Performance effects of IT capability, service process innovation, and the mediating role of customer service

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ABSTRACT

Few academic studies have investigated how information technology (IT) capability and service process innovation can create performance gains for firms through customer service. We propose that customer service is a significant mediator through which IT capability and service process innovation influence the performance of a firm, and that IT capability is also a critical factor that facilitates service process innovation. Empirical support for our argument was derived from data collected from 174 firms in the Taiwan IT industry. The results suggest that managerial initiatives should be directed at developing IT capability and service process innovation and leveraging them to facilitate customer service to attain superior firm performance. Furthermore, greater IT capability would lead to a higher degree of service process innovation.

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Introduction

The impact of information technology (IT) on firm performance is best measured through intermediate-level contributions such as marketing and operations effectiveness. This has been the subject of considerable interest among information system (IS) research, marketing academics, and practitioners, spurred by the original work of Sambamurthy et al. (2003). Due to the ever-increasing importance of customer service in customer satisfaction and loyalty, a number of IS – customer relationship management (CRM) research scholars (e.g., Albert et al., 2004; Lankton and Wilson, 2007; Luo and Seyedian, 2003; Mithas et al., 2005; Jayachandran et al., 2005) have begun to examine how to identify and use IT to manage customer service activities. At the same time, special attention has been...
given to electronic CRM (e-CRM; Jukic et al., 2002; Pan and Lee, 2003). This increased emphasis on IT may enable firms to change the way they interact and coordinate practices with customers, reflecting an appropriate implementation of IT. This, in turn, could create more competitive services and serve as a strategic resource that facilitates major changes in competitive behavior, marketing, and customer service. Nonetheless, there is limited empirical research on how customer service may lead to superior firm performance and how IT may be exploited to facilitate customer service (Levenburg and Klein, 2006). Thus the relationships among these factors remain incomplete and unclear. Furthermore, the fundamental elements of customer service are not well understood. Thus, this article fills this void by applying a resource-based view (RBV) to investigate the effects of IT capability on firm performance due to the intervening role of customer service.

The demands of customers concerning the quality and innovativeness of products and services put firms under pressure. Together with the rising pressure to reduce service costs, this may require firms to redesign their organizational structure. One possible solution is to focus service innovation practices on the processes of service delivery. While many essential service processes that support customer service are invisible to firms, understanding how innovative service processes can facilitate competitive customer service is essential to attain superior firm performance. Despite substantial IS-CRM and e-CRM research on IT applications for customer service, there is a lack of studies demonstrating the potential benefits and pitfalls of service innovation practices. In particular, there is little information on the roles and contribution of service process innovation in managing and facilitating customer service. Furthermore, from the RBV, to maintain a competitive advantage, it is imperative for firms to possess rare and valuable resources (Barney, 1991). Interacting with customers is critical for firms to share resources and capabilities and develop new products/services, which in turn lead to competitive customer service. Firms should understand that customer value can be generated by (re)designing or innovatively utilizing resources and capabilities that may be embedded in service processes. Accordingly, developing a deeper understanding of service process innovation is but one of many challenges facing firms that attempt to redesign service processes and develop innovative service delivery methods.

Our approach examining how IT capability and service process innovation impact firm performance via customer service is consistent with the research of Brynjolfsson et al. (2000), who studied information technology, organizational transformation, and business performance. This suggests complementarity between the factors of organizational structure and IT, indicating that firm performance is greatest when both IT and organizational structure are emphasized. We consider service innovation a type of organizational structure and a crucial factor that affects firm performance. Although there is a wealth of evidence indicating a positive relationship between innovation and firm performance (e.g., Akgün et al., 2009; Fallah and Lechler, 2008; Irwin et al., 1998), specific analyses on the relationship between service process innovation and firm performance are still relatively rare. In this respect, we argue that IT capability and service process innovation support customer service activities, and therefore the impacts of these factors on firm performance should be assessed where the customer service effect is expected to be realized. In addition, we examine the relationship between IT capability and service process innovation.

Our research is based on Brynjolfsson et al.’s (2000) suggestion and was motivated by a desire to demonstrate from a service-orientation perspective how IT capability (i.e., IT factor) and service process innovation (i.e., organizational factor) enable customer service to yield gains in performance, and how IT capability enables service process innovation. Specifically, we addressed the following questions: How does IT capability impact customer service and service process innovation? How does service process innovation enable customer service? What are the performance consequences of IT-enabled and service process innovation-enabled customer service for firms? The remainder of the paper is organized as follows. In the sections Literature review and Model hypotheses, we synthesize research constructs from a literature review and develop hypotheses. In the section Research methodology, we present our research methodology and describe how the constructs developed in the section Literature review were operationalized into a survey instrument used to survey 174 IT managers in Taiwan. Statistical analyses of the data are presented in the section Data analysis and results. The paper concludes with a discussion of the findings as well as directions for future research in the section Discussion and conclusions.
Literature review

An examination of the literature revealed that little has been published on the possible relationships among IT capability, customer service, service process innovation, and firm performance in the IT industry. We based our approach on the assumption that we could increase understanding of the interactions among these factors by applying the RBV as well as new empirical data from our survey and analysis of 174 IT firms. Fig. 1 depicts the research model. IT capability can be leveraged to develop customer service and service process innovation, which are important to firm performance. Further, service process helps facilitate customer service.

IT capability

IT capability is the capacity to control IT-related costs, deliver systems when needed, and affect business objectives via IT implementation (Ross et al., 1996). It has been examined from multiple perspectives, such as how it relates to work design, process transformation, power relationships, and coordination (Mulligan, 2002), and some studies have examined IT capability from the RBV (e.g., Bharadwaj, 2000; Han et al., 2008; Tyler, 2001). Building on the RBV of diversification, firms with value, rareness, inimitability, and non-substitutability resources may gain a competitive advantage. Thus, IT may be viewed as a resource that leads to a competitive advantage that translates into superior performance (Zhang, 2005). This would suggest that unique resources cannot be easily duplicated, and will be used to develop IT capability. Further, building on resource-advantage (R-A) theory's (Hunt and Morgan, 1995) notion of basic resources (typically human, organizational, informational, and relational) and higher-order resources, Madhavaram and Hunt (2008) proposed a hierarchy of basic, composite (e.g., resource A+resource B+resource C=composite operant resource D), and interconnected (e.g., A × B, A × C, B × C, and/or A × B × C on each other and on desired outcomes) operant resources. Because capabilities and/or competences are operant resources that bundle basic resources (Hunt, 2000), we proposed that IT capability is a hierarchy of “composite operant resources” (COR). COR can be formatively measured, and the lower-order resources that combine to become the COR can be either tangible or intangible (Madhavaram and Hunt, 2008). Therefore, IT capability can have as many dimensions as the number of distinct IT-related resources.

However, to develop a set of dimensions for the IT capability construct, it is important to focus on IT-related resources that are likely to lead to IT capability. Taking this stand, we identified several streams of pertinent research, which provided the basis for establishing our construct of IT capability derived from the RBV. Key contributions came from Bassellier et al. (2003), Bharadwaj (2000), Bhatt and Grover (2005), and Ross et al. (1996). For example, Ross et al. (1996) posited that IT capability depends on the status of three types of IT assets, including IT human resources, technical assets, and the IT relationship. They regarded IT capability as the ability to manage these three IT assets to deploy

![Fig. 1. Research model.](image-url)
IT to meet strategic objectives. Bharadwaj (2000) modified this categorization and classified firm-specific IT resources as IT infrastructure, IT human resources, and IT-enabled intangibles. This view has received much support in the IT literature. To this extent, Bhatt and Grover (2005) further identified competitive, dynamic, and value capabilities as three distinct types of IT capability. Regarding competitive capability, they suggested that better IT business experience and IT relationship resources enhance the competitive advantage of firms. In addition, Bassellier et al. (2003) defined IT competence of business managers as their experience with IT and in managing IT projects.

We integrated these studies and R-A theory’s notion of basic resources to develop a greater scope of IT capability built on four critical IT-based resources: IT infrastructure, IT business experience, IT relationship resources, and IT human resources. More specifically, our concepts of IT infrastructure and IT human resources are based on Ross et al. (1996) and Bharadwaj (2000); that of IT business experience is based on Bhatt and Grover (2005) and Bassellier et al. (2003); and that of IT relationship resources is based on Ross et al. (1996) and Bhatt and Grover (2005). These resources are heterogeneously distributed across firms, and their presence or absence may explain the differential scope of IT capabilities and outcomes.

