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Firm-level benefits of IT-enabled resources: A conceptual extension and an empirical assessment

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ABSTRACT

While the business value of IT (BVIT) is central to the IS discipline, only recently a possible chain of causation from *IT assets* (i.e., fungible, widely available, commodity-like, technology-based products) to firm performance has been conceptually specified. Furthermore, little empirical evidence exists regarding IT assets' business value. In light of this paucity, this paper makes several contributions to IS research and practice. First, it advances the BVIT literature by empirically testing a model that traces a path from IT assets through IT-enabled resources to firm performance. Second, it extends the BVIT and resource-based view (RBV) literatures by explicating and testing the impact of a firm's external environment on its IT-enabled resources. Third, it builds on recent literature to argue for, and test, two distinct forms of firm-level outcome: operational and strategic benefits. Finally, the paper contributes to managers' and IS practitioners' knowledge by demonstrating the transformative capacity of IT assets on the strategic potential of organizational resources. Empirically, the paper develops and employs valid and reliable scales to test the research model using survey data on IT-enabled customer service departments. The findings demonstrate that when an IT asset is combined with an organizational resource, the extent of synergy borne out of the resulting relationship can positively impact the strategic potential of the ensuing IT-enabled resource. This IT-enabled resource, in turn, is positively associated with firm-level benefits. Further, the external environment is shown to exert a positive effect on the strategic potential of outside-in IT-enabled resources. In sum, this paper offers several important conceptual and empirical contributions to a stream of research that is at the core of the IS discipline.

1. Introduction

While the business value of IT (BVIT) is central to the IS discipline, the chain of causation from *IT assets* to firm performance has only recently been conceptually specified (Nevo and Wade, 2010). IT assets are fungible, commodity-like technology-based products, such as a piece of commercially-available software, that are widely available to firms without the protection of isolating mechanisms (Piccoli and Ives, 2005). As such, IT assets are not regarded as intrinsically strategic (Clemons and Row, 1991; Mata et al., 1995). By contrast, important theoretical and empirical advances have been made that collectively expand our understanding of the business value of *IT-related resources*,[1] that are often tacit and complex,

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[1] Several IT-related resources have been studied by IS scholars, such as IT competence (Bassellier et al., 2003), digital options (Sambamurthy et al., 2003), online information capabilities (Barua et al., 2004), technical IT skills (Ray et al., 2005), IT relatedness (Tanriverdi, 2005), managerial IT skills (Dehning and Stratopoulos, 2003), external IT capabilities (Nevo et al., 2007), and IT business partnership.

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Table 1
Key RBV concepts.

Property	Definition
Value	An organizational resource's ability to support strategies intended to capitalize on market opportunities or fend off threats
Rarity	A measure of the organizational resource's relative unavailability to current/potential rivals
Inimitability	The costs and difficulties associated with attempts to duplicate the organizational resource
Non-substitutability	An evaluation of the nonexistence of strategically equivalent organizational resources

frequently protected by isolating mechanisms, and must be developed and nurtured by firms over time (Wade and Hulland, 2004). Despite their obvious organizational value, IT-related resources, unlike IT assets, cannot be quickly or easily built or acquired. Furthermore, it is IT assets, rather than IT-related resources, that firms purchase in factor markets and that are at the center of cost-benefit evaluations. Accordingly, in this paper, we seek to map out an empirical path from IT assets to firm performance.

In order to provide a conceptual basis for this path, we build on a model that synthesizes two popular management theories: the RBV and system theory (Nevo and Wade, 2010). The Nevo and Wade model is deemed appropriate for our purposes since it conceptually links IT assets to firm-level outcomes. Specifically, according to the model, an IT asset is combined with an organizational resource to create a new organizational subsystem termed *IT-enabled resources*.[2] As a system of interacting components, the ensuing IT-enabled resource possesses emergent capabilities that can impact *firm performance* through enhanced *strategic potential*. In this paper we empirically test the Nevo and Wade (2010) model.

Further, we conceptually extend the Nevo and Wade model in two important ways. First, we consider the role of the firm's external environment. Second, we draw on recent literature suggesting that firm performance should be assessed at two different levels – i.e., operational and strategic. Thus, the extended conceptual model and its empirical assessment combine to widen the window in the "black box" leading from IT assets to firm performance opened by Nevo and Wade (2010) – an important gap in our knowledge of the BVIT.

The paper proceeds as follows. The next section presents the study conceptual model and hypotheses, beginning with a brief overview of the BVIT literature. The subsequent section describes the instrument development and the data collection processes and reports on the empirical results. The final section discusses the results in light of the paper's objectives.

2. The study model

2.1. The business value of IT assets

Much of the research on the BVIT has been guided by the RBV (e.g., Bharadwaj, 2000; Mishra et al., 2007; Rivard et al., 2006; Santhanam and Hartono, 2003; Tanriverdi, 2006; Zhu and Kraemer, 2005). At the heart of the RBV are *organizational resources* that, depending on their *strategic potential*, can help firms achieve positions of sustained competitive advantage (Barney, 1991; Penrose, 1959; Peteraf, 1993; Wernerfelt, 1984). An organizational resource's strategic potential depends upon four properties: *value*, *rarity*, *inimitability*, and *non-substitutability* (see Table 1).

The RBV has become a popular theoretical lens for BVIT research in part because it illuminates a clear path between strategic IT-related resources and measurable organizational outcomes. However, Nevo and Wade (2010) argue that the RBV has several theoretical limitations that hinder our understanding of the business value of *IT assets*. First, the RBV overlooks resources that are not strategic in and of themselves, like IT assets (Bharadwaj et al., 1993; Peteraf, 1993; Piccoli and Ives, 2005). This is a critical shortcoming since the focus of many managers is on the cost side of the IT equation, represented by expenditures on IT assets, rather than on the less tangible notions of IT-related resources. Second, the theory is silent on the mechanisms through which organizational resources become strategic (Priem and Butler, 2001). Consequently, organizational resources are often labeled, *a priori*, as strategic without presenting supporting evidence. Third, while it is evident that IT assets are often combined with organizational resources, such as business units, functional departments, and work teams (Markus and Robey, 1983; Orlikowski and Hofman, 1997; Orlikowski, 2000), extant RBV logic cannot be used to theorize about the outcomes of such combinations since it treats resources as elementary building blocks (Enright and Subramanian, 2007; Jackson, 2009; Thomas et al., 1999), thereby hiding their innerworkings from view. Consequently, the role IT assets play in supporting firm strategies remains unclear (Piccoli and Ives, 2005).

