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An integrative framework of comparing SaaS adoption for core and non-core business operations: An empirical study on Hong Kong industries

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Abstract Software as a Service (SaaS), which offers the possibility to cover both core and non-core business operations of a company, has profoundly transformed traditional outsourcing approaches. As SaaS represents promising solutions for a variety of business processes, it is important to identify a theoretical framework to evaluate SaaS adoption for these two types of operations. We propose an integrative framework to evaluate SaaS adoption by including four perspectives–economic savings, strategic influences, management attitudes toward ownership and vendor's service quality; and formulate hypotheses to predict the difference in SaaS adoption for core and non-core business operations. We validate our framework using data from 269 companies across different industries in Hong Kong. The results support the integrative framework. Perceived cost advantage has a positive influence on SaaS adoption for non-core business operations, whereas a gap in IT capabilities has a positive influence on SaaS adoption for core business operations. Furthermore, perceived service quality has a positive influence, and management attitude toward ownership and control has a negative influence on SaaS adoption for both types of operations.

Keywords SaaS adoption · Core business operations · Non-core business operations · Hong Kong industries

1 Introduction

What influences IT adoption for core and non-core business functions has been the subject of much debate (Goo et al. 2007; McIvor 2000; Feeny and Willcocks 1998). Alexander and Young (1996) classified core business operations as daily operations that generate major value for the business, activities that are critical to business performance, activities that create a current or potential competitive advantage, and activities that drive the future growth, innovation, or rejuvenation of an enterprise. Based on this set of criteria, a trading company may view handling of logistics for its clients as one of its core business operations, whereas high-tech companies specializing in innovative product development may view research and design of innovative products as one of their core business operations.

Core business operations are critical to decision-making processes because they affect business performance, create competitive advantage, contribute to financial growth, and drive future growth, innovation, and rejuvenation (Alexander and Young 1996). Hence, each employee is responsible for imposing tight controls over the core business operations related to their positions and the relevant IT software. Moreover, a company may develop the IT software for its core business operations in house. In case its development is outsourced or third-party software is acquired, then implementation and operation of that software is under the full control of the acquiring company.

With the growth of the Internet and the expansion of infrastructure that facilitates the delivery of software through networks, Software as a Service (SaaS) can be deployed, managed, and remotely hosted by software applications through centrally located services in a rental or lease agreement over a network. This innovative arrangement has transformed traditional practices on IT outsourcing (Xu 2012; Benlian and Hess 2011; Fan et al. 2009; Kern et al. 2002; Currie and Seltsikas 2001). SaaS along with infrastructure as a service (IaaS) and platform as a service (PaaS), is considered to be an aspect of cloud computing, which stresses on-demand services with security control. SaaS is essentially an extension of the Application Service Provider (ASP) model launched in the late 1990s. ASP service providers could not share IT infrastructure

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and application code efficiently across their customers, as the ASP model was based on a single-tenant architecture. SaaS has emerged to address the technical limitations and economic shortcomings of ASP. It uses a multi-tenant architecture, which allows customers to share common code of a given application on the vendor's server (Cusumano 2010).

As SaaS providers manage their own applications in their own datacenters for multiple customers, the total cost of ownership is usually lower for SaaS than for traditional in-house arrangements (Benlian 2009; Bibi et al. 2012). The budget for implementing SaaS is predictable as SaaS providers use a pay-per-use or timely rental model to charge their customers. SaaS is also associated with on-demand scalability and a short implementation time. A number of sizeable enterprises, such as BASF and Levi's have signed short- and long-term contracts with SaaS providers (Kern and Kreijger 2001). Following this trend, more and more enterprises are considering rental software. According to the IDG News Service on March 27, 2012 (IDG News Service 2012), SaaS sales reached 12 billion US dollars in 2011 and were projected to increase by 18 % to $14.5 billion in 2012. The Gartner Group estimates that SaaS revenue will reach $22 billion in 2015, more than doubling the 2011 figure.

According to Ekanayaka et al. (2003), senior executives believe that a dedicated provider should be responsible for the information systems of core business operations given concerns about security, integration, customer service, reliability, availability, and scalability. Nowadays, SaaS providers are addressing these concerns and offer access to an immense array of applications including accounting, collaboration, customer relationship management (CRM), enterprise resource planning (ERP), invoicing, human resource management (HRM), content management (CM), and service desk management. In this regard, we are interested in two research questions. Can SaaS be used to support the non-core as well as the core business operations in a company? Are the determinants of SaaS adoption different when supporting non-core as compared with core business operations?

2 Literature review

We reviewed the literature according to the guidelines from Webster and Watson (2002). Using the keywords "software as a service", "application service provider", and "cloud sourcing", we identified 367 articles relevant to SaaS practices in the databases–IEEE Proceedings, Science Citation Index (Web of Science), Directory of Open Access Journals, ProQuest ABI/INFORM, ACM Digital Library, IEEE Periodicals, Social Science Citation Index, Emerald Management eJournals, Association for Computing Machinery, and SciVerse Science Direct (Elsevier). We restricted the search to peer-reviewed journals and high quality conference proceedings such as ICIS and ECIS, reducing the collection to 49 articles. Of these, we looked into the abstract of each article and found 17 articles relevant to this study. The discarded articles covered other aspects such as profits and sustainability of SaaS providers (e.g. Schlereth and Kihal 2013; Ge and Huang 2011), governance of SaaS services (e.g. Zainuddin 2012; Winkler and Benlian 2012), architectural design of SaaS (e.g. Chang et al. 2012; Zo et al. 2012), and end user adoption of SaaS (e.g. Bhattacherjee and Park 2013).

SaaS services differ from a traditional in-house arrangement in significant ways, including software ownership, location of servers, implementation cost, degree of automation, production function, legal responsibility, and contract length (Martens and Teuteberg 2012; Govindarajan and Lakshmanan 2010; Limam and Boutaba 2010; Dubey and Wagle 2007; Keller and Ludwig 2003). Sambamurthy et al. (2003) stated that SaaS advocates a paradigm shift in how organizations procure the necessary resources and competencies to respond effectively to the increasing market demand of e-business readiness. There have been numerous studies on the adoption of SaaS and its ancestor ASP (e.g., Lansing et al. 2013; Du et al. 2013; Benlian et al. 2012; Bibi et al. 2012; Martens and Teuteberg 2012; Xu 2012; Stuckenberg et al. 2011; Benlian 2011; Benlian and Hess 2011; Limbasan and Rusu 2011; Wu 2011; Limam and Boutaba 2010; Xin and Levina 2008; Choudhary 2007; Susarla et al. 2003; Jayatilaka et al. 2003; Kern et al. 2002).

