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Determinants of SMEs' Transformation Toward Cloud Services: Perspectives of Economic and Social Rationalities

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Abstract

Cloud services represent a new paradigm that changes how organizations obtain advanced information technology capability. Cloud services have especially important implications for small and medium enterprises (SMEs). However, not all SMEs choose to transform toward cloud-based solutions. Accounting for both technical-economic rationality and trust-based rationality, we explore the determinants of cloud service transformation in the SME context. We conduct a survey involving 107 SMEs operating in China to examine the research model. The findings illustrate that 1) both trust and benefit have significant influences on SMEs' transformation toward cloud services; 2) information security and social influence have positive influences, whereas vendor scarcity has a negative influence on SMEs' trust in cloud services; and 3) uncertainty of service demands and information asymmetry between service clients and vendors significantly affect SMEs' perception of cloud service benefits. The theoretical and practical implications and limitations are discussed.

Keywords: cloud computing; transformation; transaction cost theory; agency theory; trust

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Introduction

The cloud service model enables ubiquitous, convenient, and on-demand network access to a shared pool of computing resources with minimal management effort, provider-user interactions, and time (Mell and Grance, 2009). Although the idea of storing and managing data on virtual servers is not particularly new, cloud computing offers an opportunity to create entirely new business models and changes the stakes for entrepreneurs, small and medium enterprises (SMEs), and governments (Greengard, 2010). Cloud services with fast response, capability, and flexibility are leading a revolution in information technology (IT). They represent a new market of IT services that is transitioning from a product-dominant logic to a service-dominant logic. As an innovative IT service, a cloud service has three key properties: 1) rapid release capability (i.e., a large pool of computing resources enables clients to access services in a short time); 2) small upfront investments for clients; and 3) flexible pay-for-use payment mechanisms (Armbrust et al., 2010).

Cloud services with these three properties have salient implications for IT use in organizations, especially for SMEs. SMEs demand advanced IT to compete in the global market, such as to integrate and do business with large companies. However, SMEs most often have limited IT resources, such as insufficient internal IT expertise, few technically skilled employees, tight access to financial capital, and few slack resources (Kuan and Chau, 2001; Salmeron and Bueno, 2006; Street and Meister, 2004), but face various business uncertainties and thus may not be willing to immediately invest in permanent IT infrastructure and systems. Cloud services allow SMEs to take the more proactive IT strategy of adopting advanced information systems while maintaining relatively low transaction costs and switching costs. However, many SMEs are still contemplating whether to use cloud services. In particular, Chinese enterprises exhibit a lower propensity to move toward cloud services than enterprises in developed economies, despite the potential attractiveness of the cloud market in China (Kshetri, 2016). Thus, the study of SMEs' intention to move toward cloud services in emerging economies is required. Understanding SMEs' cloud service transformation intention is of great importance for both practitioners and researchers (Lin and Chen, 2012; Marston et al., 2011).

Two main assumptions of organizations are identified for the investigation of the organizational IT usage phenomenon in the information systems (IS) literature (i.e., technical-economic rationality and trust-based rationality). Technical-economic rationality argues that all stakeholders in an organization should follow the economic goal of maximizing the organization's economic efficiency and effectiveness through technology usage (Kling, 1980; Kumar et al., 1998). Trust-based rationality is complementary to technical-economic rationality (Kumar et al., 1998) and calls for the analysis of trust to explain IT usage in organizations. As a consequence, studies have increasingly relied on trust-based rationality to investigate IT innovation acceptance in organizations (Li et al., 2008; Pavlou, 2002; Pavlou and Gefen, 2004; Ratnasingam, 2005). Although both literature streams provide important insights, an integrative view of exploring the determinants of organizations' transformation by embracing innovative cloud services is necessary. Compared to the traditional IT artifacts that emphasize internal control (e.g., ERP), cloud services essentially take an inside out direction in which small firms request IT resources from cloud service providers. Such a cloud-enabled business model change gives trust in the service and the service benefit calculation direct impacts on firms' transformation toward cloud services, whereas the technique-relevant factors of the cloud may become subordinate.

We argue that both technical-economic rationality and trust-based rationality are important to exploring the cloud service transformation in organizations. We also trace back to identify the determinants of the formation of the two types of

rationalities. Uncertainty and information asymmetry are especially salient in the online transaction environment. They increase the chance that participants in the transaction may pursue self-interest at the cost of harming their partners' benefit. Thus, technical-economic rationality should be identified as one way of understanding cloud service transformation in this study. IT usage activities do not only involve opportunism, but are also counterbalanced by trust relationships in which win-win strategies can be promoted. In particular, the security of cloud services is a key concern of organizational clients (Brender and Markov, 2013; Jones, 2015; Rasheed, 2014). Cloud computing is the least transparent externally provided service method of storing and processing organizational data externally in multiple unspecified locations, often sourced from other, unnamed providers, and containing data from multiple customers (Heiser and Nicolett, 2008). Thus, we integrate both technical-economic rationality and trust-based rationality to examine the cloud service phenomenon. Based on the two rationalities, we develop a model of cloud service transformation intention in SMEs. We contribute to the literature on IT innovation adoption and IT-enabled organization transformation.

The remainder of this paper is structured as follows. First, we review the theoretical background and related literature. Then, we elaborate the research model and hypotheses. Subsequently, we present the methodology and data analysis process. The paper closes with a discussion of this study's findings, limitations, and implications and a short conclusion.

Theoretical background and related literature

IT service transformation

With the integration of advances in computing, communication technology, the conception of IT efficiency, and the service-dominant logic in the IT industry, cloud services have become a hot topic for both practitioners and researchers. As some researchers have claimed, technological changes have characterized the provision of information services and altered firm operations in unanticipated ways (McFarlan and Nolan, 1995; Poppo and Zenger, 1998). Cloud services have caused fundamental changes in the IT industry in the way that IT services are invented, developed, deployed, scaled, updated, maintained and paid for (Marston et al., 2011).

