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Strategic dependence on the IT resource and outsourcing: A test of the strategic control model

Detmar Straub · Peter Weill · Kathy S. Schwaig

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Abstract Using resource dependency theory (RDT), this research analyzes how organizations control their information technology resources to improve organizational performance. According to RDT, organizations must manage their dependency on external organizations and limit external dependencies when resources are considered critical. The current study proposes and tests a portion of a Strategic Control Model positing that managers seek to control important, strategic resources in order to create value for the firm and to avoid dependency on external entities. Utilizing a research design that captured extensive quantitative data on the control of IT functions and services, the research team gathered 5 years of data on 54 business units (BUs) in 27 global companies located in seven countries. Study examined the linkages of these 54 BUs to firm performance. Locating the Extent of Control within the firm in cases where the firm depends on IT as a strategic resource proves to be a good explanation for effective decisions leading to higher performance. Viewing IT as a strategic resource alone does not lead to positive business unit outcomes, but the moderating influence of Extent of Control is found to establish the complex statistical relationship with business unit performance. For these reasons, it is critical that a theoretically grounded firm-wide process for decisions on locating IT control is in place to capture business value.

Keywords Resource dependency theory · IT outsourcing decisions · Strategic information systems · Strategic IT resources · Core competency · IT outsourcing · IT performance · Firm performance · Extent of control

D. Straub (✉)
J. Mack Robinson College of Business, Georgia State University,
Box 4015, Atlanta, GA 30302-4015, USA
e-mail: dstraub@gsu.edu

P. Weill
Sloan School of Management, MIT,
3 Cambridge Center NE20-336,
Cambridge, MA 02142, USA
e-mail: pweill@mit.edu

K. S. Schwaig
Michael J. Coles College of Business, Kennesaw State University,
1000 Chastain Road,
Kennesaw, GA 30144-5591, USA
e-mail: kschwaig@kennesaw.edu

1 Introduction

When managers outsource all or part of IT, the motivation is to create business value for the firm. One means of creating business value is by achieving dramatic cost savings through outsourcing; another is through decisions that lead to strategic control of IT resources. In the former, IT outsourcing returns profits to the firm by taking advantage of economies in the marketplace. Theoretically, IT vendors/outsourcers drive down the costs of production and technical expertise by spreading these expenses over a large client base; accordingly, their customers are able to benefit indirectly from these *economies of scale* through attractive pricing of IT products and services by vendors (Dibbern et al. 2004).

Strategic control is the second avenue for value creation. Managers who identify IT resources that are critical to their firm's operations and to its strategic direction are theoretically better able to manage those resources if the firm maintains control over them. By divesting themselves of activities that are not strategic, they can capitalize on superior design, marketing, production, inbound logistics, or distribution capabilities. Thus, organizations that out-

source IT activities that are not strategic can concentrate energies on distinctive resources that are directly related to value creation for the firm. The notion of strategic control of the IT resource has strong theoretical underpinnings in resource dependency theory (Pfeffer and Salancik 1978).

While both the cost savings and strategic control lines of reasoning have solid theoretical bases, nearly all of the research to date on IT sourcing has posited and/or tested economic and financial models, i.e., has stressed cost, rather than positing strategic control models. The current study seeks to fill this gap in the IT outsourcing research portfolio by proposing and testing a Strategic Control Model.

The notion of resource dependency is central to RDT and to the current study. Specifically, a resource dependency is created any time a firm relies on an external entity for a resource needed by the firm. The more critical the resource is to the firm, the more serious is the dependency. This thesis posits, therefore, that, overall, when organizations depend on external entities for IT resources critical to their survival, they yield control and ultimately jeopardize firm performance.

The results of this study offer insights for researchers and managerial guidelines regarding whether and how managers control the IT resource. When making such critical decisions, strategic control proves to be a good explanation for how the most effective managers outsource IT and how the firm reaps downstream benefits from their control decisions.

2 Theoretical and conceptual background

2.1 Resource dependency theory

Resource Dependency Theory (RDT) examines organizational decision making in light of the impact of the environment on the organization. RDT recognizes that the key to organizational survival is the ability to acquire and maintain resources (Pfeffer and Salancik 1978). An organization must be open to its environment due to its dependence on that environment to obtain critical resources such as personnel, information, raw materials and technology. Resource acquisition may be problematic and unpredictable. To guarantee the flow of resources, therefore, a firm will adapt to changes in its environment that impact the flow of resources to the firm. Adaptation is not passive, however, but rather a strategic choice to cope with pressure in the environment (De Wit and Verhoeven 2000). Successful organizations, therefore, attempt to minimize their dependence on or increase their influence over organizations in their environment (Birkinshaw et al. 2001; Teng et al. 1995; Grover et al. 1994).

Although organizations are constrained by their dependency on their environment, opportunities exist to pursue organizational interest (Pfeffer and Salancik 1978). Firms can negotiate their positions within these constraints. RDT recognizes that organizational strategy focuses not only on products and customers but also on the suppliers and other entities in the environment that impact the flow of resources to the firm. Organizations thereby interact dynamically as they act strategically to manage their resource dependency on other firms (Pfeffer and Salancik 1978).

Given the preceding discussion of RDT, an important research question emerges: To what extent does the degree of dependency that results from outsourcing various IT resources affect firm performance? The ultimate decision that organizations make is based upon the degree of control desired for a given IT resource. According to RDT, firms will choose to own, nurture, have exclusive access to, and thus *control* strategic resources that will lead to improved competitiveness. Conversely, it is not necessary for firms to own and *control* those assets that are not strategic and integral to their distinctive competence.

2.2 Information technology outsourcing and RDT

Prior studies indicate that outsourcing is a strategic arrangement for a firm (Lacity and Hirschheim 1993; Insinga and Werle 2000). At its core, RDT argues that no firm can exclusively rely on its own resources to survive. The effectiveness of a firm, therefore, is related to its ability to acquire needed resources from external vendors.

