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## A Resource-Based Perspective on Enterprise Resource Planning (ERP) Capabilities and Upgrade Decision

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### Abstract

*The complexities in making an enterprise resource planning (ERP) upgrade decision have been widely cited in the trade press. As a consequence, a significant percentage of ERP clients deferring the upgrade decision is resulted. Yet, to date we observe paucity of research with which to conceptualize and explain the important factors influencing ERP upgrade decision. This study attempts to explain the rationales behind the upgrade decision (regardless for short- or long-term) using the resource-based view (RBV). The hypotheses derived from the theoretical perspective are proposed and the research method is discussed.*

**Keywords:** enterprise resource planning, resource-based theory, information systems resources, IT resources, software upgrade decision, competitive advantage

### • Introduction

ERP solutions remain to be the IT backbone for internal business process and a pre-acquisition for large, medium and small organizations to expand, to remain competitive and to collaborate with employees, business partners and all players along the supply chains. The importance of ERP solutions are unquestionable especially for organizations operating in a dynamic economy and volatile business environment.

In spite of the previous boom followed by stagnant and decline observed in ERP market in the past five years, the growth for ERP industrial market in particular are expected to continue. According to Clouter (2004), the worldwide market for ERP solutions to discrete manufacturers (automotive, heavy machines, electronics) and process manufacturers (food and beverage, pharmaceutical, primary metals, refining, textiles) was \$9.1 billion on 2003 and is forecasted to be over \$12 billion in 2008, growing at a compounded annual growth rate of 5.7% over the next five years. This is cited to be driven by global factors such as rebounding global economies, the expanding European Union, the strong euro, a focus on value-added services, and the need for more implementations in the process industries (Clouter 2004).

From the ERP vendors' perspective, ERP revenues do not only come from the software sales, but also from the ERP related services such as consulting, implementation, training and maintenance. The latter represents 70% of the total ERP revenues in 2003; out of the 70% of these revenues, maintenance and support services are found to account for a large percentage (Clouter 2004).

Based on ARC Advisory Group report, manufacturers are increasing their IT expenditures, to replacing, or at least upgrading their ERP solutions that were implemented prior to Y2K issues (ARC Advisory Group 2004). It is believed that there are a lot of potential growths for ERP maintenance and upgrade projects (for the vendor). In year 2002, 1,145 upgrades were complete worldwide, with the remaining 90% of the customer base yet to upgrade (Barling 2002). On the other hand, 30% of Baan's clients (2600) have upgraded to iBaan V (Evers 2003). Table 1 shows the (partial/incomplete) trend of ERP upgrade projects' take-up. From perspective of the ERP clients, the issues of maintenance and upgrade are continuously existing and requiring extensive attentions and effort as far as continuous business improvement and benefit-realization are concerned.

**Table 1: Trend of ERP upgrade projects take-up**

	<b>Year 2002 (worldwide) (Barling 2002)</b>	<b>Year 2003 (Baan only) (Evers 2003)</b>
Upgraded	10%	30%
Yet to upgrade	90%	70%

Despite of the importance of upgrade, we still observe a significant percentage of ERP clients postponing the upgrade decision. Yet, to date we observe paucity of research with which to conceptualize and explain the important factors affecting the upgrade decision. 'An upgrade decision' is defined as a decision made which results in the installed old ERP version being replaced by a newer and superior version either for the same or different vendor's product.

This research investigates IS/ERP (competitive advantage) resources effect on firm decision. While there could be many factors influencing an ERP upgrade decision (see also (Ng 2005)), this study chooses to focus on the impact of and study how competitive advantage factor affects ERP upgrade decision. Wade et al. (2004) argue that resource-based view (RBV) provides "a cogent framework to evaluate the strategic value of information systems resources" (p. 109). This study assumes that upgrading an existing ERP system to a more advanced and superior version (an ERP upgrade version) will generate a set of new resources and when assembled, organized deployed and use in firm-specific organizational and business processes will create competitive advantages to the ERP client-organization. This assumption is supported in the writings by other researchers (Beaumont 2004; Davenport 1999; Davenport 2002; Davis 1998; Dunn 2003; Heald et al. 1999; Jakovljevic 2000; Markus et al. 1999; Scott et al. 2002; Travis 1999; Weston 1998). This research proposes that competitive advantage bring about by ERP system will affect ERP upgrade decision. Using the IS/ERP assets and capabilities offered by the new upgrade version and the RBV characteristics, this study determines how competitive advantage affects ERP upgrade decision. Our research question is: which ERP resources and capabilities are critical to driving the decision to upgrade an ERP system.

