Allocation of IT resources in complex firms: The alignment with business and corporate strategy

Completed Research Paper

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ABSTRACT

This paper contributes to our understanding of IT organizational arrangements in complex firms by focusing on the question of whether to conduct IT activities at the corporate or division level. It argues that co-location of IT resources at the SBU level is contingent on (i) the extent to which IT activities are a critical success factor in the focal industry, (ii) the competitive strategy followed by the focal SBU, and (iii) the SBU’s role within the internal network of cross-unit business synergies. Hypotheses are tested with data from a sample of 85 business units within 25 large diversified industrial firms. Findings suggest that the dominant logic for the allocation of IT resources in related diversified firms is the role of the SBU as either a provider or receiver of cross-unit services in the pursuit of corporate-wide synergies. This complements results from the prior literature on IT governance.

KEYWORDS

IT structure, IT governance, multibusiness firms, synergy, multi-level studies.

INTRODUCTION

The organization of the information systems (IS) / information technology (IT) function is a perpetual topic of importance to both theory (Brown & Grant 2005; Sambamurthy & Zmud 1999, 2000) and practice (Brancheau, Janz, & Wetherbe 1996; Luftman & McLean 2004). A number of insights have been offered regarding organization logics that may be used to orchestrate the activities of the IS function in modern firms. The bulk of the prior literature has focused on the matter of governance; that is to say, on the distribution of decision-making rights over IT resources between corporate headquarters (HQ) and strategic business units (SBUs). One of the key prior contributions to this literature is the notion that the best IT governance arrangement is contingent on business-level (as opposed to firm-level) context variables and, thus, that a variety of IT governance solutions should be used across business units of product-diversified firms (Brown 1997; Brown & Magill 1998). Contemporary enterprises employ differentiated IT governance solutions for individual business-units (Sambamurthy & Zmud 2000), and such customized designs are seen as critical to effective IT activities in modern firms (Weill 2004).

Another important contribution is a view that stresses complementarities and co-evolution of IT resources with the business side as a key rationale for organizing IT activities (Agarwal & Sambamurthy 2002; Sambamurthy & Zmud 2000; Sambamurthy, Bharadwaj & Gover 2003;Tanriverdi & Venkatraman, 2005). Again the emphasis in the prior literature has been on studying the implications for governance. This paradigm recognizes the growing value-creating role of IT as a necessary resource for business innovation and, to support this role, IT governance is argued to call for greater integration of IT and business resources in order to develop the necessary capabilities (Agarwal & Sambamurthy 2002; Sambamurthy & Zmud 2000; Sambamurthy et al. 2003). Calls have been made for further thinking that extends this rationale (Agarwal & Sambamurthy 2002) as well as for studies that examine organizational arrangements that may foster integration of IT and business resources and, thus, aid in the development of the required capabilities for business success (e.g., Sambamurthy et al. 2003).

The present paper attempts to contribute to our understanding of complex IT function arrangements in modern multi-business firms by extending the value-creating view of IT to another important administrative consideration, besides governance: the configuration (or structure) of IT personnel and assets. The focus here is on the physical distribution of IT personnel and
resources either to a pooled or shared unit at the group or corporate level or to dispersed units within SBUs. In other words, as opposed to governance (i.e., who has the rights to make decisions about the IT activities), the present research focuses on who conducts the IT activities themselves.

The decision of whether to undertake IT activities at the corporate or divisional level is a contentious question in most diversified firms; and it is a complementary but distinct consideration to the matter of governance. For example, in firms with centralized governance all decision related to IT infrastructure and IT applications will be made by corporate; however this does not inform about the configuration of IT resources: This governance solution could be implemented either via a corporate IS unit that conducts all the IT activities for divisions, or via IS units within each SBU that do not have any IT decision making rights, but who are responsible for implementing the decisions taken by a central coordinating unit; or by a combination of these two resource allocation extremes. Similarly, in firms with decentralized IT governance this could be implemented through a central IT services unit that cannot impose anything on SBUs and must rather “sell” customized solutions to internal business customers.