RDT argues that organizations will engage in a strategic decision making process when deciding whether or not to acquire critical resources from external entities (Pfeffer and Salancik 1978). Important resources will be retained in-house while less important resources will be outsourced. Implicit in the outsourcing deal will be a dependent relationship that will have to be negotiated and constructed. According to Pfeffer and Salancik (1978) this dependence is determined by three resource dimensions: importance, discretion and substitutability for that resource. Important resources are those critical to the survival of the firm. Discretion is the ability of the firm to control resource availability. Finally, substitutability refers to the availability of alternative sources for obtaining the resource. By assessing all three factors with respect to a given IT resource, a firm can determine the degree of dependence associated with outsourcing a specific resource and make the decision according to the degree of control the firm is willing to relinquish.

Importance of the IT resource is probably the most researched of the three factors affecting the firm's dependence. IT resources are playing an increasingly critical role in organizations. Much has been written about the strategic role

of the IT resource in organizations (Sethi and King 1994; Clemons and Row 1991; Brynjolfsson and Hitt 1996) and studies have found a relationship between IT and sustained competitive advantage (Clemons 1991; Clemons and Row 1991). With respect to discretion, firms attempt to minimize dependency on external entities through negotiation and contracts. In addition, many IT resources in firms are idiosyncratic to the business and not easily duplicated. Hence, few or no substitutes exist for those IT resources that have a great deal of specificity to the firm. While discretion and substitutability are important factors, we have chosen to focus on and operationalize the importance factor.

Lacity and Willcocks (2001) analyzed hundreds of case studies and determined that the decision to outsource critical IT applications increased the firm's dependency on the external entity. The resultant dependency is enough to deter the firm from transferring control via an outsourcing deal. Similarly Kern and Willcocks (2002) analyzed several outsourcing relationships and concluded that too much dependence on vendor's performance is risky.

Traditionally, core IT applications are recommended for in house control (Lacity and Hirschheim 1993). Research suggests that core competencies are what make an organization "unique" in its competitiveness (Quinn and Hilmer 1994). It is the knowledge that the organization has gained of its own processes (Prahalad and Hamel 1990) that allows it to compete with the best in the world (Quinn and Hilmer 1994). An organization that possesses a core competency can integrate core technologies and governance processes, realizing price-performance ratios and customer service levels that exceed those of its competitors (Prahalad 1993). Core technologies are a critical enabler of this capability (Prahalad 1993). To compete globally, firms need to ask whether external control of a function will improve its ability to perform an activity at a level comparable with the best of breed (Drtina 1994).

2.3 Control of the IT resource

Although the issue of IT as a strategic resource has been discussed widely in IS studies, little previous research has empirically examined the effect of a resource-dependency perspective on sourcing decisions (Dibbern et al. 2004). Prior research using transaction cost analysis (Ang and Straub 1998, Beier 1989, Grover et al. 1996, Nam et al. 1996, Schary and Coakley 1991) has studied the impact of asset specificity on external procurement. While Grover et al. (1994) and Teng et al. (1995) used RDT as a theory base for studying the impact of resource gaps and strategic role of IS on the IS outsourcing decision, the wider implications of resource dependency through IS outsourcing on firm performance were not examined. Whereas case study evidence suggests that managers think value is created in the IT function through strategic focus on core competencies (Lacity et al. 1994), more quantitative evidence is needed to support this qualitative work in order to better understand the relationships between views about IT as a strategic resource and the control of IT functions.

Reasoning from transaction cost and agency theories, for example, Ang and Beath (1993) discusses the role of agents of the firm and agents of the outsourcing vendor and how the nature of the relationship leads to different kinds and different intensities of control. Part of this control is related to the contract that binds the organizations, but part is built into the management decision to give up control over assets.

The basic argument in Ang's work is that the degree of outsourcing depends on which agent has control over the activity. When one agent is completely responsible for an activity, then her conceptualization argues that this would be a case of either "total outsourcing" to outsiders or "total insourcing" to insiders. In the former situation, the firm has lost nearly all control of the asset. In the latter, the firm retains total control. But monitoring by one of the agents of the firm would indicate a higher level of firm control decisions whereas providing information or other inputs to the outsourcer, without extensive monitoring, would represent less control.

Based on RDT and consistent with other researchers, we conceptualize the notion of control of the IT resource as a continuum (see Fig. 1). One end of the continuum occurs when the firm yields control of all of its IT resources resulting in the greatest dependency on the external environment. In this case the firm is engaged in "Total Outsourcing." Conversely, the decision to control all IT resources may be said to be a "Total Insourcing" decision. The extent of control of the IT resource, therefore, represents a set of decisions regarding which resources are to be retained and which are not. We refer to this as *Extent*

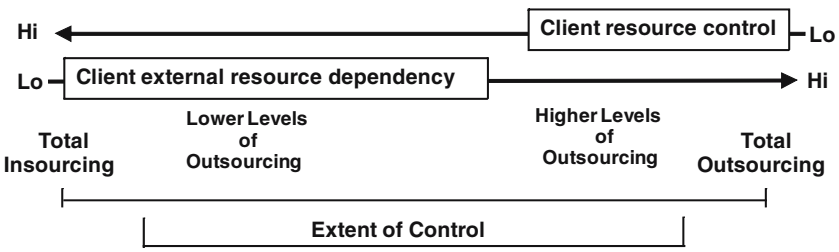

Fig. 1 Continuum of control of the IT resource

of Control. This notion is conceptually close to what Lacity and Willcocks (1998) call "selective" outsourcing.[1]

2.4 Research model and hypotheses

The Strategic Control Model (SCM; Fig. 2) expresses causal relationships in the context of resource dependency. The model indicates that when firms depend on external entities for resources critical to their survival, they yield control. IT functions that are viewed as important and, thereby, strategic are more likely to be controlled internally. IT functions that are less strategic are more likely to be outsourced to some extent. Our contention is that the effects of IT as a strategic resource on performance will depend on *where* the resource is controlled. The more strategic the resource, the more the need to control that resource internally. The less strategic the resource, the less the need to control that resource internally. When a "match" exists (Venkatraman 1989) between how strategic a resource is and where that resource is located, higher performance should ensue. Where such a match is not observed, lower levels of performance should be expected. SCM argues, therefore, that extent of control moderates the effect of strategic IT resources on performance (H_1).