Cloud computing makes IT usage and IT service delivery more service dominated, responding to the service-dominant logic transformation trend. The mindset of the service-dominant logic is to be effective (Hefley et al., 2008). In recent years, numerous industries have moved from a product-dominant logic to a service-dominant logic (Cusumano, 2008; Ulaga and Reinartz, 2011). The integration of telecommunication, application software, and consulting has introduced new online services (Bennett and Timbrell, 2000) and has made way for the service logic transformation in the IT industry, critically challenging traditional packaged software companies. The service logic transformation process involves the further integration of products and services, which present as hybrid offerings or hybrid solutions. To capture the online service market, online service vendors and traditional packaged software companies are making efforts to supply hybrid offerings or hybrid solutions. Hybrid offerings or hybrid solutions are referred to products and services combined into innovative offerings, where flexible bundles, peace of mind bundles, multi-benefit bundles, and one-stop bundles are four common types of hybrid offerings with different extents of complementarity and independence between products and services (Shankar et al., 2009). Accordingly, cloud services can be considered flexible bundle hybrid solutions, as their significant value comes from combining IT products and IT services in a flexible way. Furthermore, IT products and IT services themselves are to some extent independent. Cloud services, as flexible bundle hybrid offerings, can help attract

potential customers and increase demand among existing customers by providing superior value. Thus, it is critical for online service vendors and traditional packaged software companies to obtain insight into this new IT solution. Therefore, research on cloud service transformation is of great value for IT companies that are trying to capture the new market.

According to the varieties and levels of end-user usage, cloud services can be categorized into three groups: 1) infrastructure as a service; 2) software as a service; and 3) platform as a service (Durkee, 2010; Mell and Grance, 2009). The rapid release capability, small upfront investment, and pay-for-use payment mechanisms of cloud services attract various clients. This is especially relevant for customers in the SME sector who do not know the true valuation of the infrastructure, software, or platform before cloud service adoption, as they can learn their valuation through trial use without making a significant upfront investment and can make more informed adoption decisions later on (Xin and Levina, 2008).

For cloud service design and implementation, several frameworks have been proposed for organizations to consider. Conway and Curry (2012) proposed a mitigation framework, namely, the cloud lifecycle management framework, based on the conjoint work of leading organizations from the industry, the non-profit sector, and academia. The lifecycle model consists of four phases in the process of cloud adoption. Chang et al. (2013) proposed the cloud computing business framework (CCBF) to help organizations achieve good cloud design, deployment, migration, and service. The CCBF explicates four key areas to be addressed, including classification, organizational sustainability modeling, service portability, and linkage. The recent case studies of Chang et al. (2016) in the U.K. further suggest that the emerging organizational sustainability modeling technique is more appropriate for organizations to evaluate the balance between the benefits and risks of cloud computing adoption.

Despite the superior value of cloud services to both vendor and user companies, organizations have significant concerns regarding their transformation. Scott (2016) commented, "After 10 years, cloud computing is still perplexing to many CIOs; thus, it is not being exploited for its maximum benefit. While cloud computing is a foundation for digital business, we estimate less than one-third of enterprises have a documented cloud strategy". Hsu et al. (2014) similarly asserted that cloud adoption in Taiwan is still in its initial stages due to the low adoption rate. Furthermore, the cloud service adoption and implementation framework in the context of leading organizations may not be suitable for the SME context (Carcary et al., 2014). Thus, we must continue investigating the cloud service transformation phenomenon in different contexts, in particular that of SMEs in emerging economies.

Technical-economic rationality

Technical-economic rationality is one of the primary frameworks used to investigate the IT usage or IT innovation acceptance phenomenon in organizations. The key principles of technical-economic rationality are self-interest, opportunism, and utility maximization (Kling, 1980). Firms engaging in transactions always try to maximize their self-interest and utility and to avoid the opportunistic behavior of other parties in the transaction process. Accordingly, in the context of IT innovation acceptance, companies make economic concerns a primary consideration. Such technical-economic rationality dominates the study of stakeholders' attitudes and decisions regarding specific IT innovations.

Based on technical-economic rationality, a key factor in the IT innovation acceptance literature is the benefit that companies can obtain or perceive to obtain through adoption. For example, research has shown that top managers' frustration with electronic data processing (EDP) is primarily caused by the lack of benefits from EDP (Danziger, 1977). This means that EDP use is influenced by whether EDP generates favorable benefits that can be perceived by organization executives.

Although clients in an emerging market may have limited knowledge and experience of new technologies, they may still prefer to try innovative products that offer genuine benefits over existing products (Zhou et al., 2005). Benefit is also identified as a key factor in explaining employees' attitudes toward compliance with the information security policy (Bulgurcu et al., 2010). Thus, it should be included in studying cloud service transformation.

Transaction cost theory (TCT) and agency theory underpin the research stream of technical-economic rationality in which organizations' IT adoption and usage behavior are benefit driven. TCT examines the appropriate governance structures for conducting transactions (Coase, 2007; Oliver, 1975; Williamson, 1979, 1981, 1985). It assumes that rational entities act in self-interest (Lewick and Bunker, 1996) and higher uncertainty improves the cost that occurs when parties in the transaction need to renegotiate the contract (Aubert et al., 2005). When uncertainty exceeds the processing capability of the related parties, the decision may not be made with complete rationality. This bounded rationality may bring additional costs during transactions, thus lowering the benefits. This is especially true when technology undergoes rapid and significant changes. Some studies based on TCT have been conducted on innovation acceptance (Liang and Huang, 1998; Poppo and Zenger, 1998; Teo and Yu, 2005).

Agency theory addresses the principal-agent relationship in which the principal authorizes the agent to perform work according to an agreed upon contract. In this principal-agent relationship, the agent is assumed to have more information about the performed work. This information asymmetry makes it very difficult for the principal to monitor the agent's behavior. When information asymmetry exists, the principal cannot guarantee that the agent behaves in of the principal's interest. Some researchers in the IS field have based their research on agency theory to study online exchange relationships and the drivers of IS project success (Pavlou et al., 2007; Rai et al., 2009). Agency theory can be applied to all transaction exchanges in the social-economic system where information asymmetry exists (Milgrom and Roberts, 1992). Both uncertainty and information asymmetry may induce opportunistic behavior, which lowers the efficiency of transactions and thus benefit maximization. As such, we include uncertainty and information asymmetry as two primary factors that may affect the benefits of cloud services.