The work-in-progress begins with a discussion of ERP upgrade in section 2. Section 3 provides the theoretical rationale and the hypotheses for the study. This is followed by a discussion of the research method in section 4.

- **ERP Upgrade Project and Motivation**

Upgrading an ERP solution is not trivial as elements such as program code, user interface, data structures, tables, reports, business processes, and formats or methods for integrating with other systems inside or outside the enterprise could have changed dramatically (Beaumont 2004). AMR Research reported that on average, upgrade costs one man week of project effort and \$1,839 per business user (Swanton et al. 2004). In general, the costs of upgrades are still too high, regardless of the reason behind them (Caruso 2004).

Many clients in fact have the plans to do upgrade to new releases where they can offer solutions to their needs (O'Brien 2003). The vast majority of companies using ERP may choose to delay ERP upgrades (McMahon 2004) but there is no evidence that they will never upgrade their ERP solutions in the future. They would not consider giving up vendor support for such a mission-critical application (Swanton 2004b) or paying exorbitant maintenance fees after the official support period (McMahon 2004).

Upgrade is a must or necessity for ERP clients that could not afford to forego vendor's maintenance support, and are operating in ever-changing, competitive and collaborative environment. For instance, many Oracle 11i users have been on a continuous upgrade path for years because of new releases consist of bug fixes and technology platform changes with new functionality and statutory updates (Swanton 2004a). This is supported by Thompson (2002) that new releases typically have a number of applications enhancements, technical enhancements and bug fixes. Technical enhancements include system and data security, processing speed, system performance, compatibility with other software and hardware, and leveraging new database and operating system features which are mostly needed to enable installation of new modules; and bug fixes are always a part of a new release (Thompson 2002). More importantly, upgrade is an opportunity to implement all the patches to keep up to the standard or at a controlled level. Thompson (2002) emphasizes that an upgrade decision is not an absolute yes or no answer but it is more of a now or later decision. Upgrade decision has to be justified by its value, usefulness, and contribution to the business of the client organizations.

According to Kremers (2000), ERP upgrades are important to both ERP vendors and clients. Upgrades are important to ERP vendor because: (1) upgrade intensify the customer lock-in effect (a phenomenon where it is always cheaper to upgrade an installed version to a new version from the same vendor rather than switching to another new vendor), (2) a smaller number of different software versions is less costly and easier to support and service than a large variety of products, (3) upgrades can lead to increased revenues through more sales (i.e. more seats for new software solution, sales of add-on products supported by the new version), and (4) a unified customer base served as a reference base to attract new customers can be developed (Kremers et al. 2000).

More relevant or important reasons for the ERP clients to do upgrades are the need to adopt changes and to make compliance to new standard, regulatory or government regulation (Kremers et al. 2000). New and enhanced functionality in the new release is another compelling factor driving the decision to upgrade (Ostrom 2004a). According to AMR Research (Jahnke 2002) based on 109 companies, the most often cited benefits were enhanced functionality and improved ability to collaborate with business partners. (However, the learning scope may increase due to new transactions, screens and enhanced functionality.) Allesch (2004) and Ostrom (2004a) find that (for the case of SAP ERP system) total cost of ownership (TCO) savings can also be achieved with new release such as SAP NetWeaver or extension set such as integrated Internet transaction system and business warehousing because of reduction in integration costs and reduced maintenance license on other products, and opportunity to eliminate redundant software components in the architecture. Some clients may take up upgrades in order to take advantage of new technical features (e.g. Java platform within Web Application Server (Web AS)) (Ostrom 2004b). Other reason is to avoid higher maintenance costs for the older versions, such as an additional 2% (could be an increase of \$50K per annum) on fees for certain versions (Ostrom 2004b). Other reasons for the clients to conduct upgrades are strategic business benefits of new solutions (CRM, SCM, portal) (Beaumont 2004) and operational benefit such as operational cost reduction (Jahnke 2002). The drivers for ERP upgrade projects (distilled from the existing literature) from the client's perspective can be divided into basically four main categories based on the intrinsically intuitive *objective* behind the reason for upgrading (as shown in column 2) in Table 2.