2.2. IT-enabled resources and synergistic relationships

The Nevo and Wade (2010) model supplements the RBV with concepts from systems theory.[3] Systems theory regards systems as being comprised of interacting components that give rise to emergent (system) capabilities[4] (Ackoff, 1971;

[2] Note that other researchers have used the term "IT-enabled resource" to represent different organizational phenomena (c.f., Bharadwaj, 2000; Dong et al., 2009; Qu et al., 2010).

[3] We note that Black and Boal (1994) also recognized the potential of systems theory to augment the resource-based view of the firm.

[4] In line with C. West Churchman's observation that systems ought to be described in term of what they might do under certain circumstances (1971; p. 11), the term 'capabilities' is preferred to 'properties'.

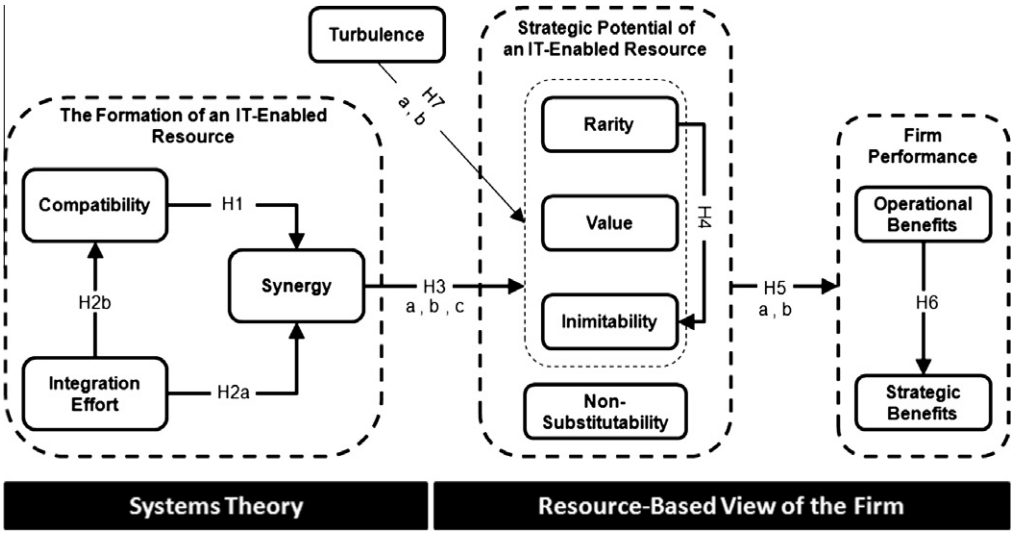

Fig. 1. Firm-level benefits of IT-enabled resources (OR = organizational resource).

Gharajedaghi, 2006; Jackson, 2009; von Bertalanffy, 1968). At the heart of the Nevo and Wade model is the concept of the *IT-enabled resource*, which is a system (or a subsystem, depending on one's perspective) comprised of an IT asset and an organizational resource (OR) in a relationship (see Fig. 1). As a system, an IT-enabled resource possesses *emergent capabilities* – that is, either new capabilities that are possessed by neither the IT asset nor the organizational resource in isolation, or existing capabilities with previously unattainable values. Since not all emergent capabilities are desirable (Weetman, 2009), positive emergent capabilities are identified as *synergy*.[5] Hence, a synergistic relationship between an IT asset and an organizational resource is evidenced when the IT asset provides the organizational resource with new or modified capabilities that would make the ensuing IT-enabled resource more likely to achieve its organizational tasks or goals (Nevo and Wade, 2010).

Next, we examine the antecedents of synergy and its outcomes, by developing a series of testable hypotheses. Since Hypotheses 1–4 are based on the corresponding propositions developed by Nevo and Wade (2010), only a brief discussion is provided.

2.3. Antecedent of synergy

Realizing synergy from a relationship between an IT asset and an organizational resource depends upon the presence of two enabling conditions – namely, compatibility and integration effort (Nevo and Wade, 2010). Since IT-enabled resources are systems, their parts should be *compatible* with one another. Compatibility reflects the ability of an IT asset and an organizational resource to form a relationship. It indicates whether the two components can interact. To illustrate the notion of compatibility, consider a case study by Orlikowski and Hofman (1997). The authors argued that compatibility between a customer service department's culture and a groupware technology's collaborative nature, made the realization of benefits possible. They contrasted this outcome with another organization where the employees' work style and the groupware technology's knowledge sharing functionality were incompatible, thus hurting the realization of benefits. It is important to understand that compatibility is not an assessment of the outcome of the interactions. That is, compatibility does not tell us whether or not the components *should* interact. Compatibility, thus, makes it possible for an IT asset and an organizational resource to interact without friction, thereby improving the likelihood that synergy will ensue. Hence,

Hypothesis 1. Greater compatibility between an IT asset and an organizational resource is associated with greater realized synergy.

Next, in order for an IT asset and an organizational resource to become a system, these components must be *integrated* (Katz and Kahn, 1978). IT asset–organizational resource integration effort represents activities undertaken by the organization's management to support, guide, and assist with the implementation of the IT asset within the organizational resource (Nevo and Wade, 2010). By instituting proper organizational structures and providing relevant technical and procedural guidance before, during, and after the implementation of an IT asset into an organizational resource, management can help

[5] Note that while the present conceptualization of synergy is consistent with the systems theory literature (e.g., Corning, 2000) it should not be confused with the microeconomic perspective (e.g., Milgrom and Roberts, 1990, 1995), which equates synergy with two factors of production jointly producing something greater than the sum of their individual contributions to production. Indeed, most IT assets, in and of themselves, produce nothing.

with the realization of synergy (Nevo and Wade, 2010). Accordingly, we hypothesize that the extent of the integration effort would have a positive effect on the extent of synergy realized from a relationship between an IT asset and an organizational resource. Accordingly,

Hypothesis 2a. Integration effort has a positive impact on the realization of synergy from a relationship between an IT asset and an organizational resource.

According to Nevo and Wade (2010), integration effort is distinct from compatibility since the latter concerns the fit between two system components, while the former describes the attempts of management to facilitate the successful combination of components. However, the two concepts are also related logically. Specifically, the same activities taken by management to help with the integration of an IT asset into an organizational resource can also have a positive effect on their mutual compatibility. For example, hands-on training and involvement with the implementation can help reduce incompatibility between users' existing technical knowledge and the skills necessary to make use of the IT asset. Therefore,

Hypothesis 2b. Integration effort has a positive impact on the compatibility between an IT asset and an organizational resource.

2.4. Direct outcomes of synergy: An IT-enabled resource's strategic potential

Nevo and Wade (2010) argued that the extent of synergy borne out of a relationship between an IT asset and an organizational resource can determine the ensuing IT-enabled resource's strategic potential, which the RBV assesses via four properties – i.e., value, rarity, inimitability, and non-substitutability (VRINS for short).