The literature on SaaS adoption covers three broad areas: economic savings and strategic concerns, quality assurance and risk concerns, and application domains. In early 20's, Jayatilaka et al. (2003) investigated approximately 200 IT managers and developed a four-stage model for ASP adoption, incorporating transaction cost, resource dependence, and knowledge management for the decision process. With the development of SaaS, which is evolved from ASP, Loebbecke and Huyskens (2006) empirically found that strategic management factors, rather than transaction cost economic factors, are relevant to SaaS adoption. Similarly, Wu (2011) proved that the cost and benefits are essential factors for SaaS adoption. Bibi et al. (2012) highlighted that while on-site software development focuses on product customization as a means of market innovation, cloud-based development restricts customization to save the total cost of operations.

To study quality assurance and risk concerns, Choudhary (2007) theoretically compared the software quality of SaaS with traditional software. He found that the SaaS licensing model leads to greater investment in SaaS development under most conditions. This increased investment leads to higher software quality in equilibrium under SaaS compared to traditional software. Similarly, Fan et al. (2009) investigated the competition between SaaS and traditional software, finding that service operation costs may significantly affect an SaaS provider's ability to improve software quality. Limam and Boutaba (2010) developed a rating model for the assessment

of software service quality and trustworthiness. Recently, Benlian et al. (2012) developed an SaaSQual construct with six dimensions (reliability, features, responsiveness, flexibility, security, and rapport) to predict SaaS adoption in the US market and Du et al. (2013) developed a four dimension equivalent (ease of use, security, reliability, and responsiveness) for the China market. Upon the risks and opportunities of adopting SaaS, Benlian and Hess (2011) found that cost advantage and security risk are the dominant factors influencing IT executives' evaluation of SaaS adoption. Martens and Teuteberg (2012) deduced a mathematical decision model using cost and risk concerns for the selection of appropriate services offered by different SaaS providers. Along this vein, Lansing et al. (2013) indicated that cloud service certifications on quality assurances are necessary for SaaS adoption.

A number of studies have focused on application domains. Godse and Mulik (2009) used the Analytic Hierarchy Process (AHP) to select a SaaS provider. Limbasan and Rusu (2011) suggested how SaaS could help real estate companies with their customer relationship management. Stuckenberg et al. (2011) conducted three exploratory case studies of leading SaaS vendors and highlighted that SaaS vendors are working toward the compatibility with clients' business operations. Benlian (2011) showed that SaaS-based office suites such as Google Docs excel in the fulfillment of time-to-value and data recoverability compared with traditional office suites. Xu (2012) described how manufacturing can adopt cloud computing, which is a kind of SaaS. In educational institutions, Mousannif et al. (2013) described how private cloud would offer the teaching and learning platform for student, staff and lecturers. With this focus on SaaS adoption in different industrial domains and coverage of core business operations, no study has investigated the differences in SaaS adoption for core and non-core business operations.

3 Research framework

Our research framework, as shown in Fig. 1, is developed based on cost-benefit and risk evaluations, which are commonly examined in technology adoption (e.g. Benlian and Hess 2011; Martens and Teuteberg 2012). We include two cost-benefit evaluation factors: the cost advantage of adopting SaaS from an economic perspective, and the advantage of filling a gap in IT capability from a strategic perspective (Loebbecke and Huyskens 2006; Dubey and Wagle 2007). From the risk assessment literature, we adopt two major factors: service quality from the vendor perspective and management attitudes toward ownership and control (Limam and Boutaba. 2010; Fan et al. 2009; Choudhary 2007; Lee and Kim 1999; Grover et al. 1996). In this study, we assess the differential influences of the above four factors on SaaS adoption for core and non-core business operations.

Williamson (1981) addressed the make-or-buy decision in software development from an economic perspective by comparing the internal production cost with the transaction cost with external parties. Companies are more likely to outsource if there is a high level of perceived cost advantage in outsourcing over developing software internally (Smith and Kumar 2004; Ang and Straub 1998; Grover et al. 1996). IT outsourcing vendors have lower costs due to economies of scale and use templates to deploy applications cost-effectively among their clients (Lacity and Willcocks 1998; Cheon et al. 1995). SaaS adopters require less capital investment in IT hardware and software, do not need to hire as many IT professionals, and incur lower system maintenance costs (Shilpa and Gopal 2011; Dubey and Wagle 2007; Mertz et al. 2007).

SaaS uses a "rental" model that converts clients' fluctuating capital outflows into predictable operating outflows (Dubey and Wagle 2007). Clients either are charged directly for use or enter into a service agreement with fixed terms and conditions and a fixed charge structure with a SaaS vendor. Benlian (2009) stated that by converting capital outflows (purchase of software and infrastructure) into operating outflows (SaaS rent), SaaS adopters can enhance the restructuring of their IT budgets. Lower and predictable costs are the essential benefits of SaaS adoption and we predict that companies tend to adopt SaaS when the perceived cost advantage is high.

> H1a: The *perceived cost advantage* has a positive influence on SaaS adoption for non-core business operations.
> H1b: The *perceived cost advantage* has a positive influence on SaaS adoption for core business operations.

Pfeffer and Salancik (1978) stated that an outsourcing vendor's importance and discretion determine the degree to which an organization will depend on it. We expect that the perceived cost advantage will have a strong influence on SaaS adoption for non-core business operations, as these operations are less complex and more standardized. When considering SaaS for core business operations, SaaS adopters demand creditability, reliability, and technological sophistication from vendors. The cost advantage may thus not be an essential concern for SaaS adoption for core business operations. Accordingly, the perceived cost benefit may have a stronger influence on the intention of companies to adopt SaaS for non-core business operations than for core ones.

> H1c: The *perceived cost advantage* has a stronger influence on SaaS adoption for non-core business operations than for core operations.

From the strategic perspective, Loebbecke and Huyskens (2006), Jayatilaka et al. (2003) and Kern et al. (2002) used resource-based theory to explore the strategic effects of IT outsourcing. Internal resource requirements are evaluated against the external capabilities that would be obtained from the SaaS vendor. This fills the IT capability gap, which refers to

