacture. Instead, it is the application of specialized competences (knowledge and skills) through deeds, processes, and performances for the benefit of another entity or the entity itself. Organizations should co-produce with their customers and see their customers as one of service providers to gain the information and skills through the process of co-production.

2.5 Service Innovation

Service innovation can provide two types of new solutions to customers: one involves combining new issues or concepts to form new solutions, and is broken down into improvement innovation and radical innovation; the other involves solving the same problem with greater efficiency, and can include the enhancement of productivity, suitability, or quality [8]. Managers tend to measure service innovation with financial standards or other quantifiable indicators such as sales figures and market shares. Voss, Johnston, Silvestro, Fitzgerald and Brignall [7] divide the performance measurement of service innovation into process and results performance measurement, which are described as follows.

Researcher point out several characters: service outcome, competence and technology of service provider and customer’s competence [7]. In addition, Vere [25] mentioned that service innovation is not from single source, instead, the innovation comes from a collaborative network, which includes different employees with different competences, partners and supplier collaboration and the competence from combination of company and deliver technology. Any change in this network can produce new service. Moreover, based on this network model, they added the character of customer technology in the network and suggested that customer use different technology is also

a kind of innovation.

The adoption of cloud computing was affected by above reasons. Furthermore, Vries [34] mentioned that service innovation is not from single source, instead, the innovation comes from a collaborative network, which includes different employees with different competences, partners and supplier collaboration and the competence from combination of company and delivered technology. Therefore, the action of cloud computing adoption can be regarded as a way of cooperation.

According to this definition, service innovation not only focuses on the innovation of service product but every activities or processes which can create new value are part of service innovation.

3. RESEARCH FRAMEWORK & PROPOSITIONS

3.1 Scale development

The survey targeted as three industries that are information technology, travel and tourism, and finance and bank industry in Taiwan. According to the information of Common Wealth Magazine and Digital Age, we selected information technology industry, travel and tourism industry, and finance and bank industry as our target industries. Furthermore, we based on the top five thousands largest corporations in Taiwan, which published by Chin Credit Information Service (2008) to seek out the firm list of above three industries. After that we filter target firms by search keywords with the name list to check which has applied cloud computing.

According to previous academic reviews, our questionnaire was revised and took pretests that based on the discussion with three scholars and three specialists of industry. Furthermore, for being more specific and appropriate to the research, many existing scales were modified and have been developed maturely to extend to each construct in the questionnaire. The information of assessment is from five-point Likert-type rating scales from 1 to 5, which 1 denote strongly disagree, and 5 is strongly agree to analyze the data.

A questionnaire survey approach was developed to investigate the technology adoption and the role of interorganizational relationship between cloud computing service supplier and adopters.

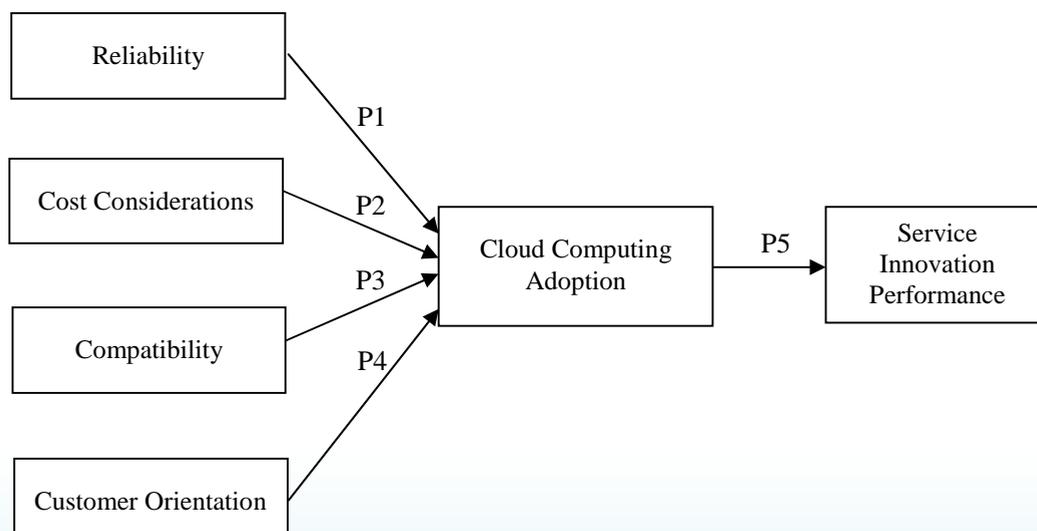
3.1 Reliability

Reliability defined as the degree that a positive trust relationship and represents the degree to which reliable partners are psychologically bonded [33]. It ordinarily gauges the strength of the relational ties [25]. In addition to, it's an interaction process which complementary assets are exchanged with external partners. Otherwise, information security is one of the most often-cited objections to cloud computing, most companies almost outsourcing payroll and many companies using external email services to hold sensitive information [26]. Reliability includes external ties, information security, and relationship with cloud computing suppliers.

One customer's bad behavior can affect the reputation of others using the same cloud. And legal issue is the question of transfer of legal liability—cloud computing providers would want customers to be liable and not those [24]. Selecting suitable and reliable partners achieve great partner's reliability. The relationship between a company and cloud computing suppliers are more reliable relationship, the extent of cloud computing adoption are higher. Because the more high-end cloud computing application, more related to the enterprise customer privacy information. Partners with high reliability are more likely to adopt cloud computing. Therefore, reliability is far more likely to be associated with increased involvement in adoption. Hence,

P1: Reliability with cloud computing suppliers has positive effect on cloud computing adoption.

