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THE FORMATION AND VALUE OF IT-ENABLED RESOURCES: ANTECEDENTS AND CONSEQUENCES OF SYNERGISTIC RELATIONSHIPS[1]

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ensuing IT-enabled resources are capable of positively affecting firms' sustainable competitive advantage via their improved strategic potential. This is an important contribution since IT-related organizational benefits have been hard to demonstrate despite attempts to study them through a variety of methods and theoretical lenses. This paper synthesizes systems theory and the resource-based view of the firm to build a unified conceptual model linking IT assets with firm-level benefits. Several propositions are derived from the model and their implications for IS research and practice are discussed.

Keywords: Business value of IT, systems theory, resource-based view of the firm, IT-enabled resources, emergent capabilities, synergy, strategic potential, compatibility, integration effort

Abstract

This paper informs the literature on the business value of information technology by conceptualizing a path from IT assets—that is, commodity-like or off-the-shelf information technologies—to sustainable competitive advantage. This path suggests that IT assets can play a strategic role when they are combined with organizational resources to create IT-enabled resources. To the extent that relationships between IT assets and organizational resources are synergistic, the

Introduction

Information technology has become an integral part of modern organizations, yet researchers and practitioners have struggled to pinpoint its contribution to business performance (Kohli and Grover 2008). Since the business value of IT has been so hard to quantify, many have settled for a classification of IT as a strategic necessity, that is, it is necessary but not sufficient for sustainable competitive advantage (Clemons and Row 1991). This paper challenges this view and develops a conceptual model representing a synthesis of systems theory and the resource-based view of the firm. The unified model is used to theorize about the path from IT assets to sustainable competitive advantage by employing the concepts of *emergent capabilities*, *synergy*, and *strategic poten-*

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tial. In particular, the paper argues that a key factor in enabling strategy execution relates not to the individual capabilities of organizational resources or IT assets in isolation, but rather to the emergent capabilities that arise from their combination.

In this paper, we define IT assets as *widely available, off-the-shelf or commodity-like information technologies that are used to process, store, and disseminate information* (Wade and Hulland 2004). We note that while some IT assets are customizable, and as such may not be regarded as completely undifferentiated, they are still considered commodities since they are not protected by isolating mechanisms (Ray et al. 2005). IT assets are an important focus for research since, from a cost-justification standpoint, most managers are interested in the business value of tangible assets rather than the more abstract notion of resources (Piccoli and Ives 2005). Yet, the link between IT assets and firm-level benefits remains elusive (Kohli and Grover 2008). This paper proposes that IT assets can be placed in a relationship with certain organizational resources, thereby creating synergistic IT-enabled resources, the emergent capabilities of which can be used to attain and sustain competitive advantage. We seek to shed light on this complex and poorly understood process.

The paper proceeds as follows: the next section summarizes the literature and extant knowledge on the business value of IT, and its main theoretical lens—the resource-based view of the firm (RBV)—to identify critical gaps in this research stream. The subsequent section introduces systems theory as a supplementary theoretical lens. Next, we synthesize systems theory and the RBV to derive a unified model conducive to identifying the link between IT assets and sustainable competitive advantage. We then further refine the model and put forward several propositions and discuss their implication for researchers and practicing managers. The paper concludes with contributions for research and practice, and directions for future research.

The Business Value of IT and the Resource-Based View of the Firm ▬▬

Following Melville et al. (2004, p. 287), we define the business value of IT (BVIT) to be the *organizational performance impacts of information technology at both the intermediate process level and the organization-wide level, comprising both efficiency and competitive impacts*. BVIT research is defined as "any conceptual, theoretical, analytical, or empirical study that examines the organizational performance impacts of IT" (Melville et al. 2004, p. 288). Recently, two

important observations about BVIT research were made (Kohli and Grover 2008). The first was that BVIT research is an important element at the intellectual core of the IS field. The second was that the IS field does not do enough to explain how and when business value is created. This paper aims to add to BVIT research by examining the role played by IT assets in the creation of business value.

The dominant conceptual paradigm guiding BVIT research is the resource-based view of the firm (e.g., Bharadwaj 2000; Santhanam and Hartono 2003; Tanriverdi 2006; Zhu and Kraemer 2005). According to the RBV, *organizational resources* are the basis for competition among firms—their ability to help achieve positions of sustained competitive advantage is conditioned upon their strategic potential (Barney 1991; Penrose 1959; Peteraf 1993; Wernerfelt 1984).[2] Organizational resources are defined as *tangible or intangible factors of production that organizations own, control, or have access to on a semi-permanent basis* (Helfat and Peteraf 2003).

The *strategic potential* of an organizational resource reflects its ability to "enable a firm to conceive of and implement strategies that improve its efficiency and effectiveness" (Barney 1991, p. 102) and depends upon four properties: *value*, *rarity*, *inimitability*, and *non-substitutability*. Value refers to the ability of an organizational resource to support strategies intended to capitalize on market opportunities or fend off threats. Rarity is a measure of the relative unavailability of an organizational resource to current and potential rivals. Inimitability is a reflection of the costs and difficulties associated with attempts to duplicate an organizational resource. Non-substitutability is a property that evaluates the non-existence of strategically equivalent organizational resources (Barney 1991; Dierickx and Cool 1989; Wernerfelt 1984).

The weight of the conceptual and empirical evidence within this stream has concluded that due to their fungible nature, IT assets do not embody these four properties, and thus are unable to affect sustainable competitive advantage (Mata et al. 1995; Wade and Hulland 2004). Instead, a number of IS resources have been proposed that may possess these properties (e.g., IT management skills are firm specific and cannot easily be traded or transferred; Mata et al. 1995). Subsequently, IS resources—and not IT assets—are at the center of IT-based RBV. IS resources, such as IT relatedness (Tanriverdi 2005), IT-business partnership (Piccoli and Ives 2005), and IS planning and change management (Clark et al.

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[2]For a broad review of the RBV in IS research, see Wade and Hulland (2004).

1997) are distinguished from IT assets by their intangible nature: one cannot purchase an IS resource directly from a vendor. Rather, IS resources must be built and cultivated over time. Empirical evidence has shown that many IS resources can provide organizational performance gains (e.g., Bharadwaj 2000; Rai et al. 2006; Ravichandran and Lertwongsatien 2005; Santhanam and Hartono 2003; Tanriverdi 2006).

There are three theoretical limitations to the RBV that are important to acknowledge in the context of the BVIT. First, RBV research tends to disregard resources that are not strategic in and of themselves, like IT assets (Bharadwaj et al. 1993; Peteraf 1993; Piccoli and Ives 2005). Second, the RBV is silent on the mechanisms through which resources attain strategic potential (Priem and Butler 2001). Third, while we know that IT assets are often combined with organizational resources, such as departments, teams, or groups (Markus and Robey 1983; Orlikowski 2000; Orlikowski and Hofman 1997), the present conceptualization of the RBV does not allow us to theorize about the outcomes of such combinations since the theory treats resources as basic building blocks (Enright and Subramanian 2007; Thomas et al. 1999). Hence, it is unclear what role, if any, IT assets play in supporting firm strategies (Piccoli and Ives 2005).

In sum, the RBV has helped to advance our understanding of the usefulness of information technology and the importance of IS resources. However, our knowledge is still lacking regarding the business value of IT assets, which forms the basis of most cost–benefit calculations (Tallon et al. 2000). Consequently, the path leading from IT assets to enduring organizational benefits, if such a path exists, remains a "black box," and exposing the contents of this box is an important topic of research (Melville et al. 2004).

The conceptual model developed in this paper presents an effort to address these gaps. The model is motivated by recent literature suggesting that analyzing the effect of IT assets on the strategic potential of organizational resources might help to observe more endurable IT-based organizational benefits (Ranganathan and Brown 2006; Ray et al. 2004).

Systems Theory

In order to provide a more complete conceptual picture of the BVIT, we propose to supplement the RBV with concepts from systems theory.[3] As we explain in the following

sections, systems theory provides a complementary theoretical lens to the RBV for the purpose of studying the strategic role of IT assets.

Things and Their Properties

Drawing on Mario Bunge's *Treatise on Basic Philosophy*, in particular *Ontology I: The Furniture of the World* (1977) and *Ontology II: A World of Systems* (1979), as well as C. West Churchman's *The Design of Inquiring Systems* (1971), we begin our exposition of systems theory with the following assertions. First, the world is made up of *things*—for example, molecules, human beings, organizations, and information technologies. Second, things possess *properties*.[4] Properties are used to describe things and distinguish among them.[5] Examples of properties that are associated with the abovementioned things are number of atoms, intelligent quotient, profit-orientation, and interface type. Third, each property is represented by some *value* at any point in time. Two (e.g., O_2), 110, not-for-profit, and graphical user interface are, respectively, possible values for these properties. Fourth, the values of a thing's properties determine its *state*.