**IT infrastructure.** IT infrastructure provides the foundation for firms to deliver business applications and services, share information across different functions, and respond to changes in business strategy. Keen (1991) defined IT infrastructure in terms of its “reach” and “range.” Whereas reach determines the locations a platform can access and to which it can link (i.e., hardware), range defines the kind of information that can be seamlessly and automatically shared across systems and services (i.e., software). Thus, two types of IT infrastructure that are especially relevant for building IT capability are hard and soft infrastructure, referring to the set of general hardware and software (Bharadwaj, 2000; Ross et al., 1996; Weill and Broadbent, 1998).

**IT business experience.** IT business experience gives a firm the ability to integrate IT strategy and business strategy (Sambamurthy and Zmud, 1997). When a firm solves problems through IT, it facilitates the development of IT knowledge and competence of IT staff. In addition, we adopted Bhatt and Grover’s (2005) conceptualization of business experience and extended it to include IT staff’s understanding of business. That is, IT staff with higher technical skills and superior knowledge in business operations and strategies would have a better understanding of business advantage.

**IT relationship resources.** Relationship resources are the firm’s ability to incorporate IT functions into business units and exploit IT resources. The stronger the relationship between IT and business unit management, the more effective those IT resources will be. Karimi et al. (2007) indicated that relationship resources facilitate the free flow of information, allowing the firm to transform and exploit information; a cooperative IT–business relationship, in turn, enables knowledge or information dissemination throughout the organization. In addition, IT leads to the decentralization of organizational decision making (Malone, 1997), and supports employees with greater responsibilities and empowered roles (Psinoos et al., 2000). In the context of building IT capability, knowledge dissemination and trust building require building relationship resources, which can be accomplished by IT groups and business unit involvement in implementation (Karimi et al., 2007).

**IT human resources.** IT human resources are a key component of the IT asset base, and represent a strategic organizational resource and a significant organizational capability. To identify the key dimensions of IT human resources, this study includes two critical dimensions based on Grant’s (1991) classification scheme, namely technical IT skills (e.g., competencies in emerging technologies) and managerial IT skills (e.g., the effective management of IS functions). This categorization is commonly used when measuring IT human resources from the RBV perspective (e.g., Bharadwaj, 2000; Ross et al., 1996). More specifically, we focused these resources on the ability of IT staff to use (new) IT (Ross et al., 1996). Firms with these capabilities can enable organizational changes and achieve greater organizational effectiveness (Roepke, 2000).

**Customer service**

An increased emphasis on customer service has emerged as a key driver for IS priorities (Negash et al., 2003) and a strategic imperative for most firms (Reichheld and Sasser, 1990). Customer service, which is associated with the delivery of a tangible/digital product, shares attributes with trade and
professional services. In this study, we view customer service as a type of customer solution, or a customized and integrated combination of goods and services for meeting a customer’s business needs (Tuli et al., 2007). This definition highlights two key dimensions in which customer solutions can be categorized: the degree of integration and the degree of customization (Sawhney, 2006). From the integration perspective, services and products are the solutions (in marketing and operational terms) that are delivered using an integrated services platform. From the customization perspective, the value of a solution derives from the fact that it is customized to the contexts of specific customer segments, namely, for the customers’ specific needs and context. As mentioned above, to provide a more in-depth examination and discussion, the value of integration and customization represent the difference between the “whole” (the value of the solution) and the “sum of the parts” (the value of component products and services). The RBV is a useful tool when discussing value creation. It views a firm as a bundle of resources and emphasizes the joint creation and exploitation of resources by the client and the provider. Based on RBV and a customer solution perspective, we illustrated the classification of customer service in two key dimensions: service delivery and service customization.

Service delivery. Resources (i.e., assets and capabilities; Wade and Hulland, 2004) are used to perform the actual work of delivering a service. A firm’s ability to deliver targeted levels of quality, speed, customization, and cost for given resource levels depends on both how much work is done ahead of demand and how the firm allows customers to tap into its resources (Chopra and Lariviere, 2005). Here, service delivery refers to a firm’s ability to assemble final elements and deliver services/products (i.e., firm’s goods) to the customer (Zeithaml et al., 1988). To provide quality and efficient delivery services, an organization must examine the various aspects of service delivery. In addition to the traditional format (face-to-face), companies are using voice-to-voice (toll-free telephone support) and bit-to-bit (online service delivery) modes, as well as combinations thereof (Wiertz et al., 2004). From an IT management perspective, Pavlovski (2007) illustrated the key components essential to a service delivery platform, which consists of transport functions (e.g., protocol gateways, messaging gateways, and network element nodes), access control (e.g., quality of service), core functions (e.g., service menu, registration for services, and maintaining personal profiles), and integration services (e.g., Web service gateway, download managers, and content repositories). From a service management perspective, service delivery may be regarded as a service profit chain, which encompasses the linkages among organizational features, employee attitudes, service quality, customer responses, and financial outcomes (Dean, 2004).

Service customization. Pine et al. (1995) described customization as a learning relationship between the organization and its customers that results in a direct response to a particular customer’s needs and preferences over time. Accordingly, service customization refers to a firm’s ability to tailor products and services that more precisely fit the individual customer’s needs (Chen and Ching, 2004), and capability to rely on customer segmentation based on that customer’s preference information (Liang and Tanniru, 2006). In addition, service customization requires integrating the customer into the process of designing the service. For example, Cao et al. (2006) developed an interactive service customization model to support individual service for customers. They argued that the service activities were customized dynamically according to the customer’s requirements. The service providers could integrate the knowledge of a specific customer into the model to provide customized products or services to the customer.

Service process innovation

Bitner et al. (2008) indicated that the service process can be viewed as a chain or constellation of activities that allow the service to function effectively. It is also the existence of the customer within the production process (Silvestro et al., 1992). Most studies of service processes have focused on resources1 as the key factor in service design (Chopra and Lariviere, 2005). However, without the customer, service processes cannot take place (Krishnan et al., 1999), because they require customer interaction with the production of the service provider. According to this view, Fließ and Kleinaltenkamp (2004) distinguished service processes in four ways: (1) they should be characteristic

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1 Here, we refer to operant resources (e.g., customer knowledge and information).
for innovative services where neither the customer nor the service provider has the knowledge to
direct the service process; (2) the customer has a knowledge advantage to direct the service process
and therefore the service outcome; (3) the service provider knows more than the customer does
regarding how, where, and when the customer will participate in the service operating system; (4) the
customer and service provider know exactly how to deliver the service. Thus, developing innovative
service processes requires changing not only the service process itself but also the design of the
servicescape and service encounters (Hill et al., 2002).

Model hypotheses

IT capability, service process innovation, and customer service

The RBV asserts the potential of resources and capabilities to create economic value by enabling
firms to create and implement strategies (Barney, 2002). Most research in strategic IT has traditionally
focused on the ability of IT to add economic value to a firm by differentiating its products or services
(e.g., Porter and Millar, 1985). With the implementation of IT (e.g., CRM system), organizations can
offer their customers a variety of products, lower prices, and personalized service (Karakostas et al.,
2005). Moreover, to meet the increasing customer demand for more diverse product/service offerings,
and to develop customized or personalized products/services, firms are adopting relevant
technologies to customize their services (Pine, 1993). For example, Dell Computers has an extensive
CRM system that tracks its customers and transactions and helps customers configure computers to fit
their needs (Orman, 2007). Other technologies, such as data warehouses and data mining techniques,
also allow individual customer behavior and characteristics to be traced and analyzed, which make
customization more feasible (Kalakota and Robinson, 2001). It seems that IT could help to enhance and
support service operations by increasing convenience, collecting service performance information for
management use, and offering extra services. Thus, we postulate that IT capability would have a
positive and significant effect on customer service.