Value, in RBV terms, reflects a resource's ability to help conceive of and execute strategies intended to fend off threats, capitalize on opportunities, or avoid weaknesses (Barney, 1991). Nevo and Wade (2010) argued for the existence of a positive relationship between a resource's repertoire of capabilities – presumably expanded via a synergistic relationship with an IT asset – and its value property. Thus, a greater set of capabilities, made possible by the implementation of the IT asset component, could make an IT-enabled resource more likely to be employed in the execution of strategies. Hence we hypothesize the following:

Hypothesis 3a. Greater synergy between an IT asset and an organizational resource is positively related to the value of the ensuing IT-enabled resource.

The next hypothesis is motivated by the notion that emergent capabilities are predicated upon the relationships among individual components, rather than the components themselves (Bunge, 1977). Therefore, while the components may not be inherently rare – specifically, the IT asset – the IT-enabled resource, that now possesses emergent capabilities, is likely to be so. Accordingly,

Hypothesis 3b. Greater synergy between an IT asset and an organizational resource is positively related to the rarity of the ensuing IT-enabled resource.

The following hypothesis is motivated by the notion that complexity arises from synergistic relationships among components that are not necessarily complex in and of themselves (Holland, 1998). Thus, while an IT asset might be easy to imitate due to its wide availability and commodity-like nature, its interactions with an organizational resource can produce a complex IT-enabled resource that competitors would find difficult to understand and imitate. Competitors may be able to identify the components – i.e., the IT asset and the organizational resource – but are less likely to recognize the nature of their relationship. In turn, competitors will have a harder time duplicating an IT-enabled resource, the innerworkings of which they do not clearly understand (i.e., causal ambiguity). Therefore,

Hypothesis 3c. Greater synergy between an IT asset and an organizational resource is positively related to the inimitability of the ensuing IT-enabled resource.

Nevo and Wade (2010) observed that although rarity and inimitability are distinct concepts, they are not orthogonal. To see this, note that since, by definition, there are fewer opportunities to observe rare IT-enabled resources, it becomes all the more difficult to understand them and, consequently, to imitate them. Conversely, less rare IT-enabled resources are more likely to be observed, understood, and subsequently duplicated by competitors, *ceteris paribus*. Hence,

Hypothesis 4. Rarer IT-enabled resources will tend to be less imitable.

Following Nevo and Wade (2010) we do not hypothesize a link between synergy and the resource's non-substitutability property.[6]

[6] Nevo and Wade (2010) argue that it is impractical to formulate hypotheses regarding the antecedents of non-substitutability since the links are not expected to remain invariant under the myriad potential strategies. In addition, substitutability is dependent on the exogenous activities of competing firms, and thus outside of the firm's locus of control.

2.5. Indirect outcome of synergy: Firm-level impacts of IT-enabled resources

While the RBV regards sustainable competitive advantage as the relevant dependent variable, extant research has approximated it with one or more firm performance indicators (e.g., Aral and Weill, 2007; Hatch and Dyer, 2004; Melville et al., 2004; Mithas et al., forthcoming; Ray et al., 2004; Wade and Hulland, 2004). Consistent with these studies, and with a forward looking view toward the subsequent operationalization of the model's constructs, we restricted our outcome variable to a comparative assessment of firm performance, and thus leave the sustainability of that performance to future research.

Firm performance may be assessed via operational benefits or via strategic benefits (Tallon et al., 2000). This distinction reflects Williamson's (1991) categorization of firms' behavior into 'economizing' and 'strategizing.' According to Michael Porter, operational benefits represent heightened efficiency with which input are utilized (Stonehouse and Snowdon, 2007). Common indicators of improved efficiency include increase in revenue and cost reduction (Kohli and Devaraj, 2003; Melville et al., 2004). On the other hand, strategic benefits represent the firm's effectiveness (Folta and Janney, 2004) and may be indicated by better competitive positioning (Barney and Clark, 2007), and enhanced flexibility in responding to changing market demands (Johnson and Hooper, 2003). In this study, we extend Nevo and Wade (2010)'s model by testing both operational and strategic benefits.

2.5.1. Operational benefits

We posit that to the extent that IT-enabled resources are *valuable* and *rare*, firms possessing such resources are expected to improve their *operational performance*. We base this argument on Peteraf and Barney (2003, p. 311) who suggested that rare and valuable resources "*are more 'efficient' in the sense that they enable a firm to produce more economically and/or better satisfy customer wants... deliver greater benefits to their customers for a given cost (or can deliver the same benefit levels for a lower cost)*." Accordingly, operational benefits may be evidenced in the ability of the firm to operate with a lower cost base. Alternatively, a firm possessing valuable and rare resources may be more successful in maintaining its current level of operations while simultaneously enjoying an increase in revenue. We further argue that since operational benefits represent internal efficiency measures (Melville et al., 2004; Subramani, 2004), a resource's inimitability and non-substitutability properties, which are externally oriented (Peteraf and Barney, 2003), are not expected to play a significant role in affecting these firm-level benefits. Hence,

Hypothesis 5a. Each of an IT-enabled resource's value and rarity is positively linked to operational benefits.

2.5.2. Strategic benefits

Strategic benefits characterize the attainment of competitive advantage more so than operational benefits (Melville et al., 2004; Wade and Hulland, 2004). Since strategic benefits represent the external effectiveness of the focal firm vis-à-vis its competitors (Barney, 1991; Peteraf and Barney, 2003), an IT-enabled resource's *value*, *rarity*, *inimitability*, and *non-substitutability* are expected to play a significant role in affecting those benefits. In other words, for a resource (including an IT-enabled resource) to offer more than internal efficiency improvements, it must also be costly to imitate and have no strategically equivalent substitutes (Powell, 2001). Thus, in line with RBV rationale, we hypothesize that all four properties of an IT-enabled resource would play a positive role in determining the strategic benefits obtained by the firm owning or controlling the IT-enabled resource. Hence,

Hypothesis 5b. Each of an IT-enabled resource's value, rarity, inimitability, and non-substitutability is positively linked to strategic benefits.

2.5.3. From operational benefits to strategic benefits

The distinction between operational and strategic benefits can be seen as a demarcation of the firm's internal operations versus its external viability. Michael Porter, in an interview with Stonehouse and Snowdon, argued that both types of benefits are important to firms (Stonehouse and Snowdon, 2007); and in the context of EDI links, Mukhopadhyay and Kekre (2002) found evidence that the operational benefits may have a positive effect on strategic benefits. Yet, in the context of BVIT research, these outcomes – i.e., operational and strategic benefits – are often studied by distinct research streams with little dissemination across boundaries (Melville et al., 2004). In this paper, we expect that firms that are successful in leveraging a synergistic IT-enabled resource to reap operational benefits would also be more likely to enjoy strategic benefits. Hence,

Hypothesis 6. Greater operational benefits are positively associated with greater strategic benefits.