**Table 2: Main categories of upgrade drivers**

<b>Upgrade driver category</b>	<b>Description (objective)</b>	<b>Upgrade reason</b>
Technical	Keeping the system operational at certain level of performance, cost-effectively maintainable, avoiding the system from vendor support termination	Compliance to the vendor's standard code or keeping the system up-to-date, Expired maintenance support, Take advantage of new technical features, Synchronizing existing systems, Third-party application/ hardware no longer support existing version, Removal of high maintenance enhancements or workarounds, Retirement of legacy system and bolt-ons, Maintenance is too expensive
Business improvement	Realizing business benefits from the system	TCO savings, Increased efficiencies, Operational business benefits of new functionality, Dissatisfaction with the current system
Business operating needs	Adapting the system to new business requirements, business process, government regulations	New and/or enhanced functionality, Compliance to new business environment, Competitive advantages, Strategic business benefits of new solutions
External business needs	Meet the suppliers, business partners, and customers	Pressure from the value chain

	needs	
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• **Theoretical foundation and research model**

**1.1 Resource-Based View**

The theory that explains how firm competes based on firm’s resources is known as the resource view theory of competitive advantage (Barney 1991; Peteraf 1993). According to Wernerfelt (1984) and Barney (1991), firm resources can be important factors of sustainable competitive advantage and superior firm performance. Resources are defined to be “all assets, capabilities, organization processes, firm attributes, information, knowledge, etc. controlled by a firm that enable the firm to conceive of and implement strategies that improve its efficiency and effectiveness” ((Barney 1991), pg. 10). Firm can use these resources for creating, producing, and/or offering its products (goods or services) to a market (Sanchez et al. 1996).

Based on the literature review, resources can provide competitive advantage to firm in either or both of the following scenarios. The first is that the resources themselves possess special characteristics that make firm competitively advantage by having the resources. These characteristics are valuable, rare, inimitable and non-substitutable (Barney 1991). The definitions for these characteristics distilled from major literature are summarized in Table 3. With these resource characteristics, firm is capable of creating and sustaining competitive advantage that affords the accrual of superior long-term performance (Barney 1991; Grant 1991; Penrose 1959; Peteraf 1993; Wade et al. 2004).

**Table 3: Definitions of RBV characteristics**

<b>RBV characteristic</b>	<b>Definition</b>
Valuable	A resource or capability enables a firm to implement strategies that improve efficiency and effectiveness (Barney 1991). A resource or capability that has little value has a limited possibility of contributing a sustained competitive advantage on the possessing firm (Wade et al. 2004).
Rare	A resource or capability is scarce and not simultaneously available to a large number of firms (Amit et al. 1993). A resource or capability that is not rare is not likely to create a strategic benefit.
Inimitable	A resource or capability is not quickly duplicable. Three factors contributing to inimitability, i.e. <i>unique firm history</i> , <i>causal ambiguity</i> , and <i>social complexity</i> (Barney 1991; Mahoney et al. 1992; Rumelt 1984). A resource or capability is related to <i>unique firm history</i> when it can only be developed over long periods of time (Mata et al. 1995). <i>Causal ambiguity</i> happens when the link between a resource or capability and the particular competitive advantage is unclear or poorly understood. As a consequence, it is extremely hard for other firm to duplicate the resource or capability (Dierickx et al. 1989; Reed et al. 1990). This can include firm’s culture (Barney 1986) and/or tacit attributes (Reed et al. 1990). On the other hand, <i>social complexity</i> describes the multifarious relationships within the firm and between the firm and key stakeholders (Hambrick 1987). This can include a firm’s organization’s culture (Barney 1986), reputation (Klein et al. 1978), and trustworthiness (Barney 1994).
Non-	A resource or capability is rare and inimitable (Black et al. 1994).