Trust-based rationality

In addition to technical-economic rationality, trust-based rationality is also vital for fully understanding the IT usage phenomenon in the organizational context. As not all real-world settings for transactions are dominated by values such as self-interest and opportunism, trust should also be considered to provide adequate explanations for organizational IT usage (Kumar et al., 1998). Trust is a core premise of positive relationships in various contexts, which may help facilitate win-win cooperation strategies and thus improve transaction efficiency.

Much trust research in the IS field has been conducted in the context of interpersonal relationships (Gefen et al., 2003; Goo et al., 2009; Jarvenpaa et al., 1999; McKnight et al., 2002; Stewart, 2003), such as relationships between clients and service providers or partner relationships. Jarvenpaa et al. (1999) examined trust in online stores and found it to be positively related to purchasing behavior. Stewart (2003) showed that trust transfers from physical shopping channels to related website channels. Additionally, Goo et al. (2009) discovered the role of trust in partner relationship governance in the context of IT outsourcing. Trust in technological innovation or IT artifacts has recently been studied in various contexts (Corritore et al., 2003; Komiak and Benbasat, 2006; Li et al., 2008; McKnight et al., 2011; Wang and Benbasat, 2005, 2008). Wang and Benbasat (2008) studied trust in recommendation agents in the context of e-commerce and elaborated several determinants of trust formation.

McKnight et al. (2011) suggested that trust in IT itself also shapes IT-related beliefs and behavior. These studies suggest that trust in technological innovation is also a primary predictor of innovative technology usage and should be taken as a fundamental construct. Rogers (1995) defined an innovation as an idea, practice, or object that is perceived as new by any stakeholders. Cloud services as a new type of information service mode can be considered as type III innovation embedded in the core technology of business in Swanson's typology (Swanson, 1994). Thus, we dedicate our efforts to investigating the role of trust in cloud services in the new IT service mode transformation.

The antecedents of trust separated from trust itself should be explicitly identified (Mayer et al., 1995) and the antecedents of trust may be different in various contexts. Researchers should focus more on users' perceptions or concerns specific to a particular context (Malhotra et al., 2004; Smith et al., 1996; Stewart and Segars, 2002). As some researchers have claimed, novel perspectives on trust in information systems aim to explore novel aspects of trust in new and under-researched IS contexts (Benbasat et al., 2010). Cloud services as an emerging IT service mode are obviously new and under-researched IS contexts. Therefore, the determinants of trust attitude formation in the cloud service context must be examined.

Some researchers consider trust as a cognitive process and suggest that second-hand knowledge, impressions, and cognitive cues affect trust formation (Brewer, 1981; Li et al., 2008), especially when direct information and repeated experiences with the discussed trust target are lacking. For an IT service innovation with which most companies are unfamiliar, several factors may influence trust in cloud services. First, trust reflects the perceived security of using the discussed technology. For company users, a primary concern of cloud services is information security. A survey conducted by Gartner showed that the first hindrance to cloud services is security concerns (Peter, 2012). Researchers have also claimed that it is necessary for both practitioners and academic researchers to understand consumers' security concerns about cloud services (Marston et al., 2011). Second, as a trustor may categorize the discussed target as trustworthy or untrustworthy based on the target's reputation (Li et al., 2008; McKnight et al., 1998) and as a larger number of potential competitive vendors mitigate small-numbers bargaining in product markets (Pisano, 1990), the number of reputable cloud service vendors in the market may give potential users more confidence that the new service mode is trustworthy. Third, the informal communication network of innovation is powerful in the initial stage of technology diffusion when evaluations based on firsthand knowledge and experiences are inadequate. Evaluations of or attitudes toward innovation from other users may show even more persuasive power than technology experts, especially in the initial decision stage (Rogers, 1995). Thus, we include three antecedents of trust in cloud services from three aspects: the information security of the technology itself, the level of vendor scarcity in the cloud service market, and the social influence from the social aspect.

In summary, based on technical-economic rationality, trust-based rationality, and the theories underlying the two rationalities, we try to develop a model to explore the cloud service transformation phenomenon. Specifically, we try to explore the influences of benefit and trust on cloud service transformation intention and the determinants of benefit and trust in the context of cloud services.

We propose our research model in Figure 1. The model considers the relative impacts of benefit and trust on cloud service transformation. Uncertainty and information asymmetry should influence the benefit of cloud services. Information security, vendor scarcity, and social influence are identified as the three main factors influencing trust in cloud services.