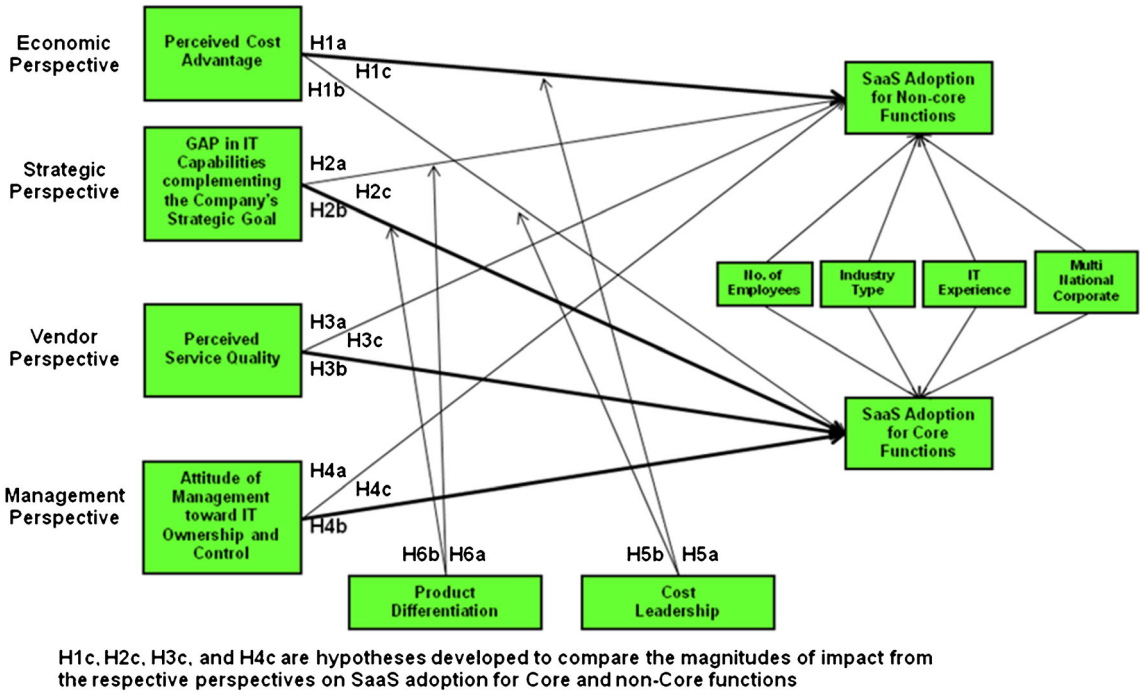

Fig. 1 SaaS adoption for core and non-core business operations

the difference between a company's and the SaaS vendor's IT resources, knowledge, and agility (Loebbecke and Huyskens 2006; Smith and Kumar 2004; Bennett and Timbrell 2000). The widely adopted construct "perceived gap in IT capabilities" measures how SaaS can meet a company's strategic IT support needs.

From the knowledge-based view, competitive advantage depends on a company's role in the development, deployment, and use of knowledge. Companies can enhance their competitive advantage by gaining strategic IT knowledge through the deployment of SaaS (Xin and Levina 2008; Jayatilaka et al. 2003). When internal IT departments are incapable of responding to the rapid changes in business and technological environments, SaaS vendors can provide companies with instant access to technical talent and up-to-date strategically agile technologies (Xin and Levina 2008; Loebbecke and Huyskens 2006; Smith and Kumar 2004; Jayatilaka et al. 2003; Chen and Soliman 2002; Bennett and Timbrell 2000). If SaaS vendors can quickly fulfill a company's internal IT deficiency and complement its strategic goal for competitive advantage, this company is likely to adopt SaaS for its business operations. In line with this idea, we propose the following hypotheses.

> H2a: The *perceived gap in IT capabilities* has a positive influence on SaaS adoption for non-core business operations.
> H2b: The perceived *gap in IT capabilities* has a positive influence on SaaS adoption for core business operations.

According to the resource-based view, a company achieves a competitive advantage by implementing strategies that exploit internal strengths, neutralize external threats, and avoid internal weaknesses (Barney 1991). When a company lacks the internal IT capability for its business, it can adopt SaaS to fill the gap. Jayatilaka et al. (2003) found that the strategic value of an application is one of the most significant factors influencing service provider adoption. In general, SaaS adoption for core business operations strengthens the competitive advantage of a company by meeting an IT deficiency in core business operations. The potential gain from meeting a deficiency in core business operation is considerably higher than that from meeting a deficiency in non-core operations. Thus, we put forward the following hypothesis.

> H2c: The *perceived gap in IT capabilities* has a stronger influence on SaaS adoption for core business operations than for non-core operations.

The service quality provided by the software vendor includes security, availability, reliability, customer service, and credibility (Du et al. 2013; Benlian et al. 2012; Limam and Boutaba 2010; Choudhary 2007; Ma et al. 2005; Smith and Kumar 2004; Pavlou and Gefen 2004; Jayatilaka et al. 2003). This is an essential factor from the vendor's perspective. Williamson (1991) and Lorange (1982) suggested that outsourcing failure is likely to happen when the service quality is poor. Service quality consideration is thus a risk concern for potential adopters. Grover et al. (1996) conducted a survey in the US with 188 valid respondents. The sample data proved that perceived service quality plays a critical role influencing the decision whether to outsource IT. The literature (e.g. Du et al. 2013; Benlian et al. 2012; Limam and Boutaba 2010;

Choudhary 2007) stated the importance of service quality of SaaS acceptance. Fan et al. (2009) showed that improving SaaS service quality is an essential factor for its sustainability. We thus propose that the perceived service quality is a critical factor influencing SaaS adoption.

> H3a: The *perceived service quality* has a positive influence on SaaS adoption for non-core business operations.
> H3b: The *perceived service quality* has a positive influence on SaaS adoption for core business operations.

Following the rationale as stated above, SaaS vendors have to offer good quality service to convince a company to adopt SaaS. While core business functions demand fault-free and seamless operations, the requirements for non-core business functions are less stringent. Thus, we believe that the effect of perceived service quality will have a stronger influence on SaaS adoption for core business operations than for non-core operations. We state this in the following hypothesis.

> H3c: The *perceived service quality* has a stronger influence on SaaS adoption for core business operations than for non-core operations.

From the management perspective, Lacity and Willcocks (1998) examined outsourcing risks and identified loss of control and dependency of IT assets as the main factors. Although SaaS vendors have a better security framework than ASP, many potential adopters still worry about its standard (Benlian and Hess 2011). In this regard, Lansing et al. (2013) indicated that cloud service certifications on quality assurances are necessary for SaaS adoption. Hence, we consider an important factor, the attitude of the management toward ownership and control (Langfield-Smith and Smith 2003; Das and Teng 2001; Lacity and Willcocks 1998; DiRomualdo and Gurbaxani 1998). Child and Warner (2003) argued that Asians may feel insecure if assets are not under their ownership and control. According to Redding (1995) and Whitley (1992), Chinese family businesses exhibit the tendency of family control, which is characterized by centralized decision-making and family-centered resource ownership. Given that SaaS is rental-based software, we propose that the attitude of the management toward ownership and control will have a negative influence on SaaS adoption. We exemplify this idea as follows.

> H4a: The *attitude of management toward IT ownership and control* has a negative influence on SaaS adoption for non-core business operations.
> H4b: The *attitude of management toward IT ownership and control* has a negative influence on SaaS adoption for core business operations.

Core business operations include all activities that generate major value for a business and thus critical to business performance. Distinct core business operations could create competitive advantages for a company and drive future growth, innovation, or rejuvenation of its business (Alexander and Young 1996). In this regard, core business operations are more important than non-core operations. Consequently, management has a higher desire to own and control core business operations than non-core ones. We expect this desire to extend to the related IT support and we formulate the following hypothesis.

> H4c: The *attitude of management toward IT ownership and control* has a stronger negative influence on SaaS adoption for core business operations than for non-core operations.