2.6. The role of the firm's environment

Traditional RBV conceptualizations tend to under-emphasize the role of the firm's external environment (Montealegre, 2002). The dynamic capabilities perspective recognizes this shortcoming and aims to infuse the resource perspective with

elements that would render the RBV more responsive to external (to the firm) events (Eisenhardt and Martin, 2000; Makadok, 2001; Teece et al., 1997). Within IS research, the dynamic capabilities approach has been applied to explain myriad phenomena at the process-level and firm-level (e.g., Harris et al., 2009; Koch, 2010; Sambamurthy et al., 2003; Wheeler, 2002). Yet, while the dynamic capabilities approach provides an important extension to the RBV, little is known about the role of the environment in affecting the strategic potential of organizational resources.

According to systems theory, firms, as open systems, may only be understood in the context of their environment, a notion that captures the uncontrollable elements that can affect firms (Gharajedaghi, 2006). According to Priem and Butler (2001), the strategic potential of organizational resources is contingent upon the firm's market conditions, which is part of its environment. Wade and Hulland (2004) further suggest that we should consider the orientation of organizational resources when studying them in different environments; they propose that outside-in IS resources would tend to be more important in turbulent environments. Given firms' inability to control events in their environments, it becomes important to make sense of these events and interpret them (Choudhury and Sampler, 1997; Grabowski and Roberts, 1997). Day (1994) conceptualized outside-in resources as interfaces between firms and their environments that enable the former to compete by creating and sustaining relationships with customers and business partners and anticipating market demands ahead of the competition. Doherty and Terry (2010) argued that the importance of outside-in resources stems from their ability to impact competitive positioning. We extend these arguments and propose that in *turbulent environments*, outside-in IT-enabled resources would become more *valuable* since, as sensors located at the interface between a firm and its environment, these subsystems are increasingly relied upon for interpretation and anticipation of changes in market requirements. Accordingly,

Hypothesis 7a. The value of outside-in IT-enabled resources is positively affected by the level of turbulence in the environment.

In addition, as the turbulence in the environment increases, outside-in resources, which interface with the firm's environment, may have to change and adapt as well, thereby rendering themselves moving targets for would-be imitators. We argue that it is easier to duplicate an organizational resource that is stagnant, and which remains unchanged under varying contexts, than one that is responsive to environmental changes. Specifically, competitors may be presented with a wider window of opportunities to understand the mechanics of an organizational resource that remains invariant as external conditions change, compared with a resource that reacts to those changes. Note that while all organizational resources are harder to duplicate when they do not remain static, we do not expect a similar impact on inside-out resources since those are deployed internally and are therefore sheltered, at least partially, from external effects (Meznar and Nigh, 1995). Hence,

Hypothesis 7b. The inimitability of outside-in IT-enabled resources is positively affected by the level of turbulence in the environment.

3. Research methodology

The hypotheses were tested empirically using survey data. This decision was based, in part, on work suggesting that our understanding of the BVIT would benefit from the use of primary data to empirically examine the link between IT and firm performance (Melville et al., 2004; Wade and Hulland, 2004). In the following section, we outline the instrument development, validation, and dissemination processes.

3.1. Instrument development

As an outside-in resource, the customer service department (CSD) (Bharadwaj, 2000; Day, 1994) was the focal organizational resource studied in this paper. CSDs are an appropriate choice for this study since (1) they can be found in most firms, and (2) they employ a variety of IT assets with varying results (Ray et al., 2005). The processing and storage features of IT assets, coupled with their ability to quickly disseminate vast amounts of information across time and space can enhance a CSD's capability to assist customers in making informed purchasing decisions (Adria and Chowdhury, 2004). Given its importance to potential and existing customers, the provision of quality customer service has become a strategic imperative for many companies (Day, 2003; Zeithaml, 2000).

Following Straub (1989), the research instrument was developed using a multi-phase process of validation and refinement. These phases included an extensive search of the literature, discussions with academic and non-academic experts in IS and customer service, two rounds of card sorting, pre-testing the sampling frame, and a pilot test. Table 2 describes these phases.

3.2. Data collection

Data were collected over three rounds following guidelines set forth by Dillman (1999), and Churchill (1979). The sampling frame used for the study was membership of the International Customer Service Association (ICSA). The first two rounds – 4 weeks apart – included mailing an envelope with a questionnaire, a stamped return-addressed envelope, a gift card for a popular coffee chain valued at $3, and a cover letter. Each intended informant was also entered into a draw to

Table 2
Instrument development.

Phase	Description
Phase 1: Sampling frame	The population of interest is managers of customer service departments (CSD) since this group is likely to be knowledgeable about IT asset implementations in their CSD and subsequent IT-related impacts. The sampling frame came from the membership list of The International Customer Service Association (ICSA)
Phase 2: Literature review and item generation	We began the scale development process by surveying the extant literature for validated scales that could be used in our study. Although we did not find complete scales that were suitable for the study, we were able to identify several items and scale fragments, and included these in the initial pool of items (see Appendix A). Additional items were developed for the scales for which insufficient coverage of the construct domain was deemed an issue. See Appendix B for a final list of items
Phase 3: IS researcher panel	Based on comments provided by a panel of IS researchers with extensive industry experience regarding the appropriateness of the items, we added, deleted, and modified items to improve content and face validity. In their comments, the experts judged the items' ability to cover the domain, the clarity of the questions and the instructions, and the length of the questionnaire
Phase 4: Card sorting	The revised item list was subjected to a two-stage card-sorting exercise following the guidelines suggested by Moore and Benbasat (1991). Following this stage, several items were removed and others were rephrased. Light's Kappa – a version of Cohen's Kappa designed for multiple raters – was used to calculate inter-rater agreement among judges in the final round. The statistical software package R was used for that purpose. The test statistic was .713, which exceeded the recommended minimum score of .650 (Jarvenpaa, 1989)
Phase 5: Non-IS researcher panel	Three Marketing scholars who specialize in consumer research were contacted and asked to comment on the relevance of the questionnaire to customer service professionals. We felt it was important to receive feedback from non-IT experts, as the intended respondents were customer service managers and other individuals with close links to customer service. The scholars offered some useful comments, and minor modifications to the questionnaire were made accordingly
Phase 6: Pre-test with members of the sampling frame	To further assess the instrument's validity, we sent the questionnaire to five senior customer service specialists. A number of wording changes were suggested. We also made adjustments to the instructions provided to respondents at this stage
Phase 7: Pilot test	Finally, 134 survey packages were sent to a random sample drawn from the list of International Customer Service Association (ICSA) membership. Each respondent received by mail a package containing a questionnaire and a stamped return-addressed envelope. A cover page was attached to the questionnaire that included an informed consent form and selection criteria to ensure that the respondents were familiar with a recent implementation of an IT asset in the customer service department. The cover page also included the logos of the researchers' University and of the ICSA, and clearly stated that the identity of the individual and his or her firm would not be revealed. After an initial round and a follow-up mailing, 23 questionnaires were returned. We analyzed the completed questionnaires and made minor modifications to the scale items based on our analysis. Overall, the analysis indicated that the survey instrument was a useful tool for collecting data that could be used for hypotheses testing. The data collected during the pilot study were not used in the following stages

win a prize valued at $500 and was offered a summary of the results. In the third round, executed 4 weeks after the second round, the remaining non-respondents were contacted by e-mail and presented with a Web version of the paper-based questionnaire. Overall, 635 firms were contacted, 126 questionnaires were undelivered, and 168 completed questionnaires were received, generating a response rate of 33%.