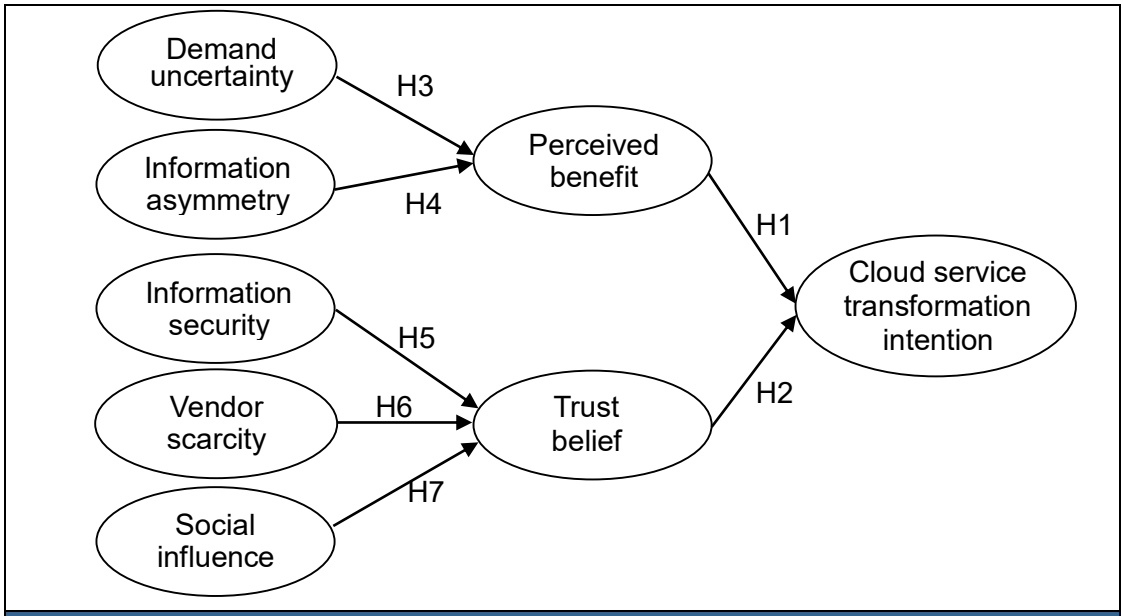

Figure 1. Research Model

Hypotheses

Benefit, trust, and cloud service transformation

As we illustrate in the theoretical background and literature, trust and benefit are two primary predictors of cloud service transformation. Cloud service transformation intention is defined as a company's willingness to use a cloud service to support its operations, management, and decision making in business. Adapted from Kim's conception of benefit (Kim et al., 2008), we define benefit as a firm user's belief about the extent to which the firm would be better off as a result of using cloud services. Research based on the resource-based view and production cost economics argues that organizations operating in environments with more uncertainties should increase their flexibility by taking advantage of vendors' capability (Balakrishnan and Wernerfelt, 1986; Levina and Ross, 2003; Slaughter and Ang, 1996). As SMEs usually operate in environments with more uncertainty, they should increase their IT capability by adopting cloud services, especially when they face IT resource poverty or need not keep IT capacity as a core competitiveness. Under the conditions mentioned above, cloud services help SMEs reduce costs, save time, and increase work productivity, thus improving their overall competitiveness. The more benefits that firms can perceive obtaining from cloud services, the more likely they are to transform to cloud services. Therefore, we hypothesize the following:

> *H1: SMEs' perceived benefit from cloud services has a positive effect on their transformation intention toward cloud services.*

Researchers have conducted comprehensive reviews of the notion of trust (Gefen et al., 2003; McKnight and Chervany, 2002), in which a common view is that trust is a subjective belief that the trustee behaves in the interest of the trustor within a transaction. In the context of this study, trustor refers to firm users of cloud services and trustee refers to cloud services. Accordingly, trust in cloud services is defined as the degree to which the company users believe that cloud services constitute a dependable IT service mode. Trust has a direct impact on trustors' behavioral intentions (Komiak and Benbasat, 2006; McKnight et al., 2011; Rustagi et al., 2008), as trust belief increases trustors' performance

expectancy and reduces the uncertainty of IT usage outcomes. SMEs' generic trust in cloud services can be indicated by SMEs' belief in the reliability, helpfulness, and functionality of cloud services. When SMEs establish trust in cloud services, they believe that the technology is reliable, is dependable to provide adequate help, and has the capability or features to do what they need it to. The more trust belief in cloud services that SMEs have, the more likely they are to transform toward cloud services. Therefore, we hypothesize the following:

H2: SMEs' trust belief in cloud services has a positive effect on their transformation intention toward cloud services.

Uncertainty, information asymmetry, and benefit

Uncertainty is one of the most analyzed independent variables in transaction cost economics (David and Han, 2004). SMEs operating in a highly competitive environment face various uncertainties in adopting information systems and services in a perpetual mode. Such uncertainties include uncertainty of online service demands and the related requirements of rapidly changing IT. In this study, online services refers to IT solutions that are supplied through the Internet in a perpetual mode, which is different from cloud services. Cloud services with little scale of upfront investment and pay-for-use payment mechanism enable SMEs to reduce the uncertainties induced by the rapid development of online IT and obtain benefit expectancy, as cloud services make service vendors take on most of the responsibilities of dealing with IT uncertainties. SMEs only need to pay for their usage of services according to their instant IT demand with little upfront investment. Thus, the more uncertainty SMEs have about online services, the more likely they are to believe that cloud services with the property of uncertainty aversion are beneficial for them. Therefore, we hypothesize the following:

H3: Uncertainty regarding online service demands and requirements increases SMEs' perception of the benefits of cloud services.

Based on previous researchers' definition (Pavlou et al., 2007), we define information asymmetry as firm users' perception that online service vendors have a greater quantity or quality of information about its services, characteristics, and service practices. In the context of this study, online service vendors are agents and firm users are principals. In the traditional IT service in which firm users often have high switching costs, information asymmetry is likely to induce the service vendor's opportunistic behavior if the IT service vendor has far more information about the supplied IT solutions than the firm users. However, such a situation is flipped for cloud-based online services, which emphasize users' experiences. Although information asymmetry is also unavoidable between the cloud service vendor and the small firm users, firm users are allowed to learn the true value of the cloud service and experience the service quality of cloud service vendors through initial usage without making a significant upfront investment. Pay-for-use payment mechanisms give company users flexible choices based on the real performance of cloud services and the service vendors' behavior. These mechanisms reverse the negative effect of information asymmetry (i.e., opportunistic behavior). However, the perceived information asymmetry in cloud services by SMEs is transferred into positive perceptions of and expectations on the cloud service vendors, such as their knowledge of new technologies. Consequently, SMEs can preview more benefits of using cloud services. Therefore, we hypothesize the following

H4: Information asymmetry has a positive effect on SMEs' perceptions of the benefits of cloud services.