Systems and Their Properties

Systems are composite things—that is, they have interacting components that may be systems in their own right (in which case we refer to them as subsystems) or they may be basic elements. In addition, systems possess properties that are derived from the interactions (or relationships[6]) among the components (Ackoff 1971; Checkland 1999; Churchman

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cybernetics (Ashby 1956), complex adaptive systems (Holland 1998), soft systems methodology (Checkland 1999), viable system model (Beer 1985), and system dynamics (Forrester 1968). Many organizational scholars (e.g., R. L. Ackoff, G. P. Huber, R. L. Kahn, F. E. Kast, D. Katz, A. Y. Lewin, H. Mintzberg, J. Rosenzweig, and H. A. Simon) have adapted systems theory models to the domain of the human organization.

[4]According to the online version of the *Oxford English Dictionary*, the words *property*, *attribute*, and *characteristic* are synonyms (retrieved August 13, 2009).

[5]*Merriam-Webster Online Dictionary* (retrieved August 13, 2009) and *Webster's Online Dictionary* (retrieved August 13, 2009). See also Benbasat and Zmud (2003, p. 184).

[6]We say that two things, *x* and *y*, are in a relationship if at least one of them acts upon the other—that is, if they interact (Bunge 1977, 1979).

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[3]Note that systems theory is not a single theory but rather a perspective for conceptualizing and modeling systems. Under this conceptual umbrella one may find, among others, general systems theory (von Bertalanffy 1968),

1971; Gharajedaghi 2006; Kast and Rosenzweig 1972; Von Bertalanffy 1968).[7]

Some system properties may be properties of their components but with new values. For example, one property of a customer service department (CSD; thing *x*) may be an ability to trace customer complaints. Let's assume for simplicity that this property can have only one of two possible values, *slow rate* and *fast rate*. Let's further assume that on its own, the CSD is able to trace customer complaints at a *slow rate*. A relationship between a CSD and an incident tracking support system (ITSS; thing *y*) may result in a new system (ITSS-enabled CSD; thing *z*) with an ability to trace customer complaints at a *fast rate*. Figure 1 illustrates this example.[8]

Other system properties are new in the sense that no individual component possesses them in isolation. For example, computers are composites made up of an operating system, a processor, main memory, secondary memory, etc. Processing power is a property of the computer, not of its components. This system property stems from the relationship between the processor and the main memory (Wand et al. 1999). As another example, consider the case of remote surgical service (Anvari et al. 2005): A local surgical team needs to operate on a patient but lacks the necessary knowledge to perform the surgery while a remote surgical team has the necessary knowledge but is too far from the patient to perform the surgery. A telerobotic system can be put in place to connect these two teams, allowing them to jointly operate on the patient. According to this example, illustrated in Figure 2, the ability to perform tele-laparoscopic surgery is a property of the system (thing *z*) that was created as a result of the relationships among the local team (thing *w*), the technology (thing *x*), and the remote team (thing *y*).[9] This property is not possessed by any of the individual components although it is predicated upon the individual properties and values of the

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[7]Not every collection of things makes up a system. *Aggregates* are comprised of things that do not interact with one another (i.e., are not in a relationship).

[8]We acknowledge that things have an unlimited number of properties. However, "only some of these are relevant to any particular research" (Ackoff 1971, p. 662). Therefore, only the properties of the systems and the components that are relevant for the subject matter under consideration are presented in this paper. For example, the programming language in which the ITSS was developed is not pertinent to the present discussion.

[9] Note that there are not four distinct things here (i.e., *w*, *x*, *y*, and *z*). Instead, we can zoom into system *z* to see its *w*, *x*, and *y* components and their relationships. Alternatively, we can zoom out of things *w*, *x*, and *y* and focus on system *z*.

constituent elements (i.e., extensive knowledge of laparoscopic surgery, ability to use robotic arms, synchronous data transmission, and provision of telepresence). Thus, while each component lacks the ability to perform tele-laparoscopic surgery, this property emerges from the interactions among the components.

Whether the system incorporates existing properties with new values or new properties altogether, those system properties emerge from the relationships among the components. Accordingly, we refer to both instances as *emergent properties*.

Since emergent properties are rooted in the components and their interactions, attempting to trace their source by examining the components in isolation may be unproductive (Checkland 1999; Gharajedaghi and Ackoff 1984). As an example, consider the case study reported by Robey and Sahay (1996) in which two identical GIS were implemented within similar departments at two different organizations. Despite the similarities of the components, marked differences between the outcomes associated with the implementations of the IT assets were observed. Those were attributed, in part, to the nature of the interactions among the constituent components. First, in one organization, technical personnel served as an intermediary, thereby "keeping [users] in a dependent relationship" (p. 105). In contrast, in the other organization, interactions with the IT asset were direct. Second, in one organization, training to use the IT asset was provided by technical personnel whereas in the other organization training was provided by the group that had initiated the project. Thus, to identify the sources of emergent properties, one should consider both the components and their relationships (Holland 1998; Jackson 2000). Accordingly, we define emergent properties as *context-specific properties of systems, not of their components* (Gharajedaghi 2006; Von Bertalanffy 1968).

Emergent Capabilities

In this paper, we are interested in systems that are formed through relationships between IT assets and organizational resources. We refer to such systems as *IT-enabled resources*.

It is important to note that while the interactions among components give rise to emergent properties, those may not become immediately apparent if an opportunity to use them has not yet presented itself. For example, a globally dispersed team supported by videoconferencing technology—an IT-enabled resource—may not demonstrate its improved ability to communicate more effectively, despite having this property, until it is required to make a team-based decision. Similarly, an ITSS-enabled CSD possessing an enhanced
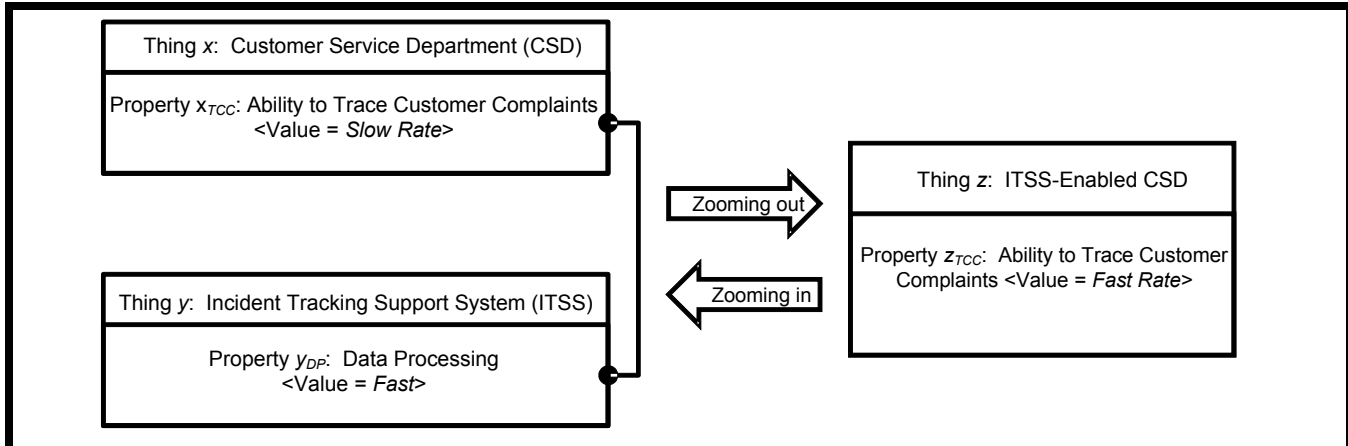
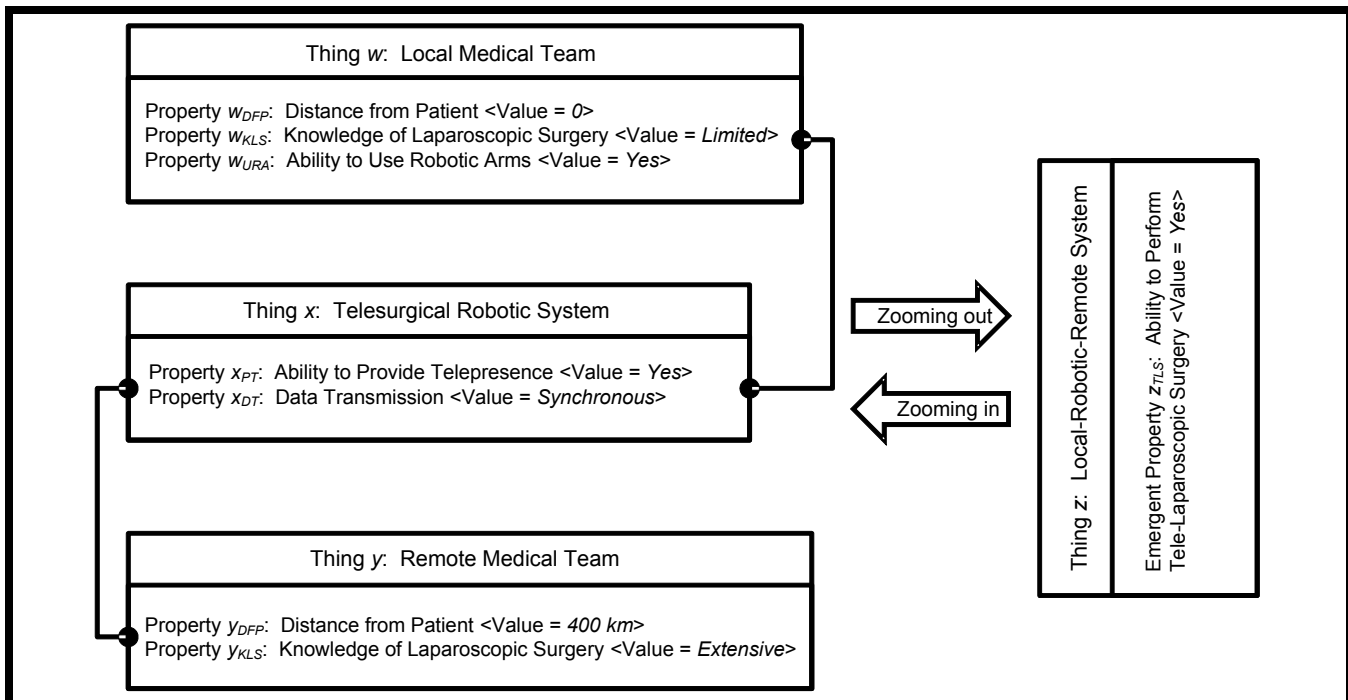**Figure 1. Emergent Properties (Existing Properties with New Values)**