Grover et al. (1994) found that the relationship between the gap in IT resources and outsourcing is significantly moderated by a company's strategic type. Aubert et al. (2008) examined the relationship between a company's strategic profile and the decision to outsource IT services. They found that both prospectors and analyzers rely on outsourcing IT operations more than defenders do. In contrast, Teng et al. (1995) measured the strategic orientation of companies using Miles and Snow's (1978) typology, but did not find any relationship between strategic type and use of outsourcing. In this study, we examine two generic strategies from Porter (1980), cost leadership and product differentiation. Cost leadership refers to the strategic orientation of a company toward cutting operation and procurement costs. Product differentiation is the strategic orientation of a company toward product innovation, market exploration, and customer service (Porter 1980; Miles and Snow 1978). Along this vein, Heart et al. (2004) found that improvement in business performance and gains in competitive advantage influence service provider adoption. Companies with a strong strategic orientation toward cost leadership would tighten the positive relationship between the perceived cost advantage and the degree of SaaS adoption. Hence, we suggest the following hypotheses.

> H5a: Strategic orientation toward *cost leadership* moderates the relationship between the perceived cost advantage and SaaS adoption for non-core business operations.
> H5b: Strategic orientation toward *cost leadership* moderates the relationship between the perceived cost advantage and SaaS adoption for core business operations.

IT adoption could differentiate products or services, which adds value to a company (Wiseman 1988; Bakos and Treacy 1986; Porter and Millar 1985; McFarlan 1984). To handle increasingly complex product development, world-class SaaS vendors such as PTC, Unigraphics Solutions, and Dassault Systems offer web-based collaborative platforms for new product development (Mesihovic et al. 2004). Hence, we expect that companies with a strong strategic orientation toward product differentiation would adopt SaaS to fill the gap in IT capabilities for creation of differentiated products. Thus, we formulate the following hypotheses.

H6a: Strategic orientation toward *product differentiation* moderates the relationship between the gap in IT capabilities and SaaS adoption for non-core business operations.

H6b: Strategic orientation toward *product differentiation* moderates the relationship between the gap in IT capabilities and SaaS adoption for core business operations.

Previous studies on IS outsourcing and feedback from informed participants suggest a number of additional factors may influence SaaS adoption. These factors include company size, industry type, IT experience, and scope of business (multinational corporation or local one). As most informed participants are not willing to provide financial data on sales and profit, the number of employees in a company is used as a proxy for firm size.

4 Data collection and analysis

The measurement items in the survey were adapted from existing scales to meet the SaaS adoption context and operationalized in a manner that is similar to prior research. All items, except objective-based measures, were assessed using a 7-point Likert scale with scores ranging from 1 (highly disagree) to 7 (highly agree). Two MIS professors, a SaaS consultant, and five senior executives from potential SaaS adopters reviewed the questionnaire to ensure that all measurement items were clear. Table 1 summarizes the constructs we adapted in the questionnaire and highlights their sources.

We investigated organizations that were aware of and interested in adopting SaaS but had not yet adopted the service. The number of SaaS vendors in Hong Kong is still relatively low, and the percentage of current SaaS adopters could be significantly small. This study thus investigates companies that are not yet SaaS clients but intend to be so in the future. Potential SaaS adopters were selected from the trade and industry associations of Hong Kong (Table 2). Senior executives/CIOs, who are the decision-makers for IT management, were considered the key informants.

We started to carry out the survey on October 1, 2009. Two thousand companies were selected at random from the member lists of trade and industrial associations. Duplications due to overlaps in membership were removed to ensure 2,000 different companies. These companies were contacted by telephone to screen for companies that were aware of and interested in adopting SaaS. We informed the target respondents in writing of the upcoming survey. One week later, we delivered the questionnaire with a cover letter explaining the importance and objectives of the survey, the definition of SaaS, and the classification of core and non-core business operations according to Alexander and Young (1996). The cover letter listed our contact information including phone number and email address for any enquiries. To achieve a good response rate, the respondents could return the questionnaire via e-mail, regular mail, or facsimile. We informed the target respondents that we would distribute the results of the survey to them (Dillman 2000). To expedite the gathering of responses, two reminders were emailed to non-responding companies on October 15 and October 31, 2009. The importance of their responses and of the survey were briefly mentioned in both reminders. According to Dillman (2000), using different media will help motivate respondents to cooperate. We thus made repeated contact by telephone with non-respondents, from 2 weeks after the second reminder until the survey finished on January 1, 2010. 315 questionnaires were returned, garnering a response rate of 15.8 %. This is comparable with most mail surveys in IS studies, which have a range in response rates of 12.2 % to 22.4 % (Dekleva 1992; Loch et al. 1992; Raymond et al. 1995; Falconer and Hodgett 1999)

Among the 315 respondents, 30 indicated that they are current SaaS clients. Since the factors that determine the intention to adopt SaaS may differ from non-adopters to adopters, the 30 respondents from the current SaaS clients were omitted from the analysis. The usable samples that remained totaled to 285. In addition, 16 questionnaires were found to have a definite pattern in their answers and were thus excluded. The final usable sample size was 269 as reflected in Table 3.

In order to test for the non-respondent bias, the extrapolation method was used (Churchill 1991; Hartman et al. 1985). As suggested by Compeau and Higgins (1995), the midpoint in the

Table 1 Descriptive statistics and reliability

Construct number of items[a]	Source of references
SaaS adoption for non-core functions (ANC) 5 items	Ang and Straub (1998)
SaaS adoption for core functions (AC) 5 items	Ang and Straub (1998)
Filling the gap in IT capabilities (GAP) 5 items	Jayatilaka et al. (2003), Chen and Soliman (2002) and Grover et al. (1994)
Perceived service quality (PSQ) 5 items	Pavlou and Gefen (2004), Ganesan (1994) and Anderson and Narus (1990)
Perceived cost advantage (PCA) 4 items	Smith and Kumar (2004), Ekanayaka et al. (2003) and Jayatilaka et al. (2003)
Attitude of management toward ownership and control (O&C) 5 items	Langfield-Smith and Smith (2003) and Das and Teng (2001)
Cost leadership (CL) 3 items	Porter (1980) and Miles and Snow (1978)
Product differentiation (PD) 3 items	Porter (1980) and Miles and Snow (1978)

[a] Please refers to Table 4 for details of each item

Table 2 Trade and industrial associations in Hong Kong

Trade and industrial associations	Number of members
Hong Kong General Chamber of Commerce	4,000
Federation of Hong Kong Industries	2,500
The Chinese Manufacturers' Association of Hong Kong	3,600
The Chinese General Chamber of Commerce	6,000
Hong Kong Chamber of Commerce in China-Guangdong	900
The Hong Kong Association of International Co-operation of Small & Medium Enterprises	300
Hong Kong (SME) Economic and Trade Promotional Association	120
The Hong Kong Chamber of Small and Medium Business Limited	1,000
Hong Kong Small and Medium Enterprises Association	900
Hong Kong Metal Merchants Association	400
The Hong Kong Exporters' Association	700
The Hong Kong Printers Association	350
Hong Kong Auto Parts Industry Association	300
Hong Kong Toys Manufacturers Association	250
Hong Kong Young Industrialists Council	130
Hong Kong Procurement Professional Association	150
Hong Kong Plastic Machinery Association Ltd	150
Hong Kong Economic and Trade Association	600
Hong Kong Electrical Appliances Manufacturers Association	250
Hong Kong Electro-Plating Merchants Association	200
The Hong Kong Mould & Die Technology Association	220
Hong Kong Die-casting and Foundry Association	360
Hong Kong Critical Components Manufacturers Association	300
PRD Council	1,500
Junior Chamber International Hong Kong	1,500
Total	22,680