Information security, vendor scarcity, social influence, and trust

Information security is defined as the degree to which firm users' information processed by cloud services can be guaranteed to be confidential. In the digital era, information security is of great value to organizations. Hacker attacks, virus dissemination, personal mistakes, and other factors may all lead to information leakage, loss, and misuse. Information insecurity may induce a series of problems for companies, such as malicious attacks from competitors, reputation crisis, and business failure. For SMEs, competition in the environment is more intense. The relative weak crisis resistance capability of SMEs makes them more vulnerable to the damage of information leakage, loss, and misuse. Cloud services magnify the problem of information security (Ryan, 2011), as data storage, processing, and transactions are operated through clouds that reside in the vendors. When cloud service vendors can solve information security concerns, such as the aforementioned information leakage, loss, and misuse, those small firm users gain trust beliefs in the cloud computing technology, such as trust in the reliability and dependability of cloud services. The more information security that can be guaranteed, the more trust SMEs have in cloud services. Therefore, we hypothesize the following:

> *H5: Information security has a positive effect on SMEs' trust belief in cloud services.*

Based on a prior definition of supplier presence (Walker and Weber, 1984), we define vendor scarcity as the degree to which reputable and qualified service vendors are inadequate in the service market. Companies may be constrained in their vendor selection if the IS service they need is not available from another vendor in the market (Ang and Cummings, 1997). The selection constraint may cause lower service quality, as benign competition encourages perfection and enough reputable vendors in the emerging market facilitate benign competition. The presence of sufficient, reputable, and competent vendors increases company users' confidence in cloud services and their likelihood of forming positive trust attitudes toward transformation. Conversely, vendor scarcity reduces firm's trust in cloud services. Therefore, we hypothesize the following:

> *H6: Vendor scarcity has a negative effect on SMEs' trust belief in cloud services.*

Small firms' attitude toward cloud service can be influenced by their customers, competitors, and suppliers. Following Venkatesh (2003), we define social influence as the degree to which a firm perceives from important entities that they should use a cloud service. Social influence, as an important component of innovation communication networks, has an essential effect on innovation diffusion (Rogers, 1995). During the initial diffusion of an innovation, peer evaluation is of great significance for potential users, especially when knowledge and experience are inadequate. We focus on the normative influence that is fermented in organizations' communication networks. Normative influence happens when one's behavior or attitude is influenced by those who are connected and respected (Karahanna et al., 1999; Kelman, 1958). Given that cloud services are relatively new IT services with many uncertainties, the social influence of small firms' communication networks, including their clients, suppliers, and leading industry peers, may help them reduce the worries of potential risks of using cloud services and increase their trust in the new service. When small firms notice that their clients, suppliers, and peers have already used cloud services, they may trust that cloud services have good features. The leading firms in industries, which are pioneers of cloud service adopters, can further deliver an even prospective signal that allows the small firms to believe in the potential value of cloud services to them. Accordingly, we make the following hypothesis:

H7: The social influence of SMEs' communication networks has a positive effect on their trust belief in cloud services.

Methodology

Measurement and data collection

Constructs and related measurement scales were adapted from the literature. Some minor modifications were made to fit the context of this study. All items except for the items of trust and service transformation intention were measured using 7-point Likert scales. Trust and service transformation intention were measured using 5-point Likert scales. Thereafter, the questionnaire was reviewed for content validity by a group of IS academics. As the survey was administrated in China, we translated the English questionnaire into Chinese and then back to English to ensure translation equivalence. As the items were adapted from past studies, card sorting was conducted to ensure the face validity of the modified items in this specific research context following the procedures described by Moore and Benbasat (1992). Face validity is a measure of a test's quality, in which researchers determine whether the test measures what it is intended to measure. Specifically, every item was coded with a number and printed on a small paper strip. Three judges were invited to sort all of the items into categories and define each category. After the sorting, the percentages of correctly sorted survey items were calculated. The average hit rate was 80.2%. Based on the hit rates, a number of ambiguous items were identified and then modified until all of the judges reached agreement. Interviews with several SME managers and experts were also conducted to refine the questionnaire. Finally, a structured questionnaire was prepared for greater data collection. The English version of the questionnaire is provided in Appendix A.

The chief executive officer (CEO) and the chief information officer (CIO) of the SMEs were chosen as the key informants. As CEOs and CIOs are key participants in the IT strategy decision process, especially in SMEs, it is reasonable to consider their attitude toward cloud services as the most representative standpoint of the investigated companies. We collected the data from the Pearl River Delta and the Yangtze River Delta. They are the most developed areas in China with the largest amount of SMEs operating in various industries, making them good representative areas for the study. The definition of SMEs in this study adhere to that of China's National Bureau of Statistics (2012), which classifies enterprises as SMEs based on their number of employees and annual sales. The SME classification criteria differ for different industries. Based on the classification criteria, we post-mailed the questionnaire to 795 SMEs that were randomly selected from a commercial database of the SME classification in China and conducted two rounds of e-mail follow-up to remind non-responding SMEs every 3 weeks after the initial post-mail. In total, 112 responses were collected and 5 responses were excluded due to uncompleted questions and one number ticked for all questions. Ultimately, 107 valid responses were used for the data analysis. The characteristics of the participating SMEs are presented in Table 1.

Table 1. Characteristics of the participating SMEs							
Business Sector	%	Annual Sales (Millions)	%	Employees (Persons)	%	Area of Residence	%
Manufacturing	55	0-1	23	1-50	54	Pearl River Delta	35
Retail & wholesale	13	1.01-5	34	51-100	18	Yangtze River Delta	65
Business service	8	5.01-10	8	101-200	14		
Agriculture	7	10.01-20	19	201-600	14		
Construction	6	20.01-40	8				
Real estate	4	40.01-150	8				
Transportation	1						
Others	6						

Data analysis

Partial least squares (PLS) was used to analyze the data and examine the hypotheses. PLS, as a second-generation multivariate technique, can simultaneously assess a measurement model and a structural model. It can also model latent constructs under the condition of non-normality and a small to medium sample size (Chin et al., 2003). Thus, PLS is considered to be more suitable for this study. We examine the measurement model and the structural model in the following section.