If tight coupling between IT and business resources is important for the co-production of strategic capabilities (Sambamurthy et al. 2003; Tanriverdi and Venkatraman 2005), then it is likely that the co-location of IT and business resources has strategic implications. Given this, the present paper seeks to shed light onto differentiated, division-level predictors of IT resource configuration within multi-business firms.

The purpose of the study is twofold: First, to seek to provide evidence of the extent to which large, related-diversified, multi-business firms may employ differentiated IT resource allocation solutions across individual business units. Second, to extend the value-creation view of the IT function (Sambamurthy et al. 2003; Tanriverdi and Venkatraman 2005) to derive and test hypotheses regarding predictors of the local distribution of IT resources to individual business units.

HYPOTHESES

This paper investigates whether the co-location of IT resources at the business unit level is contingent on (i) the importance of IT to succeed in the SBU’s industry; (ii) the competitive positioning sought by the SBU within this industry; and (iii) the role of the SBU within the corporate network of cross-unit business synergies.

Importance of IT Activities to Compete in the Focal Industry

The greater the importance of IT activities for a business unit to compete in its industry (Brown 1997; Brown & Magill 1998), the greater the coordination and inflexibility costs associated with shared (i.e., non-dedicated) IT personnel and resources. Given this, I expect that IT structure designers will be more willing to allow greater co-location of IT resources where the latter are key to success in the focal SBU’s industry.

Hypothesis 1. The perceived importance of IT activities as key success factors in the focal SBU’s industry will be negatively related to the extent to which such activities are conducted by a shared central provider.

SBU Competitive Strategy

A cost-leadership strategy seeks to provide relatively standardized products so as to take advantage of process improvements and volume efficiencies (Porter 1985). Since activity sharing produces scale advantages, the use of shared resources is most beneficial to SBUs that pursue a low cost competitive positioning (Gupta and Govindarajan 1986). By contrast, a strategy of differentiation seeks to create innovative products and services for which the buyer will be willing to pay a premium. The greater need for flexibility and innovativeness in differentiation SBUs will be better served when the unit has direct control over its own IT resources (Brown 1997; Brown & Magill 1998). Hence, it is expected that IS structure designers will be more willing to allow greater co-location of IT resources in differentiation (as opposed to low-cost) SBUs.

Hypothesis 2. Business unit competitive strategy (measured as a continuum from low-cost to differentiation) will be negatively related to the extent to which IT activities are conducted by a shared central provider.

SBU’s Role in Cross-unit Business Synergy

A firm’s pursuit of cross-unit business synergies has also been argued to be an important contingency for IT organization design in multibusiness firms (Sambamurthy & Zmud 1999; Weill & Ross 2004). To date IT governance studies have modeled this variable at the firm level of analysis and have used corporate diversification as a proxy for it. In particular, it has been argued that related diversification, which is associated with greater opportunities for business synergies, calls for a
centralized IT governance mode. In turn, unrelated diversification provides less opportunities for cross-unit synergies so that decentralized IT governance will be preferred in this case (e.g., Sambamurthy & Zmud 1999).

Research in strategic management suggests that business units within a single firm may exhibit different levels of involvement in cross-unit synergies (e.g., Gupta & Govindarajan 1986). Also, individual business units may play different roles within the network of intra-corporate exchanges associated with the pursuit of synergy. In particular, units that are in possession of a strategic resource or capability are expected to act as providers of services to sister units; while related units are expected to participate as recipients of such services (Vancil 1980; Gupta & Govindarajan 1991, 2000). Such intra-firm variation in SBU involvement and roles in cross-unit business synergy may have important implications for the organization of IT activities.