substitutable	
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The second case is emphasizing on a firm's unique assembly and deployment of the resources to create competitive advantage. Firm-specific and optimal assembling, arrangement, organization, utilization and deployment of these resources create unique organizational capabilities that once embedded in unique organizational or business process creates firm's competitive advantage (Grant 1991; Makadok 2001). This is because unique organizational capabilities can provide economic returns for example, better business efficiency and effectiveness. These create firm's competitive advantage because the firm is more efficient and effective than its rivals in utilizing and deploying the resources (Makadok 2001). Improved business efficiency and effectiveness can lead to better customer service, higher customer satisfaction, lower production costs, transaction costs, cheaper product price to the customers, and increased profits. Figure 1 illustrates the transformation from firm's resources to firm's competitive advantage.

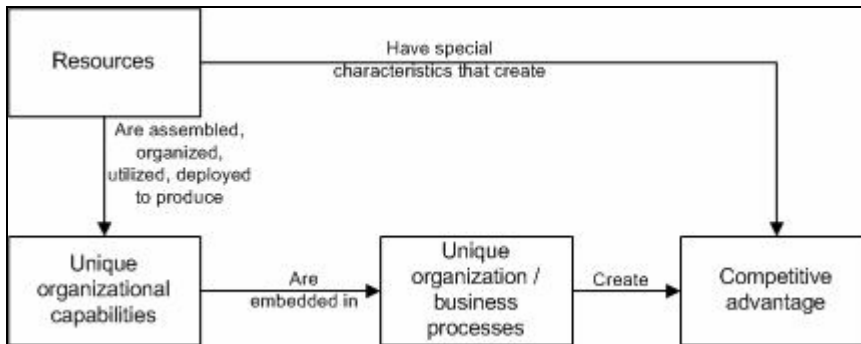


Figure 1: Transformation from resources to competitive advantage

This second scenario is important in explaining how resources create competitive advantage when these resources by themselves are not rare, imitable and substitutable. However, via firm-specific assembly and deployment of the resources and their utilization in specific organization or business processes, they will eventually create organizational capabilities and/or organization and business processes that are valuable, rare, inimitable and non-substitutable.

IS resources can be broadly divided into IS assets (technology-based) and IS capabilities (system-based) (Wade et al. 2004). While IS assets are easy to copy and most fragile source of sustainable competitive advantage (Leonard-Barton 1992), competitive advantage bring about by a firm's superior deployment of IS capabilities is not (Day 1994). Distilling from existing literature, Wade and Hulland (2004) classify IS resources into eight major resources: external relationship management, market responsiveness, IS-business partnerships, IS planning and change management, IS infrastructure, IS technical skills, IS development, and cost effective IS operations. The definition of these IS resources are given in Table 4. Using the IS resources typology proposed by Day (1994), Wade and Hulland further group external relationship management and market responsiveness IS resources as belonged to the *outside-in* capabilities (i.e. focusing on a firm's external activities); IS infrastructure, IS technical skills, IS development and cost effective IS operations IS resources as *inside-out* capabilities (focusing on a firm's

internal activities); and IS-business partnerships and IS planning and change management IS resources as *spanning* capabilities (that integrate both *outside-in* and *inside-out*). This is also shown in Table 4. Based on thorough literature review, Wade and Hulland (2004) hypothesized that there exist relationships between each (of the eight) IS resource(s) and each (of the four) RBV attribute(s); this will be discussed later in the paper.