3 Study hypotheses

3.1 Detailing of hypotheses

When organizations depend on external entities for resources critical to their survival, they yield control. Yielding control of highly dependent resources leads to lower performance. Based on the Strategic Control Model, we test the following:

> H_1: Extent of control negatively moderates the relationship between strategic dependence on IT resources and firm performance.

The conventional graphical model showing this set of relationships is Model A (see Fig. 3a). Directionality is a measurement issue as to which direction the variables move to show stronger effects. Extent of Control in this study is being measured as higher when a firm outsources. Therefore, as this number goes higher (and dependence is also high), the firm performance declines. This is why we expect a negative coefficient.

[1] Lacity and colleagues use the term "selective outsourcing" in apposition to total outsourcing or insourcing, which is why "Extent of Outsourcing" appears within these two extremes in Fig. 1. Our argument is a selective outsourcing argument in that firms that abjure total outsourcing are making decisions about not outsourcing what are viewed as strategic resources, which allows them more control over their core assets.

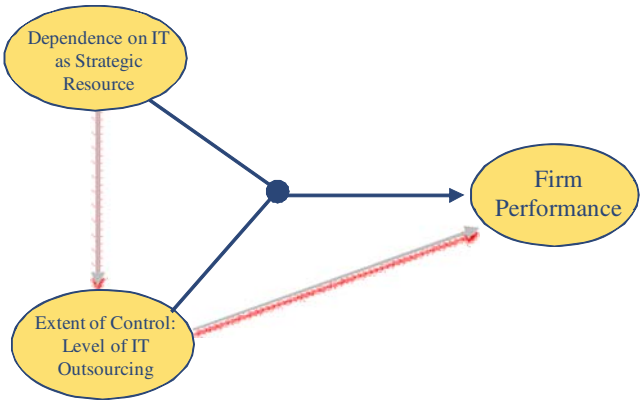

Fig. 2 The strategic control model (SCM). The *solid dot* represents a moderated path tested by H_1. The *grayed paths* are part of the SCM but are not tested in this paper

From a resource dependency perspective, management must direct the acquisition and deployment of resources, and thereby, control resources to optimize performance and obtain organizational goals. RDT stresses the need for firms to capitalize on their unique assets and to develop management strategies to exploit the advantages from strategically positioned resources.

A full testing of the moderating effect calls for a comparison with the direct effect of strategic dependence on the IT resource on performance (Sharma et al. 1981; Chin et al. 2003). A direct effect is not expected to add significantly to the explained variance and is examined specifically to see if the posited moderation is the most powerful explanation of performance. Formally, H_2 is:

> H_2: A model linking the moderator extent of control X resource dependence to performance will have statistically higher explained variance than a model linking only resource dependence to performance.

What is being tested in H_2, in effect, is the difference in explained variance between Model A and Model B.

3.2 Design, sampling, and measures

To assess the hypotheses, 54 business units (BUs) in 27 firms were investigated. Since outsourcing and firm performance were measured at the BU level, our N for testing was 54. See Appendix A for a list of international firms chosen to represent a breadth of industry deployment of IT as a strategic asset; this sample also represented a breadth of outsourcing experiences, as can be seen in Table 1. These firms were headquartered in seven countries (USA, Canada, Malaysia, Singapore, Australia, UK and Switzerland) in the financial, retail and manufacturing industries. These three industries are at the forefront of change in industry structure due to the combination of technological innovation and the accelerated pace of globalization (Bradley

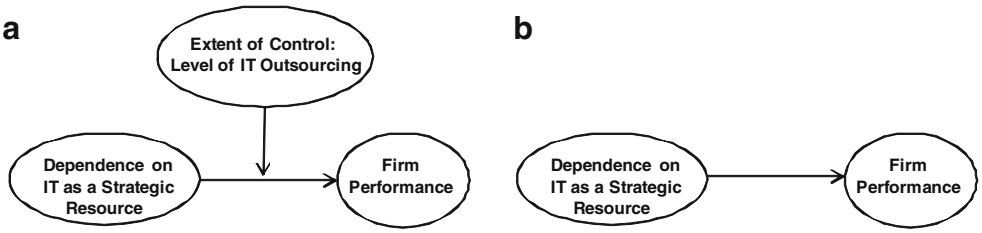

Fig. 3 **a** Model A. **b** Model B

et al. 1993). They also provide a contrast in their strategic use of information and information technology (Cash et al. 1992; Porter and Millar 1985). Data were collected both at the firm and business unit (BU) levels. The firm level provides insight into the strategic role of IT in the organization. The business unit level allows us to examine the outsourcing decision at the point closest to the outsourcing experience.

In order to focus on BU outsourcing of IT in complex and representative settings, the firms selected met the following criteria:

1. Comprised of at least two autonomously managed BUs with a distinct set of products or customers
2. Were in the top five in their industry by market share in their region
3. Recorded data on historical IT investment, IT outsourcing and performance which could be made available to the researchers; and
4. As a group of firms, offered a broadly based international perspective

To implement the study internationally, a research team collected data from universities located in or near the country of the firm's headquarters (see "Acknowledgments" for list of research partners). The researchers met to refine the concepts and methods for the study and then used the same data collection procedures.

Appendix B shows the instrument that was used to collect data (Table 1 below is a shorthand version) and details of the research method, including the justification of measures employed.

3.3 Descriptive statistics

As can be seen from Table 2, the variables demonstrate reasonable dispersion, none suffering from a floor or ceiling effect. This distribution suggests that the data is conducive for further statistical testing.

Firms varied in the level of their strategic IT investment from 0 to 70% of their portfolios, and the average deltas varied from a 100% decrease to 75% increase. Clearly, all firms were engaged in making decisions about which IT functions to outsource in that no firm or business unit in the study completely outsourced all of their IT activities. As a percentage of IT investment, the 5 year average of IT outsourcing varied from 0 to 50%, averaging 8.6%. The average delta increase over that time was 3.9%, moreover, which suggests that firms were gradually outsourcing more and more of their IT services over time.

3.4 Data analysis

The frequency distributions for CONTROL1 indicate that the sample group did not have cases of total outsourcing.