Correspondingly, the present study operationalizes the pursuit of cross-unit synergy as a business-unit level phenomenon. Cross-unit business synergy is defined here as intra-corporate transfers of operating activities (i.e., transfers of services from core business functions) to/from a focal business unit. Also, following prior studies of intra-corporate exchange flows (Gupta & Govindarajan 2000; Schulz 2001), the study disaggregates business synergy into outflows and inflows. Business synergy outflows are operating activities conducted by the focal unit for the benefit of sister units’ products. Business synergy inflows are operating activities conducted for the benefit of the focal unit’s products by other units of the firm (either a central function or a sister unit’s functional department).

Business Synergy Outflows

Consistent with the resource-based view of diversification (Markides & Williamson 1996; Robins & Wiersema 1995; Tanriverdi & Venkatraman 2005), business units involved in synergy outflows are expected to possess some capability that is perceived to be strategic and, thus, is being leveraged across other SBUs. A capability is the capacity of a combination of resources to perform a given activity (Grant 1991; Amit & Schoemaker 1993), and what makes it strategic is that the resulting activity is not only valuable, but also difficult for competitors to copy or substitute, and not easily traded (Barney 1986; Wernerfelt 1984; Peteraf 1993). Because they are imperfectly tradable (Peteraf 1993), strategic capabilities are by definition internally developed (Markides & Williamson 1996). This implies that outflow sharing business units will be a locus of value-creating innovation –i.e., are involved in the creation and future development of strategic capabilities. IT structure theorists argue that these value-creating innovation processes require relational governance and tight coupling of IT resources with other business assets and activities (Sambamurthy & Zmud 2000; Agarwal & Sambamurthy 2002; Weill & Ross 2004). Therefore, it is expected that IT resources will tend to be co-located with business resources in outflow units.

Hypothesis 3. Business synergy outflows of a focal division will be negatively related to the extent to which IT activities are conducted by a shared central provider.

Business Synergy Inflows

In contrast, the dominant focus of IT activities for inflow divisions will be services provisioning (Agarwal & Sambamurthy 2002), where the main goal will be exploitation of economies of scope, as opposed to local innovation. The emphasis here will be on imposing common and mutually-reinforcing applications, standards, and procedures to create IT compatibility among inflow units and facilitate the intended leverage of the strategic capability (Fiedler et al. 1996; Tanriverdi 2005). Prior research suggests that this is best accomplished through centralized IT governance (Sambamurthy & Zmud 1999; Weill & Ross 2004, 2005; Tanriverdi 2006), and I further expect that this will be associated with centralized IT resources as well.

Hypothesis 4. Business synergy inflows of a focal division will be positively related to the extent to which IT activities are conducted by a shared central provider.

METHODS

Sample and Data

Data were gathered through a combination of mail survey of business unit general managers, and secondary firm- and industry-level data from COMPUSTAT and the Directory of Corporate Affiliations. The sample was drawn from the population of manufacturing firms (SIC codes 2000-3999) in COMPUSTAT Business Segment data tapes. The focus on manufacturing, as opposed to a mix of manufacturing and service firms, allowed for more precise definition and operationalization of business synergy flow constructs (see below).

The sampling procedure was as follows: First, entropy measures of diversification (Palepu 1985) were computed for all COMPUSTAT manufacturing firms, and a random group of 166 companies that fell within the upper quartile of the related
component of entropy were initially selected. Second, the Directory of Corporate Affiliations as well as annual reports and company web pages were consulted for evidence that selected companies were organized under a multidivisional structure. Firms were dropped when such evidence either could not be found or suggested otherwise. Third, following prior division-level studies (e.g., Pitts 1976; Govindarajan 1988), it was required that at least six US-based divisions reporting directly to a U.S.-based headquarters could be identified, as an indication of organizations with high potential for intra-corporate synergy flows among domestic business units. This requirement also created reasonable odds of obtaining multiple observations per firm in the final sample, which was a key methodological consideration (as discussed below). Finally, names and addresses of key informants (i.e., business-unit heads) were collected from the Directory of Corporate Affiliations and crosschecked with Standard & Poor’s Register of Directors and Executives. Subjects were dropped whenever discrepancies between the two directories could not be reconciled. These steps produced a survey frame of 792 SBU general managers at 72 firms.