Table 3 Profile of respondents

	Category	Number	Percentage
Position	Top management	121	45.0 %
	Functional head	88	32.7 %
	IT head	60	22.3 %
Multi-national corporate	Yes	121	45.0 %
	No	148	55.0 %
Industry type	Manufacturing	142	52.8 %
	Service	127	47.2 %
Number of employees	< = 50	68	25.3 %
	51 to 100	60	22.3 %
	101 to 1,000	92	34.2 %
	>1,000	49	18.2 %
Annual sales revenue (HK$)	< = 10 M	14	5.2 %
	11 to 100 M	137	50.9 %
	101 M to 1B	96	35.7 %
	> 1B	22	8.2 %
Number of IT staff	< = 2	130	48.3 %
	3 to 5	75	27.9 %
	6 to 10	47	17.5 %
	>10	17	6.3 %
Skill level of IT staff	Inadequate	85	31.6 %
	Acceptable	118	43.9 %
	Competent	66	24.5 %

data collection period was used as the cutoff point to distinguish early respondents from late respondents. Respondents whose responses were returned by November 15, 2009 were classified as early respondents, whereas respondents who returned their responses after November 15, 2009 were classified as late respondents. Out of the 269 respondents, 114 (42 %) were classified as early respondents, whereas 155 (58 %) were classified as late respondents. The profiles of the early respondent and late respondent groups were examined, and their mean values were compared. No significant differences were found. Thus, we combined the early and late respondents' questionnaires for the subsequent analysis (Compeau and Higgins 1995). To assess the normal distribution and outliers of the data, we sketched the histograms and normal probability plots to examine the normality of all non-parametric variables. We checked for multivariate normality of the data, which were found to be normally distributed. Table 4 presents the items of the construct in the survey and their descriptive statistics.

The Cronbach's alpha values, which indicate the internal consistency of the multi-item scales of all the constructs (Table 4), are over 0.7. Hence, the result supports the reliability of the data. According to Fornell and Larcker (1981), the convergent validity of the measurement scales is evaluated using the following criteria: (i) all the indicator factor loadings should be significant and exceed 0.70, and (ii) the average variance extracted (AVE) for each construct should exceed the variance because of measurement errors for that construct (i.e., it should exceed 0.5). The factor loadings of the 29 items are shown in Table 5. All items, except PCA4 with a marginal value of 0.695 exhibit a loading value higher than 0.7 on their respective constructs. Hence, the acceptable item convergence on the intended construct is achieved. As shown in Table 6, the AVE values of the constructs are all greater than 0.5. Hence, both conditions for convergent validity are fulfilled.

The correlation matrix of the data enables the examination of all potentially overlapping constructs. Table 6 shows that the diagonal elements (the square root of the variance shared between a construct and its measures) are all higher than the correlations between target constructs without exceptions. This result suggests the discriminant validity of all the constructs in the current study (Fornell and Larcker 1981)

Table 4 Descriptive statistics pand reliability

Construct (Cronbach's alpha)		Mean[a]	Standard deviation
ANC	SaaS adoption for non-core functions (0.936)	4.88	1.122
ANC1	Our company is likely to use SaaS for non-core operations	4.48	1.167
ANC2	In the next 2 years, our company will be likely to use SaaS for non-core business operations	4.88	1.302
ANC3	In the next 5 years, our company will be likely to use SaaS for non-core business operations	5.62	1.318
ANC4	For any non-core operations that can be outsourced, our company will consider to use SaaS service	5.27	1.006
ANC5	On preparation of IT budget, our company will consider to use SaaS service for non-core operations	4.69	1.164
AC	SaaS adoption for core functions (0.950)	3.51	1.257
AC1	Our company is likely to use SaaS for core operations	3.15	1.327
AC2	In the next 2 years, our company will be likely to use SaaS for core business operations	3.57	1.401
AC3	In the next 5 years, our company will be likely to use SaaS for core business operations	4.06	1.451
AC4	For any core operations that can be outsourced, our company will consider to use SaaS service	4.17	1.262
AC5	On preparation of IT budget, our company will consider to use SaaS service for core operations	3.46	1.361
GAP	Filling the Gap in IT capabilities (0.926)	4.64	1.292
GAP1	Compensate our company's lack of resources in hardware and software	4.83	1.616
GAP2	Compensate our company's shortage of qualified IT professionals	4.74	1.604
GAP3	Compensate our company's insufficient IT investment	4.54	1.367
GAP4	Compensate our company's shortage of quick adaptation to IT technology change	4.58	1.523
GAP5	Fill the gap in IT resources and capabilities to facilitate business strategy	4.51	1.196
PSQ	Perceived service quality (0.910)	5.13	1.204
PSQ1	SaaS can provide proper and ease of use of application features to support our business operations	5.39	1.479
PSQ2	SaaS can provide high security for data exchange, data storage, data back-up, data restoration, and disaster recovery plan	5.33	1.585
PSQ3	SaaS can provide reliable, readily available, and scalable services	4.86	1.380
PSQ4	SaaS can provide responsive and flexible services to meet our company's needs	4.90	1.283
PSQ5	Credibility of SaaS vendor is good and trustful	5.15	1.265
PCA	Perceived cost advantage (0.879)	5.27	1.056
PCA1	Reduction in IT system purchasing cost compared with In-house Installation	5.48	1.280
PCA2	Reduction in the cost of hiring IT staff compared with In-house Installation	5.43	1.153
PCA3	Reduction in the cost of enhancing IT applications with SaaS vendors than with traditional In-house Installation	5.28	1.287
PCA4	Predictable cost in using SaaS vendor within the contract period of the Service Level Agreement	4.87	1.209
O&C	Attitude of management toward ownership and control (0.893)	4.70	1.065
O&C1	Prefer to maintain ownership and control of IT system	4.42	1.352
O&C2	Prefer to maintain ownership and control of IT professionals	4.52	1.306
O&C3	Prefer to maintain ownership and control of IT applications revision update	4.22	1.169
O&C4	Prefer to maintain ownership and control of data processing	4.63	1.328
O&C5	Prefer to maintain ownership and control of data security	5.68	1.198
CL	Cost leadership (0.792)	5.12	0.796
CL1	Our company focuses more on cost competition	5.04	1.050
CL2	Our company focuses more on resource efficiency and process improvements that cut operation costs	5.11	0.907
CL3	Our company focuses more on vendor sourcing and supplier management that cut procurement costs	5.20	0.874
PD	Product differentiation (0.791)	4.78	0.781
PD1	Our company focuses more on product differentiation	4.60	0.899
PD2	Our company is more likely to take risk in product innovation and market exploration	4.64	0.942
PD3	Our company focuses more on customer service to create difference from competitors	5.10	0.947