**H1.** Firms with a higher degree of IT capability will have better customer service.

Innovation requires a great variety of resources and a departure from existing technology and
practices (McDermott and O’Connor, 2002); a firm can achieve innovation using its technology
resources, knowledge, and relationship network (Chapman and Soosay, 2003). Firms with more IT
resources should have a high degree of innovation. Firms take advantage of IT in designing or
modifying new service processes (Avlonitis et al., 2001), such as using Web services for customer
information inquiry and consultation, enriching multi-channel purchasing features, and enhancing
after-sale services. Firms with greater service process innovation often require using IT applications to
analyze and identify customer needs and preferences. Hence, IT plays an even more critical role in the
provision of innovative service processes. For example, Cisco Systems processes a large percentage of
its orders online, and continuously provides innovative services. Because most new service processes
developed and provided by Cisco rely heavily on the use of IT systems, Cisco’s IT applications have
greater effects on service process innovation compared to many other firms. Therefore, we suggest that
IT capability has positive and significant effects on service process innovation.

**H2.** Firms with a higher degree of IT capability will have better service process innovation.

According to the RBV, innovation resources may influence a firm’s ability to create value that will
transform the way customers interact with service offerings. Innovation in service process can be
viewed as a service-logic innovation\(^2\) that is a customer-oriented term (Michel et al., 2008). Service
process innovation requires changes in customer thinking, participation, and capabilities to create and
realize value (Michel et al., 2008). Once firms have information about customers' needs, requirements,
and behavior, customer service practices are often initiated by service process redesign. Therefore,
new service processes should involve both the input of prospective customers and the active

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\(^2\) Michel et al. (2008) indicate that “all innovation, whether a service process or a tangible product, should be viewed as a
service-logic innovation”.

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cooperation of the firms that will ultimately be delivering the customer service. Further, when customer requirements are identified, new service processes that are needed to meet these needs are defined and customer service is undertaken. Customer service requirements are determined by developing innovation practices of service processes. Through this activity, firms have found that customers value constant feedback about customer service practices. Firms can thus identify information about customers, such as their individual preferences, and develop the supporting innovation resources necessary to meet their expectations. Thus, the input of business resources and output of service process redesign can be used by firms to facilitate customer service practices. Accordingly, we propose the following hypothesis.

**H3.** Firms with a higher degree of service process innovation will have better customer service.

**Customer service and firm performance**

The RBV states that firms can achieve superior performance by owning and deploying resources and capabilities (Barney, 1991). From a service delivery perspective, empirical research supports the notion that superior service delivery has a positive impact on performance in terms of sales growth, return on assets (ROA), market share gain, and overall competitive position (Tracey and Tan, 2001). A better service delivery helps a firm differentiate its offerings, extract more business from existing customers, and attract new customers, which in turn leads to improved financial performance. Furthermore, from a customization practices perspective, firms implement customization practices to effectively improve performance (Rabinovich et al., 2003). Similarly, Ghosh et al. (2006) indicated that companies that take customization practices seriously provide a better match between their offerings and customer needs and preferences, foster customer loyalty, and increase profit. For example, Dell Computers quickly customizes products to an individual customer to enhance performance in efficiency, satisfaction, and profit. Thus, customization is an important factor determining customer satisfaction (Fornell et al., 1996). We propose that the implementation of customer service practices is a possible determinant of firm performance. Hence, we hypothesize the following.

**H4.** Firms with a higher degree of customer service will perform better.

**The mediating role of customer service**

Previous RBV studies have argued that resources and capabilities will have a direct effect on business performance. The basic assumption is that firms should have the ability to effectively make use of their resources and capabilities to further increase their performance. Whereas IT resources enable firms to gain benefits in the IT–performance relationship, IT capability involves the exchange and transfer of information and/or resources from the project to the organizational level. The implementation of customer service projects should interact with technological resources to promote IT capability and convert into favorable performance. For example, customer service practices can integrate technological resources and capabilities into service forms such as the creation of new products or services to attain superior performance. Furthermore, technological resources can be well adapted to customer–oriented settings in information gathering and retrieval, human skills training and idea generation, repositories for organizational knowledge, and infrastructure building. We propose that customer service converts IT capability to support service operations that achieve performance. According to the RBV, when firms take advantage of such resources effectively, they are more inclined to be effective and efficient and to achieve favorable performance. Based on these arguments, customer service acts as an intermediate variable to mediate the relationship between IT capability and firm performance. IT capability will affect firm performance but will do so primarily through the mediating influence of customer service.

Further, service process innovation improves firm performance by reducing costs or improving quality or operations effectiveness and efficiency (Tushman and Nadler, 1986). According to the RBV, the expected output of the service process innovation is enhanced competitiveness and/or improved
firm performance. However, not all innovations may necessarily have a direct impact on performance (Orfila-Sintes and Mattsson, 2009). They may have an indirect or lagged impact that it is difficult to measure. Therefore, innovation practices may impact firm performance through mediators. In fact, firms utilize new service processes to introduce new service operations, improve delivery process effectiveness and efficiency, and realize favorable innovation outcomes and performance. It follows that firms that constantly innovate service processes would improve firm performance by excelling at utilizing new service delivery methods and/or new customization practices and enhancing customer satisfaction to fulfill the constantly changing needs of their customers. Accordingly, we argue that service process innovation will affect customer service and that customer service will, in turn, positively affect firm performance.

Thus, we argue that IT capability and service process innovation will affect firm performance via customer service. We propose the following hypotheses.

**H5.** Customer service mediates the influence of IT capability on firm performance.

**H6.** Customer service mediates the influence of service process innovation on firm performance.

**Research methodology**

**Measures and scale development**

The structured questionnaire was generated based on academic- and practitioner-oriented literature. Following the suggestions of Churchill (1979), we adopted, modified, and extended existing scales. We conducted in-depth pilot interviews with 5 academic domain experts and 10 executives, including chief information officers, chief technology officers, and business managers who were knowledgeable about the IT organizations of their firms. We asked them to complete the questionnaire and indicate any ambiguity regarding the phrasing of the items. During follow-up interviews, we invited these participants to provide suggestions for improving the questionnaire. After this pretest, we and our colleagues further refined the phrasing of some items to produce the final version of the questionnaire. The data were secured by means of a four-page self-administered questionnaire as part of a wider examination of IT capability, service process innovation, service delivery, service customization, and firm performance. Information was gathered using a five-point Likert-type scale that ranged from (1) “strongly disagree” to (5) “strongly agree” (see Appendix A).

**Independent variables.** We developed an integrated measurement scheme for IT capability. As discussed in the literature review, this study identified four formative first-order dimensions for the IT capability construct, by IT infrastructure (ITI), IT business experience (ITBE), IT relationship resources (ITRR), and IT human resources (ITHR). IT infrastructure was measured using two items that focus on the investment of common hardware and software (Bharadwaj, 2000; Ross et al., 1996; Weill and Broadbent, 1998). IT business experience was measured using four items, two of which are based on the fact that IT staff are knowledgeable about business strategy and procedure; the other two, which were adopted and modified from Sambamurthy and Zmud (1997), emphasize IT applications and strategy that can be aligned with business strategy. IT relationship resources were measured using four items that focus on the relationship between IT and business units (e.g., IT function interacts and integrates with the business units, and business units use IT resources to support employees in their empowered roles). IT human resources were measured using three items drawn from Ross et al. (1996) that focus on IT employee competencies in emerging technologies (e.g., building bridges between old IT systems and new ones, delivering data across locations and applications, and recognizing opportunities to apply new technologies as they become available). Service process innovation (SPI) was adopted and modified mainly from Davenport and Short (1990) and Zeithaml et al. (1988), and included five items, namely post-service, information inquiry, marketing campaign, purchasing, and new service development.

**Mediating variable.** Customer service was measured with two reflective first-order constructs, by service delivery (SD) and service customization (SC). Service delivery was mainly adopted and modified from Wouters (2004), with three items, namely, delivery reliability (e.g., deliver services or
products on time), quality of deliveries (e.g., offer quality to satisfy customer’s needs), and commercial flexibility (e.g., shorten the transaction process to reduce customer’s waiting time). Service customization was measured using four items: use personal preference information to create customized products for individual customers, provide services matched with different customers’ needs, have highly flexible manufacturing integration capability to facilitate the response to customers’ demands, and be tailor-made for different types of customers. These items were an adaptation of Glazer (1991) and an extension of Liang and Tanniru (2006), Pine (1993), and Pine et al. (1995).