3.2.1. Informants

We used a key informant approach (Bagozzi et al., 1991) to collect data on firms, their customer service departments (CSD), and their recent customer service-related IT projects. Key informants are often used to collect data on organizational factors in IS research, especially in the context of the business value of IT (e.g., Ray et al., 2005; Tanriverdi, 2005). The reported positions of the informants (Table 3) suggested that the sample was an accurate representation of the population of interest, namely customer service managers: 87.6% of the respondents were in a managerial position, with an additional 8.8% in a supervisory-type role. Furthermore, based on their position within the firm, the informants were likely to partic-

Table 3
Organizational positions of the informants.

Position	Observed *N*	Expected *N*	Residual
President, CEO, COO, founder, or chairman	3	6.0	−3.0
Director, vice president, principal	58	57.2	0.8
Customer service manager	78	64.9	13.1
Other manager	9	16.6	−7.6
Coordinator, supervisor	10	10.2	−0.2
Team leader	5	5.6	−0.6
Consultant, specialist, representative	5	5.6	−0.6
Total	168		

ipate in decision-making processes related to the topic of the survey (Phillips and Bagozzi, 1986). Informants had been with their firms, on average, for more than 10 years with more than 5 years in their current position. The median size of the CSD was 20 employees, the median firm size was 450 employees, and $400 million was the median annual firm sales figure.

3.2.2. Common method bias

One concern with key informants is the possible presence of systematic error related to the informants. We assessed the presence of respondent error (or common method bias) by conducting two tests. Following the recommendations made by Podsakoff et al. (2003), Harman's single-factor test was conducted by entering all independent and dependent variables in an exploratory factor analysis (EFA). The first factor accounted for 36.61% of the total 79.40% variance, indicating a lack of evidence of a substantial common method bias in this study. A second test was conducted, comparing the average score of the Operational Benefits and Strategic Benefits scales with an objective measure of performance (Return on Capital[7]) resulting in a correlation coefficient of .45 ($p < .01$). This finding suggested that the key informants did not systematically err in their responses.

3.2.3. Non-response bias

To evaluate the presence of non-response bias, we conducted two tests. The first test compared the distribution of the position of the respondents with that of the complete sampling frame (respondents plus non-respondents) provided by the ICSA. In Table 3, we refer to the positions of the respondents as the *observed* value, while we refer to the positions of members of the full sampling frame as the *expected* value (see Table 3). If the two values are significantly different, then that might indicate a bias between respondents and non-respondents. A nonparametric χ^2 test comparing the two distributions found no significant differences. As a second test for non-response bias, we compared early and late respondents on several individual and firm demographic measures. A series of one-way ANOVA tests did not find significant differences between the two respondent groups, strengthening the claim for an absence of non-response bias (Armstrong and Overton, 1977).

3.2.4. Measurement validation

Since new scales were developed for this study, an assessment of the psychometric properties of the scales began with an exploratory factor analysis on the reflective scales using a principal component analysis (PCA) with Varimax rotation (SPSS 17). A few items were removed due to high cross-loadings. The factor analysis demonstrated that each of the remaining items loaded more strongly on its respective scale than on other scales, indicating strong construct validity (more on this below). The second stage of the measurement validation process was carried out by observing the statistics associated with the measurement model following confirmatory factor analysis (CFA) using PLS (SmartPLS 2.0). PLS was appropriate for the present study since it can handle both reflective and formative scales, both of which are included in the model. Specifically, the firm performance scales, i.e., Operational Benefits and Strategic Benefits, were modeled as formative on the premise that the indicators for each scale are independent of one another. An added advantage of PLS involves its ability to handle non-normality in the data.

To assess the scales' psychometric properties, several tests were conducted. We describe those tests next, beginning with the reflective scales and then discussing the formative scales.

3.2.5. Convergent validity

Two tests were used to assess convergent validity. Convergent validity was first assessed by observing the loadings of the items. According to Comrey (1973), items with loadings greater than .70 indicate strong convergent validity. All items had loadings in excess of .70 (Table 4), demonstrating the instrument's convergent validity. Convergent validity was also assessed by observing the square root of the average variance extracted (diagonal elements in Table 5). A minimum level of .70 is suggested (Fornell and Larcker, 1981), since it indicates that, on average, the construct accounts for at least 50% of its measures' variance. All reflective scales met this criterion, indicating satisfactory convergent validity.

3.2.6. Discriminant validity

To assess the instrument's discriminant validity, we conducted three tests. Evidence of discriminant validity is obtained when the square root of the average variance shared among a construct's measures (diagonal elements in Table 5) is larger than the correlations between the construct and other constructs (off-diagonal elements) in the model. All scales met this criterion (Fornell and Larcker, 1981) suggesting good discriminant validity. Another way to assess discriminant validity is by observing the difference between the loadings and the cross-loadings. An acceptable difference is .10 (Wixom and Todd, 2005). None of the differences in our study was lower than this cutoff. Further, the instrument development process, specifically the card sorting exercise, revealed that the constructs were, in fact, conceptually distinct (Moore and Benbasat, 1991).

3.2.7. Construct reliability

Composite reliability (CR) scores (see Table 5) are used as an indication of the scales reliability. All scales met the .70 cutoff suggested by Straub (1989), indicating that results based on these scales should be consistent.

[7] The correlation analysis was based on a subset of 40 public companies for which financial data were available.

Table 4
Confirmatory factor analysis.