Table 1 Constructs and measure

Construct, Source, and Nature	Code	Description of measure
Dependence on IT as a strategic resource: objective measures (CE; formative)	RESOURCE1	% of strategic IT investment in prior year
	RESOURCE2	% of strategic IT investment—average % change over previous 5 years
Dependence on IT as a strategic resource: subjective measures (CIO; reflective)	RESOURCE3	The extent that BU managers consider IT in their strategic decision-making
	RESOURCE4	The extent that IT infrastructure has a role in BU decision-making
	RESOURCE5	Senior managers see IT as providing competitive advantage
	RESOURCE6	IT enables new business strategies
Extent of control of IT resource: level of outsourcing (BU IT mgrs.; formative)	CONTROL1	Average of rankings of the extent to which IT is outsourced by the BUs in each of 15 functional areas
	CONTROL2	% of IT investment spent on services outside t he firm—average % change over past 5 years
	CONTROL3	% of IT investment spent on services outside the firm over last 2 years
Firm performance: business units (CE and BU IT mgrs.; formative)	PERF1–2	Profits per employee ($)
	PERF3	Pricing against competitors (index)
	PERF4	Return on assets

Table 2 Descriptive statistics from study

Construct	Scale Items/Code	(Rank) Mean	SD	Range	Max	Min
Dependency on IT as a strategic resource: objective measures	RESOURCE1	26.88	23.11	NM[a]	70	0
	RESOURCE2	1.78	27.37	NM	75	−100
Dependency on IT as a strategic resource: subjective measures	RESOURCE3	2.85	1.53	1–5	5	1
	RESOURCE4	4.00	1.21	1–5	5	2
	RESOURCE5	3.89	1.42	1–5	5	1
	RESOURCE6	3.72	1.32	1–5	5	1
Extent of control of IT resource	CONTROL1	1.47	NM	1–3	2.13	1.0
	CONTROL2	3.70	22.07	NM	63.36	−33.15
	CONTROL3	8.44	12.18	NM	50.00	0
Performance	PERF1	94,109	12216	NM	553,000	0
	PERF2	54,048	8531	NM	446,760	0
	PERF3	79.07	45.17	NM	126.2	0
	PERF4	12.22	20.94	NM	110.43	−23.24

[a] *NM* Not meaningful

Fortunately, there is dispersion on the CONTROL variables, although it is equally clear that no firms were engaged in total outsourcing. This means that a straightforward PLS analysis can be performed on the CONTROL variables without transforming them to match the conceptualization of Extent of Control in Fig. 2. In this case, higher levels of internal control should moderate IT as a strategic resource and this moderation should lead directly to higher performance.

Partial Least Squares (PLS) was used to analyze the variables and relationships posited for explaining the IT outsourcing environment. Table 3 is a snapshot of the overall results of hypothesis testing.[2] While the distinction between formative and reflective indicators is still ambiguous in the methodological literature (Diamantopoulos and Winklhofer 2001), we are convinced that the constructs of Extent of Control and Firm Performance are formative and thus treated them in that way. Dependence on IT is a multi-dimensional construct with both formative and reflective aspects and was modeled in the PLS runs as such (Petter et al. 2007).

Sample size was sufficient for PLS analysis (Gefen et al. 2000). The path coefficients, their T statistics, and the explained variance for the models are shown in Fig. 3. The model to test H_1 explains circa 49% of the variance in the latent dependent variable.

In the test of H_1, the coefficient linking BU-level IT resources moderated by extent of control of those resources with performance was statistically significant. This result supports H_1 (formative coefficient=−0.702; p value<0.05; R2 = 0.487). The finding suggests that firms that invest in IT as a strategic asset are less likely to outsource, and supports the proposition that strategic or core competencies should be retained within the organization and not be outsourced (Prahalad 1993).

[2] These results will be examined further in "Section 4".

3.5 H_2 comparative model analysis

To examine the moderation issue further, a PLS run was performed that linked only the dependence on IT as a strategic resource with performance. In this way we are able to compare a model (Model B) that links our resource dependence variable directly to performance with the moderation acting alone (Model A). The test is a pseudo-F test, which in both the case of the formative and reflective interpretation are highly significant ($p<0.05$). Effect sizes (f^2) are calculated as $\left(R^2_{\text{Model1}} - R^2_{\text{Model2}}\right)/\left(1 - R^2_{\text{Model2}}\right)$(Mathieson et al. 2001; Chin et al. 2003). Multiplying f^2 by $(n-k-1)$, where n is the sample size and k is the number of independent variables (IVs), yields a pseudo-F test for the change in R^2 with 1 and $n-k$ degrees of freedom (Mathieson et al. 2001). According to Cohen (1988), an effect size of 0.02 is small, 0.15 is medium, and 0.35 is large. In our case, the effect size difference is medium, indicating that the models are markedly different in terms of their ability to explain the variance in the dependent variable. In short, the SCM is validated by this model comparison.

4 Discussion, implications, and limitations

The analysis uncovered numerous exciting findings about control over IT resources and the effects of IT outsourcing. The strategic control model, a major contention of the research, was supported in the hypotheses. Firms that invest at significant levels in strategic systems are sensitive to when they should retain control of core assets (Lacity 1995). This has major implications for the concept of strategic fit.

C-level executives are responsible for recognizing which assets the firm is dependent on for its competitive

Table 3 Overall results of study hypothesis testing

H_x	Hypothesis	PLS statistics (formative)	Support?
H_1	Extent of control moderates the relationship between a strategic dependence on IT resources and firm performance ($Model_1$)	Coeff=−0.702 T=3.95 R^2=0.487	Yes
H_2	A model linking the moderator extent of control×resource dependence to performance will have statistically higher explained variance than a model linking only resource dependence to performance	Model A R^2=0.487 Model B R^2=0.281	Yes

advantages and to nurture these core assets. This fitting of strategy to firm performance is one of the most important jobs of a C-level manager. Not to recognize the strategic nature of this choice is tantamount to allowing the firm to drift and to only randomly capitalize on what has or can make it a success. Outsourcing too much or outsourcing the wrong assets represents a failure of strategic fit.

This is one of the first studies that examines under which circumstances outsourcing will contribute to relatively better firm performance. As such, our focus is set on the role of fit between the strategic role of IS assets within a firm and its sourcing strategy as a key enabler for higher firm performance.