[a] All of the above constructs were assessed using a 7-point Likert scale with scores ranging from 1 (highly disagree) to 7 (highly agree)

To test for common method bias, we applied the Harman's single factor test (Podsakoff et al. 2003). The results of the total variance obtained from the exploratory factor analysis indicate that no single factor, with the dominant value of 34.5 %, accounts for most of the covariances. Moreover, we also applied Marker Variable Technique to examine the effect of

Table 5 Exploratory factor analysis

Variable	Factors–dependent variables		Factors–independent variables			
GAP1	.210	.143	.865	.098	−.167	.095
GAP2	.075	.129	.865	.085	−.157	.142
GAP3	.040	.190	.857	.028	−.087	.094
GAP4	.040	.085	.811	.148	.087	.190
GAP5	.108	.195	.824	.233	−.115	.006
PSQ1	.284	.243	.098	.731	−.197	.119
PSQ2	.272	.252	.063	.763	.041	.186
PSQ3	.137	.100	.258	.802	−.074	.138
PSQ4	.138	.146	.047	.782	−.198	.230
PSQ5	.133	.146	.159	.844	−.051	.179
PCA1	.365	.084	.163	.161	−.133	.747
PCA2	.347	.144	.159	.235	−.028	.782
PCA3	.360	.166	.107	.253	.031	.733
PCA4	.221	−.162	.175	.247	.002	.695
O&C1	−.056	−.263	−.078	−.101	.773	−.136
O&C2	−.121	−.091	−.239	−.072	.796	−.123
O&C3	−.028	−.247	.006	−.108	.799	.010
O&C4	−.129	−.232	−.046	−.089	.794	.023
O&C5	−.175	−.252	−.070	−.022	.802	.087
ANC1	.845	−.183	.109	.236	−.088	.188
ANC2	.874	−.114	.048	.246	−.140	.209
ANC3	.871	−.094	.020	.177	−.131	.280
ANC4	.720	.083	.164	.099	−.138	.233
ANC5	.841	.011	.109	.117	−.047	.173
AC1	−.100	.808	.177	.199	−.236	.150
AC2	−.047	.856	.168	.268	−.289	.061
AC3	−.068	.825	.174	.210	−.314	.017
AC4	−.014	.847	.088	.109	−.244	−.051
AC5	−.034	.825	.252	.102	−.195	.0470
Eigenvalues	9.991	5.034	2.892	2.362	1.352	1.064
% of variance	34.45 %	17.36 %	9.97 %	8.15 %	4.66 %	3.67 %

common method variance on structural relationships (Williams et al. 2010; Malhotra et al. 2006). Consequently, we applied partial least squares (PLS) with and without the marker. Table 7 lists the path coefficients on SaaS Adoption for non-core and core business operations. The analysis shows no obvious difference between the path coefficients with and without the marker. Hence, common method bias is not a concern in the current study.

We used PLS to analyze the data. PLS involves a nonparametric approach to evaluate relationships within, the variance of which is explained by a structural equation model (Gefen et al. 2000). PLS is particularly useful for our study because it is robust to relatively small sample sizes and data with non-normal distribution (Chin 1998). Figure 2 and Table 8 report the path coefficients of the structural equation model in the present study and highlight the nature of the interrelation using PLS. Table 8 also shows that the R^2 values of SaaS adoption for non-core and core business operations are 0.443 and 0.474, respectively. Our analysis indicates that perceived cost advantage (β=0.483**), perceived service quality (β=0.148**), and management attitude toward ownership and control (β=−0.115**) have a significant influence on SaaS adoption for non-core operations, and thus supports hypotheses H1a, H3a, and H4a. In line with this result, the gap in IT capabilities (β=0.255**), perceived service quality (β=0.192**), and management attitude toward ownership and control (β=−0.413**) have a significant influence on SaaS adoption for core business operations, thus the result validates hypotheses H2b, H3b, and H4b.

Moreover, our result reveals the presence of a moderating effect of cost leadership on the relationship between perceived cost advantage and SaaS adoption for non-core operations (β=0.113**). Thus, hypothesis H5a is valid. The moderating effect of product differentiation on the relationship between

Table 6 Correlation matrix

		AVE	1	2	3	4	5	6	7	8
1	GAP	0.780	0.883							
2	PSQ	0.741	0.351[b]	0.861						
3	PCA	0.737	0.365[b]	0.537[b]	0.858					
4	O&C	0.703	−0.267[b]	−0.294[b]	−0.174[b]	0.838				
5	ANC	0.798	0.275[b]	0.446[b]	0.535[b]	−0.271[b]	0.893			
6	AC	0.833	0.294[b]	0.394[b]	0.203[b]	−0.501[b]	0.134[a]	0.913		
7	CL	0.684	0.432[b]	0.318[b]	0.486[b]	−0.109	0.405[b]	0.127[a]	0.827	
8	PD	0.529	0.169[b]	0.274[b]	0.022	−0.044	0.044	0.063	0.179[b]	0.727

[a] Correlation is significant at the 0.05 level (2-tailed)

[b] Correlation is significant at the 0.01 level (2-tailed)

the gap in IT capabilities and SaaS adoption for core business operations is also supported ($\beta = 0.214^{*}$) as proposed in hypothesis H6b. In contrast, the interaction effects of PCA*CL on AC and GAP*PD on ANC are not significant. Hence, the two hypotheses (H5b and H6a) are not supported.

Table 8 and Fig. 2 also indicate that both the perceived service quality and attitude of management toward ownership and control are significant common factors influencing SaaS adoption for core and non-core business operations. In this connection, we compared the magnitude of the regression coefficients using the slope test according to Cohen (1988). This was done by subtracting SaaS adoption for core operations (AC) with the expected value of SaaS adoption for non-core operations ($\tilde{\text{ANC}}$) based on the influence of the perceived service quality. The equation in calculating the AC–$\tilde{\text{ANC}}$ is as follows:

$$AC - \tilde{\text{ANC}} = \text{b} + \text{b}_1 * GAP + \text{b}_2 * PSQ + \text{b}_3 * PCA + \text{b}_4 * \text{O\&C}.$$

Subsequently, we tested whether the slope of the derived difference versus perceived service quality is significantly different from 0. Our analysis, as shown in Table 9, indicates that there is no significant difference between the two path coefficients; hence, H3c is not supported.

Furthermore, the path coefficients of the attitude of management toward ownership and control of SaaS adoption for core and non-core business operations as indicated in Table 8 and Fig. 2 are -0.413^{**} and -0.115^{**} respectively. To compare the magnitudes of the regression coefficients, we tested the slope of the derived difference versus the attitude of management toward ownership and control is significantly different from 0. As revealed in Table 9, a significant difference exists between the two path coefficients ($\beta = -0.222^{***}$); thus, H4c is validated.