**Table 4: IS resources (Wade et al. 2004) (p. 113-115)**

IS resource	Description
<i>Outside-in</i>	
External relationship management	Firm's ability to manage linkages between the IS function and stakeholders outside the firm. This includes managing relationship with outsourcing partners and customers. It is an important organizational resource leading to competitive advantage and superior firm performance.
Market responsiveness	It involves the collection of information from external sources and dissemination of a firm's market intelligence across departments (Day 1994). It allows the firm to undertake strategic change when necessary (Bharadwaj 2000).
<i>Spanning</i>	
IS-business partnerships	The capability that represents the processes of integration and alignment between the IS function and other functional areas or departments of the firm. It is the support for collaboration within the firm.
IS planning and change management	The capability to plan, manage and use appropriate technology architectures and standards to effectively manage to resulting technology change and growth (Mata et al. 1995).
<i>Inside-out</i>	
IS infrastructure	The IS infrastructure that is either proprietary or complex and hard to imitate (Benjamin et al. 1993). However, this resource has generally not been found to be a source of sustained competitive advantage for firms (Mata et al. 1995).
IS technical skills	The technical skills (relating to both system hardware and software) that are advanced, complex, and, therefore, difficult to imitate. These resources can become a source of sustained competitive advantage.
IS development	Future-oriented capabilities that are associated with managing a system development life-cycle that is capable of supporting competitive advantage (Bharadwaj 2000; Ross et al. 1996), and should therefore lead to superior firm performance.
Cost effective IS operations	Encompass the ability to provide efficient and cost-effective IS operations on an ongoing basis. Firm can develop long-term competitive advantage by using this capability to reduce cost and develop a cost leadership position in their industry (Barney 1991).

This study assumes that upgrading an existing ERP system to a more advanced and superior version (an ERP upgrade version) will generate a set of new resources and when assembled, organized deployed and use in firm-specific organizational and business processes will create competitive advantages to the ERP client-organization. This assumption is supported in the writings by other researchers (Beaumont 2004; Davenport 1999; Davenport 2002; Davis 1998; Dunn 2003; Heald et al. 1999; Jakovljevic 2000; Markus et al. 1999; Scott et al. 2002; Travis 1999; Weston 1998). This research proposes that competitive advantage bring about by ERP system will affect ERP upgrade decision. Using the IS/ERP assets and capabilities offered by the new upgrade version and the RBV characteristics, this study determines how competitive advantage affects ERP upgrade decision.



## 1.2 Research hypotheses

### *Resources and Capabilities Offered by an ERP System*

The upgrade drivers given in Table 2 can actually be interpreted as a firm's IS resource and IS capability expectations from a new ERP version/system. In other word, the resources or capabilities that a new ERP version can provide are the expected benefits (and vice versa) when the client-organizations upgrade the systems. In this case, we mapped the upgrade drivers onto the needs for IS resources and capabilities.

The technical issues that influence an upgrade is actually driven by a firm's needs for an up-to-date and a better *IS infrastructure*. A better and new IS infrastructure allows the business operations to perform at a cost-effective level, to facilitate better system performance, and to ensure that the system remains economic to maintain and supported by the vendor. Business improvement upgrade driver in Table 2 is belonged to a firm's needs for *cost effective IS operations*. This is because this upgrade driver is leaded by the needs for increased business efficiency, cost savings and operational business benefits such as reducing inventory cost, raw material cost, lead time in servicing customer and production time, and production cost (Ragowsky et al. 2002). Business operating needs are motivated by a firm's *market responsiveness* needs. For example, in order for a firm to be responsive to the market it is important for a firm to be compliant to a new business environment where it operates, equipped with the powerful ERP system or software functionalities, to allow it to operate competitively in a changed environment. On the other hand, external business needs are caused by a firm's needs to *manage external relationship* with customers, suppliers and business partners due to pressure from the value chain. Table 5 describes how the abovementioned four ERP resources and/or capabilities are sustained and enhanced mainly through new upgrade version.

**Table 5: ERP resources and/or capabilities enhancement through new upgrade version**

<b>ERP resource and/or capability</b>	<b>How it is sustained and enhanced through new upgrade version and not from old version</b>
IS infrastructure	With better and up to date technology, new version can facilitate better system performance. On the other hand, with old version/system, the infrastructure and/or technology can be obsolete – resulting in slow response time, unable to support further business expansions and have difficulties to operate in a robust ever changing external environment. Moreover, old version that is not supported by the vendor would lead to higher system maintenance costs and difficulties in recruiting technical experts to continue maintaining the system.
Cost-efficient IS operation	New version with improved and new business functionalities and business processes will ultimately provide more business processing capabilities and produce more cost-effective business operations. This automatically facilitates cost reductions and develops a cost leadership position. This allows more and continuous business benefit realizations from the new upgrade version. On the other hand, with the old version, not all new business functionalities can be 'add-on' or can be supported by the old system. Comparatively, old system can hinder business improvement.
Market responsiveness	A new upgrade version is usually better designed and equipped with enhanced business functionalities to meet new requirements, to comply with government regulations, and to accommodate strategic changes in a