Sustaining an IT-enabled competitive advantage requires continuous innovation, environmental scanning and a corporate mindset that understands the strategic use of IT. Such an environment is difficult to cultivate when control over a strategic asset is handed over to an integrator or service provider.

Whether managers view IT as a strategic resource or not, the outsourcing decision is almost certainly not an indiscriminate one. There is evidence in the study that selective sourcing decisions lead to higher performance and that there are adverse consequences involved in ignoring the connection between viewing IT as a strategic resource and selectively outsourcing it. Higher levels of performance uncovered in this study include: (1) larger profits per employee and (2) higher ROA. PERF3, increased competitiveness or comparative pricing against competitors, did not load significantly (see Appendix B), but the other performance measures did. These significant effects are last in a value chain that begins by arguing that strategic choices about sourcing IT eventually impact the firm's bottom line.

Grounded in resource dependency theory, the strategic control model expresses these relationships in a parsimonious fashion. In this study, the model received sufficient support to justify further research in this vein. In short, it appears that firms that selectively outsource IT and take advantage of these competitive opportunities will be justified in their investment decision. A significant business payoff awaits firms that can successfully manage selective outsourcing.

Managers and researchers alike need to consider the implications of these findings. For scholars, it is important to note that the strategic control hypothesis received support through both the objective and subjective measures, but that the theoretical framework does needs further work in construct specification and testing of subjective measures and alternate measures of performance.

Of course, all research has limitations and there are some that need to be noted in the present study and addressed in future work. Whereas the quality of the data was generally excellent and 14 observations per business unit assessing the outsourcing activity (CONTROL1) added richness to our measures, further studies in differing settings and locales are always in order and part of the process of normal science.

Measurement issues lie at the heart of solid research and, although most of the measures in the instrument performed reasonably well, further work in this vein can refine and hone the approach. It would be useful, for example, to have accompanying subjective and objective measures for even more of the variables in the data set. This would help to rule out methods bias and to conclude that the effects observed are not artifactual. Instrumentation of the attitudes toward IT as a strategic asset needs to be revisited.

Given that the present study represents a departure from the usual outsourcing theory bases of transaction cost and incomplete contracting (Ang and Straub 1998; Lacity and Hirscheim 1993; Richmond et al. 1992a, b), we feel that RDT has proven itself to be a useful lens for formulating theoretical propositions related to the outsourcing decision.

Practitioners should recognize that deciding which IT resources are strategic is a crucial phase in the overall systems integration process. Non-core assets can be taken over by outsourcers with no loss of *strategic control*. On the other hand, retaining IT assets that are strategic will enable the firm to remain competitive and better capable of responding to future technological uncertainty.

This study raises interesting questions about the worldwide trend of increasing IT outsourcing. For example, some governments (e.g. Federal Government of Australia)[3] have mandated market testing for outsourcing all IT investments, often combining several departments in the outsourcing contract (e.g., Taxation and Health) to achieve a stronger bargaining position. In contrast to this approach, the results

[3] See www.aph.gov.au for details of a Federal Australian Government inquiry into IT outsourcing.

of this study strongly support a selective approach to outsourcing based on strategic control of key IT assets and the core competencies of the organization. Strategic control should be the ultimate purpose of outsourcing, rather than any arbitrary attribution of value to IT outsourcing in its own right. Managers in the position to influence key outsourcing decisions should think about the need to strategically control each IT activity and make their decisions accordingly.

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Appendix A: Annotated instrument item

[CONSTRUCT: DEPENDENCE ON IT AS A STRATEGIC RESOURCE: OBJECTIVE MEASURES (RESOURCE1 AND RESOURCE2)]

Levels of investment in I/T infrastructure The following questions relate to the level of investments in I/T in the corporate I/S function and the BUSINESS UNITs. Please be as accurate as you can. If you don't have the information, please provide your best estimation and mark the estimate with a star (*).In completing these questions, please use the FIRM's or BUSINESS UNIT's reporting year. For example, if the last month of your reporting year is September, for Year 1 you would report for the year ended September Year.

Corporate I/T investment In answering the following questions, please consider I/T Infrastructure as: *the base foundation of I/T capability budgeted for and provided by the I/S function and shared across multiple BUSINESS UNITs. The I/T capability includes both the technical and managerial expertise required to provide reliable services.*

1.Of the corporate I/T investment identified in Question 3, what percentage would you classify as I/T Infrastructure?

Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**	**Year 6**
_____ %	_____ %	_____ %	_____ %	_____ %	_____ %

2. Of the corporate I/T investment in Year 6 that is not infrastructure, estimate the percentage which was to:

(i) Cut operating costs - e.g.: reduce costs of preparing and sending invoices _____ %

(ii) Increase or protect your sales (or market share) by providing new (or improved) customer service or products. This type of investment generally positions the firm in the marketplace _____ %

(eg: Create competitive advantage by significantly reducing the delivery time of your services by placing order entry links in your customer's offices) **[RESOURCE1]**

(iii) Provide information. This would include information for control, communication, accounting, managing quality, EIS, MIS, etc. _____ %

3. Please estimate this breakdown in previous years.

	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
(i) Cut Costs	_____%	_____ %	_____ %	_____ %	_____ %
(ii) Gain Sales **[RESOURCE2]**	_____%	_____ %	_____ %	_____%	_____ %
(iii) Provide Information	_____%	_____ %	_____ %	_____ %	_____ %

[CONSTRUCT: DEPENDENCE ON IT AS A STRATEGIC RESOURCE: SUBJECTIVE MEASURES (RESOURCE3 THROUGH RESOURCE6)]

Decisions about I/T infrastructure investments I/T Infrastructure refers to the base foundation of I/T capability budgeted for and provided by the I/S function and shared across multiple BUSINESS UNITS. The I/T capability includes both the technical and managerial expertise required to provide reliable services.The following questions relate to the way decisions are made about I/T Infrastructure investments. Please CIRCLE the number that best describes your FIRM.