Fig. 1 Research Model



3.2 Cost Considerations

Cost considerations can be defined as the expenditure of physical facilities and professional training for personnel in the long term. Lyde and Girbert [6] address that cloud computing could make continuously cost down and improve operating efficiency [25]. Cloud computing lets an organization pay by the hour for computing resources, potentially leading to cost savings even if the hourly rate to rent a machine from a cloud provider is higher than the rate to own one [19]. Besides, cloud computing is often described as “converting capital expenses to operating expenses” (CapEx to OpEx) which is a great incentive especially for SMEs, it equivalent to “pay as you go” that capture more economic benefit to the adopters. Hence,

P2: Cost considerations have positive effect on cloud computing adoption.

3.3 Compatibility

Compatibility is one of important facilitator for IT adoption [26]. We separate organizational compatibility and technical compatibility to discuss. Organizations are more likely to adopt a technology if they perceive that it is consistent with their culture, values and preferred work practices [30]. Because the adoption of cloud computing technologies often requires adopting firms to modify existing business practices and processes to gain benefits, organizational compatibility can impact the firm’s adoption decision [17].

Besides, the extent to which IS innovation can be readily integrated into the firm’s existing IS environment is also important to the firm’s adoption decision. Incompatibility of an innovation with a firm’s existing software, hardware, telecommunications, or networking architecture may inhibit adoption [10]. Because cloud computing technology may require that organizations modify there is technical infrastructure, organizations must assess the impact of cloud computing on current and future processing. So that IS managers are reluctant to involve their staff in cloud computing development, because they lack familiarity with a vision for this technology. Thus, technological incompatibility seems a more appropriate term for cloud computing can be readily integrated into the firm’s existing IS architecture may be more likely to rapidly adopt. So that according to above analysis, there is a positive relationship between organizational and technical compatibility with cloud computing adoption. Hence,

P3: Compatibility with cloud computing suppliers has positive effect on cloud computing adoption.

3.4 Customer Orientation

From S-D logic context, customer as an operant resource, which is a resource that is capable of acting on other resources, a collaborative partner who co-creates value with the firm. Customer orientation places the highest priority on the profitable creation and maintenance of superior customer value [20]. It emphasizes the need for the entire organization to acquire, disseminate, and respond to market intelligence from the firm’s target buyers and current and potential competitors. Some researchers suggest that market orientation is essentially customer orientation [6], representing the concept of “customer pull” in a firm’s strategic planning and implementation.

By prioritizing customers, a customer-oriented firm excels in its ability to seek and use market information to create and deliver superior customer value. Unlike a customer-led firm, which simply listens to its customers, a customer-oriented firm commits to understanding both the expressed and the latent needs of its customers [20]. We know that customers will expect a company provides some new service while the emergence of a new technology, and customer performance changed. So if a company pays attention to customer need, they will also want to use this technology and create new products or service. So we view customer orientation as an indicator to judge whether a firm pay attention to customer which is an operant resource. Hence,

P4: Customer orientation has positive effect on cloud computing adoption.

3.5 Service Innovation Performance

The adoption of cloud computing was affect by above reasons. And furthermore, Ordanini and Rubera [4] mentioned that service innovation is not from single source, instead, the innovation comes from a collaborative network, which includes different employees with different competences, partners and supplier collaboration and the competence from combination of company and deliver technology. We formulate the following hypothesis:

P5: Cloud computing adoption will be positively related to service innovation performance.

4. CONCLUSION

Because the adoption of cloud computing is not widespread in Taiwan, so some limitations of this study and can provide suggestions for future research. First, the adopters of firms of industries are particular, so it might not enough to represent the whole comments of Taiwanese firms. Second, service innovation performance might be changed overtime, because cloud computing adoption is initial stage in Taiwan. Third, try to use various dimensions to improve research model, even more, add the concept of time-based or S-curve to

discuss the performance of different adopt phases of cloud computing in the future.

Besides, this study provides some management implication and contribution as following. First, this study provides some comments for cloud service suppliers that let them understand the considerations of cloud computing adopters, and improve their technologies based on these comments. Second, companies which would like to adopt cloud computing can assessing the effectiveness refer to adopters' experiences through this study. Third, there is few studies related cloud computing in Taiwan, this study could be a reference for future research.

Some people think that technology boom is always one after another, cloud computing is just one of the cycle, and will eventually end in disappointment. International Research and consultancy (Gartner Inc.) claims that cloud computing technology has come to the maturity phrase of hype cycle that it had been placed great hope. Besides, the survey of Gartner also shows that, in a company, cloud computing are most likely one of the innovative behavior in the new year.

But in Taiwan, cloud computing is still at the initial stage now. In this study, we investigated the adoption antecedent and the relationship of adopter and supplier of cloud computing service, including reliability, cost, compatibility, and customer orientation, are combine the features of cloud computing and the constructs that used to be discussed in several researches of IT adoption.

In summary, the results of this study, we would like to discuss that if the qualities of relationship affect the extent of cloud computing adoption (SaaS, PaaS, and IaaS). Furthermore, we also probe into the influence of the extent of cloud computing adoption and service innovation performance. And this research provides a practice that let the adopter or supplier of cloud computing service to know the adoption antecedents of cloud computing impact on service innovation.

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