	<p>changed external business environment.</p> <p>On the other hand, old version that is not flexible enough or is not originally designed for all (new) operating environments, could have problems to accommodate big changes or could be technically infeasible (or impossible) adaptable to new operating environment. Failure to adapt to a changed environment may lead to business operations inefficiencies and management difficulties.</p>
External relationship management	<p>A new upgrade version that can allow one to be more easily manage, maintain, improve and expand relationship with suppliers, business partners and customers can lead to better market competitive advantage position.</p> <p>On the other hand, old version that can no longer effectively support this capability can cause communications delays and breakdowns, and competitive downgrade gradually.</p>

According to Wade et al. (2004), each of these four IS resources (IS infrastructure, cost effective in IS operations, external relationship management, market responsiveness) has the four RBV attributes, i.e. rarity, inimitability, and non-substitutability. Wade et al. (2004) hypothesized the relationships between the four IS resources and each (of the four) RBV attribute(s) ranging from low to high as shown in Table 6. These relationships are mentioned to be the relative ones among the four IS resources. Table 6 serves as a basis for our hypotheses formulation in the subsequent section.

**Table 6: ERP resource and capability and RBV attribute (Wade et al. 2004)**

ERP resource and/or capability	RBV attributes			
	Value	Rarity	Inimitability	Non-substitutability
<i>Inside-out</i>				
IS infrastructure	Medium - High	Low - Medium	Low	Medium - High
Cost-efficient IS operation	Medium - High	Low - Medium	Medium - High	Low - Medium
<i>Outside-in</i>				
Market responsiveness	High	Medium - High	High	Medium - High
External relationship management	High	Medium - High	High	Medium - High

*New ERP Version Resources and RBV Attributes*

(1) Value

An ERP upgrade requires a lengthy upgrade evaluation and execution time, and also it is a costly endeavor. It requires a lot of other investment in re-training users and recruiting external consultant. An upgrade project may disrupt the normal business operation, and will therefore cause some business losses. Besides, an ERP upgrade effort requires a comprehensive understanding in existing business processes, complete information for all modifications done in the earlier version, and sufficient knowledge in the functionality and configuration needed in the new version. Moreover, users' participations and buy-ins, employees' re-learning skill, and organizational commitments for change management to deal with change resistance and business process reengineering are a must in order to success.

An upgraded ERP system can provide a better IT backbone or *IS infrastructure* for integrating internal cross-functional area business processes, which in turn allows *cost effective IS or business operations*. Together with other bolt-ons such as supply chain management (SCM), customer relationship management (CRM) and data warehousing, the upgraded system permits a firm to *manage external relationship* with suppliers and customers. ERP vendors continuously develop improvements and enhancements in a new/upgrade version can ensure client's *market responsiveness* in a changed or changing environment. According to Wade and Hulland (2004), IS resources for external relationship management and market responsiveness are comparatively more valuable than IS infrastructure and cost effective IS operations. ERP outside-in IS resources, such as external relationship management and market responsiveness that require more investment than ERP inside-out IS resources like IS infrastructure and cost effective IS operations are more valuable. Thus, we hypothesize that

H1a: ERP outside-in IS resources are more valuable than ERP inside-out IS resources.

H1b: Outside-in IS resources, from the ERP new version, are more valuable than from the existing installed old ERP version.

H1c: Inside-out IS resources, from the ERP new version, are more valuable than from the existing installed old ERP version.

## (2) Rarity

ERP upgrade is a reinvestment in the previous ERP implementation project. However, not all firms are willing to do upgrade (see Table 1) before they get the returns from the previous investment. As a consequence, many firms have difficulties in justifying for an ERP upgrade project. The prohibitive upgrade costs (Ohlson 2000; Swanton et al. 2004) does not encourage many firms to take up ERP upgrade project, and this enables upgrading to a new ERP version to be a source of competitive advantage.