Dependent variable. Firm performance (FP) is a complex and multidimensional construct (Dvir et al., 1993). Because of the typical unwillingness to share actual performance data, and the difficulty of creating valid measures of firm performance, we followed Moorman and Rust’s (1999) approach and collected managers’ subjective perceptions of performance. Previous studies have found a strong correlation between subjective assessments and their objective counterparts (Moorman and Rust, 1999). In our study, we asked managers to rate firm performance relative to their firm’s stated objectives. The subjective performance measures focused on three domains (Moorman and Rust, 1999). Firm financial performance reflects the firm’s perceived profitability (Venkatraman and Ramanujam, 1987) and market performance (e.g., market share) (Kaplan and Norton, 1996). Customer relationship performance refers to the firm’s perceived ability to satisfy and retain customers (e.g., customer satisfaction and customer loyalty (Evans and Laskin, 1994)) by offering quality products and services. Finally, new product success in general assesses the firm’s perceived financial performance, speed, and creativity of new product/service development. Here, we referred to the firm’s perceived business brand and image (e.g., Aaker, 1991; Biel, 1992) by offering new products and services.

Control variables. Firm size can influence firm performance (Zhou et al., 2005). Larger firms, with their larger operating budgets, technology base, and resources, are generally able to develop better customer service practices. In addition, larger firms have more resources that can lead to differences in relative firm performance. This study controlled for firm size by taking the logarithm of the firm’s number of employees. In addition, firm capital may have a positive effect on sales growth (Florin et al., 2003). Firms that are able to accumulate more funds and resources can better afford to grow fast (Chandler and Hanks, 1994), which, in turn, may lead to superior performance. Therefore, we included firm capital as a control variable. Firm age may influence performance (Baum et al., 2000). Established firms may have a first-mover advantage in obtaining sustained superior performance (Barney, 1991) or, alternatively, startups could enhance their initial performance by forming alliances with established rivals that provide access to diverse information, capabilities with minimum operational costs, more opportunities for learning, and less risk of intra-alliance rivalry (Baum et al., 2000). Therefore, we included firm age as a control variable and measured it as the number of years the firm has been established.

Sample and data collection

Data were collected from a sample of 827 IT firms in Taiwan, drawn from “Top 5,000 – The Largest Corporations in Taiwan,” published by the Taiwan Credit Information Center. We chose the IT industry for this study primarily for three reasons. First, as Patrakov and Olson (2007) noted, the industry has had a great influence on global business, which relies heavily on IT to offer and innovate products and services, and conduct business in new ways. Second, as market competition grows more intense, the role of customer service becomes more critical for IT firms, because most IT product life cycles are short (and growing shorter). Third, the industry is one of the largest in Taiwan, and a number of Taiwan IT firms are well known worldwide as global supply chain operators. Thus, we feel that surveying Taiwan IT firms may provide more valuable insights for a global audience. The key target respondents for the survey were IT managers because we were concerned about “IT-based resources,” particularly with regard to IT capability, and they were best positioned to answer questions related to technology management and innovation practices and their effects on firm performance. The questionnaire was accompanied by a cover letter explaining the purpose of the research and assuring respondents that answers would remain confidential. We indicated that we would provide a summary of the survey
results, and a gift certificate, after receiving their responses. Three weeks after the initial mailing, we received a total of 74 responses. Telephone calls were subsequently made to IT managers of firms that did not reply to the questionnaire. This effort increased the total responses to 174 (via return mail, e-mail, and fax). The effective response rate was 21%, which is acceptable for survey research.

To examine non-response bias, following Armstrong and Overton (1977), we compared the early and late respondents. The first mailing was classified as early (n=74), while the follow-up contacts were considered late (n=100). The independent-sample t tests revealed no statistically significant differences between the two groups in terms of capital (t=1.94, p=.06), years established (t=0.63, p=.56), the percentage of IT spending to annual revenue (t=0.74, p=.45), the percentage of new products/services revenue to annual revenue (t=0.52, p=.61), or number of employees (t=0.83, p=.42). The analysis indicated that the two groups were statistically similar on all demographics. Early and late respondents were also compared using a chi-square test, and again no significant differences

### Table 1
Demographics of the sample firms.

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<th>Variable</th>
<th>Category</th>
<th>N</th>
<th>Rate (%)</th>
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<tbody>
<tr>
<td>Years since established</td>
<td>Less than 3 years</td>
<td>1</td>
<td>.6</td>
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<td></td>
<td>3–5 years</td>
<td>14</td>
<td>8.0</td>
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<td>6–10 years</td>
<td>50</td>
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<td>11–15 years</td>
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<td>16–20 years</td>
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<td>Over 20 years</td>
<td>45</td>
<td>25.9</td>
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<td></td>
<td>Aggregate</td>
<td>174</td>
<td>100.0</td>
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<td>Firm capital (1 US dollar = 32.5 NT dollars)</td>
<td>Less than USD 3.1 millions</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>USD 3.1–3.9 millions</td>
<td>110</td>
<td>63.2</td>
</tr>
<tr>
<td></td>
<td>USD 3.1–9.3 millions</td>
<td>35</td>
<td>20.1</td>
</tr>
<tr>
<td></td>
<td>USD 9.3–15.5 millions</td>
<td>11</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>USD 15.5–31.0 millions</td>
<td>11</td>
<td>6.3</td>
</tr>
<tr>
<td></td>
<td>Over USD 31.0 millions</td>
<td>2</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>Aggregate</td>
<td>174</td>
<td>100.0</td>
</tr>
<tr>
<td>% of IT (software, hardware, and staff) spending comparing to annual revenue</td>
<td>Less than 1%</td>
<td>61</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>1–3%</td>
<td>62</td>
<td>35.6</td>
</tr>
<tr>
<td></td>
<td>3–5%</td>
<td>29</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>5–10%</td>
<td>16</td>
<td>9.2</td>
</tr>
<tr>
<td></td>
<td>10–30%</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>Over 30%</td>
<td>1</td>
<td>.6</td>
</tr>
<tr>
<td></td>
<td>Aggregate</td>
<td>174</td>
<td>100.0</td>
</tr>
<tr>
<td>% of new products/services revenue to annual revenue</td>
<td>Less than 5%</td>
<td>45</td>
<td>25.9</td>
</tr>
<tr>
<td></td>
<td>6–10%</td>
<td>44</td>
<td>25.3</td>
</tr>
<tr>
<td></td>
<td>11–19%</td>
<td>22</td>
<td>12.6</td>
</tr>
<tr>
<td></td>
<td>20–29%</td>
<td>29</td>
<td>16.7</td>
</tr>
<tr>
<td></td>
<td>30–50%</td>
<td>26</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>Over 50%</td>
<td>8</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td>Aggregate</td>
<td>174</td>
<td>100.0</td>
</tr>
<tr>
<td># of employees</td>
<td>Less than 100</td>
<td>34</td>
<td>19.5</td>
</tr>
<tr>
<td></td>
<td>100–500</td>
<td>93</td>
<td>53.4</td>
</tr>
<tr>
<td></td>
<td>500–1000</td>
<td>25</td>
<td>14.4</td>
</tr>
<tr>
<td></td>
<td>1000–2000</td>
<td>12</td>
<td>6.9</td>
</tr>
<tr>
<td></td>
<td>2000–3000</td>
<td>4</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>Over 3000</td>
<td>6</td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>Aggregate</td>
<td>174</td>
<td>100.0</td>
</tr>
<tr>
<td>Sectors of IT industry</td>
<td>Electronic devices and Semiconductors</td>
<td>79</td>
<td>45.4</td>
</tr>
<tr>
<td></td>
<td>Computers and Peripheries</td>
<td>58</td>
<td>33.4</td>
</tr>
<tr>
<td></td>
<td>Telecommunications</td>
<td>37</td>
<td>21.2</td>
</tr>
<tr>
<td></td>
<td>Aggregate</td>
<td>174</td>
<td>100.0</td>
</tr>
</tbody>
</table>
were found. Because the data were self-reported, we used Harmon’s one-factor test to examine whether a common-method bias was present. The items used to measure the dependent and independent variables were entered into a single exploratory factor analysis. The results did not suggest a common-method bias, because a single factor did not emerge, nor did one factor account for most of the variance. The demographics of the firms surveyed are shown in Table 1. Among them, 28.7% had been established 6–10 years at the time of the survey, 63.2% had annual earnings of USD$3.1–31 million, 35.6% had an IT spending-to-revenue ratio of 1–3%, 25.9% had a new products/services-to-revenue ratio of less than 5%, and 53.4% had 100–500 employees. In addition, the sample represented a wide range of IT firms, involved in the following sectors: electronic devices and semiconductors (79 companies, or 45.4% of sample); computers and peripheries (58, 33.4%); and telecommunications (37, 21.2%).