Measurement assessment

The validation of the measurement model was conducted by examining the reliability, convergent validity, and discriminate validity. Composite reliability (CR) should be greater than 0.7 and average variance extracted (AVE) should be greater than 0.5 to show the reliability of a construct (Fornell and Larcker, 1981). Convergent validity can be assessed by checking whether the item loadings on the respective constructs are high enough, such that loading>.50 (Wixom and Watson, 2001). Discriminate validity can be assessed by checking whether the square root of the AVE is higher than the correlation coefficient between the discussed construct and other constructs (Fornell and Larcker, 1981).

The analysis results of the measurement model are listed in Tables 2 and 3. As shown in Table 1, the CRs for all of the constructs were greater than 0.7 and the AVEs were greater than 0.5. The results indicate that all of the variables in this study meet the conditions for reliability. As shown in Table 2, the item loadings were high enough to achieve good convergent validity. As shown in Table 3, all square roots of the AVE were greater than the correlation coefficient between the discussed construct and other constructs, demonstrating the good discriminate validity of all of the variables. Based on the above analysis, the reliability and validity of the variables were established.

Table 2. Reliabilities, AVEs, and item loadings			
Constructs	Items	Loadings	t-statistics
Cloud Service Transformation Intention (CR=0.936, AVE=0.829)	CTI1	0.909	41.237
	CTI2	0.896	38.629
	CTI3	0.926	41.232
Trust Belief (CR=0.925, AVE=0.805)	TR1	0.895	34.053
	TR2	0.895	30.428
	TR3	0.900	43.837
Information Security (CR=0.941, AVE=0.843)	IS1	0.909	30.006
	IS2	0.936	48.626
	IS3	0.914	61.037
Vendor Scarcity (CR=0.842, AVE=0.732)	VS1	0.978	6.091
	VS2	0.713	3.135
Social Influence (CR=0.900, AVE=0.750)	SI1	0.883	14.897
	SI2	0.877	14.548
	SI3	0.839	16.049
Perceived Benefit (CR=0.926, AVE=0.713)	PB1	0.835	22.514
	PB2	0.892	29.236
	PB3	0.839	17.842
	PB4	0.802	14.012
	PB5	0.853	24.031
Demand Uncertainty (CR=0.837, AVE=0.562)	DU1	0.732	7.760
	DU2	0.784	14.304
	DU3	0.783	8.214
	DU4	0.695	6.063
Information Asymmetry (CR=0.943, AVE=0.867)	IA1	0.910	43.388
	IA2	0.943	37.739
	IA3	0.907	24.920

Note: CR=composite reliability; AVE=average variance extracted.

Table 3. Means, standard deviations, and correlations										
Construct	Mean	Std. Dev.	CTI	TB	IS	VS	SI	PB	DU	IA
CTI	3.542	0.802	**0.910**							
TB	3.311	0.675	0.376	**0.897**						
IS	4.157	1.282	0.211	0.535	**0.918**					
VS	4.307	1.129	-0.123	-0.180	0.025	**0.856**				
SI	4.931	1.078	0.363	0.373	0.135	-0.008	**0.866**			
PB	5.475	0.952	0.354	0.369	0.187	-0.067	0.572	**0.845**		
DU	5.065	0.825	0.316	0.226	0.184	0.313	0.454	0.519	**0.750**	
IA	5.009	1.124	0.285	0.208	0.210	0.142	0.282	0.374	0.398	**0.920**

Note: CTI=cloud service transformation intention; TB=trust belief; IS=information security; VS=vendor scarcity; SI=social influence; PB=perceived benefit; DU=demand uncertainty; IA=information asymmetry.
*The boldface numbers are the square roots of the average variance extracted.

Results and discussion

The PLS results of the structural model are reported in Figure 2. The benefit of cloud services had a significant effect on cloud service transformation intention (β=0.277, t=2.507), thereby supporting H1. SMEs that believe that cloud services benefit them are more likely to accept them. This reflects that companies, especially SMEs, always make benefit a priority when making IT solution decisions. SMEs' trust in cloud services had a significant effect on their transformation intention (β=0.228, t=2.058), thereby supporting H2. Therefore, both technical-economic rationality and trust-based rationality have a significant influence on cloud service transformation intention. As the perceived benefits of adopting particular technologies are generally considered factors by companies, trust is proposed as another crucial determinant factor of IT innovation acceptance. The trust belief in IT innovation is especially important, when firms have already been convinced by the power of IT to improve overall competitiveness and when the technology evolves so fast that companies are swamped under successive waves of new technologies.