To collect more qualitative inputs for the three hypotheses, which were not supported in the survey, in-depth follow-up interviews were conducted in October 2010 with senior executives who are either CEO or IT director and are capable to decide on the IT arrangement in their company. Through the business relationship from our second author, we contacted with three typical companies, which are good representatives of Hong Kong industries: trading, food distribution, and manufacturing. Each interview lasted for about an hour. The structure of the interview was similarly to our questionnaire, but the interviewees were prompted for reasons behind their answers. For each company, the whole interview was recorded and secondary data including company publications and annual reports were collected for analysis and validation (Easterby-Smith et al. 2002). In analyzing the interviews, the recordings were replayed and every independent aspect mentioned by each interviewee was highlighted. Table 10 summarizes the comments explaining their essential concerns on SaaS adoption.

5 Discussion and findings

By adopting SaaS, a company can reduce the cost of developing and maintaining an IT system and hiring an IT staff (Dubey and Wagle 2007; Smith and Kumar 2004; Jayatilaka et al. 2003). With reference to the transaction cost theory, Williamson (1981) believed that companies are more likely to outsource if the relative cost advantage is high. Our findings suggest that perceived cost advantage would induce SaaS adoption for non-core operations only. Its influence on SaaS adoption for core operations is not supported. Consequently, perceived cost advantage could have a stronger influence on the intention to adopt SaaS for non-core operations compared with the intention for core operations. Moreover, a company may consider other issues other than cost reduction when they adopt SaaS for their core business operations.

Xin and Levina (2008), and Dubey and Wagle (2007) identified that SaaS adoption will fulfill the internal need for IT resources in terms of capabilities, critical resources, and time constraints. Furthermore, the gap in IT capabilities has a positive influence on SaaS adoption for core operations, but they do not have any significant influence on SaaS adoption for non-core operations. In this regard, our in-depth interviews with Company A and Company B as reported in Table 10 demonstrate that functional fitness, ease of use, availability of service, service quality, and scalability are the major reasons for SaaS adoption for core operations, not cost reduction.

Table 7 Marker variable analysis

Variable	Path coefficients on ANC		Path coefficients on AC	
	Without marker	Marker	Without marker	Marker
PCA	0.483**	0.488**	−0.031	−0.036
GAP	−0.056	−0.062	0.255**	0.253**
PSQ	0.148**	0.142**	0.192**	0.195**
O&C	−0.115**	−0.120**	−0.413**	−0.416**
CL*PCA	0.113**	0.114**	−0.012	−0.010
PC*GAP	−0.079	−0.078	0.214*	0.212*

Table 8 PLS analysis

Variable	SaaS adoption	
	Non-core functions	Core functions
Control variables		
Industry type	0.035	−0.087
Multi-national corporate	−0.003	−0.056
No. of employees	0.070	−0.202**
No. of IT staff	−0.018	0.071
Experience of IT staff	0.021	0.040
Skill level of IT staff	−0.025	0.105
Annual sales revenue	0.056	−0.024
Main effects		
GAP	−0.056	0.255**
PSQ	0.148**	0.192**
PCA	0.483**	−0.031
O&C	−0.115**	−0.413**
Interactions		
PCA*CL	0.113**	−0.012
GAP*PD	−0.079	0.214*
Model information		
R^2	0.443	0.474

*p <0.05, **p <0.025

Various research studies (e.g., Aulbach et al. 2009; Godse and Mulik 2009; Xin and Levina 2008) have regarded that the quality of data security, reliability, availability, scalability, and functionality of SaaS are important criteria for SaaS adoption. Similarly, the perceived service quality of SaaS vendors has a positive influence on SaaS adoption for core and non-core business operations. Relatively, perceived service quality would be a stronger driving force for SaaS adoption for core business operations than for non-core operations. As Table 10 shows, Company A and Company C view service quality as essential for all kinds of outsourcing activities including core and non-core business operations. In addition, service quality affects the decision making of vendor selection. Company B considers service quality to be a key issue for the selection of service providers. Company C even stated that data security is crucial for the decision on SaaS adoption for core business operations.

Asian culture might have molded the attitude of management toward IT ownership and control (Redding 1995; Whitley 1992) and this consequently affects SaaS adoption (Poon and Yu 2006; Child and Warner 2003). In general,

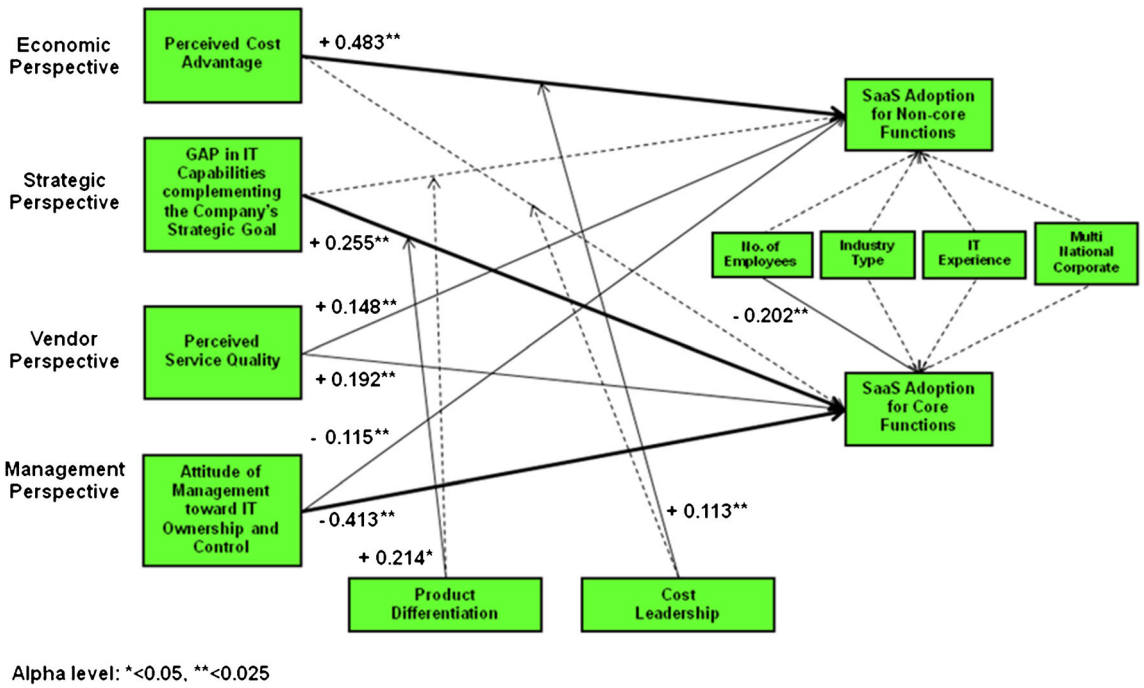

Fig. 2 Empirical findings on SaaS adoption for core and non-core business operations

Table 9 Multivariate analysis on AC–AÑC

Control variable	Path coefficients AC-expected(ANC)
Industry type	−0.072
Multi-national corporate	−0.091
No. of employees	−0.085
No. of IT staff	−0.146
Experience of IT staff	0.008
Skill level of IT staff	0.149
Annual sales revenue	0.018
Main effects	
GAP	0.091
PSQ	0.072
PCA	−0.337***
O&C	−0.222***

#<0.1, *<0.05, **<0.01 and ***<0.001

ethnic Chinese business owners are believed to possess traditional thinking with regard to the purchase, ownership, and control of IT assets and business functions. This belief coincides with our findings that the attitude of management toward IT ownership and control is an inhibiting factor to SaaS adoption for both core and non-core business operations. Furthermore, the attitude of the management toward IT ownership and control will have a more negative influence on the intention to adopt SaaS for core business operations than that for non-core operations.