Figure 2. Emergent Properties (New Properties)

complaint traceability property has the ability to quickly and accurately trace customer complaints even when it does not engage an irate customer. Moreover, certain properties may assume any value from a possible range of values. For example, the *number of complaints processed in a workday* can be any integer between, say <0, 100>. If a CSD is combined with an ITSS, then the range of possible values may increase to, say, <0, 200>. Yet, the ITSS-enabled CSD may not attain previously unfeasible values—despite having the

ability to do so—until the number of complaints due for processing exceeds 100.

The aforementioned issue was succinctly summarized by Churchman (1971, p. 11) who observed that "only rarely do [systems] become tested for their properties" and then suggested that systems be described "in term of what they *might do* under certain circumstances." Consequently, this paper refers to emergent properties of IT-enabled resources as

emergent capabilities to connote the potential for certain types of actions or behaviors rather than restricting our attention to observed behavior (Linden et al. 2007).

Predictability

Some emergent capabilities may be predictable from a consideration of IT assets and organizational resources and their intended relationships. Huff and McNaughton (1992) describe a client management system that was implemented within a sales department, intended for use by sales representatives before, during, and after their meetings with prospective clients. According to this case study, the following emergent capabilities were predictable based on the anticipated interactions between the sales representatives and the client management systems: (1) servicing customer inquiries faster, (2) reprospecting within the client base, and (3) improved time management. However, in some cases, emergent capabilities are not fully predictable. For example, Klein and Sasser (1994) describe a case where a customer analysis and retention system was implemented within a customer service department. Unlike the Huff and McNaughton case, the relationship between the IT asset and the organizational resource had several unexpected outcomes, including: (1) increased retention rates among complaining customers, (2) reduced monetary compensation, and (3) increased satisfaction among customer service employees. Similarly, Boudreau and Robey (2005, p. 10) note that the interactions between an ERP and its users produced outcomes "that were neither planned nor anticipated." In other cases, relationships between an IT asset and an organizational resource may produce a mixture of predictable and unpredictable outcomes. For example, when studying an incident tracking support system implementation within a customer service department, Orlikowski and Hofman (1997) reported several expected outcomes, such as the capability to capture full incident histories and provide enhanced customer service, but also found unexpected consequences, such as the capability to redistribute call loads and the use of the technology as a department-wide informal learning mechanism.

While the complexity of the components that participate in a relationship may be used to partially explain unpredictability, the unexpectedness of certain outcomes can also stem from the notion that relationships may not be fully understood until they have occurred in a specific context (Bunge 1979; Corning 2000). It can be inferred from the case studies presented above that emergent capabilities of a technical nature (e.g., servicing customer inquiries faster and capturing full incident histories) may be easier to predict than emergent

capabilities of a strategic nature (e.g., increased retention rates among complaining customers and using an IT asset as a department-wide informal learning mechanism). Perhaps strategic capabilities are further removed from the interacting components compared with technical capabilities, making them less predictable. Thus, the full extent of IT assets' business value may not become apparent until they are placed in a relationship with organizational resources and used to create IT-enabled resources.

Synergy

The examples presented in the preceding sections might create the impression that emergent capabilities are synonymous with beneficial outcomes. However, this is not always the case. In fact, emergent capabilities can be negative, neutral, or positive. Moreover, the distinction is often a matter of perspective (Churchman 1971). As an example, consider an implementation of an automated voice response (AVR) system within a customer service department. One possible emergent capability is faster response time (more precisely, the value of the customer responsiveness capability will change, say, from *slow* to *fast*). Customers who seek quick resolution to their problems may view this as a positive outcome; however, customers who prefer human interactions might view it as a negative outcome. To the extent that the costs of the AVR system are balanced by the foregone salaries of laid-off employees, the organization may view this outcome as neutral.

This perspective suggests that the goals of a system should guide the evaluation of the emergent capabilities. Ackoff (1971, p. 666) defined a system's goal as "a preferred outcome that can be obtained within a specified time period." Hence, in this paper emergent capabilities are considered positive or beneficial if they have the potential to help an IT-enabled resource achieve organizational tasks or goals. Drawing once again on Orlikowski and Hofman's example, since the enhanced complaint-traceability capability helped the ITSS-enabled CSD provide improved customer service, it is considered to be a positive emergent capability.

Given that the concept of emergent capabilities is independent of the desirability of the outcomes of the relationship, it may be useful to employ another concept that is better suited for exposing positive outcomes associated with implementation of IT assets. The word *synergy*—derived from the Greek word *synergos*, which means "to work together" (Corning 1995)—is often used to label relationships, including those between humans and their technologies, that result in positive

outcomes. Increased efficiency, augmentation effects, enablement of new processes, and improved scanning and detection abilities are examples of synergistic outcomes that can be associated with IT-enabled resources (Brown and Eisenhardt 1995; DeSanctis and Jackson 1994; Ives et al. 1993; Mitroff 1994).

Building on the above, we define synergy as *positive emergent capabilities*.

Synergistic outcomes may emerge from relationships (or appear in systems) that are based either on division of labor (i.e., when the components of a system are assigned to different tasks) or on functional complementarities (i.e., when the components' capabilities complement one another) (Corning 1995, 2000; Ross et al. 1997; Shenkar and Li 1999). Clemons and Row (1988) provide an example of the first type of synergy where division of labor was achieved by shifting low-value, labor-intensive tasks to the IT asset component of the IT-enabled resource, thus freeing the sales department component to offer new and lucrative consulting services to clients. Mukhopadhyay et al. (1992) provide an example of the second type of synergy by discussing a relationship between a case-based reasoning technology and a human expert. According to Mukhopadhyay and his colleagues, "the general domain knowledge of the expert with the precision and speed of [the technology's] memory and analogical mapping may lead to a powerful synergy" (p. 167).

In summary, a relationship between an IT asset and an organizational resource results in a system that we call an IT-enabled resource. The interactions between the components of this system give rise to emergent capabilities—that is, capabilities that neither component possessed by itself or that were modified (by assigning new values to properties of the components or by expanding their ranges of possible values) as a result of the relationship. The presence of emergent capabilities suggests that an IT-enabled resource is not merely the sum of its components, and as such, it cannot be explained simply by aggregating the capabilities of its constituent components. Instead, it can only be explained in totality (i.e., by considering the relationships among its components). When an IT-enabled resource possesses positive emergent capabilities—capabilities that make it more likely to complete its tasks or reach its goals—we say that the relationship among the components is synergistic (Gharajedaghi 2006; Holland 1998; Kast and Rosenzweig 1972).

For any given case of a synergistic relationship, we may ask how we can verify that a certain component is necessary for this outcome. In the context of this paper, an answer to this question can help to establish the business value of IT.