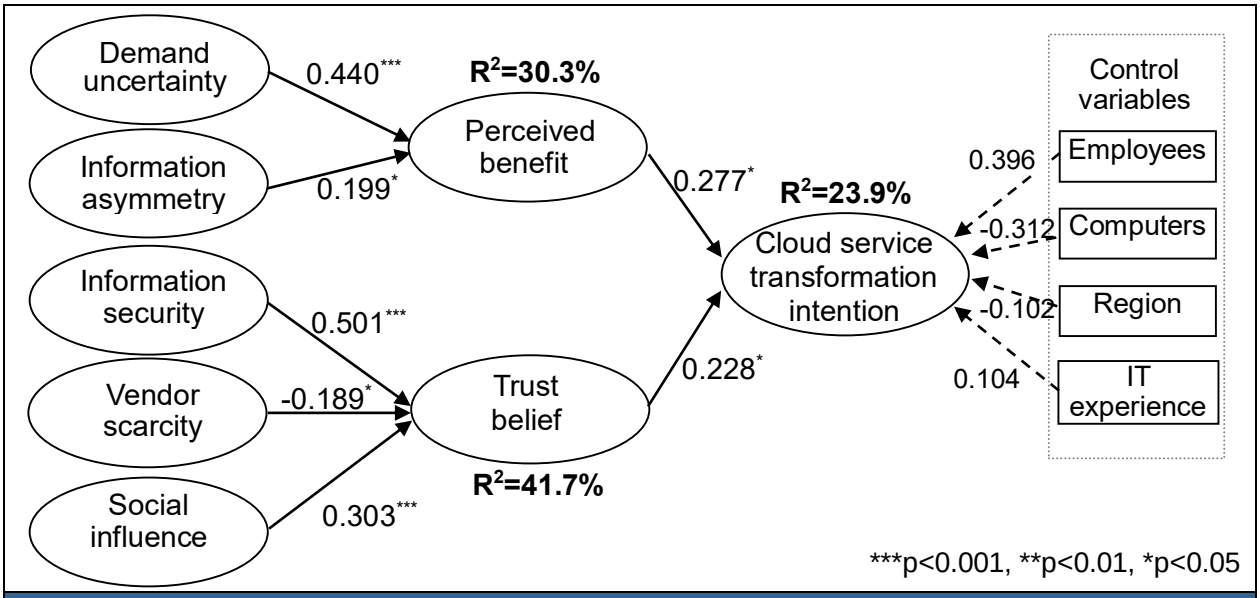

Figure 2. Results of the Structural Model Assessment

We further check the determinants of the perceived benefit and the establishment of trust beliefs in SMEs. Both uncertainty (β=0.440, t=6.171) and information asymmetry (β=0.199, t=2.222) were positively associated with SMEs' perception of benefits from cloud services, thereby supporting H3 and H4. The more uncertainties and information asymmetry that SMEs perceive surrounding the adoption of information systems and services in a perpetual mode, the more they are willing to use cloud services.

Information security (β=0.501, t=6.142), vendor scarcity (β=-0.189, t=2.514), and social influence (β=0.303, t=4.716) had a significant positive, negative, and positive influence, respectively, on trust, thereby supporting H5, H6, and H7. The significant influence of information security on trust in cloud service indicates that when company users believe the information processed by clouds to be sufficiently secure, they trust the service more. This result is consistent with the investigation of the Gartner survey, which found that security is one of the primary concerns of cloud services (Peter, 2012). The significant effect of vendor scarcity on trust in cloud services shows that users trust cloud services more if they can easily find more reputable service vendors in the existing market to fulfill their IT usage requirements. This gives users more confidence that the discussed market is becoming more mature and that the

obstacles to using the new IT service are reduced to some extent. The significant effect of social influence suggests that users' trust in cloud services is influenced by other important entities that participate in their business activities. This finding is consistent with innovation diffusion theory, which also claims that social influence is of vital importance in the persuasion stage of innovation diffusion (Rogers, 1995).

Furthermore, all of the control variables, including the number of employees and the number of computers that the SMEs had, the region in which the SMEs resided (Pearl River Delta vs. Yangtze River Delta), and the extent to which the SMEs had past IT experience, had insignificant impact on the SMEs' transformation intention toward cloud services. This helps eliminate the potential effect of the variance of SMEs' prior IT experience and the environmental effect of the geographically distributed regions in which those small firms resided.

Implications

Theoretical implications

This study has three theoretical implications. First, cloud service transformation intention in SMEs in emerging economies has yet to be widely studied. As the cloud service market has tremendous business potential, research on this phenomenon is of critical value. Recent empirical studies of cloud service adoption at the individual level have been conducted with a focus on particular cloud applications (e.g., Arpaci, 2017; Lian, 2015; Wu et al., 2017). However, few theoretical and empirical works on organizational cloud service adoption have explored the factors that directly and indirectly drive organizations to adopt or hinder their adoption of cloud services (Haag and Eckhardt, 2014). We holistically investigate these direct and indirect factors from both the technical-economic and trust-based rationality aspects and verify their influences on small firms' transformation intention in emerging economies, adding important value to the literature on cloud service adoption.

Second, we enrich the trust and benefit literature by integrating the two aspects in explaining SMEs' cloud service transformation and empirically testing their impacts. Based on technical-economic rationality and trust-based rationality, we provide a more comprehensive view of IT service acceptance at the organizational level. We empirically justify that although self-interest driven behavior dominates IT usage activities, trust is also crucial in promoting efficient transactions. Specifically, both technical-economic rationality and trust-based rationality play significant roles in organizations' cloud service transformation. Based on technical-economic rationality, firms' pursuit of benefits determines their willingness to accept IT innovation. Meanwhile, the trust rooted in trust-based rationality supplies a complementary explanation and exerts significant influence on firms' IT usage decisions. Trust-based rationality may be more salient in small firms that are faced with more competitive and uncertain environments but equipped with less technological knowledge and capability. As IT evolves faster than ever before, we should recognize the importance of the development of the general trust belief in various technologies.

Third, we further contribute knowledge to the trust and benefit literature by identifying three determinants of trust and two factors influencing benefit in the context of cloud service transformation. The three determinants of trust include information security, vendor scarcity, and social influence. Some researchers have recognized the information security problem as a critical concern in cloud services (Jhang-Li and Chang, 2017; Marston et al., 2011; Ryan, 2011). We empirically validate that the information security of cloud services is really the concern of SMEs and has a stronger effect on the trust in cloud services than vendor scarcity and social influence. The identified factors enrich the trust literature in organizational studies, especially in the area of IT innovation acceptance. Online service related uncertainty and information

asymmetry are also confirmed as two critical determinants of benefit in the context of cloud services. Identifying the antecedents of benefit and trust is an important contribution, as little empirical research has investigated the antecedents of benefit and trust in the context of cloud services.

Finally, we extend TCT and agency theory to the cloud service transformation context. Most research has acknowledged technical-economic rationality and has recognized that perceived benefit is fundamental for IT innovation acceptance (e.g., Danziger, 1977; Zhou et al., 2005). Most often, studies have found that uncertainty and information asymmetry may impede firms' acceptance of traditional IT innovation (e.g., Aubert et al., 2005). However, in the cloud service context, the influential direction is reversed. It is the demand uncertainty of small firms and the information asymmetry between such small firms and service vendors that lead small firms to believe they may benefit from cloud-based innovation. Nevertheless, cloud services distinguish themselves from traditional IT services via their emphasis on customers, flexible payment methods, low up-front customer investments, and pay-for-use payment mechanisms.