Questionnaire design and survey implementation followed the Dillman (2000) method, which resulted in a total of 127 completed questionnaires returned, for a response rate of 16 percent. Responses were judged unusable for the present study whenever: (i) the surveyed unit did not to fit the concept of a product division; (ii) the respondent had been with the firm for less than one year, or reported to be someone other than the division general manager; or (iii) there was no other return from the same firm. Data from multiple business units was important in order to control for firm effects in statistical analyses. This process resulted in a total of 85 returns from 25 corporations that could be included in the study. Business units in the final usable sample ranged from $3 million to $5.5 billion in annual sales, with median SBU sales of $151 million, and median firm sales of $3.9 billion.

**Measurement**

**Dependent Variable: Percent of Divisional IT Activities Conducted/Contracted by HQ.** Respondents were asked to report the percentage of their overall IT activities that were conducted (i) by the business unit itself, (ii) by a group level or corporate IS department, or (iii) by an outside firm contracted by corporate. Reported percentages added to 100% in all cases. The measure used was the sum of percent IT activity conducted by a central function plus percent IT activity conducted by corporate subcontractors. Percent centralized IT ranged from zero to 100%, with an average 28.13% (stdev=35.22) IT activity conducted (directly or indirectly) by a shared central unit.

**Competitive Strategy.** Business-unit strategy was defined as Porter’s (1980, 1985) generic competitive strategies and measured using Gupta and Govindarajan’s (1986) instrument. Survey respondents were asked to rate their divisions’ products relative to those of leading competitors in the following five areas: (i) product performance and quality; (ii) product features, (iii) brand name/reputation, (iv) customer service, and (v) product price, using a five-point Likert-type scale ranging from “significantly lower” to “significantly higher”. Responses across the five items were averaged to produce an index of competitive positioning (alpha = 0.77), with high values indicating a strong differentiation strategy and low values indicating a strong low-cost strategy. (Mean=3.89; Stdev=0.59).

**Importance of IT.** Respondents were asked to rate on a 5-point Likert scale (ranging from “not important” to “extremely important”) the importance of IT activities for a business to succeed in the focal marketplace. (Mean=3.36; Stdev=1.01).

**Business Synergy Outflows.** Measurement of synergy flows followed an approach similar to Gupta and Govindarajan’s (2000), except that objective (as opposed to perceptual) indicators were used. To capture outflows respondents were asked to consider all activity carried out by departments or facilities under their command in each of seven core functional areas (science/basic research, product/process engineering, procurement, manufacturing, distribution and sales, after sale service/support, and marketing). Responses were averaged to produce an overall summary measure of business synergy outflows, as a matter of formative indicators (Bollen 1989). (Mean=3.93; Stdev=5.38).

**Business Synergy Inflows.** Respondents were asked to consider all activity conducted for the benefit of their divisions' products in each of the seven core functional areas enumerated above, and to break this down in terms of percent activity that...
was (i) carried out by the division itself; (ii) provided by a corporate or group-level functional department, (iii) provided by an outside firm contracted by corporate, and (iv) provided by a sister business unit. For each functional area, reported percentages added to 100 percent in all cases. Objective indicators of functional inflows were computed as the sum of percent activity provided by corporate, subcontractors, and sister divisions. Functional inflows were then factor analyzed using principal components and varimax rotation. Two factors were extracted based on the Kaiser-Guttman rule, which explained 66% of the overall variance. After rotation, inflows of research, engineering, procurement, and manufacturing loaded clearly in the first factor, which was labeled upstream inflows; while inflows of sales, after-sale-service, and marketing loaded on the second, labeled downstream inflows. Given this, the overall measure of business synergy inflows was constructed by, first, compiling average percentages of upstream (α= 0.76) and downstream (α= 0.73) inflows and, then, combining the two scores into an average inflows index, as a matter of formative indicators. (Mean= 15.44; Stdev= 18.07).