Verification may be obtained by applying Aristotle's logic, according to which many components may be involved in a relationship (i.e., make up a system) but if the removal of a particular component annuls the synergy, then we may conclude that this component was a "major" synergy contributor (Corning 2000). Consider, for example, a case where an automated multimedia system utilizing electronic linked measurement instruments, voice recognition, and interconnected LAN databases was implemented to assist gemologists at Zales Corporation (Newman and Kozar 1994). Newman and Kozar reported that the gemologists believed that their performance would have suffered had the IT asset been removed, and thus were able to conclude that this relationship "demonstrates synergy between a human and a machine" (p. 29).

The specification of a clear conceptual path between individual things, systems, and synergy has proven to be elusive. Researchers have struggled to spell out the mechanisms through which positive emergent capabilities can accrue. The next section examines this chain of causation.

Potential Synergy

Organizations try[10] to anticipate the emergent capabilities of IT-enabled resources and how those may contribute to the achievement of organizational goals (Churchman 1971). They invest in an IT asset if it appears, for example, to functionally complement an organizational resource. Hence, the decision to invest in an IT asset and combine it with an organizational resource is associated with the pair's *potential synergy*—that is, the *ex ante* assessment of the range and extent of possible emergent capabilities. Potential synergy can be considered akin to the mechanical engineering concept of potential energy (i.e., when a ball is held in place by a barrier at the top of a ramp, it contains potential energy). This energy may not be converted into realized, or kinetic, energy until the barrier is lifted. Similarly, the combination of an IT asset and an organizational resource, which appears to have a synergistic potential, may not result in any realized synergistic benefits until enabling conditions are met.

We propose that organizations should pay close attention to these enabling conditions for two reasons. First, while potential synergy is used to inform IT investment decisions, *realized synergy*—that is, the *ex post* evaluation of the positive emergent capabilities that accrue from the relationship—

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[10]The word *try* is used here to convey the notion that emergent capabilities are context-specific, that is, they are often unforeseeable until the system's components are placed in a relationship (Corning 1995).

is used to calculate the business value of IT. Second, the realization of synergy is complex and hard to predict (Nayyar 1995). Larsson and Finkelstein (1999) succinctly described this phenomenon by observing that in the context of synergistic relationships, potentials are not automatically realized. Hence, to realize the potential synergy that informs the investment decision and to increase the odds of a successful outcome, certain enabling conditions must be considered.

Enablers of Synergy

As discussed above, and illustrated in Figure 3, synergy might not be realized without the presence of enabling conditions. There are two important enablers to consider in the context of IT assets and organizational resources. First, as systems, IT-enabled resources must consist of components that are *compatible*. Second, to become a unified system, the components of the IT-enabled resource must be *integrated*. We illustrate the causal chain from the systems theory notions of potential and realized synergy through to the RBV concepts of strategic potential and sustainable competitive advantage in Figure 3. The conceptual model, which includes the proposed constructs and relationships, is presented in Figure 4. The following sections build a theoretical case for these linkages.

IT Asset–Organizational Resource Compatibility

The mere combination of any two components is not sufficient to guarantee a synergistic outcome even when inspection of the individual capabilities of each component suggests the potential for a synergistic relationship. Instead, the realization of synergy depends upon the mutual compatibility of the components (Dyer and Singh 1998). An obvious example of this notion is the requirement for compatibility among components of an IT asset (e.g., between computer hardware and software). Components are compatible when certain properties match or are in alignment. For example, when a new computer's (thing x) network protocol (property x_{np}) and the existing IT infrastructure's (thing y) network protocol (property y_{np}) share a communication standard (i.e., the values of x_{np} and y_{np} are the same, say TCP/IP), then they may exchange messages—that is, they are compatible. Likewise, compatibility must also exist between an IT asset and the organizational resource with which it is combined (Markus and Robey 1983). For instance, the ability of a group support system (GSS) to facilitate communication and decision-making suggests that teams that use GSS technologies will improve their performance. However, as observed by Davison and Martinsons (2002), synergies may not be realized if the GSS is incompatible with the team's cultural norms. Also,

knowledge sharing may not be realized if the consulting function's (thing x) culture (property x_c) and a groupware technology's (thing y) collaborative nature (property y_{cn}) are incompatible—hat is, if the values of the properties are incongruent (Orlikowski 2000). These findings suggest that organizational resources and IT assets are compatible when the features and functionalities of the latter fit, or are congruent with, the working routines, level of expertise, and other characteristics of the former. Conversely, an organizational resource and an IT asset might be considered incompatible when they must be greatly modified before interactions can take place.

Notions of compatibility have been described in various forms in the literature; Markus and Robey (1983) provided several examples of compatibility between IT assets and organizational resources. They deemed an interactive inquiry system with a decentralized architecture and a department such as research and development characterized by non-routine work habits to be compatible. Similarly, a centralized MIS with optimization models was seen as compatible with departments characterized by routine work processes (e.g., production scheduling). Robey and Sahay (1996) present a similar analysis where the focal IT asset is a GIS. Rogers (1983) considered consistency with existing values, past experiences, and needs to be elements of compatibility. However, Moore and Benbasat (1991) argued that thinking of compatibility in terms of needs is a source of confounding with another concept (i.e., relative advantage). Consequently, they removed all references to need from their conceptualization of compatibility. Recently, Karahanna et al. (2006) reiterated the importance of removing needs from the discussion of compatibility. To avoid conceptual confounds in this paper, our treatment of compatibility is consistent with those of Moore and Benbasat and Karahanna et al. in that we conceptualize compatibility as a "need-free" variable.

In this paper, we define IT asset–organizational resource compatibility as *the ability of an organizational resource to apply an IT asset in its regular activities and routines*. More generally, compatibility is an assessment of the ability of a system's components to interact—that is, form a relationship; it is not an assessment of the outcome of the interaction. In other words, compatibility represents the feasibility of the relationship, not its desirability.

The discussion thus far supports the notion that compatibility and synergy are distinct concepts. This distinction is generally recognized in the literature (e.g., Moore and Benbasat 1991; Shenkar and Li 1999). Furthermore, compatibility has been recognized as a factor capable of influencing the realization of synergy in different circumstances (e.g., Sarkar et al. 2001).
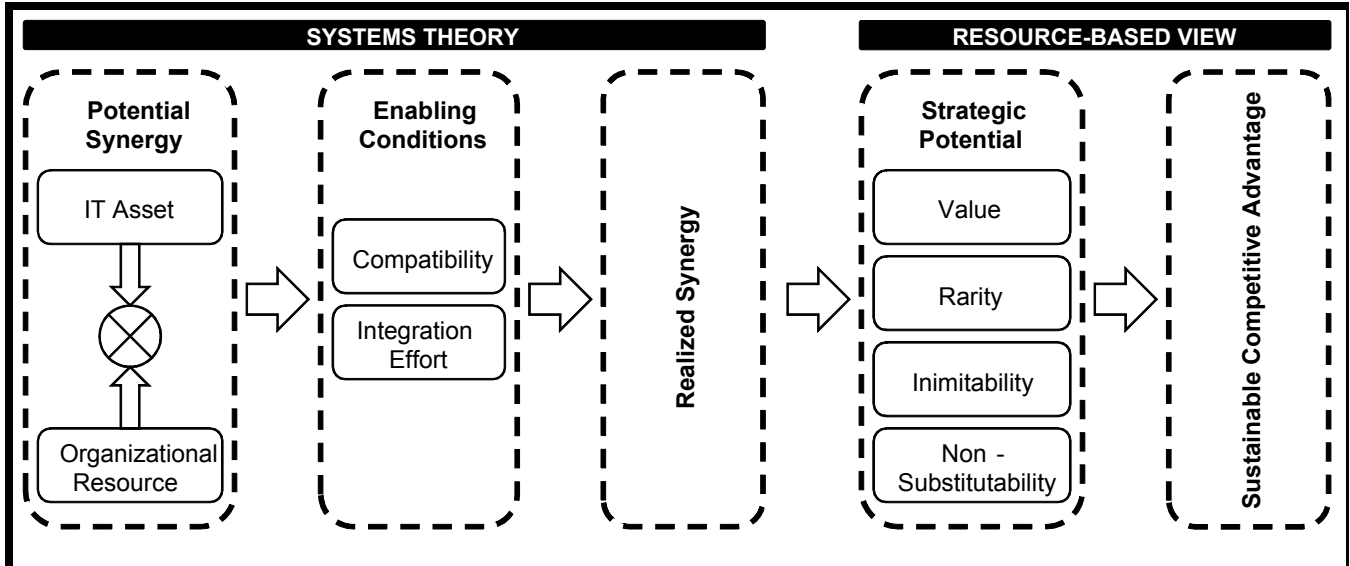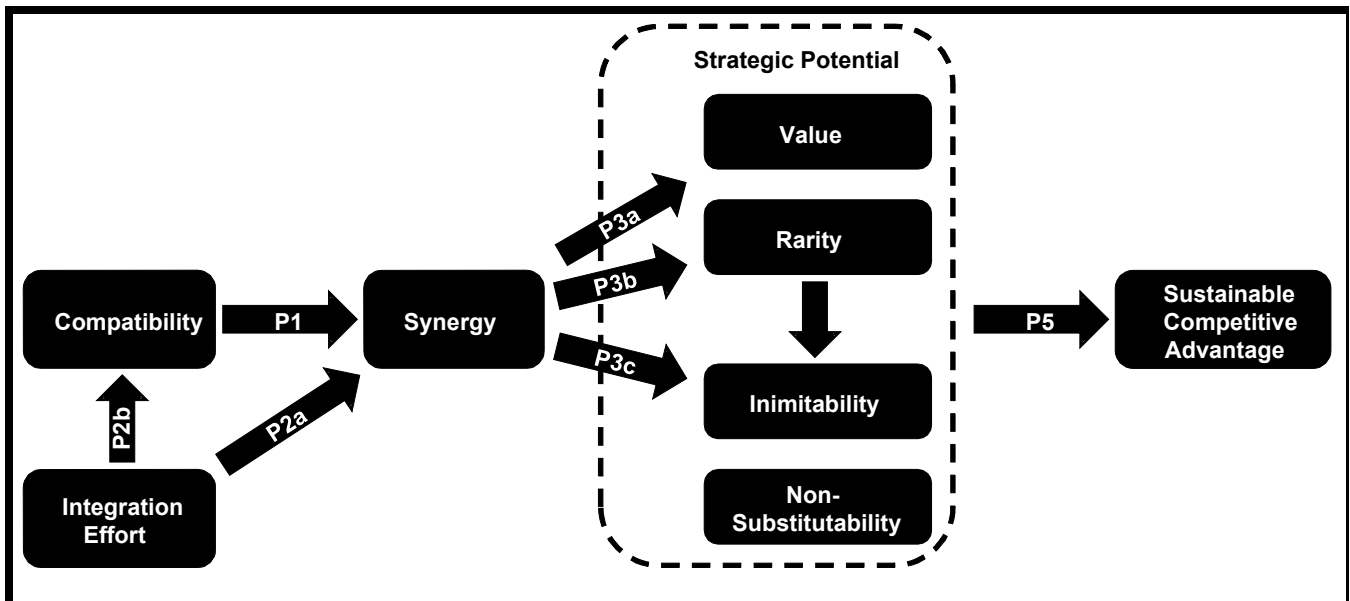
Figure 3. Potential and Realized Synergy