RESOURCE3. In forming business strategies, the BUSINESS UNIT (BU) considers the capabilities of the I/T Infrastructure

1	2	3	4	5
Never	**Sometimes in Some BUs**	**Sometimes in All BUs**	**Often in Most BUs**	**Always in All BUs**

RESOURCE4. In justifying Infrastructure investments, the flexibility to quickly meet future, but as yet unspecified, BUSINESS UNIT strategies is valued

1	2	3	4	5
Never	**Rarely**	**Sometimes**	**Usually**	**Always**

RESOURCE5. Senior managers of the FIRM perceive a flexible I/T Infrastructure as providing a competitive advantage

1	2	3	4	5
Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**

RESOURCE6. In meetings between senior I/T managers and senior BUSINESS UNIT managers, the most important topic is the capabilities of I/T to enable new business strategies.

1	2	3	4	5
Never	**Rarely**	**Sometimes**	**Usually**	**Always**

[CONSTRUCT: EXTENT OF CONTROL OF THE IT RESOURCE (CONTROL1, CONTROL2, AND CONTROL3)]

Management of IT activities This question seeks to identify various types of responsibility and input for different I/T related activities throughout the FIRM. There are four groups indicated: the Corporate I/S group, the Business I/S group, Business Unit Line Managers and any organizations external to the firm. For each of the activities listed (Items 1–15), please indicate the level of management responsibility and input for each of the four groups using the following symbols:

R = Responsible for this activity
I = Provide Input for this activity
M = Monitor this activity
N = No involvement at all in this activity

Each box should have one of the letters (R,I,M,N) entered into it. For a particular activity there may be dual responsibility (or perhaps input). Thus a letter can be used more than once for an activity.

	Corporate IS Group	Business IS Group	Line Manager	Organization external to the Firms
1. IT Planning				
2. Operations				
3. Systems Development				
4. Systems Maintenance				
5. Overall Architecture				
6. Data				
7. Hardware				
8. Applications				
9. Communications				
10. Security				
11. Infrastructure				
12. Technology Transfer				
Introducing existing technologies into the FIRM:				
13. Human Resource Management for IS group				
14. Training in the use of IT				
15. Research and Development (Developing new technology)				

[CONTROL1. This measure was a mean rank of the codings of each of the 15 IT activities in the above scale.]

CONTROL2. Of the business unit IT investment identified earlier in Question 3, what percentage is spent on services provided outside the firm ?

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
_____%	_____%	_____%	_____%	_____%	_____%

[CONTROL3. Average of last 2 years of the data collected in CONTROL2.]

[CONSTRUCT: PERFORMANCE (PERF1–PERF4)]

BUSINESS UNIT Financial Performance The following questions refer to the financial performance of this BUSINESS UNIT.

PERF1&2. Please report this BU's revenue for the past five years. If a bank, please define revenues as NET INTEREST INCOME (after INTEREST PAID) plus OTHER OPERATING INCOME

Year 1	Year 2	Year 3	Year 4	Year 5
$M_____	$M_____	$M_____	$M_____	$M_____

PERF1. Please report this BU's expenses (including cost of goods sold) for the past five years.

Year 1	Year 2	Year 3	Year 4	Year 5
$M_____	$M_____	$M_____	$M_____	$M_____

PERF2. Please report this BU's cost of goods sold for the past five years.

Year 1	Year 2	Year 3	Year 4	Year 5
$M_____	$M_____	$M_____	$M_____	$M_____

PERF3. For each year, please indicate how your pricing of products compared to your three largest competitors. For example, if this BU's prices averaged 10% above those of the three largest competitors, then 110% is reported for each year.

Year 1	Year 2	Year 3	Year 4	Year 5
100 %	_____%	_____%	_____%	_____%

PERF4. Please report your Return on Assets (ROA) for the past four years. ROA is calculated by dividing (i.e.: profit) before interest and tax (EBIT) by total assets.

Year 1	Year 2	Year 3	Year 4
_____	_____	_____	_____

Appendix B: Research methods

Data collection

To adequately address the issues raised in the current study requires a study design that collects data from multiple respondents, thereby achieving independence of sources and reducing the likelihood of systematic bias. Data were collected via interviews, the completion of response forms by participants, analysis of organizational documentation (e.g., memos, internal reports) and notes of presentations made by executive managers about recent strategy and technology developments.

In each firm there were a minimum of four participants, some interviewed on multiple occasions. The four participants were the Chief Information Officer (CIO), IS executives from at least two different business units, and a corporate executive (CE) who was able to provide a strategic perspective across the firm as a whole. This person was the CEO, the Chief Financial Officer, Chief Operating Officer, or the Director of Strategy. In each firm, the CIO was interviewed about IS arrangements and the decision-making process relating to both business and IT strategy and the extent of IT outsourcing. Four different response forms were distributed to participants. When these were completed and returned, interviews were held with each IT manager, including the CIO and the BU manager to explore the issues in more depth and to ensure that consistent definitions of constructs were used in the data collection. Excerpts from these interviews appear later in the paper.

To ensure independence of variables, data on IT investment was gathered through different sources. The subjective view of IT as a strategic resource was provided by the CIO while objective IT investment data and performance data were gathered primarily from the CE and his/her staff, the one exception being IT investment in competitive systems, as described below. IT managers from the respective business units provided data on the nature and degree of outsourcing in the BUs. Some of these measurements called for judgments whereas others were more oriented toward accounting-type data. Performance data was also gathered from two sources: the CE and the BU information technology managers and then checked for inter-rater reliability.

Measures

Dependence on IT as a strategic resource: Objective measures To capture the firm's dependence on IT as a strategic resource, we chose first to use objective measures of the percentage of the IT budget that was considered strategic. To achieve consistency across the sample we provided respondents with a simple definition of strategic IT based on the work of Clemons (1991), Ives and Learmonth (1984), and Porter and Millar (1985). CIOs were asked to provide the percentage of the IT budget over the past 5 years that was invested to:

> …increase or protect your sales (or market share) by providing new (or improved) customer service or products. This type of investment generally positions the firm in the marketplace (e.g. creates competitive advantage by significantly reducing the delivery time of your services by placing order entry links in your customer's offices).

Besides RESOURCE1, data on actual firm actions included the calculation of both a 5-year average and an average year-to-year percentage change in assessments of IT as a strategic resource (RESOURCE2).