**Control variables.** The study controlled for random firm-level effects in regression analyses. Nevertheless, it was also deemed important to examine correlates that might explain these firm effects. To avoid redundancy, the emphasis was on organizational characteristics that were not already accounted for by the division-level study variables. **Firm Size** (measured as the natural logarithm of 3-year average firm sales, in $ millions); **Diversification Scope** (measured using the unrelated component of the entropy index of diversification; Palepu 1985); and **Extent of Diversification** (measured as the number of firm divisions) were added as firm-level controls. At the SBU level, controls were added for: **SBU Size**; operationalized as the natural log of 2-year average SBUs sales in $ thousands. Decision-Making Autonomy, measured as the percent of operating and strategic decisions (out of a list of 16) for which the SBU had final approval rights. And **Industry Risk**, defined as annual variability in income in the SBU’s main industry (4-digit SIC code), and measured using the standard deviation of industry ROA (Miller & Bromiley 1990) for the preceding 5-year period.

**Analysis**

Hypotheses were tested by means of multiple regression. The dependent variable was a percentage and, therefore, had a limited observable range between zero and 100. The data included a sizeable number of lower-limit (31 observations) as well as a few upper limit observations. Given this, two-sided Tobit censored regression was used to estimate the models of interest (Maddala 1999).

In addition, the data had a hierarchical structure –the 85 observations (divisions) were clustered into 25 groups (firms), suggesting possible lack of independence of observations as well as possible heteroscedasticity. Given this, hypotheses were tested by means of random-effects Tobit models. The random firm effect controlled for unobserved factors driving the different average levels of IT centralization at each firm (over and above firm-level controls). In order to clearly separate firm-level from division-level effects, division-level regressors were group-mean centered (Hoffman & Gavin 1998).

**RESULTS**

Table 1 presents the results of the random-effects Tobit analysis. A series of regression equations are reported: Equations 1 and 2 explore firm effects. Equation 1 is the unconditional means model, which regresses the dependent variable against random firm-effects only, and informs of their relative importance (i.e., this is a one-way analysis of variance model). Equation 2 is the firm-level model, which explores factors that may explain random firm effects. Equation 3 includes both firm-level and division-level controls, and provides the base-line used to assess the joint significance of the explanatory variables of interest. Equation 4 is the full model, which provides a joint test of hypotheses.

The likelihood ratio chi-square comparing Equation 4 to Equation 3 indicated that the block of variables of interest made a significant contribution to the explanatory power of the regression model (LR = 27.85, p <0.001). Results for individual hypotheses, however, were rather mixed.

The importance of IT for competing in the focal division’s industry was found not to be related to the percent of IT activities conducted centrally, so that Hypothesis 1 was not supported.

The coefficient for competitive strategy was not significantly different from zero either. Thus, Hypothesis 2 was not supported.

Results for the synergy flow variables, however, were as predicted. The regression coefficient for business synergy outflows was negative and significant (β = −1.86; p<0.05); while the coefficient for synergy inflows was positive and strongly significant (β = 1.96; p<0.001). This provides support for Hypotheses 3 and 4, respectively.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Hypothesized Relationship</th>
<th>Equation 1</th>
<th>Equation 2</th>
<th>Equation 3</th>
<th>Equation 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Importance of IT</td>
<td>H1 (−)</td>
<td>2.67</td>
<td>(4.54)</td>
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<td>Competitive Strategy</td>
<td>H2 (−)</td>
<td>-8.59</td>
<td>(7.87)</td>
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<td>Intra-Corp. Network Model:</td>
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<td>Business Synergy Outflows</td>
<td>H3 (−)</td>
<td>-1.86 *</td>
<td>(0.81)</td>
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<td>Business Synergy Inflows</td>
<td>H4 (+)</td>
<td>1.96 ***</td>
<td>(0.35)</td>
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<td>Division-level Control:</td>
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<td>Divison Size</td>
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<td>5.55 †</td>
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<td>(4.83)</td>
<td>(3.13)</td>
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<td>(0.46)</td>
<td>(0.39)</td>
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<td>Industry Instability</td>
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<td>376.93 *</td>
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<td>(236.40)</td>
<td>(173.76)</td>
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<td>-1.96 ***</td>
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<td>(18.74)</td>
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<td>(-2[L(b_{Equation3}) - L(b)] )</td>
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<td>Random firm effect(^{c})</td>
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<td>34.22 ***</td>
<td>13.95</td>
<td>18.39 †</td>
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</table>