Figure 4. Conceptual Model

Source	Example
Gharajedaghi (2006)	Many organizations contain a manufacturing department and a sales department. These departments are interdependent: the sales department cannot sell unless the manufacturing department manufactures, and the manufacturing department has no reason to manufacture if the sales department cannot sell. Thus, the interaction between these departments is expected to be **synergistic**. However, in many organizations, the performance criteria of these two departments are **incompatible** and often result in friction. Specifically, the criterion of cost minimization for the manufacturing department and the criterion of maximum revenue for the sales department are often in stark contradiction. To reach its goal, the sales department may wish to offer customers a wide variety of customizable products with varying and flexible delivery schedules. On the other hand, it is in the best interest of the manufacturing department to strive for standardization, limited product variety, and long-term production and delivery schedules. Hence, potential cross-departmental **synergies** may not be realized due to **incompatible** performance criteria.
Huff and McNaughton (1992)	Maestro, a sales force productivity system (IT asset) was implemented to enhance the capabilities of SunLife Canada's sales force (organizational resource). Maestro was expected to generate three benefits: to allow sales reps to service customer inquiries more rapidly, to provide an opportunity to "reprospect" within the existing client base, and to improve sales reps' time management. These **synergistic** outcomes were associated with the relationship between a sales rep and his/her Maestro-loaded laptop. In particular, a sales rep was expected to use Maestro to store and retrieve client data, tailor offerings to customers based on their stored data and present needs, and plan, set and manage goals. However, the IT asset was partially **incompatible** with its intended users: it was "an American product for the American marketplace." Thus, several modifications had to be made before synergies would be realized. Specifically, the IT asset had to be made bilingual and its date and postal code formats had to change.
This stylized example is motivated by Huber (1984)	Consider an organization in which the top management team (TMT; organizational resource) is geographically dispersed. This property of the TMT suggests that an IT asset such a BlackBerry may participate in a **synergistic** relationship with the TMT since the capabilities of the BlackBerry make it suitable for maintaining communication and enabling decision-making regardless of geographical and temporal boundaries. Thus, a BlackBerry-using TMT (IT-enabled resource) may be capable of leading and managing the organization as if it were colocated (a **synergistic** outcome). However, the realization of this synergy depends upon the TMT's understanding of the technology's use and functionalities and the ability to incorporate it into its business routines (**compatibility**).

Table 1. Compatibility and Synergy

The distinction between compatibility and synergy can be illustrated using several examples (see Table 1). These examples not only point to the difference between the two concepts, but also to the notion that compatibility is a precursor of synergy. Churchman (1968) hinted at this by noting that, "if [an IT asset] is able to take data and analyze it very rapidly and hand it back to the decision maker when he is in no position adequately to interpret the meaning of the data, then the rapidity will create more harm than it does good" (p. 132).[11] Hence,

Proposition 1: Greater compatibility between an IT asset and an organizational resource positively affects the extent of realized synergy.

[11]Note that the absence of synergy does not mean absence of a relationship (interaction). In this example, the decision maker may interact with the system by, say typing a search query and pressing a submit button.

IT Asset–Organizational Resource Integration Effort

All purposeful systems have at least one component capable of directing the system. The responsibilities of such components are (1) to determine a desired system state, (2) to compare the present state of the system with the desired state, and (3) to make the necessary changes to move the system to the new state. Organizations are purposeful systems and management is the component with the ability and responsibility to direct the entire organization (Ackoff 1971).

Systems theory regards management as a mechanism for transforming the organization's numerous parts into an organized whole; it is needed in order to integrate unrelated and disorganized components such as employees, machines, and raw materials, along with different activities into an organized system that can accomplish one or more goals (Johnson et al. 1964). Indeed, managing an organization concerns governing not only the independent actions of its

components, but also their interactions—that is, relationships (Gharajedaghi and Ackoff 1984; Glouberman and Mintzberg 2001). Only when a system becomes organized and the relationships among its components follow persistent interactions would one expect emergent properties to arise, and the system to become greater than the sum of its parts (Holland 1998, Weick 1979). Accordingly, integration is needed to ensure the unification of the system's components and the achievement of the system's goals (Katz and Kahn 1966; Lawrence and Lorsch 1986).

In the context of this paper, integration effort is needed not only to ensure that an IT asset and an organizational resource interact, but that they do so in a manner that is congruent with the organization's goals (Anderson 1999). For example, Boudreau and Robey (2005) report that while users interacted with a newly installed ERP system, they did so in a manner that reinforced the status quo, thereby preventing the organization from achieving its goals. Building on Churchman (1971), we identify management's roles more specifically for the context of this paper: Management must estimate how a relationship between a specific IT asset and an organizational resource will serve the organization's goals (i.e., its preferred outcomes). Thus, management should evaluate potential IT asset–organizational resources synergy. However, managements' responsibilities extend beyond merely estimating potential synergy: If those potential synergies are to be realized, management must convert its thoughts into actions. This means that integration effort is required to ensure that the IT asset and the organizational resource are properly combined (i.e., in line with the organization's goals).

Researchers have noted that it is difficult to accurately predict the effects of direct interventions or of mandating use (e.g., Markus and Keil 1994). Thus, management's integration effort should involve establishing boundaries and setting local constraints within which organizational components are encouraged to interact, working toward both local and global maxima (Dooley 1997; Schneider and Somers 2006). Management is, therefore, tasked with the responsibility of setting the context and defining the nature of the relationship between the organization's components (Uhl-Bien et al. 2007), but at the same time, it should focus on facilitation and support for interactions (Anderson 1999; Lewin 1999; Markus and Robey 1988). In other words, management's role is as a catalyst. Its objective is to provide the necessary facilitating conditions so that the likelihood is increased that a synergistic combination will occur. Providing roadmaps for implementation, encouraging users to try out the IT asset and to participate in the implementation, offering training sessions, and modifying organizational structures are types of integration effort activities that can help with the realization of synergy.