Besides, when the *ERP infrastructure* is deployed in a firm's unique organizational environment and competitive idiosyncrasies business operations or rules are embedded in the *cost effective ERP system operations*, these resources are likely rare and competitive advantage can be achieved. In addition, by adding extra functionalities to the ERP system to *manage existing unique external relationship* and to obtain selected quality external information to improve *market responsiveness*, a firm is able to utilize resources that are rare and will therefore competitive advantage be attained. Based on Wade et al. (2004), in comparison with inside-out IS resources such as IS infrastructure and cost effective IS operations, outside-in IS resources for instance external relationship management and market responsiveness tend to be "socially complex and cannot be easily acquired in factor markets, and must instead be developed through on-going, firm-specific investments" (pg. 120). Based on this line of argument, we hypothesize that

H2a: ERP outside-in IS resources are rarer than ERP inside-out IS resources.

H2b: Outside-in IS resources, from the ERP new version, are rarer than from the existing installed old ERP version.

H2c: Inside-out IS resources, from the ERP new version, are rarer than from the existing installed old ERP version.

### (3) Inimitability

A new ERP version incorporating idiosyncrasies business processes, standard code modifications to meet specific system requirement, unique organization culture, and customized way of doing business with suppliers and customers will make the new upgrade version inimitable by other competitors. In comparison with new ERP version inside-out IS resources (i.e. *IS infrastructure* and *cost effective IS operations*), its outside-in capabilities (i.e. *managing external relationship* and *market responsiveness*) are difficult to imitate because each firm's suppliers and customers are unique in some ways, and the type of information needed for market responsiveness is not necessarily the same. Moreover, both of these ERP capabilities will evolve uniquely for each firm (Wade et al. 2004). Based on this, we hypothesize that,

H3a: ERP outside-in IS resources are more inimitable than ERP inside-out IS resources.

H3b: Outside-in IS resources, from the ERP new version, are more inimitable than from the existing installed old ERP version.

H3c: Inside-out IS resources, from the ERP new version, are more inimitable than from the existing installed old ERP version.

### (4) Non-substitutability

According to Black and Boal (1994), a non-substitutable IS resource or capabilities is defined as being rare and inimitable. As from the previous discussions, a new ERP version capabilities for managing external relationship and market responsiveness are more rare and inimitable than a resource for IS infrastructure and cost effective IS operations. Therefore, we hypothesize that,

H4a: ERP outside-in IS resources are more non-substitutable than ERP inside-out IS resources.

H4b: Outside-in IS resources, from the ERP new version, are more non-substitutable than from the existing installed old ERP version.

H4c: Inside-out IS resources, from the ERP new version, are more non-substitutable than from the existing installed old ERP version.

Having reviewed the connections among the IS resources and/or capabilities offered in a new ERP version and the four major RBV attributes, we propose the following general hypotheses:

H5: Outside-in IS resources, provided by a new ERP version, will have a stronger impact on competitive advantage than inside-out IS resources.

H6: Outside-in IS resources, provided by a new ERP version, will have a stronger impact on upgrade decision than inside-out IS resources.

## • Research Methodology

In order to collect data to test the hypotheses developed, survey is to be administered to large ERP client-organizations that are in the middle of considering an ERP upgrade project. This study is intended to focus on SAP and Oracle clients alone before a large

scope will be attempted in the future project. SAP and Oracle are chosen as they are the worldwide top tier ERP vendors, have the largest customer base internationally, and majority of previous studies and discussion are based on these vendors' software. Survey method is the most appropriate, feasible and economical way to obtain more and representative amount of data. The objective is to determine which and how the IS resources and capabilities offered in a new ERP version and competitive advantage affect an ERP upgrade decision. This survey is designated for all ERP system-users, and the top executives who involved in making ERP upgrade decision. Example of survey questions are as follows. Do you agree that a new ERP version can provide the following IS resources and capabilities: IS infrastructure, cost effective IS operations, external relationship management, and market responsiveness. For each IS resource, rate what is its relative value, rarity, inimitability and non-substitutability (to your company) compare to other resources (5 point-scale). External relationship management and market responsiveness provided by a new ERP version will have a stronger impact on competitive advantage than the other resources for IS infrastructure and cost effective IS operations. Will your company upgrade its ERP system? In your opinion, what is the possibility that the company will upgrade its ERP system: (0% to 100% or unknown).

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