Table 1. Random-effects Tobit Regressions of Percent of Divisonal IT Activities conducted by HQ\(^{a}\)

\(^{a}\) Unstandardized coefficients (std errors in parentheses). † \( p < .10 \), * \( p < .05 \), ** \( p < .01 \), *** \( p < .001 \). Wald tests of coefficient estimates.

\(^{b}\) Significance of Likelihood-ratio \( X^2 \) relative to null model (Equation 1) reported.

\(^{c}\) Variance component reported, and significance of Likelihood-ratio \( X^2 \) relative to fixed-effects Tobit.

DISCUSSION

This paper investigates strategy-related predictors of IT function structure within large, related diversified firms. The specific question addressed is: What factors help explain the extent to which business unit’s IT activities are being performed by a central IS function as opposed to being carried out by the business unit itself?

Findings reveal that there are both firm-level as well as division-level determinants of the location of IT activities and, thus, that multibusiness firms use a variety of IT function structure arrangements across their SBUs.

Among firm-level factors, greater levels of diversification (both in terms of number of businesses and the scope of industries included) were found to be related to greater co-location of IT resources at the SBU level.

Among division-level factors, IT structure arrangements were found to be related to the SBU’s role in cross-unit business synergy. As predicted, greater synergy outflows of a focal SBU were found to be related to greater co-location of IT
resources. By contrast, greater synergy inflows were found to be associated with lesser allocation of IT personnel and resources at the division level.

Greater SBU risk was also found to be related to lesser co-location of IT resources at the divisional level. This result may be due to an attempt to lower division overhead as a response to earnings variability.

This study makes several contributions to our understanding of IT organization arrangements in complex organizations, which have implications for future research. The most important implications include: First, the paper suggests that, along with IT governance, future research on the organization of the IT function must also consider IT structure (i.e., the pattern of concentrated or dispersed IT assets and resources) as an important administrative consideration. Second, findings regarding SBU-level predictors of IT structure are consistent with a resource-based view of the IT function which conceptualizes capabilities as a set of mutually-reinforcing resources (e.g., Amit & Schoemaker 1993; Choudhury & Xia 1999) and argues that IT activities are complementary to business assets in the creation of strategic capabilities (Sambamurthy et al. 2003; Tanriverdi 2005). This study suggests that distributed IT assets should be favored in situations where IT-enabled innovation by the SBU becomes a priority. The co-location of IT resources at the local level ensures a richer ongoing dialog between the IT and business functions and allows for IT investments and activities to be tightly coupled with specific business needs and opportunities. Third, the present study suggests that administrative priority within related-diversified firms is defined by the possibility for an SBU to create or improve on products and processes that can be leveraged across multiple businesses of the firm. In other words, as opposed to supporting all local IT-enabled innovation needs of SBUs, the dominant organization logic for the distribution of IT resources seems to be to support loci of innovation that are strategic in the sense of providing opportunities for economies of scope.

The present findings need to be interpreted in the context of several limitations: First, to facilitate operationalization of synergy constructs, this research focused on manufacturing firms. It is therefore unclear if the same relationships apply to service firms, which tend to be more reliant on IT resources. Second, this research explores IT structure arrangements followed by firms, but does not investigate the performance implications of these choices. Future research could also extend the present findings by using more fine-grained measures of centralization of IT assets and activities. Finally, it would be important for future work to explore the interplay between different IT structural and governance solutions.

REFERENCES