As an example of how modifying organizational structures can facilitate IT asset–organizational resource integration, consider the case study reported by Lapointe and Rivard (2005) in which physicians began to interact with a newly installed electronic medical records system (EMR) only after the hospital's management appointed a dedicated nurse to enter data into the EMR. The case study presented by Webster (1998) exemplifies the importance of offering training sessions to potential users. Webster noted that in the absence of proper training and documentation, nonusers were unaware of certain properties and values of the installed videoconferencing system (e.g., application sharing and privacy features), thereby explaining the low levels of interaction with the system.

Accordingly, we define IT asset–organizational resource integration effort as *activities taken by the organization's management to support, guide, and assist the implementation of the IT asset within the organizational resource*.

Building on the above, we propose that integration effort may serve as an enabler of synergy by facilitating interactions between an IT asset and an organizational resource and providing (or maintaining) the organizational context of those interactions. Subsequently,

> *Proposition 2a: Management's efforts to integrate an IT asset and an organizational resource positively impact the extent of realized synergy.*

The preceding discussion further suggests that activities taken by management to help with the integration of an IT asset and an organizational resource can have a positive effect on the compatibility between the two components. To see this, note that users are more likely to understand the capabilities of the IT asset and be able to put the IT asset into use if they receive training, are encouraged to experiment with the IT asset, and are involved with the implementation. Drawing once again on the tele-laparoscopic surgery example provided above (Anvari et al. 2005) and illustrated in Figure 2, we note that the local surgical team had received training with the robotic system to increase the value of the "Ability to Use Robotic Arms" property to a level that would make it possible for the local team to use the robotic system—that is, to make them compatible. Hence,

> *Proposition 2b: Management's efforts to integrate an IT asset and an organizational resource positively impact their compatibility.*

The preceding section described a process starting from two individual components (things), in this case an IT asset and an

organizational resource, through to the realization of synergy in the form of an IT-enabled organizational resource with positive emergent capabilities. The proposed relationship between the IT asset and the organizational resource contains potential synergy. When this potential synergy is subjected to certain critical enablers—compatibility between the components (more precisely, between the values of certain properties of the components) and integration effort on the part of management—then potential synergy can be converted into realized synergy. The next section extends the causal chain from realized synergy to strategic potential and finally to sustainable competitive advantage.

From Synergy to Sustainable Competitive Advantage: A Synthesis of Systems Theory and the Resource-Based View of the Firm ▮▮▮▮▮▮▮▮▮▮

The discussion thus far has drawn on systems theory to build a case for the role of IT assets in generating synergies via their relationships with organizational resources. Specifically, IT assets are combined with organizational resources to create IT-enabled resources based on the potential synergy of the pair. To the extent that the IT asset and the organizational resource are compatible and are properly integrated, potential synergy is expected to be realized (i.e., the ensuing IT-enabled resource will possess positive emergent capabilities). Yet, systems theory is silent on the organizational benefits that may be ascribed to those positive emergent capabilities. Unlike many other theories used in management research, systems theory does not explicitly feature a dependent variable. Rather, the focus is on the goals of the systems, such as adaptation, equilibrium, and survival (Dooley and Van de Ven 1999; Morel and Ramanujam 1999; Porra 1999). This lack of a clear dependent variable inhibits the utility of the theory to shine light on beneficial firm-level outcomes— such as competitive advantage and firm performance—that are of substantial interest to practicing managers. Thus, we propose to augment systems theory with the RBV, a theory that contains a well-defined dependent variable. In particular, we argue for the establishment of a link between the concept in systems theory of *synergy* and the concept of *strategic potential* in the RBV, as illustrated in Figure 3.

Before we explore the link between these concepts, it is worth noting important parallels between systems theory and the RBV that provide support for a conceptual synthesis. According to Bunge (1983), a synthesis of theories is meaningful when the "precursor theories… share referents

and therefore some specific concepts (variables, functions)" (p. 44). Furthermore, the synthesis is likely to be "fruitful if the [theories] study the same [system]… or if one of them studies the components of the system investigated by the other" (p. 173).

There are clear similarities between the notion of an organizational subsystem and that of an organizational resource. Systems theory sees organizations as collections of interacting subsystems that can be identified by the activities (or mission, or tasks) they perform and the goals they pursue (Churchman 1968; Courtney 2001; Daft 1992; Kast and Rosenzweig 1972). Thus, functional departments like customer service, finance, marketing, research, and sales are recognized as individual subsystems within organizations (Ackoff 1969; Bunge 1979; Gharajedaghi 2006). Similarly, the RBV regards organizations as bundles of organizational resources with different capabilities and functions (Amit and Schoemaker 1993; Helfat and Peteraf 2003; Wernerfelt 1984). Thus, the RBV includes the sales department, the customer service department, and the R&D department among firms' sets of organizational resources (see Eisenhardt and Martin 2000; Galunic and Eisenhardt 2001). Hence, systems theory sees functional departments as organizational subsystems, whereas the RBV sees them as organizational resources. Yet, while systems theory treats subsystems as comprised of interacting components, the RBV does not formally recognize a level below that of organizational resources and as such treats them as basic elements (Enright and Subramanian 2007; Thomas et al. 1999).

The recognition that some organizational resources are systems—that is, organizational subsystems—implies that the key concepts of systems theory and the RBV are isomorphic, and that a synthesis of the theories is meaningful. Moreover, we argue that such a theoretical synthesis is fruitful since, as a system, an IT-enabled resource is the endpoint of systems theory but, as an organizational resource, it is the starting point of the RBV. Accordingly, an IT-enabled resource can be regarded as the conceptual "glue" that binds the two theories together.

A final motivation for the synthesis is provided by C. West Churchman, who argues, in *The Design of Inquiry Systems* (1971), that "what matters most to [management] is that [it] can conceptualize how [it] can change…a part and the change makes a difference in the performance of the whole" (pp. 49-50). We propose that the strategic potential of a resource allows management to conceptually link emergent capabilities to sustainable competitive advantage. More formally, Churchman states that

S is a system…only if: (1) S is regarded to be [goal seeking] and hence to have a measure of performance M; (2) S is regarded to have [goal seeking] components each with a measure of performance m_i, and; (3) [management] can conceptualize how changes in the components' measure of performance m_i produce changes in M (p. 50).

Wearing the lenses of the RBV and systems theory, we identify sustainable competitive advantage as the goal-seeking organization's measure of performance (*M*); synergy as the IT-enabled resource's measure of performance (m_i); and strategic potential as the mechanism that allows management to conceptualize how changes in m_i produce changes in *M*.

In sum, when wearing only the lens of the RBV, the abstract and opaque nature of organizational resources precludes us from observing how they form or combine with other components within organizations. Adding the lens of systems theory provides us with the ability to examine the role of IT assets in forming IT-enabled resources. Conversely, systems theory alone is insufficient to study IT assets in terms of competitive advantage and organizational performance—elements at the core of BVIT research (Melville et al. 2004). Thus, neither the RBV nor systems theory is sufficient, in and of itself, to study the business value of IT assets, but their synthesis provides enough conceptual range and power to accomplish this task.

Thus far, we have motivated the conceptual synthesis of two complementary theories—systems theory and the RBV. Next, we continue developing our unified model by deriving additional propositions that link systems theory and RBV concepts.

The Strategic Potential of IT-Enabled Resources

According to the RBV, the strategic potential of organizational resources is predicated upon their value, rarity, inimitability, and non-substitutability properties. In this section, we argue for the presence or absence of links between IT asset–organizational resource synergy and these resource properties.

First, we propose that a synergistic relationship between an IT asset and an organizational resource can have a positive effect on the IT-enabled resource's value property. This link is based on the notion of requisite variety in systems theory (Ashby 1956), according to which subsystems that exhibit a greater repertoire of capabilities are more useful to the larger system that contains them. In the context of this paper, an IT-

enabled resource may exhibit greater requisite variety because it possesses emergent capabilities. Hence, resource-level synergies may allow an organization to use an IT-enabled resource to capitalize on strategic opportunities. For example, if a customer service department uses an IT asset (e.g., an incident tracking support system or a client management system) to store and access information about clients—their complaints, feedback, and desires—then it may be possible to custom-fit a new product or service to a group of customers that matches a certain profile (McFarlan 1984). IT-enabled resources may also be used to fend off threats. For example, an analysis of customer data might reveal intentions to switch to a competitor, thus allowing for preemption (Roos and Gustafsson 2007). These outcomes suggest that synergistic IT-enabled resources are likely to be considered valuable. Hence,

> *Proposition 3a: Greater synergy between an IT asset and an organizational resource positively impacts the value property of the ensuing IT-enabled resource.*

Next, we propose that a synergistic relationship between an IT asset and an organizational resource can produce a rare IT-enabled resource. This notion is exemplified in the study by Clemons and Row (1988) in which two competing drug manufacturers—McKesson and Bergen—had implemented similar IT assets: "Customers who had worked with both claimed that McKesson and Bergen have equivalent order entry systems" (p. 40). However, only at McKesson was the relationship synergistic, making it possible for the IT-enabled sales department to offer new, and lucrative, consulting services (a positive emergent capability). Clemons and Row then observed that while Bergen was able to obtain a similar IT asset, it was not able to obtain an equivalent IT-enabled resource. Hence, McKesson's IT-enabled sales department was a rare resource although it contained an IT asset that was not rare.