	Compatibility	Inimitability	Integration effort	Rarity	Synergy	Value	Non-substitutability
Compatibility 1	**.836**	.042	.446	.030	.337	.308	.104
Compatibility 2	**.890**	.048	.605	−.002	.384	.297	.047
Compatibility 3	**.800**	.103	.504	.092	.439	.277	.078
Inimitability 1	.135	**.914**	.220	.510	.353	.269	−.075
Inimitability 2	−.015	**.859**	.102	.352	.230	.129	−.130
IT integration effort 1	.555	.176	**.886**	.119	.428	.334	.090
IT integration effort 2	.516	.075	**.875**	.082	.384	.361	.131
IT integration effort 3	.559	.123	**.897**	.083	.493	.380	.073
IT integration effort 4	.555	.271	**.863**	.210	.570	.414	.022
Rarity 1	−.030	.245	.095	**.755**	.140	.158	−.146
Rarity 2	.097	.470	.174	**.910**	.339	.423	−.096
Rarity 3	−.010	.415	.040	**.715**	.123	.163	.019
Synergy 1	.411	.324	.438	.266	**.863**	.531	.011
Synergy 2	.486	.270	.530	.262	**.883**	.476	.049
Synergy 3	.322	.232	.425	.191	**.829**	.430	.018
Synergy 4	.328	.313	.433	.240	**.826**	.350	.036
Value 1	.367	.161	.427	.246	.496	**.826**	.119
Value 2	.294	.202	.360	.320	.430	**.907**	−.102
Value 3	.261	.249	.338	.368	.474	**.908**	−.090
Non-substitutability 1	.088	−.112	.087	−.089	.015	−.028	**1.000**

All items loaded significantly ($p < .01$) on their respective scales. Bold values signify the items that loaded highest on the factor.

Table 5
Inter-construct correlations and composite reliability (CR).

Construct	Mean[a]	S.D.	1	2	3	4	5	6	7	CR
IT integration effort	4.842	1.301	**.880**							**.932**
Compatibility	4.917	1.149	.622	**.843**						**.881**
Synergy	5.083	1.245	.539	.461	**.851**					**.913**
Value	5.075	1.245	.425	.348	.531	**.881**				**.912**
Rarity	4.022	1.290	.144	.047	.284	.355	**.798**			**.839**
Inimitability	3.900	1.304	.188	.077	.336	.232	.495	**.887**		**.880**
Non-substitutability[b]	6.023	1.495	.087	.088	.015	−.028	−0.89	−.112	–	–

Diagonal elements are the square roots of the average variance shared (AVE) among the constructs and their respective measures. Off-diagonal elements are correlations among constructs. Bold values signify the square roots of the average variance shared (AVE) among the constructs and their respective measures.

[a] Based on a scale of 1 through 7.

[b] Non-substitutability was measured using a single item and has no composite reliability score and AVE.

Table 6
Item-to-construct correlations.

	Operational benefits	Strategic benefits
Operational benefits 1	**.885**	.695
Operational benefits 2	**.907**	.702
Strategic benefits 1	.748	**.913**
Strategic benefits 2	.671	**.922**

All item-to-construct correlations are significant at $\alpha = .01$. Bold values signify highest item-to-construct correlations.

3.2.8. Formative scales

For the two formative scales, evidence of convergent and discriminant validity was obtained by observing the correlations between the items and the construct they are intended to form, as well as with the other construct. Each item correlated highly with its own construct indicating convergent validity, and correlated to a weaker extent with the other construct, providing evidence of discriminant validity (see Table 6).

Since individual items in formative scales need not correlate, it is inappropriate to subject them to the same reliability tests as reflective scales (Petter et al., 2007). Instead, an indication of item-to-scale importance may be assessed by observing the items' weights (Chin, 1998). All item weights were significant at $\alpha = .01$ or better.

4. Empirical results

The structural model of the PLS regression (SmartPLS v. 2.0.M3) was used for testing the hypotheses and assessing the predictive power of the model. A bootstrapping procedure (500 samples) was used to assess the significance of the

hypothesized paths and the amount of variance in the dependent variables attributed to the explanatory variables (Chin, 1998). The results of the analysis are presented in Fig. 2.

Based on the structural model generated by PLS, the hypotheses were tested systematically, using two-tailed tests. As can be seen from Fig. 2, the results provided support for all hypotheses except Hypothesis 5b. The results provide mixed support for this hypothesis with value and inimitability exhibiting positive and significant path coefficients at the $p < .01$ level or better. However, the paths leading from rarity and non-substitutability to strategic benefits were not significant. We discuss these findings in the discussion.

The predictive power of the model can be assessed by observing the percentage of variance attributed to the explanatory variables (i.e., R^2). The model was able to explain the following variances: Compatibility (39%), Synergy (32%), Value (31%), Rarity (8%), Inimitability (30%), Operational Benefits (38%), and Strategic Benefits (68%). These results indicate the model's strong predictive power (Falk and Miller, 1992). The R^2 values are presented, along with the path coefficients and significance levels, in Fig. 2.

5. Discussion

5.1. Contributions to research

This paper contributes to research on the business value of IT (BVIT) that, despite its centrality to the IS field's intellectual core, has not received sufficient empirical attention (Kohli and Grover, 2008). The paper presented evidence supporting the argument that even though IT assets are widely available and commodity-like in nature, they can nonetheless play a strategic role when they are integrated with organizational resources to create IT-enabled resources. This finding challenges the isolating mechanisms argument (Rumelt, 1984, 1987) since it demonstrates that the absence of such mechanisms for one component – in this case, an IT asset – does not diminish the strategic potential of the system to which the component belongs – in this case, an IT-enabled resource. Consequently, while not inherently strategic (Carr, 2003), IT assets have an important role to play in augmenting the strategic potential of the organizational resources with which they are combined. The study's findings indicate that synergy is likely to be realized when the IT asset and the organizational resource are compatible (H1). Moreover, appropriately integrating the components and setting the right context for interactions is expected to contribute to the realization of synergy (H2a). The results also demonstrated that firms can compensate, to a degree, for low compatibility between an IT asset and an organizational resource by instituting certain activities, such as training programs, intended to support the IT asset implementation into the organizational resource and helping to promote the realization of synergy (H2b).

Subsequently, this synergy determines the value (H3a), rarity (H3b), and inimitability (H3c) of the resultant IT-enabled resource. In turn, these resource properties were found to have a positive impact on firm performance. In particular, value and rarity are capable of impacting operational benefits (H5a), whereas value and inimitability are capable of impacting strategic benefits (H5b). In sum, IT assets appear to derive their business value from their ability to contribute to the formation of strategic (i.e., valuable, rare, and inimitable) IT-enabled resources; ability that becomes apparent when they participate in synergistic relationships with organizational resources.