Dependence on IT as a strategic resource: Subjective measures The goal of this set of measures (RESOURCE3–RESOURCE6) was to capture the CIO's belief of the extent to which managers (both senior managers and BU managers) saw IT as a strategic resource. We asked the CIO to consider his or her dealings with senior business managers and answer four items. The items measured factors such as whether BU managers considered IT when they formed business strategies or whether they viewed a flexible IT infrastructure as strategic. Scores from the four, five-point Likert scales were used to measure IT as a strategic resource, with higher scores indicating IT was a highly strategic resource. The measures tap into arguments that a focus on IT lowers dependency on others' IT resources which will, in turn, lead to advantages. The measures, positioned at a molar level of abstraction, are omnibus measures. See Appendix B for the relevant instrument items.

Extent of control of IT resource: Subjective measures To capture the extent to which managers decided to give up control of IT resources to outsourcers, we queried managers about fifteen typical IS activities (CONTROL1). The control perspective on IT outsourcing has been conceptualized by Ang (1994) and validated in Ang and Straub (1998). In psychometric tests in the latter study, the researchers found that measures of the control of IT as a resource (not necessarily a strategic resource) correlated highly with an applications-oriented perspective and an operations-oriented perspective. Since validation is always "egalitarian and symmetrical" (Campbell 1960, p. 548), their cross-methods validation suggests that a control-oriented perspective captures the essence of the construct of IT outsourcing (Ang and Straub 1998). Using Ang's

Table 4 Coding categories for construct: control of IT functions/ services

Corporate IS group	Business IS group	Line manager	Organization external to the firms
I	I		R

R Responsible for this activity
M Monitor this activity
I Provide input for this activity
N No involvement at all in this activity

theoretical perspectives (Ang 1994; Ang and Beath 1993), the instrumentation measured the shift in control from internal to external service providers for each of fifteen IT resources. Participants filled in the matrix entitled "Management of IT Activities" in Appendix B. The list of IT activities on the research instrument was similar to that used in the validated Ang and Straub (1998) field study and Smith et al. (1987) case study; it also aligned well with activities identified in the IT services work of Weill and Broadbent (1998).

The four groups responsible for sourcing are indicated in Table 4 below, which presents an example of how a respondent may have filled out the form. Levels of control were denoted by the respondents as "R" if the group was responsible for an activity, "M" if the group monitored the activity, "I" if the group provided input, and "N" if there was no involvement.

The coding of these levels of control for each activity was a straightforward ordinal scaling, varying from 1 to 4. If the matrix data indicated that control was entirely internal, the IT activity was coded "1." In cases where the outsourcer was being monitored by the client firm, the decision was coded as "2." If control was shared with the external provider but only input was provided by the firms' agents, then it was coded "3." If control was entirely in the hands of the outsourcer, then the coding was a "4."

An example might help to explain how this coding was performed. If the codes "M" or "R" was denoted for *any* of the inside agents (IS corporate, business unit, or line manager) *and* the outsider ("organization external to the firm") role was coded "R" as being responsible for the activity, IT planning was coded as a 2. The reasonable assumption here is that the firm is attempting to control this activity by either monitoring it or sharing in the delivery of the service. If the outsider is responsible for the activity (coded as "R") and one or more of the firm agents is providing input (coded as "I"), then the firm is exerting less influence over the delivery of the service. This lower level of control was classified as "3," therefore.

Extent of control of IT resource: Objective measures An objective surrogate for control over the IT resource is the extent to which a firm outsources IT. Two objective measures were also used. The first, CONTROL2, was gathered at the corporate level. It is a financial measure where the outsourcing budget is expressed as a percentage of the firm's total IS budget for that year. Five years of data were collected allowing the calculation of both a 5-year average (CONTROL2) and an average year-to-year percentage change in outsourcing (CONTROL3). Similar approaches were used in Loh and Venkatraman (1992) and Grover et al. (1996). The second objective variable, CONTROL3, was the percentage of IT investment spent on services outside the firm. Averaged over the last 5 years, CONTROL3 measured the delta or change in percentage of IT investment outside the firm.

Business unit performance The construct "Performance" is used extensively in organizational and information systems research. A broad range of quantitative performance measures are often employed by researchers, including measures of profit such as return on assets (ROA) (Floyd and Woolridge 1990; Hitt and Brynjolfsson 1996), return on net worth (Cron and Sobol 1983), expenses as a ratio of income (Bender 1986; Harris and Katz 1991), and the ratio of operating profit to revenue (Markus and Soh 1993). These measures of profitability are lagging measures (i.e., accounting end-of-period measures). Kaplan and Norton (1992) recommend a balance of leading (i.e., measures of performance that predict lagging measures) and lagging measures to capture performance. We chose three measures that provide a balance of leading and lagging measures that also relate well with the theoretical issues we are expostulating. They tap into: (1) labor productivity, (2) competitiveness, and (3) return on assets. First, profit per employee (PERF1–2) was chosen as a measure of labor productivity (Weill 1992) as it is likely to be sensitive to the level of outsourcing used. The first of the measures

Table 5 Loadings/weightings from PLS run

Construct	Item	PLS loading or weight	*T*
Dependence on IT as strategic resource (objective; formative)	RESOURCE1	.9464	7.6849*
	RESOURCE2	.6580	1.7191
Dependence on IT as strategic Resource (subjective; reflective)	RESOURCE5	.9194	1.9704*
	RESOURCE6	.7558	1.9871*
	RESOURCE4	.5280	2.7585*
	RESOURCE3	.4837	3.1304*
Firm performance (formative)	PERF1	.8758	13.5146*
	PERF2	.7094	4.8963*
	PERF4	.4613	2.7507*
	PERF3	.3282	1.5997

*Significant at $p = .05$

included cost of goods sold (COGS) and all other expenses. The second was COGS alone. Two other firm-level measures were used, namely, an index of competitiveness of the firm compared to its industry (PERF3). This was assessed by the chief officer of the business unit. Finally, a standard return on assets (ROA) measure (PERF4). All of these measures should reflect higher performance if the firm does not outsource more strategic assets than the SCM argues it should. See Appendix B for instrument items and elaboration.