Conceptually, the link between synergy and rarity is motivated by the idea that emergent capabilities are associated with the interactions among the individual components, not with the components themselves (Bunge 1977; Checkland 1999; Courtney 2001). Thus, while the components may not be rare in and of themselves, the ensuing IT-enabled resource with its emergent capabilities might be rare, illustrating the idea that "the whole is…different than the sum of its parts" (Alpaslan et al. 2006, p. 13). In the context of this paper, an IT asset may not be rare since other firms can easily obtain a similar IT asset with comparable capabilities on factor markets (Ray et al. 2005). However, those firms will have a harder time obtaining a similar IT-enabled resource with

equivalent emergent capabilities at the marketplace since those are idiosyncratic to the firms in which the underlying relationships are established.

The preceding arguments linked rarity to emergent capabilities. To anchor rarity in synergy (that is, positive emergent capabilities), we note that if the relationship between an IT asset and an organizational resource does not result in synergy, then the relationship is likely to be discontinued and the IT asset discarded (Bhattacherjee 2001). Accordingly,

> *Proposition 3b: Greater synergy between an IT asset and an organizational resource positively impacts the rarity property of the ensuing IT-enabled resource.*

Next, we suggest that a synergistic relationship between an IT asset and an organizational resource can result in a difficult to imitate IT-enabled resource. The link between synergy and inimitability passes through the concept of complexity in systems theory (Holland 1998). Complex systems arise from synergistic relationships among things that are not necessarily complex per se (Anderson 1999; Jackson 2000). Hence, even though an IT asset might be a "simple" building block due to its wide availability and commodity-like nature (Mata et al. 1995), its relationship with an organizational resource may produce a complex organizational subsystem (i.e., an IT-enabled resource) that is not easily understood and, hence, difficult to imitate by those not involved in the relationship (e.g., competitors). To see this, note that due to the presence of emergent capabilities, complex systems exhibit behaviors that can be unpredictable or unexpected; and the more complex the system is, the more deeply ambiguous are its activities, and the less knowable it is (Anderson 1999; Corning 1995). Hence, a fungible, commodity-like IT asset can form a relationship with an organizational resource and create synergies that might not be understood by competitors: They may recognize the nature of the components (i.e., the IT asset and the organizational resource) but not the nature of their relationship. The presence of synergy suggests that attempts to duplicate the IT-enabled resource are unlikely to be successful despite the wide availability of the IT asset component. Hence,

> *Proposition 3c: Greater synergy between an IT asset and an organizational resource positively impacts the inimitability property of the ensuing IT-enabled resource.*

Finally, we discuss the link between synergy and the non-substitutability property of an IT-enabled resource. An organizational resource is considered substitutable if it has strategically equivalent substitutes—that is, if other resources can be used to conceive of and implement the same strategy (Barney 1991). Alternatively, an organizational resource is considered non-substitutable when other resources cannot be used for the same purpose (Priem and Butler 2001). Thus, in order to argue for a link between synergy and non-substitutability of an IT-enabled resource, it is necessary to assess the equifinality of outcomes (Von Bertalanffy 1968). Equifinality means that systems (e.g., organizations) can reach the same final state (e.g., a particular strategy) even when they start from different initial conditions and follow dissimilar paths (Gresov and Drazin 1997; Katz and Kahn 1978). Thus, the presence of synergy would appear to provide no protection again an equifinal result that was created from a different resource set. There appears to be no logical or theoretical reason to argue that an IT-enabled resource would be more or less substitutable if the relationship between the underlying IT asset and resource is synergistic. Different organizational resources or combinations of resources could conceivably be used to achieve the same organizational outcomes as the IT-enabled resource. Thus, we do not hypothesize a link between synergy and non-substitutability.

From Present Rarity to Future Rarity

The RBV recognizes rarity and inimitability to be distinct properties of organizational resources (Barney 1991). Rarity is an *ex ante* limit to competition, in that it restricts the attainment of competitive advantage, whereas inimitability is an *ex post* limit to competition, in that it places restrictions on competitive advantage sustainability (Peteraf 1993). While distinct, the two concepts are logically related. If an organizational resource is rare, then it is less likely to be imitated since competitors have fewer opportunities to observe it and, in turn, to understand how to duplicate it. Conversely, the greater the availability of the resource, the higher the likelihood that it will be imitated. If a resource is imitated, then it becomes less rare by definition. Inimitability restricts the ability of competitors to duplicate a resource, thus maintaining its rarity over time. Hence, inimitability can be regarded as logically related to future rarity. To see this, note that before a resource may be imitated it must be observed and understood. While Proposition 3c theorizes about the impact of synergy on the ability, or lack thereof, of competitors to understand IT-enabled resources, a causal path from rarity to inimitability can be used to link observing with understanding. Indeed, some researchers have hinted at such a causal link (Barney 1986; Menon and Menon 1997; Wade and Hulland 2004). Accordingly, this paper argues for a causal path from rarity to inimitability. Thus,

Proposition 4: The rarity property of an IT-enabled resource is positively related to its inimitability property.

IT-Enabled Resources and Sustainable Competitive Advantage

Firms enjoy competitive advantage when they implement strategies that are unavailable to their competitors. Further, the competitive advantage is sustained when the strategies cannot be duplicated by the firms' current and future competitors (Barney 1991). Strategies are based on collections of organizational resources and, as such, their ability to confer a competitive advantage and sustain it depends upon the strategic potential of the underlying organizational resources. According to the RBV, the ability of an IT-enabled resource (or any organizational resource, for that matter) to generate sustained competitive advantage and affect performance is contingent upon its value, rarity, inimitability, and non-substitutability (VRINS) properties (Barney 1991; Peteraf 1993; Wernerfelt 1984).[12] Hence,

Proposition 5: The strategic potential of an IT-enabled resource, measured through its value, rarity, inimitability, and non-substitutability properties, positively impacts sustainable competitive advantage.

Discussion ▮

Theoretical Contributions

C. West Churchman noted that artificial boundaries among disciplines often prevent us from recognizing linkages between theories, thereby restricting the accumulation of knowledge (Porra 2001). Hence, conceptual synthesis can help to recognize parallels among different disciplines and shed light on shared phenomena (Bunge 1983). In this paper, we synthesized systems theory and the resource-based view of the firm (RBV) with the goal of providing a unified conceptual path from IT assets to sustainable competitive advantage. The theoretical synthesis was feasible due to the isomorphism between key concepts of systems theory and the

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[12]Note that while we do not propose a link between synergy and non-substitutability, we do propose a link between non-substitutability and sustainable competitive advantage. This logic is consistent with the RBV, which is silent on the antecedents of resource properties, yet is very clear on the links between these properties and sustainable competitive advantage.

RBV. Furthermore, it provided additional insights beyond the individual theories since those only overlap at the boundaries— resources are the end point of systems theory and the starting point of the RBV. Thus, we have put forward IT-enabled resources as a form of conceptual glue binding the two theories together. The resulting unified model extends the chain of causality, thereby enabling us to hypothesize about the mechanisms through which IT assets establish their business value.

Much of RBV-based BVIT research to-date has focused on IS resources and capabilities rather than IT assets, which firms must purchase and justify from a cost–benefit standpoint. In part, this scholarly attention was a natural response to works that labeled IT assets as non-strategic (e.g., Mata et al. 1995) or even went so far as to claim that IT does not matter (Carr 2003). However, we argue that those works underemphasize the fact that IT assets *in situ* cannot be considered in isolation. As Bunge (1983, p. 42) succinctly stated, "there are no perfectly isolated things." Hence, the fact that IT assets are widely available, are regarded as commodity products, and are not protected by isolating mechanisms does not tell the full story of their business value. Instead, we argue that IT assets derive their business value from the impact they make on the organizational resources (e.g., a customer service department) with which they interact. Thus, the intrinsic capabilities of the IT assets should not be used, or used to a lesser extent, to infer their business value; instead, the emergent capabilities arising from their relationships with organizational resources should be examined and evaluated. To date, few studies have examined those emergent capabilities, and thus the business value of IT assets may have been underrepresented in the literature.