Data analysis and results

Partial least squares (PLS) analysis was chosen as the most appropriate technique for analyzing our model. The analysis, including significance tests for path coefficients, was performed using PLS-Graph 3.0 (Chin, 2001). Our choice of PLS was guided by four considerations: (1) Its ability to model latent constructs as formative or reflective. Patnayakuni et al. (2007) suggested that constructs are modeled as formative if the direction of causality is from indicators to constructs; indicators do not have to co-vary or be interchangeable and the nomological net of indicators can differ. In contrast, if the opposite conditions apply, they are modeled as reflective. Thus, items within a formative scale are not expected to correlate. In our research model, two second-order constructs of IT capability are modeled as formative while customer service is modeled as reflective. Two first-order constructs (SPI and FP) are considered reflective. (2) Its ability to assess the psychometric properties of the constructs (the measurement model) within its theoretical context (the structural model). (3) Its ability to support the hierarchical component approach for modeling second-order factors in which the second-order factor is measured using the first-order factor scores as manifest indicators of the second-order construct (Karimi et al., 2007). (4) Its ability to examine a relatively small sample size (Chin et al., 1996) (N=174 firms). The analyses were conducted in two stages. First, the measurement model was tested to ensure that the constructs had sufficient psychometric validity; this was followed by an assessment of the structural model in which the hypotheses were tested. A bootstrap resampling procedure was conducted and coefficients were estimated.

Measurement properties

After data collection, measures were subjected to a purification process to assess their construct reliability, convergent validity, and discriminant validity. No unidirectional path was specified among any latent variables. The Cronbach alpha values ranged from 0.71 to 0.94 for the eight constructs that exceeded the .7 threshold (Nunnally, 1978), indicating high internal consistency of measure reliability. Likewise, the composite reliabilities for all measures were high, ranging from 0.81 to 0.95. Accordingly, as seen in Table 2, convergent validity was assessed by reviewing the item loadings. All factor loadings of the indicators for each underlying construct were significant. Further, we examined the item total correlations for these constructs (see Table 3). The correlation pattern indicated that every item had a stronger correlation with its construct than another construct. Additionally, all of the values of average variance extracted (AVE), the ratio of construct variance to the total variance among indicators, were above the recommended threshold of .50 (Barclay et al., 1995), proving the convergent validity of each construct. The discriminant validity of the measures was assessed by examining the correlations between measures with potentially overlapping constructs. As shown in Table 4, the main constructs were more strongly correlated with their own measures than with any of the other constructs. The values of the square root of the AVE (reported on the diagonal) were all greater than the construct correlations (the off-diagonal) (Fornell and Larcker, 1981). The validity of all constructs and their indicators was also supported by the above tests. Therefore, discriminant validity was confirmed.
First-order versus second-order factor models of IT capability and customer service

We tested the first-order and second-order factor models of IT capability and customer service to assess how each factor may account for the observed firm performance. We investigated how each IT resource affects each aspect of customer service, and the resultant combined effect on firm performance. As shown in Fig. 2, Model A hypothesizes four independent first-order factors of IT capability (ITI, ITBE, ITRR, and ITHR) and two first-order factors of customer service (SD and SC). In Fig. 3, Model B hypothesizes IT capability and customer service as two second-order factors where IT capability is formed by four first-order factors and customer service is treated as a reflective factor. Consequently, the structural links among IT capability, customer service, and firm performance (Model B) is positive and significant. However, in Model A, only ITBE has significant impacts on SD and SC. The results for each first-order factor model are presented in Table 5. Collectively, these results identify IT capability and customer service as second-order constructs. These findings indicate that ITBE can act as an independent variable with a significant association with SD and SC, but most importantly, reinforces the notion that service operations need to be integrated (i.e., customer service) and their effects may be contingent on the combination of the four IT resources.

Table 2
Results of measurement properties.

<table>
<thead>
<tr>
<th>Construct name</th>
<th>Items</th>
<th>Factor loading</th>
<th>Cronbach alpha</th>
<th>Composite reliability ($\rho_c$)</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT infrastructure (ITI)</td>
<td>ITI1, ITI2</td>
<td>0.93</td>
<td>.87</td>
<td>0.93</td>
<td>0.88</td>
</tr>
<tr>
<td>IT business experience (ITBE)</td>
<td>ITBE1, ITBE2, ITBE3, ITBE4</td>
<td>0.75, 0.76, 0.71, 0.69</td>
<td>.71</td>
<td>0.82</td>
<td>0.53</td>
</tr>
<tr>
<td>IT relationship resources (ITRR)</td>
<td>ITRR1, ITRR2, ITRR3, ITRR4</td>
<td>0.73, 0.81, 0.77, 0.67</td>
<td>.73</td>
<td>0.83</td>
<td>0.56</td>
</tr>
<tr>
<td>IT human resources (ITHR)</td>
<td>ITHR1, ITHR2, ITHR3</td>
<td>0.91, 0.94, 0.85</td>
<td>.89</td>
<td>0.93</td>
<td>0.82</td>
</tr>
<tr>
<td>Service process innovation (SPI)</td>
<td>SPI1, SPI2, SPI3, SPI4, SPI5</td>
<td>0.74, 0.71, 0.78, 0.83, 0.85</td>
<td>.88</td>
<td>0.89</td>
<td>0.62</td>
</tr>
<tr>
<td>Service delivery (SD)</td>
<td>SD1, SD2, SD3</td>
<td>0.87, 0.85, 0.88</td>
<td>.85</td>
<td>0.90</td>
<td>0.76</td>
</tr>
<tr>
<td>Service customization (SC)</td>
<td>SC1, SC2, SC3, SC4</td>
<td>0.80, 0.78, 0.60, 0.67</td>
<td>.82</td>
<td>0.81</td>
<td>0.52</td>
</tr>
<tr>
<td>Firm performance (FP)</td>
<td>FP1, FP2, FP3, FP4, FP5</td>
<td>0.90, 0.93, 0.91, 0.90, 0.86</td>
<td>.94</td>
<td>0.95</td>
<td>0.81</td>
</tr>
</tbody>
</table>
Table 3
Item-construct correlation.

<table>
<thead>
<tr>
<th>Items</th>
<th>Constructs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ITI</td>
</tr>
<tr>
<td>ITI1</td>
<td>.937**</td>
</tr>
<tr>
<td>ITI2</td>
<td>.939**</td>
</tr>
<tr>
<td>ITBE1</td>
<td>.398</td>
</tr>
<tr>
<td>ITBE2</td>
<td>.292</td>
</tr>
<tr>
<td>ITBE3</td>
<td>.295</td>
</tr>
<tr>
<td>ITBE4</td>
<td>.273</td>
</tr>
<tr>
<td>ITRR1</td>
<td>.357</td>
</tr>
<tr>
<td>ITRR2</td>
<td>.392</td>
</tr>
<tr>
<td>ITRR3</td>
<td>.417</td>
</tr>
<tr>
<td>ITRR4</td>
<td>.284</td>
</tr>
<tr>
<td>ITHR1</td>
<td>.275</td>
</tr>
<tr>
<td>ITHR2</td>
<td>.308</td>
</tr>
<tr>
<td>ITHR3</td>
<td>.240</td>
</tr>
<tr>
<td>SPI1</td>
<td>.250</td>
</tr>
<tr>
<td>SPI2</td>
<td>.197</td>
</tr>
<tr>
<td>SPI3</td>
<td>.215</td>
</tr>
<tr>
<td>SPI4</td>
<td>.179</td>
</tr>
<tr>
<td>SPI5</td>
<td>.197</td>
</tr>
<tr>
<td>SD1</td>
<td>.211</td>
</tr>
<tr>
<td>SD2</td>
<td>.324</td>
</tr>
<tr>
<td>SD3</td>
<td>.299</td>
</tr>
<tr>
<td>SC1</td>
<td>.265</td>
</tr>
<tr>
<td>SC2</td>
<td>.383</td>
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<tr>
<td>SC3</td>
<td>.302</td>
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<tr>
<td>SC4</td>
<td>.181</td>
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<tr>
<td>FP1</td>
<td>.178</td>
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<td>FP2</td>
<td>.171</td>
</tr>
<tr>
<td>FP3</td>
<td>.220</td>
</tr>
<tr>
<td>FP4</td>
<td>.178</td>
</tr>
<tr>
<td>FP5</td>
<td>.178</td>
</tr>
</tbody>
</table>

*p < .001.