Aubert and Croteau (2005) emphasized the necessity of scrutinizing the adoption of IT outsourcing in the context of business strategies. Our findings indicate that cost leadership will positively moderate the relationship of perceived cost advantage and the SaaS adoption for non-core operations but not for core ones. In contrast, a company with strategic orientation toward product differentiation typically looks to gain competitive advantage through product innovation and/or brand marketing, rather than through efficiency. If SaaS vendors can assist a company in enhancing its product differentiation, this may persuade the top management of the company to adopt SaaS to address the gap in IT capabilities. Our results show that strategic orientation toward product differentiation will positively moderate the relationship between perceived gap in IT capability and SaaS adoption for core business operations only.

6 Implications to theory

The transaction cost, agency cost, resource-based, and resource dependence theories are critical theories, which should serve as basis for the formulation of the IT outsourcing framework. This integrative perspective drive us to investigate SaaS adoption using a holistic approach. Moreover, we differentiated the

Table 10 Follow-up interviews

Company	Findings from follow-up interviews
Company A • A local trading company with less than 100 staff; the company has 2 IT staff	• Cost reduction is important in our business strategy. However, it is not a major factor influencing our decision on SaaS adoption for core operations. Fitness of functions, ease of use, and availability of services are more important than cost advantage. • Service quality is important for all kinds of outsourcing activities.
Company B • A multinational food distribution company with less than 1,000 staff; the company has 6 IT staff	• Our company does not consider cost reduction as an essential factor for SaaS adoption, especially on core business operations. For SaaS adoption, our company is looking for a robust system with appropriate functionality and good vendor service (i.e., rapid response and flexible towards SaaS customization). Moreover, the scalability of the SaaS is important. • Service quality is a key consideration in selection of service providers, including both core and non-core business operations. • Our company prefers to develop and operate IT applications internally as we have a strong IT department, which can handle the development of most standard business functions at a reasonable cost especially in the non-core operations. In this regard, we are not interested to adopt SaaS for non-core operations.
Company C • A multinational manufacturing company with over 3,000 staff; the company has more than 10 IT staff with competent skill set	• Our company has a strong IT team to support our business operations effectively. System and data security, but certainly not cost reduction, are our major concerns when we consider adopting SaaS, especially for core business operations. We also suspect there would be many other hidden costs for SaaS adoption, which cannot be foreseeable. • In the procurement of external services, including SaaS adoption, our company has internal policy to regulate the decision making process. For the vendor selection and evaluation, service quality is an essential factor.

SaaS adoption decisions for core and non-core business operations. Owing to the different roles of core and non-core business operations (Alexander and Young 1996), we predicted and verified the respective determinants for SaaS adoption. In particular, perceived cost advantage has a significant influence on SaaS adoption for the non-core operations. From transaction cost theory, it is interesting to explore further specific factors such as asset specificity on SaaS adoption.

Moreover, the gap in IT capability is important to SaaS adoption for core business operations. With resource dependency theory (Pfeffer and Salancik 1978), it is worthwhile to conduct further research on the concentration and diversity of resources in the environment (i.e., the service types and variety of applications offered by the SaaS). Other important concerns are munificence of the resources (i.e., the number of vendors in the market) and the interconnectedness between the organization and the environment (i.e., the ease of engaging the SaaS by defining contractual terms on service license agreements). It will also be important to know how these factors affect SaaS adoption for core operations.

7 Implications to practice

Although prior studies have suggested that companies should consider a series of determinants when outsourcing an application (Grover et al. 1996; Lacity et al. 2009), the features of SaaS such as online delivery, predictable monthly fees, and a contract with flexible timeframe, dramatically alter IT outsourcing concerns. The present study highlights the special nature of SaaS and draws attention to the factors that affect SaaS adoption. In particular, SaaS adopters could refer to our findings to understand the relative importance of the four determinants when adopting SaaS for core or non-core business operations. Similar to IT outsourcing, SaaS is cost effective for most of the non-core operations.

Moreover, SaaS vendors could rely on our findings for their marketing approach to potential SaaS adopters. If a potential client is oriented toward cost leadership, it is favorable for SaaS vendors to convince the client to adopt SaaS for non-core operations. In contrast, if the client tends toward product differentiation, this client will likely consider SaaS adoption for its core business operations to address the gap in IT capabilities. In general, our findings indicate that SaaS vendors should enhance their service quality and enable their clients a high control over their SaaS.

8 Limitations and conclusion

The present study has some limitations, which should lead to future investigations in SaaS adoption. First, SaaS is in the emerging stage. Even though many companies are aware of the SaaS trend, only a minority has adopted SaaS. This fact illustrates why our study could not include the relationship between SaaS adoption (behavioral intention) and actual behavior (actual usage). Second, based on the situation of Hong Kong, most companies have a small EDP department. Therefore, as shown in Table 3, 48.3 % respondents have one or two IT staff in their company, which is significantly lower than the ratio of developed regions such as Singapore, USA, and Europe. Thus, our findings are limited to the special situation in Hong Kong. Nevertheless, our findings are of high importance to identify underlying factors of SaaS adoption for core and non-core business operations.

Over the last decade, the SaaS market has experienced rapid growth and has played an important role in technology services. The contribution of this study is to investigate SaaS adoption from four different aspects (economic savings, strategic impact, vendor's service quality and management attitude) using the constructs perceived cost advantage, gap in IT capabilities, perceived service quality, and management attitude on control and ownership. Evidently, perceived cost advantage will have a positive influence on SaaS adoption for non-core operations, whereas gap in IT capabilities will have a positive influence on SaaS adoption for core operations. On one hand, perceived service quality has a positive influence on SaaS adoption for both core and non-core operations. On the other hand, management attitude toward ownership and control will hinder SaaS adoption for both core and non-core operations. In anticipation of the new vista for SaaS adoption, the findings of this research can provide potential SaaS adopters relevant insights. In the current dynamic market, clients need to manage their resources efficiently to maintain their competitive strategy. SaaS is an emerging and growing technological service. Therefore, to reach extensive adoption of companies in Hong Kong and around the world, SaaS vendors have to be aware of the requirements of clients to understand the determinants for SaaS adoption and thus, provide the services required effectively.

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