This paper theorizes that IT assets, despite their wide availability and commodity-like nature, can play a strategic role when combined with organizational resources for the purpose of creating IT-enabled resources. Thus, while not strategic in and of themselves, IT assets have an important role to play in enhancing the strategic potential of the organizational resources with which they are combined. The unified conceptual model developed in this paper suggests that synergy is likely to be realized when the IT asset and the organizational resource are compatible. This argument is motivated by systems theory logic according to which compatible components are more likely to interact with one another, and thus increase the likelihood of synergy realization. The conceptual distinction between compatibility and synergy is important for research since it demarcates two critical concepts that are often confounded, and because it explicates the enabling role of the former in the realization of the latter. We argue that organizational context also plays an important role in the

realization of synergy. Organizations can partially compensate for low compatibility between an IT asset and an organizational resource by instituting certain activities intended to assist with the IT asset implementation. We place these activities under the umbrella category of IT integration effort. Synergy, defined as positive emergent capabilities, can positively affect the value, rarity, and inimitability properties of the ensuing IT-enabled resource. This outcome is motivated by systems theory logic according to which synergy at the subsystem level may rise to the system level, contributing to the overall performance of the system (Churchman 1971). Drawing on the RBV, these IT-enabled resource properties are expected to have a positive impact on a firm's sustainable competitive advantage.

In sum, to the extent that the IT-enabled resource has greater strategic potential than the organizational resource in isolation, we can infer the existence and the magnitude of the business value of the IT asset. This information is likely to help us understand when and how the business value of IT assets is obtained.

In addition to providing a conceptual contribution in its own right, the synthesis of systems theory and the RBV has contributed insights to its precursor theories. For example, there are several possible extensions to the RBV. First, by focusing on intangible organizational resources, the RBV has principally attributed strategic potential to organizational resources that are difficult to control or modify, thus providing firms with few tools to affect the strategic potential of their resources. This paper, in contrast, argues that organizational resources need not be intangible in and of themselves to be considered strategic since their strategic potential is based on the capabilities that emerge from their relationships with IT assets (or possibly other components produced within the organization or obtained from the environment), not on their intrinsic properties. In other words, the paper supports the idea that what you have is less important than how you use it. Second, the paper sheds light on resource heterogeneity and evolution. By combining organizational resources with IT assets, organizations can create new resources with enhanced strategic potential. This is an important contribution since the RBV has been criticized for using path-dependency to explain resource heterogeneity without explicitly discussing the mechanisms by which this occurs (Priem and Butler 2001). Third, this paper provides an intuitive explanation for propositions recently made by researchers regarding the dynamic nature of resources. In particular, it has been noted that resources do not remain static over time, but rather evolve and change by adding and shedding components (Wade and Hulland 2004). This paper illustrates how IT assets can be

used to adapt and modify organizational resources, thereby altering their strategic potential. Fourth, the paper contributes to the RBV by arguing for an explicit and direct link between rarity and inimitability, building on the notion that inability to imitate an organizational resource over time will tend to sustain its rarity.

The paper also contributes to systems theory. First, it provides a conceptual link, heretofore missing, from the theory to an explicit dependent variable, thus demonstrating the impact of interactions and relationships on system-level effects that are of great importance to business managers. Second, it demonstrates that systems theory, which has received diminished attention in recent years, is a viable conceptual lens—one capable of informing well-used theories such as the RBV.

Future Research

In this paper, we have drawn on many case studies and prior relevant research in information systems to illustrate and exemplify key aspects of our model. Consequently, the paper is rich with examples that offer preliminary empirical support regarding the viability of the model. While grounded in well-established theories and supported by anecdotal evidence, the usefulness of the unified model should be further evaluated by operationalizing the conceptual constructs and empirically testing the propositions. Consistent with the main thesis of this paper, proper operationalization of the theoretical constructs should employ measures that reflect the IT asset, the organizational resource, and their relationship. Furthermore, it should be clear from the measures that the outcomes of the relationships are predicated upon both the IT asset and the organizational resource. Since the IT asset and the organizational resource interact, they are both likely to be affected by the relationship; however, given the focus of BVIT research, proper operationalization should evaluate the impact of IT assets on the organizational resources with which they are combined, rather than the other way around. Additionally, outcomes should be measured at the levels in which they occur—that is, synergy should reflect benefits to the organizational resource whereas strategic potential should reflect benefits to the organization. This distinction is critical since a synergistic relationship helps a resource achieve its goals while a heightened strategic potential helps the organization achieve its goals. Finally, operationalizing RBV constructs, in particular resource properties, is likely to prove a significant challenge (Priem and Butler 2001). Consider, for example, Barney's (2001, p. 44) suggestion to operationalize rarity by specifying "the maximum number of competing

firms that can possess a resource beyond which perfect competition will exist." By Barney's own account, such an operationalization would be difficult and problematic. It is, therefore, not surprising that valid and reliable measures of resource properties have not yet been developed. Accordingly, we suggest that researchers seeking to test our model should employ, as a methodological compromise, perceptual measures to operationalize RBV variables.

We believe that the unified model developed in this paper can be extended in several directions. First, according to systems theory, certain subsystems are capable of making their own decisions regarding their adaptation in response to environmental pressures (Anderson 1999). Future studies may extend the model by theorizing about whether IT implementation decisions made at the organizational level are expected to yield a different BVIT compared with decisions made at the resource level.

Second, future research may seek to apply concepts rooted in complex adaptive systems research to theorize about how resources coevolve with their organizations and how this process affects the relationships between the organizational resources and the IT assets—for example, by making them less compatible.

Third, according to Bharadwaj (2000, p. 176), "firms that achieve a competitive advantage through IT have also learned to combine effectively their IT resources to create an overall IT capability." We believe that this paper's concept of integration effort is an important element of what Bharadwaj considers a firm's learned ability to effectively combine IT resources. However, we also believe that a firm's ability to predict and assess potential synergy is another important element. While this paper focused its attention on integration effort, it did not theorize about a firm's ability to recognize and assess potential synergy to the same extent. This organizational capability can help to distinguish between successful and less successful firms. Therefore, future research can contribute to our understanding of firms' competitive advantage through IT by delving more deeply into the process through which firms assess potential synergy. Perhaps a starting point for this effort would be to recognize that a precursor to effective combination of organizational components requires management to "estimate in thought how well each alternative…will serve a specified set of goals" (Churchman 1971, p. 5).

Fourth, by understanding what impacts organizations' ability to exploit synergy—that is, to take advantage of the emergent capabilities of resources to attain and sustain positions of competitive advantage—we are likely to improve our under-

standing of what sets successful organizations apart from unsuccessful ones even when they possess similar IT assets and comparable organizational resources. Future research may be able to shed more light on this important issue by exposing the barriers that prevent these potentials from being realized.

Fifth, the literature has suggested that the strategic potential of organizational resources is affected by the level of turbulence in the organization's environment (e.g., Wade and Hulland 2004). As conditions change rapidly in turbulent environments, it becomes more important to monitor and adapt to newly formed opportunities and threats (Huber 1984), arguably making certain IT-enabled resources more valuable to the firm. Further, in turbulent environments, it may become more difficult for firms to imitate a competitor's resource set since the organizational resources themselves are moving targets. Future research should theorize about the role of environmental turbulence on key elements of the model proposed in this paper.

Implications for Practice

We believe that describing a mechanism by which IT assets have a strategic role to play in the realization of organizational benefits, despite their fungible nature, is an important contribution for IS practitioners who seek to understand when and how the business value of IT assets is created. This paper proposes that the business value of IT assets is contingent upon their ability to help create strategic IT-enabled resources when they participate in synergistic relationships with organizational resources. The realization of synergy is dependent on the degree of compatibility between the IT asset and the organizational resource, and on the efforts of management to integrate these components into an IT-enabled resource. Thus, this paper alerts managers to consider not only the IT assets in which they invest, but also the relationships of IT assets with the organizational resources in which they are implemented. Specifically, managers should think about synergy and compatibility, and make an effort to integrate IT assets and organizational resources in a manner that is conducive for the realization of synergy. Managers are advised to acknowledge the distinction between compatibility and synergy since it could help them to elucidate the business value of IT. Specifically, by separating compatibility from synergy, managers can first focus on the aspects of the relationship that are germane to the business value of IT assets (i.e., synergy) and then independently assess compatibility to determine the integration efforts required for synergy realization.

Concluding Remarks ▬▬▬▬

This paper synthesizes systems theory with the resource-based view of the firm (RBV) to argue that the business value of IT assets is associated with the emergent capabilities exhibited by IT-enabled resources produced as a result of interactions between IT assets and organizational resources. The unified model developed in this paper extends the chain of causality from IT assets to sustainable competitive advantage to suggest that neither organizational resources nor IT assets need to be strategic in and of themselves as long as their combination creates strategic IT-enabled resources. This is an important contribution since it provides a mechanism for eliciting strategic benefits from IT assets, thereby helping to establish their business value. This reasoning challenges previous conclusions regarding the business value of IT that relied solely on individual properties of IT assets to assess their business value.

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