This study provided measured support for the conceptual model of the business value of IT assets developed by Nevo and Wade (2010), thus tracing an empirical path from IT assets to firm performance. The study also made three contributions to RBV research. First, to the best of our knowledge, the key constructs of the RBV – i.e., value, rarity, and inimitability – have not been systematically operationalized. Thus, this study contributes to RBV research by developing and validating

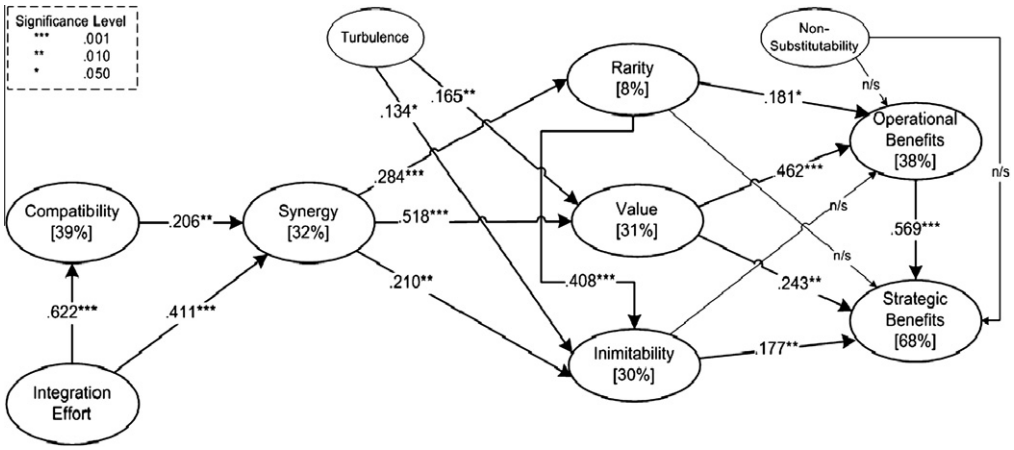

Fig. 2. Empirical model.

multi-item scales for these resource properties. The empirical results indicated that these scales are useful for assessing the strategic potential of resources. Second, the study demonstrated that it is important to incorporate an explicit and direct path from rarity to inimitability (H4), because an inability to imitate an organizational resource over time will tend to prolong its rarity. Accordingly, the rarity of a resource is an important element of its strategic potential since it (a) directly impacts operational benefits and (b) indirectly impacts strategic benefits. This interpretation can help make sense of what might appear like a counterintuitive result – i.e., lack of a significant path between rarity and strategic benefits. Third, The RBV has been criticized for overlooking the role of the environment. This study conceptually extended the RBV by explicitly theorizing about the role of the environment in affecting resources' strategic potential. By focusing on outside-in IT-enabled resources, this paper demonstrated[8] that those resources are likely to become more valuable and less imitable when the level of turbulence in the environment increases.

5.2. Contributions to practice

The research has a number of implications for management practice. First, the results show that, despite being fungible, IT assets have a role to play in impacting operational and strategic firm-level benefits. This is an important contribution to IS practice since IT assets have long been perceived to be non-strategic (e.g., Mata et al., 1995; Carr, 2003). However, this study demonstrates that while IT assets and their inherent capabilities may be commodities, the emergent capabilities of IT-enabled resources can be valuable, rare, and inimitable. Clearly, when it comes to IT assets, it is not the things you have that count, but how you use them, or more specifically, how you combine them. Second, the paper provides a diagnostic tool that managers can use to determine the strategic potential of a firm's portfolio of assets and capabilities. While the measurement items in our survey were used to measure the strategic potential of an IT-enabled resource, these measures could be modified to ascertain the strategic potential of any organizational resource, or set of resources. Third, the paper reinforces the importance of considering both the compatibility of IT assets with organizational resources and the efforts to integrate those components. These two factors are often under-emphasized in practice, and yet the results of this study suggest that they can have a strong effect on the successful deployment of IT assets within the firm, and can perhaps explain some of the performance discrepancies between firms that acquire identical IT assets.

5.3. Limitations and future research

The study entails several limitations, several of which may occasion opportunities for further research. We note that the reliance on cross-sectional data is a limitation of this study for two reasons. First, such data, while providing breadth, lack depth. Hence, ethnographic and case studies tracing the steps taken by firms to combine IT assets and organizational resources for the purpose of creating strategic IT-enabled resources would undoubtedly help to further illuminate the path from IT assets to firm performance. Such studies could offer important insights regarding the emergence of new resource-level capabilities.[9] Second, the data do not permit us to assess the sustainability of the enhanced performance levels associated with synergistic relationships between IT assets and organizational resources. Future studies may undertake longitudinal research efforts to examine the durability of any performance and competitive gains obtained via the integration of IT assets and organizational resources. Longitudinal research could also tease out the relationship between potential and realized synergy, an additional element of Nevo and Wade (2010)'s conceptual model that cannot easily be assessed using cross-sectional data.

Non-substitutability did not have a significant impact on strategic benefits, contrary to expectations. This result may be an artifact of the IT-enabled resource in question – it is difficult to conceive of many substitutes for an IT-enabled CSD and the high average score underscores this difficulty. Alternatively, there may be more fundamental conceptual issues with the non-substitutability property. Indeed, Barney (1997) proposed a modified framework – VRIO – in which value, rarity, and inimitability maintained their prominence as determinants of sustainable competitive advantage, but non-substitutability is subsumed by inimitability, and replaced by a firm-level (rather than resource-level) property describing a firm's ability to exploit the resource. Thus, it is possible that theoretical limitations, rather than (or at least in addition to) methodological concerns, explain the insignificant impact of non-substitutability on strategic benefits. We encourage future researchers to continue the examination of non-substitutability.

The use of mainly perceptual measures to assess firm performance is both strength and limitation of this study. On the one hand, it is in line with Chan's (2000) call for "soft value" BVIT research. On the other hand, it could be seen as lacking in objectivity, although tests indicated lack of common method bias.

In this study we measured the impact of environmental turbulence on outside-in IT-enabled resources using a single indicator. A second indicator was dropped due to low variability. While other studies employed a single indicator to measure environmental turbulence (e.g., Doty et al., 1993) we encourage future research to employ additional indicators and use them to examine the impact of the environment and its rate of change on various types of IT-enabled resources.

[8] This conclusion is based on the positive impact that environmental turbulence was shown to exert on the value ($\beta = .165$) and inimitability ($\beta = .134$) properties, as per the structural model (Fig. 2).

[9] We note here that Nevo and Wade (2010) discuss several case/ethnographic studies, re-interpreting them through the lenses of systems theory and the RBV, thereby providing some depth that supplements the findings of this paper.

The focal resource in this paper was the customer service department. Although this paper aims to make its conclusions applicable to other types of resources, its generalizability is yet untested. Future studies may try to replicate the research with different organizational resources. In particular, future research should explore the role of the environment when the resources in question are of the inside-out or spanning types (Wade and Hulland, 2004). This study found that the strategic potential of outside-in IT-enabled resources increased under conditions of environmental turbulence; however, we expect a different outcome for inside-out and spanning resources. In particular, we anticipate that inside-out resources would lose some of their strategic importance, vis-à-vis outside-in resources, since management is expected to pay greater attention to resources that monitor the environment and help to make sense of it, rather than to resources that are sheltered and internally focused.