Structural model and hypothesis testing

Our structural model (Model C) is shown in Fig. 4. The results for the direct effects model are presented in Table 5. The path coefficients for the research constructs are expressed in a standardized form. The path between IT capability and customer service was positive and significant (β = 0.32, t = 4.91, p < .001), in support of Hypothesis 1. The effect of IT capability on service process innovation was positive and significant (β = 0.47, t = 8.21, p < .001), supporting Hypothesis 2. The effect of service

Table 4
Means, SD, skewness, kurtosis, and correlations (n=174).

<table>
<thead>
<tr>
<th>Construct</th>
<th>Mean</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis (1)</th>
<th>Kurtosis (2)</th>
<th>Kurtosis (3)</th>
<th>Kurtosis (4)</th>
<th>Kurtosis (5)</th>
<th>Kurtosis (6)</th>
<th>Kurtosis (7)</th>
<th>Kurtosis (8)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITI (1)</td>
<td>3.82</td>
<td>.76</td>
<td>−.385</td>
<td>−.018</td>
<td>.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITBE (2)</td>
<td>3.77</td>
<td>.53</td>
<td>−.424</td>
<td>.270</td>
<td>.41**</td>
<td>.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITRR (3)</td>
<td>3.60</td>
<td>.56</td>
<td>−.191</td>
<td>.174</td>
<td>.46**</td>
<td>.57**</td>
<td>.74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITHR (4)</td>
<td>3.34</td>
<td>.68</td>
<td>−.464</td>
<td>.985</td>
<td>.29**</td>
<td>.34**</td>
<td>.39**</td>
<td>.90</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPI (5)</td>
<td>3.33</td>
<td>.66</td>
<td>−.182</td>
<td>−.191</td>
<td>.22**</td>
<td>.42**</td>
<td>.45**</td>
<td>.28**</td>
<td>.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SD (6)</td>
<td>3.77</td>
<td>.69</td>
<td>−.568</td>
<td>.806</td>
<td>.30**</td>
<td>.38**</td>
<td>.37**</td>
<td>.24**</td>
<td>.53**</td>
<td>.87</td>
<td></td>
</tr>
<tr>
<td>SC (7)</td>
<td>3.79</td>
<td>.67</td>
<td>−.373</td>
<td>.672</td>
<td>.31**</td>
<td>.42**</td>
<td>.43**</td>
<td>.31**</td>
<td>.44**</td>
<td>.59**</td>
<td>.72</td>
</tr>
<tr>
<td>FP (8)</td>
<td>3.88</td>
<td>.69</td>
<td>−.624</td>
<td>1.545</td>
<td>.17**</td>
<td>.38**</td>
<td>.38**</td>
<td>.19**</td>
<td>.46**</td>
<td>.53**</td>
<td>.62**</td>
</tr>
</tbody>
</table>

Notes: Figures in diagonal are values of the square root of the AVE.

* p < .05.
** p < .01.
process innovation on customer service was positive and significant ($\beta=0.39$, $t=5.14$, $p<.001$), supporting Hypothesis 3. The effect of customer service on firm performance was positive and significant ($\beta=0.63$, $t=9.92$, $p<.001$), supporting Hypothesis 4. Although we controlled for each firm’s age ($\beta=0.02$, $t=0.38$, $p>.05$), capital ($\beta=-0.03$, $t=0.54$, $p>.05$), and size ($\beta=0.00$, $t=0.08$, $p>.05$), none of these factors had an apparent impact on firm performance. The predictive power of the
Table 5
Results of structural model.

<table>
<thead>
<tr>
<th>Paths</th>
<th>Model Aa</th>
<th>Model B</th>
<th>Model C</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT infrastructure → service delivery</td>
<td>0.15</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IT infrastructure → service customization</td>
<td>0.13</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IT business experience → service delivery</td>
<td>0.22*</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IT business experience → service customization</td>
<td>0.22*</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IT relationship resources → service delivery</td>
<td>0.10</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IT relationship resources → service customization</td>
<td>0.17</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IT human resources → service delivery</td>
<td>0.04</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IT human resources → service customization</td>
<td>0.10</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Service delivery → firm performance</td>
<td>0.24**</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Service customization → firm performance</td>
<td>0.47***</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>IT capability → customer service</td>
<td>–</td>
<td>0.51***</td>
<td>0.32***</td>
</tr>
<tr>
<td>IT capability → service process innovation</td>
<td>–</td>
<td>–</td>
<td>0.47***</td>
</tr>
<tr>
<td>Service process innovation → customer service</td>
<td>–</td>
<td>–</td>
<td>0.39***</td>
</tr>
<tr>
<td>Customer service → firm performance</td>
<td>–</td>
<td>0.63***</td>
<td>0.63***</td>
</tr>
<tr>
<td>Firm size → firm performance</td>
<td>–0.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Firm capital → firm performance</td>
<td>–0.01</td>
<td>–0.02</td>
<td>–0.03</td>
</tr>
<tr>
<td>Firm age → firm performance</td>
<td>0.02</td>
<td>0.02</td>
<td>0.02</td>
</tr>
<tr>
<td>(R^2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Service delivery</td>
<td>0.17</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Service customization</td>
<td>0.23</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Service process innovation</td>
<td>–</td>
<td>–</td>
<td>0.22</td>
</tr>
<tr>
<td>Customer service</td>
<td>–</td>
<td>0.26</td>
<td>0.37</td>
</tr>
<tr>
<td>Firm performance</td>
<td>0.40</td>
<td>0.39</td>
<td>0.39</td>
</tr>
<tr>
<td>Average</td>
<td>0.26 (0.93b)</td>
<td>0.32 (0.77)</td>
<td>0.32 (0.74)</td>
</tr>
<tr>
<td>GoF(^c)</td>
<td>0.49</td>
<td>0.49</td>
<td>0.48</td>
</tr>
</tbody>
</table>

a Model A: direct paths between first-order factor model of IT capability, customer service, and firm performance; Model B: direct paths between second-order factor model of IT capability, customer service, and firm performance; Model C: original model.

b Average communality.

c \(GoF = \sqrt{(\text{average communality}) \times (\text{average}R^2)}\).

\(\cdot\) \(p<.05\).

\(\ast\) \(p<.01\).

\(\ast\ast\) \(p<.001\).

The research model was assessed by examining the explained variance for the endogenous constructs (Chin, 1998).

Regarding \(R^2\) values, IT capability explained 22% of the variance in service process innovation. In addition, IT capability and service process innovation explained 37% of the variance in customer service, and customer service explained 39% of the variance in firm performance. All of these values were significant at \(p<.01\). An important part of model evaluation is the examination of fit indexes that reflect the predictive power of estimated inner and outer model relationships. The goodness of fit (GoF) is an index used to validate the PLS model globally. GoF is determined by calculating the geometric mean of the average communality and the average \(R^2\). According to the results in Table 5, GoF = \(\sqrt{(0.74) \times (0.32)}\) = 0.48, which is satisfactory (Tenenhaus et al., 2005).

The mediating role of customer service and service process innovation

To assess the extent of mediation in the model, we followed Andrews et al. (2004), who indicated that four specific criteria must be met: (1) the independent variable should significantly influence the mediator; (2) the mediator should significantly influence the dependent variable; (3) the independent variable should significantly influence the dependent variable; and (4) after the mediator variable is controlled for, the impact of the independent variable on the dependent variable should no longer be significant (for full mediation) or should be reduced (for partial mediation). The independent variables are IT capability and service process innovation, and the proposed mediating variable is customer service. The dependent variable is firm performance.
Table 6
Results of PLS for mediation effects.