Instrument validation

Many of the measures employed to test the SCM are likely formative rather than reflective (Gerbing and Anderson 1988; Petter et al. 2007) in that the types of measurement and the scales being employed were radically different for most measures and constructs. For example, the construct "firm performance" was measured by two profitability per employee figures and two items tapping into competitiveness and asset utilization. While each of these very different measures "forms" the construct of firm performance, they likely do not "reflect" it (Petter et al. 2007; Campbell 1960; Fornell and Larcker 1981; Fornell and Bookstein 1982; Cohen et al. 1990; Thompson et al. 1995; Chin 1998; Diamantopoulos and Winklhofer 2001) in the sense that our four questions with similar low to high semantic anchors do "reflect" the perception of the CIO on whether IT is viewed as a strategic resource.

One indication of whether statistical tests favor a formative or reflective handling is to examine their assumptions. Reliability tests such as Cronbach's α make the assumption that scales are relatively similar in the meaning of the scale values; if not, the α statistic rapidly becomes meaningless. Constructs that rely on formative measures call for structural equation modeling (SEM) techniques such as Partial Least Squares (PLS) or LISREL, and PLS, in particular, can model the latent construct whether it is reflective or formative (Gefen et al. 2000).The other advantage of using PLS analysis is that the measurement error is being modeled, and it is, therefore, possible to use all measures even when their contribution is calculated as being small or modest.[4]

Given the choice of measures in the present study, we engaged in several different forms of analysis to examine the psychometric properties of the instrument. Cronbach's α assesses the reliability of the reflective measures. Significance of PLS loadings or weights indicate acceptable construct validity. The relevant PLS loadings/weights are presented in Table 5.

The occasionally insignificant loading/weight in Table 5 is not a surprise, given that some of the measures are formative (Edwards and Bagozzi 2000). The reflective subjective measures (no. 2 in Table B3) should have loaded well, and, indeed, they all load significantly, at α protection level of 0.05, which reinforces the interpretation that the instrument has some convergent validity.

According to Petter et al. (2007), an instrument with formative constructs demonstrates construct validity when the weights are significant, as these generally are. In addition to these tests, the Cronbach's α for the subjective view of IT as a strategic resource was 0.920, which is acceptable by Nunnally's rule of thumb (1994). Therefore, our interpretation of these loadings/weightings is that whereas the measures are not perfect, they are sufficiently valid for purposes of further testing. They are also acceptable because we are adopting a holistic analytical approach, which means that no attempts have been made to "cleanse" the constructs and reduce the a priori measurement error in the entire instrument (Bagozzi 1984). Measurement error is accounted for in the statistical technique, but not removed. If we find significance under these harsher statistical conditions, then the findings may be interpreted to be even more robust than otherwise.

We used the summated approach of Goodhue et al. to running our moderations. There are trade-offs between this approach and product-indicator approach of Chin et al. (2003) and we felt that the greater parsimony of the former warranted its use here.

[4] Particularly because we had numerous formative latent constructs in the SCM, we adopted a holistic data analysis approach with measurement and structural models being run simultaneously. That is, no confirmatory factor analysis preceded the structural model to "cleanse" the scales. A holistic analysis grants high conceptual integrity in the latent constructs. Holistic analysis retains the meaning of each construct, which is drawn from both its measurement items and the other latent variables (Bagozzi 1984).

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Detmar Straub The J. Mack Robinson Distinguished Professor of Information Systems at Georgia State University, Detmar has conducted research in the areas of IT outsourcing, computer security, Net-enhanced organizations (e-Commerce), technological innovation, international IT studies, and IS research methods. He holds a DBA (Doctor of Business Administration) in MIS from Indiana and a Ph.D. in English from Penn State.

Detmar has published over 145 papers in journals such as *MIS Quarterly, Management Science, Information Systems Research, Journal of MIS, Journal of AIS, Decision Sciences Journal, Organization Science, Communications of the ACM, Information & Management, Communications of the AIS, IEEE Transactions on Engineering Management, DATA BASE, OMEGA, Academy of Management Executive*, and *Sloan Management Review*.

Detmar is Editor-in-Chief of *MIS Quarterly* and former Senior Editor for *Information Systems Research and Journal of the AIS* and Co-Editor of DATA BASE for *Advances in Information Systems*. He is also an Associate Editor for the *Journal of International Management*. In the past he has served as Associate Editor for *Management Science and Information Systems Research*, and Associate Publisher/Senior Editor/Associate Editor for *MIS Quarterly* as well as editorial board member on a variety of other journals. Former VP of Publications for the Association of Information Systems (AIS), he has held roles as co-program chair for AMCIS and ICIS and was elected an AIS fellow in 2005.

Peter Weill is an MIT Senior Research Scientist and joined MIT Sloan faculty in 2000 to become director of MIT Sloan's Center for Information Systems Research (CISR). MIT CISR is funded by sixty corporate sponsors, and undertakes practical research on how firms generate business value from IT. Peter has written award-winning books, journal articles, and case studies on how firms govern, invest in and get value from IT. Peter's co-authored books include: *Enterprise Architecture as Strategy: Creating a Foundation for Business Execution* (Harvard Business School Press, July 2006), *IT Governance: How Top Performers Manage IT Decision Rights for Superior Results* (2004), *Leveraging the New Infrastructure: How market leaders capitalize on information technology* (1998) and *Place to Space: Migrating to eBusiness Models*, (2001) which won one of the *Library Journal of America's* best business book of the year awards and was reviewed by the *New York Times*. Before joining Sloan as Director of CISR, Peter was Foundation Professor and Chair of Management and a member of the Board of Directors of Melbourne Business School. Peter has been an Associate Editor for MISQ and ISR and was a program co-chair for ICIS2000 in Brisbane.

Kathy S. Schwaig is an Associate Professor of Information Systems and Associate Dean for Administration in the Coles College of Business at Kennesaw State University. Her research interests include information privacy, outsourcing, project management, knowledge management and electronic commerce. She also serves as a business consultant in information systems strategy. Dr. Schwaig has published in the Communications of the ACM, The Journal of Management Information Systems, DATABASE, Information and Organization, and Information Systems Research among others.