6. Conclusion

This paper conceptually extended a model that links IT assets to firm-level outcomes and then empirically tested the resultant extended model. The empirical results demonstrated that IT assets – that is, commodity-like or off-the-shelf information technologies – can play a strategic role when they are combined with organizational resources and are used to create IT-enabled resources. Thus, while one component is not strategic, in and of itself, the ensuing IT-enabled resource can be strategic if the relationship between the components is synergistic – that is, if new capabilities emerge or existing capabilities are enhanced. The results showed that a synergistic relationship has a positive impact on the value, rarity, and inimitability of the ensuing IT-enabled resources, thereby allowing the latter to impact operational and strategic benefits. We further demonstrated that the firm's external environment can affect the properties of IT-enabled resources, making them more, or less, strategic depending on the level of turbulence. In sum, this paper offers conceptual and empirical contributions to the research on the business value of IT, which is at the core of the IS discipline.

Appendix A

Initial items based on extant literature.

Item	Source	Possible measure of...
The implementation of the IT asset into the customer service department enhanced competitiveness or created strategic advantage	Mirani and Lederer (1998)	Firm performance: strategic and/or operational benefits
The implementation of the IT asset into the customer service department enabled the organization to catch up with competitors		
The implementation of the IT asset into the customer service department enabled the organization to respond more quickly to change		
The implementation of the IT asset into the customer service department enabled the organization to produce more economically and/or better satisfy customer wants	Peteraf and Barney (2003)	
The implementation of the IT asset into the customer service department enabled the organization to deliver greater benefits to customers for a given cost (or can deliver the same benefit levels for a lower cost)		
The implementation of the IT asset into the customer service department is being used to leverage unique organizational capabilities	Kearns and Lederer (2004)	IT-enabled resource's value
The implementation of the IT asset into the customer service department helped it form stronger relationships with other departments and organizational units	Nelson and Winter (1982)	
The organization initiated procedures for communications between the customer service department and the IT asset integrators during the integration process	Nidumolu (1996)	IT asset–OR[a] integration effort
During the integration process the organization scheduled group meeting between the customer service department and the IT asset integrators		
The organization created integration plans	Larsson and Finkelstein (1999)	

Appendix A (*continued*)

Item	Source	Possible measure of...
During the integration process senior management was involved		
The organization provided the customer service department with special integrators		
The organization provided the customer service department with transition teams		
The organization provides proper training for users of the IT asset	Goodhue and Thompson (1995)	
The implementation of the IT asset into the customer service department resulted in the creation of new know-how	Larsson and Finkelstein (1999)	Synergy realization
The information processing abilities of the IT asset complement the customer service's	Hitt and Brynjolfsson (1997)	
Using the IT asset is compatible with all aspects of the customer service department's work	Moore and Benbasat, 1991	IT asset–OR compatibility
The IT asset fits well with the way the customer service department likes to work		
Using the IT asset fits into the customer service department's work style		
The IT asset was embedded in the customer service's routines	Nelson and Winter (1982)	
The IT asset was embedded in the customer service's culture		
The nature of the IT asset and the style of the customer service department are compatible	Markus and Robey, 1983	
The IT asset matched the customer service department		
Few of the organization's competitors manage to implement similar IT assets into their customer service departments	Strassman (1997)	IT-enabled resource's rarity
The implementation of the IT asset made the customer service department rare among the organization's competitors		
It is unusual to find customer service departments with similar IT asset among the organization's competitors		
Compared to the organization's competitors, the implementation of the IT asset into the customer service department is unique		
It is unlikely for a competitor of the organization to have a customer service department with a similar IT asset		

[a] OR = organizational resource.

Appendix B

Questionnaire items.

Construct	Item	Mean[a] (SD)
Compatibility	The CSD[b] fully understands the functionality of the IT and how it works	4.86 (1.49)
	The CSD has easily incorporated the IT into its routines	5.02 (1.32)
	The CSD's tasks and responsibilities are compatible with the functionality of the IT	4.90 (1.34)
IT integration effort	The firm provided proper training to the CSD on the purpose, use, and function of the IT	4.84 (1.50)

(*continued on next page*)

Appendix B (*continued*)

Construct		Item	Mean[a] (SD)
		The firm created formal plans to assist with the IT implementation in the CSD	4.81 (1.48)
		The firm effectively involved the CSD in the implementation of the IT	5.02 (1.37)
		The firm put the right structure in place to facilitate the use of the IT by the CSD	4.71 (1.56)
Synergy		The IT extends the capabilities of the *CSD*	5.42 (1.43)
		The IT increases the *CSD's* efficiency	5.29 (1.51)
		The implementation of the IT creates synergies within the *CSD*	4.77 (1.49)
		The IT enables the *CSD* to adapt more quickly to environmental changes (e.g., fluctuations in call volume, seasonality)	4.64 (1.58)
Strategic potential	Value	From the *firm's* perspective, the implementation of the IT enhances the usefulness of the CSD	5.46 (1.23)
		The implementation of the IT increases the importance of the CSD to the *firm*	4.82 (1.57)
		The implementation of the IT makes the CSD more valuable to the *firm*	4.99 (1.48)
	Rarity	Few of the *firm's* competitors have managed to effectively implement a similar IT into their CSDs	4.02 (1.51)
		The implementation of the IT makes the CSD unique in comparison to those of the *firm's* competitors	4.14 (1.68)
		It is unlikely for a competitor of the *firm* to have a CSD with a similar IT	3.90 (1.54)
	Inimitability	The implementation of the IT created a CSD that few of the *firm's* competitors can match	4.04 (1.49)
		The IT implementation into the CSD cannot be easily replicated by the competition	3.83 (1.49)
	NS~	The *firm* could replace the current CSD with a self-service automated solution without a drop in service level (Reverse coded)	6.06 (1.43)
Firm performance	Operational Benefits	The IT implementation into the CSD helps the *firm* to reduce costs	4.96 (1.49)
		The IT implementation into the CSD helps the *firm* to increase revenue	4.74 (1.37)
	Strategic Benefits	The IT implementation into the CSD provides the *firm* with a competitive advantage	5.11 (1.38)
		The IT implementation into the CSD enables the *firm* to respond more quickly to change	5.01 (1.53)
Turbulence		The level of change in my organization's market environment is frequent	4.62 (1.54)

[a] Seven-point Likert-type scale with 1 = strongly disagree and 7 = strongly agree.
[b] CSD = Customer Service Department; ~NS = Non-substitutability.

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