<table>
<thead>
<tr>
<th>Paths</th>
<th>Model 1 (IV for MV)</th>
<th>Model 2 (MV for DV)</th>
<th>Model 3 (IV for DV)</th>
<th>Model 4 (control for MV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT capability → firm performance</td>
<td>–</td>
<td>–</td>
<td>0.25***</td>
<td>0.11</td>
</tr>
<tr>
<td>Service process innovation → firm performance</td>
<td>–</td>
<td>–</td>
<td>0.34***</td>
<td>0.14</td>
</tr>
<tr>
<td>IT capability → customer service</td>
<td>0.33***</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Service process innovation → customer service</td>
<td>0.39***</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Customer service → firm performance</td>
<td>–</td>
<td>0.63***</td>
<td>–</td>
<td>0.50***</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.38</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Notes:
IV, independent variable; MV, mediating variable; DV, dependent variable.
Model 3 (IV for DV) does not include the mediator of customer service; Model 4 (control for MV) includes the mediator of customer service.

* $p < .01$.
** $p < .001$.

We tested the four conditions using PLS analysis. As Table 6 shows, Model 1 and Model 2 met the first and second condition. That is, IT capability and service process innovation affected customer service, and customer service affected firm performance. Model 3 met the third condition; the independent variables of IT capability and service process innovation affected firm performance. The model did not include the mediator of customer service and fit the data reasonably well. The fourth condition (Model 4) holds if the effect of IT capability and service process innovation on firm performance become insignificant or less significant after the mediator of customer service is included. The Model 4 results show that including the mediator of customer service indeed decreased the impact of IT capability and service process innovation from Model 3 to Model 4. In particular, the impact of IT capability ($\beta = 0.11$, $t = 1.45$, $p > .05$) and service process innovation ($\beta = 0.14$, $t = 1.65$, $p > .05$) on firm performance was insignificant, indicating full mediation. Correspondingly, customer service mediated the relationship between IT capability and firm performance, as well as between service process innovation and firm performance; thus, Hypotheses 5 and 6 are supported.

Discussion and conclusions

Our findings suggest that customer service fully mediates the influence of IT capability and service process innovation on firm performance. The results extend earlier empirical findings that link IT capability with customer service practices (Karimi et al., 2001) and that link new service design (i.e., innovation) with customer service practices (Tax and Stuart, 1997). Furthermore, the results suggest that IT capability has a positive influence on customer service and service process innovation; service process innovation has a positive influence on customer service. These findings have significant implications for the management of IT and innovation practices, as they need to be focused and leveraged to create performance gains by using technological resources and process innovation to enable customer service practices.

**IT capability for customer service and service process innovation.** Our results provide evidence that IT capability targeted at service operations (e.g., customer service) and service innovation practices (e.g., service process innovation) enables the transformation of fragmented and cross-functional operant resources. An inspection of the weights associated with the four formative indicators (i.e., IT infrastructure, IT business experience, IT relationship resources, IT human resources) suggests that they are critical elements of IT capability in this context. However, IT business experience is relatively more influential than the others, suggesting the importance of not only employing IT staff who are knowledgeable about business strategy and business procedure, but also having IT applications and strategies that can be aligned with business strategy as facilitators of customer service and service process innovation practices. Further, the $R^2$ values of customer service (37%) and service process innovation (22%) indicate that IT capability was well chosen to interpret the causal relationship with
customer service, as well as with service process innovation. Thus, continuous investment in IT-related resources is a desirable approach for conducting customer service and service process innovation, and firms should follow-up by reinvestigating other issues in technological infrastructure resources, business experience, relationship resources, and human resources.

Service process innovation for customer service. The present study shows that service process innovation has an impact on customer service. Specifically, when firms transform service process innovation into customer services, these services are often perceived as very convenient or novel by customers, and tend to improve the firm’s competitive position. A firm can introduce more innovative service processes than competitors by ensuring that customer needs and wants are satisfied and manifested in the service operations routines, particularly when service process innovation is coupled with another capability such as customer problem solving, customer information acquisition and utilization, and/or the coordination of actions among the sales force.

Customer service for firm performance. The strong effect of customer service on firm performance, as indicated by the path coefficient, suggests that customer service improves firm performance. We defined customer service as the customized and integrated combination of goods and services for meeting a customer’s needs. This study is one of the first to present direct empirical evidence that customer service is necessary to derive firm-level performance-enhancing benefits from service delivery and service customization. This customer-oriented view of organizing service operations supports prior work on service marketing and relationship marketing, which has focused largely on technological resources and capabilities, innovation practice, and business strategy. The results further demonstrate that customer service has a positive and significant effect on firm performance ($R^2 = 39\%$), indicating that customer service is a good indicator of how well a firm is obtaining/retaining its performance.

Mediating role of customer service. In addition, a firm’s IT capability and service process innovation have a substantial impact on customer service. Our results suggest that customer service fully mediates the influences of both of these factors on firm performance, indicating that customer service is needed for a firm to improve performance through IT capability and service process innovation. Organizational capabilities and innovation practices are deeply embedded in the integration practices of service operations such as service delivery as well as customization practices such as service customization. Customer service associated with these service operations is achieved through a series of initiatives that may include CRM practices, relationship marketing, and customer interaction routines in addition to the deep embedding of IT capability and service process innovation as customer service enablers. The implementation of customer service that leverages technological resources integration and service innovation practices requires knowledgeable IT staff, service process redesign, a customer-oriented business strategy, and IT. Developing these capabilities and implementing innovation practices require significant time and strategy, making it difficult for competition to rapidly imitate.

Research contributions

The role of IT capability in affecting firm performance (Bharadwaj, 2000; Bhatt and Grover, 2005; Rai et al., 2006; Ross et al., 1996; Sambamurthy et al., 2003) and the value of employing service process innovation in creating new benefits (Alam, 2006; Blazevic and Lievens, 2004; Blazevic et al., 2003; Lievens et al., 1999) have been described in the IT and service innovation literatures, respectively. However, there is little understanding of how an IT factor (IT capability) and an organizational factor (service process innovation) influence firm performance through customer service practices. By empirically validating the theoretical work of Brynjolfsson et al. (2000), this study makes four significant contributions to the literature on IT capability, service innovation, and e-CRM.

First, the overarching contribution is the theoretical development of the ideas of IT capability and service process innovation in the context of customer service practices. Our findings clarify the missing link by suggesting that the effects of IT capability and service process innovation on firm performance can be realized mainly through customer service (i.e., full mediation). According to the RBV, having a valuable resource that is unique and difficult to imitate can lead to a competitive advantage. In this study, we suggest that IT capability and service process innovation are two valuable
capabilities/resources. Our findings reveal that (new) customer knowledge/information embedded in service processes will, through the use of IT applications, enhance a firm’s ability to transform operant resources into organizational service innovation practices. This will in turn lead to improvements in service operations efficiency, effectiveness, and convenience, which will help firms maintain a sustainable competitive advantage. This study also integrates the domains of IT management, service innovation management, and CRM research into one model and reconciles what had previously been presumed to be independent. IT capability, service process innovation, and customer service have rarely been studied together. In this study, we show that at least IT capability and service process innovation manifest their influence on firm performance through the implementation of customer service practices.

Second, our findings offer robust insights into the effects of IT capability on service process innovation. We add to the growing volume of research on IT capability impact that advocates the necessity of incorporating IT resources-related service innovation into examinations of the impact of IT capability. Specifically, service process innovation is important because it helps firms continually transform their capabilities and resources and focus on service process (re)design to shape their customer service strategies and tactics.

Third, recognizing the inherent multidimensionality of the concept of customer service, we conceptualized and tested the construct in a precise manner by discriminating between service delivery and service customization. We showed that such decomposition helps enrich the understanding of customer service. Although anecdotal evidence and theoretical articles have already postulated the association between customer service practices and organizational performance, the importance of the empirical validation of this association should not be underestimated.

Finally, by examining hypotheses from the Taiwan IT industry, this study fills an important gap in the empirical literature. The findings suggest that value in customer solutions, rather than IT/innovation resources, determines a firm’s performance, providing support for hypotheses that have until now been accepted almost entirely on the basis of logic and intuition. Thus, the present findings help strengthen the RBV as a rigorous theory of technology, innovation, and service management. In addition, by framing the independent variables in terms of IT factor and organizational factor, the present study more than much of the previous research in this area more accurately captures the synergy by which IT capability and innovation practice have long been argued to contribute to firm performance.