Practical implications

This study has the potential to provide insights to cloud service vendors that allow them to offer appropriate services to their clients and enrich stakeholders' understanding of the cloud service transformation process. First, benefits are key to encouraging firms to transform toward cloud services. Therefore, service vendors should consider and manage the benefits that they can provide their customers. We find that the cloud service benefits perceived by SMEs are highly dependent on how service vendors are able to reduce firms' uncertainty and information asymmetry in using the new IT solutions. If firms perceive too many uncertainties and too much information asymmetry, SMEs' benefit expectancy of using cloud services are lowered, making them less willing to transform. Cloud service vendors may consider clearly describing their services to reduce uncertainty. They may also consider enhancing their information sharing with users to reduce information asymmetry.

Second, we highlight the importance of trust in SMEs' IT service transformation process. When a new IT service mode needs to be diffused in SMEs, trust should be established to accelerate its diffusion. As stakeholders in SMEs must trust cloud services before deciding to transform, it is important for service vendors or traditional packaged software companies supplying cloud services to establish dependable impressions and maintain a trusting relationship with all clients. To enhance users' impressions of dependability, cloud service vendors may try to receive accreditation by reputable organizations. For example, cloud service vendors can collaborate with reputable companies in the IT service field and obtain recommendations from other authorized non-profit organizations, such as governments and influential enterprise associations.

Third, as one important determinant of trust, information security is an important concern when SMEs consider transforming to new IT services. This is especially true for cloud services where users are not entirely clear about which cloud distributes and handles their information. Articulating clear policies for information processing and developing security technologies can be two ways to alleviate security concerns (Ryan, 2011). Thus, service vendors should clarify their data processing policies and security guarantee technologies for target clients to address the information security concern. As reputable service vendors in the service supply market improve SMEs' confidence, more government incentive policies and survival of the fittest market mechanisms should be established in this emerging market. As the service evaluation of entities participating in users' business activities is influential for users' attitude formation during the initial stage, cloud service vendors should establish a win-win marketing strategy alliance with their existing cloud service users to attract potential clients. For

example, service vendors can try to cooperate with existing users on service marketing and share profit with them. Specifically, vendors can cooperate with existing users in marketing cloud services through benefit sharing, such as offering these partners preferential service terms. Based on benefit sharing, cloud service vendors can not only lock in existing users, but also attract more potential users through existing users' business communication networks. Cloud service vendors can also try to supply preferential policies for educational associations to encourage cloud use in performing training tasks.

Limitations and conclusion

We are aware that this study is not perfect. First, we investigate the cloud service transformation of SMEs and use samples from China. Generalizing our conclusions to other emerging economies with different cultures should be done with caution. Second, we investigate the determinants of service transformation intention from the aspects of trust and benefit. Several factors influencing trust and benefit are elaborated based on the literature and theories discussed above. Other variables that may have influential effects on trust, benefit, and service transformation intention should be examined in future studies.

In conclusion, cloud services are flourishing worldwide, but it remains unknown why SMEs are still hesitant to use/try cloud computing. We assume that the technical-economic rationality and trust-based rationality of firms and draw upon TCT and agency theory to explain the cloud service transformation phenomenon among SMEs. The results indicate that technical-economic rationality and trust-based rationality play important roles in cloud service transformation. Specifically, trust and benefit both exert significant impacts on organizations' transformation. Information security, vendor scarcity, and social influence significantly affect the trust in cloud service, whereas both uncertainty and information asymmetry significantly affect the benefits perceived by SMEs. Thus, via this study we deepen the understanding of cloud service transformation in organizations and enrich the literature on cloud computing for firms.

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Appendix A

Measurement items

Construct	Items
Cloud service Transformation Intention *Adapted from Venkatesh et al., 2003*	CTI1. Our company intend to cloud service in the next three years.
	CTI2. We predict we would use cloud service in the next three years.
	CTI3. We plan to use cloud service in the next three years.
Perceived Benefit *Adapted from Kim et al., 2008; Swaminathan et al., 1999; Moore et al., 1991*	BE1. We think using cloud service is convenient.
	BE2. We can save money by using cloud service.
	BE3. We can save time by using cloud service.
	BE4. Using cloud service will enable us to accomplish a task more quickly.
	BE5. Using cloud service will increase our work productivity.
Demand Uncertainty *Adapted from Bahli et al., 2004*	UN1. Regarding online service, our demands and requirements are difficult to predict.
	UN2. Regarding online service, service technology requires frequent change.
	UN3. Regarding online service, forecasting for IT change and requirements is difficult.
	UN4. Regarding online service, trends of changing IT business requirements are difficult to monitor.
Information Asymmetry *Adapted from Pavlou et al., 2007*	IA1. Online service vendors have more information about the quality of their service than we do.
	IA2. Online service vendors have more information about how the service contract for us will be handled than we do.
	IA3. Online service vendors have more information about their service strategy than we do.
Trust Belief *Adapted from Pavlou et al., 2004*	TR1. Cloud service is in general dependable.
	TR2. Cloud service is in general reliable.
	TR3. Cloud service is in general trustworthy.
Information Security *Adapted from Pavlou et al., 2007; Salisbury et al., 2001*	IS1. We would feel secure processing sensitive information when using cloud service.
	IS2. We would feel totally safe processing sensitive information about our company when using cloud service.
	IS3. Overall, cloud service is secure when considering processing sensitive information.
Vendor Scarcity *Adapted from Ang and Straub 1998*	VS1. There are not a sufficient number of trustworthy cloud service vendors who potentially could provide service to us.
	VS2. If we decide to terminate in-house information service, there is no other cloud service vendor who could provide us with the same level of IT service.
Social Influence *Adapted from Venkatesh et al., 2003*	SI1. Some of our clients have already used cloud service.
	SI2. Some of our suppliers have already used cloud service.
	SI3. Some of our leading peers have already used cloud service.

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