**Implications for research**

Our results have three noteworthy implications for research. First, RBV suggests that tangible/intangible resources can be important, but only valuable, rare, costly to imitate, and non-substitutable resources are the sources of competitive advantage for firms implementing corporate marketing strategies (e.g., Menon et al., 1999). In this study, we argue that IT capability and service innovation are the sources of the competitive advantage. We further extend the theory of RBV and demonstrated a strong support for customer service as a key mediator to transform the rare and valuable resources into high firm performance. The provision of a pathway (the mediating process) to bridge resources into performance can enrich the “static nature” of RBV.

Second, the theoretical underpinning of RBV is a strong foundation for further understanding the relationship between IT capability and service process innovation. A study of RBV to address a multidisciplinary and multi-scale concern for firms is needed to further understand how IT capability and service innovation can cooperate. We believe that the consideration of IT capability provides a number of additional insights into why business organizations are motivated to develop specific service innovation programs to aid in building competitive advantage by enhancing their IT capabilities. The association of these two factors (i.e., IT and organizational factors) can provide ample explanatory opportunity. In this study we have shown how this theoretical model is valuable for furthering joint understanding of IT capability and service innovation practices.

Finally, this study makes an important methodological contribution to IT–CRM research. We developed a new instrument for capturing IT–service innovation synergies arising from IT firms. This
Implications could be used to test the generalizability of the research model proposed in this study. Key informants need to be involved in IT implementation/service innovation projects or e-CRM programs. The instrument can include measures for IT resources, new service development practices, firm customer orientation, possible outcomes of service innovation efforts, and the extent to which IT/innovation resources were committed and focused. The new instrument is applicable to information services because it was developed and validated using a representative sample of IT firms. It is also appropriate for use with financial services given the need for (1) a range of products and services to meet the diverse and changing requirements of customers (Menor et al., 2002) and (2) more frequent customer contact in a technology-driven environment (Lievens and Moenaert, 2000).

Implications for practice

Given the critical role of IT capability and service process innovation in customer service, it is important to understand the implications of our findings in practice. First, this study suggests that it is appropriate for firms to develop their IT capability by coordinating IT infrastructure, IT business experience, IT relationship resources, and IT human resources. It is critical for IT managers to implement all four dimensions of IT capability simultaneously. Second, our study has provided evidence that IT capability influences firm performance via intermediate activities, i.e., customer service. An understanding of the key customer service features affecting firm performance will put firms in a better position to develop appropriate strategies for IT resources deployment and, consequently, achieve superior performance. IT firms need to continue to emphasize customer service to retain customers. They should pull more IT resources into service operations, and foster closer relationships with customers to identify market opportunities and design new services accordingly.

Third, firms must implement service process innovation (e.g., new post-service processes, new information inquiry processes, new marketing campaign processes, new purchasing processes) in a such way that can provide better quality services/products, shorten service delivery time and improve its efficiency, develop and promote new services/products, and manage customer knowledge and information that would create greater customer value or attain superior performance. In addition, firms should change or redesign service processes so that data about customer preferences can be collected easily and quickly. That is, to implement process innovation practices that support customized products/services requires a flexible service process modularity to understand the specific needs of customers (Tu et al., 2004). It is important for firms to redesign and improve service processes to facilitate customer-oriented service practices. Therefore, it would seem that firms that are better able to fulfill customer demand while delivering customized products/services will exhibit better firm performance (i.e., customer satisfaction, customer loyalty) than those that do not.

Finally, this study suggests the important role of customer service in the relationship between IT capability/service process innovation and firm performance. Awareness of this relationship could help firms target appropriate points to facilitate customer service by taking a leading role in managing customer-oriented practices (e.g., service communication/coordination (Larsson and Bowen, 1989) and customer treatment). Firms should develop direct feedback and service training programs for contact employees to build the required skills and abilities for service encounters. To enhance contact employees’ involvement and participation in service delivery processes and service customization practices, firms should nurture enabling service tools, systems, and technologies that allow contact employees to share and exchange customer problems, and how those issues were resolved, to create new customer solutions. Further, firms should build service rewards systems for contact employees, who may feel that their effort should be rewarded, because they deal with most customer problems. Thus, managers should try to understand the characteristics of service operations, and then, based on contact employees’ task domain, choose and design appropriate methods according to customer needs and wants to facilitate better service delivery and customization. However, this alone may not guarantee high firm performance; high-performance firms are found across the entire spectrum of customer service practices (i.e., service delivery and service customization).
Limitations and future research

There are three primary limitations to our work. First, the phenomenon of customer service as a mediator can only partially be captured in a cross-sectional study. Notwithstanding the preliminary insights that can be gleaned from our results, this remains a weakness of the study and the findings must be validated in future longitudinal studies. Second, due to the difficulty of collecting objective external data regarding profit, market share, and other factors, we used the key respondent approach in our survey. We directed our questionnaire at IT managers because they were best positioned to answer questions related to technology management and innovation practices and their effects on firm performance. Thus, the results may be subject to single-informant bias. A reasonable argument can be made that IT managers’ knowledge about technology management and innovation practices may be a summary that reflects a positive bias. Future research that uses top managers or other middle managers, such as marketing or sales managers, as informants would help clarify whether the results reported herein are sensitive to our methodology. In other words, it is possible to have different types of respondents answer different parts of the questionnaire (e.g., have customer service executives respond to customer service constructs, and top executives respond to firm performance questions). Nonetheless, tests of common method variance in the present study did not indicate a serious problem. Still, future research should collect objective data from all appropriate external and internal sources. Finally, the present study was conducted among Taiwanese IT firms only. Future studies should examine other industries as well as IT firms in other countries to increase the generalizability of the model.

In summary, IT capability and service process innovation are critical for facilitating customer service, which in turn is necessary to improve firm performance. Furthermore, IT capability is important to service process innovation. We identified infrastructure resources, business experience, relationship resources, and human resources as critical IT-based resources that are relevant to IT capability, as well as service delivery and customization as important service operations for customer service. This study highlights the crucial importance of the mediating role of customer service when examining the relationship between IT capability and firm performance, as well as between service process innovation and firm performance. The insights provided by this study have important implications for IT managers and others in today’s dynamic and competitive environment.

Appendix A

Survey measurement scales

Strongly disagree = 1    Disagree = 2    Neither agree nor disagree = 3    Agree = 4    Strongly agree = 5

Please indicate, on a scale of 1–5, the degree to which you agree or disagree with the following statements.

IT capability questionnaires

IT infrastructure (ITI)
For the past few years, . . .

ITI1. Our company has investigated a generous budget for establishing IT hardware.
ITI2. Our company has investigated a generous budget for purchasing and developing IT software.

IT business experience (ITBE)
For the past few years, . . .

ITBE1. Our IT applications have been implemented to deploy business strategies.
ITBE2. Our IT projects have been developed in compliance with business strategies.
ITBE3. Our IT staffs have been knowledgeable of business operations.
ITBE4. Our IT staffs have been knowledgeable of business strategies.

IT relationship resources (ITRR)
For the past few years, . . .

ITRR1. Our IT function has interacted with departmental operations.
ITRR2. Our IT function has integrated with other business functions.
ITRR3. Our IT function has cooperated with departmental operations.
ITRR4. Our IT has supported employee empowerment adequately.

IT human resources (ITHR)
For the past few years, . . .
ITHR1. Our employees have built relevant bridges between old and new IT systems.
ITHR2. Our employees have delivered data across locations and applications.
ITHR3. Our employees have been aware of opportunities to apply new technologies as they become available.

Customer service questionnaires
Service delivery (SD)
For the past few years, . . .
SD1. Our company has delivered services/products to customers on time.
SD2. Our company has shortened transaction processes to reduce customer waiting time.
SD3. Our company has provided quality delivery to satisfy customer needs.

Service customization (SC)
For the past few years, . . .
SC1. Our company’s services have matched different customer needs.
SC2. Our company has used customer profile information for customization.
SC3. Our company has had a highly flexible and integrated capability to fulfill various customer needs.
SC4. Our company has provided tailor-made services for different types of customers.

Service process innovation questionnaires
For the past few years, our company has often offered new practices in . . .
SPI1. Post-service processes.
SPI2. Customer information retrieval and inquiry processes.
SPI5. Service development processes.

Firm performance questionnaires
For the past few years, our company has been able to . . .
FP1. Increase market share.
FP2. Increase customer satisfaction.
FP3. Increase profit.
FP4. Enhance business brand and image.
FP5. Enhance customer loyalty.

References


