Fact or Fiction: The Reality Behind Executive Perceptions of IT Business Value[1]

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ABSTRACT

Despite significant progress in evaluating the productivity impacts from corporate investment in information technology (IT), the inability of traditional economic measures to fully account for intangible impacts has led to calls for a more inclusive and comprehensive approach to measuring IT business value. In this paper, we argue that perceptual measures, as reported by business and information systems (IS) executives, constitute a valid means of assessing payoffs from IT investment, but with the added advantage that, unlike traditional economic measures, perceptual measures can be used to evaluate both tangible and intangible impacts.

To formally evaluate this notion, we devise a model of IT business value based on multiple process-level measures of IT impacts across the value chain. Using data from 196 executives across 42 firms, we reveal that executive perceptions are highly correlated with objective measures of IT business value, thereby establishing executive perceptions as a valid means of assessing IT business value. Our analysis also finds a relationship between strategic alignment and IT business value, in the sense that an absence of strategic alignment can lead to reduced payoffs from IT investment. Finally, we investigate the relationship between the IS organization and IT business value. Besides having a direct impact on IT payoffs, our analysis found that the IS organization plays a key role in enabling an organization to convert strategic alignment into higher levels of IT business value.

1. Introduction

Business and information systems (IS) executives continue to struggle with a host of complex measurement issues involved in determining payoffs from corporate investment in information technology (IT). As a result, fewer than 25% of organizations use any formal ROI measures when evaluating their IT investments (Information Week 1997). Some insights into the extent of IT payoffs can be gleaned from research on the "productivity paradox", principally in the form of positive, and in some cases, excess returns to IT investment (Lichtenberg 1995; Brynjolfsson and Hitt 1996b; Dewan and Min 1997). However, the primary focus of these studies has been on the productivity impacts of IT investment. Consequently, a wide variety of impacts, including improved inventory management, greater product variety and enhanced customer service, have been excluded from an analysis of IT payoffs. The need to consider these broader impacts has led to increased calls from IS researchers and practitioners for a more inclusive and comprehensive assessment of IT payoffs (Strassmann 1990; Brynjolfsson 1993; Information Week 1997).

In response to this call, we introduce a model of IT business value[1] based on business and IS executive perceptions of IT impacts. Consistent with the diverse nature of IT investments, we employ multiple process-level perceptual measures in an attempt to capture a wide range of IT impacts across the organization. Although our model emphasizes perceptual measures of IT business value, these measures are not meant to replace or displace objective measures (where they exist). Rather, perceptual measures provide a complementary means of assessing IT business value, but with the added advantage that unlike traditional economic measures, perceptual measures can be used to evaluate both tangible and intangible impacts.

[1] IT business value is defined as the contribution of IT to firm performance (Berger, Kobielus and Sutherland 1988).

By demonstrating that perceptual measures are highly correlated with objective measures of IT business value, our research indicates that executive perceptions constitute a valid approach to measuring IT business value. In cases where organizations find it difficult to evaluate IT impacts using traditional economic measures, our findings suggest that some degree of reliance may be placed on perceptual measures as a complementary, or alternative source of information on IT payoffs.

While measuring IT business value is an inherently useful exercise, determining ways in which organizations can achieve higher levels of IT business value is equally beneficial. Two areas identified in the literature as being important to IT business value are strategic alignment and IS effectiveness.[2] We incorporate both variables into a model of IT business value in order to determine their respective impact on executive perceptions of IT business value.

The remainder of this paper is organized as follows. In the next section, we provide some theoretical background on executive perceptions. Section 3 introduces a research model of IT business value. In section 4, we describe the data and methodology used to empirically test this model. Section 5 presents detailed findings, while managerial implications are discussed in section 6. Finally, we conclude on the appropriateness of executive perceptions as an approach to measuring IT impacts.

2. Theoretical Background

Support for executive perceptions of IT business value comes from a series of research studies that associate concepts such as IS effectiveness, IT use and user satisfaction with some notion of IS success (DeLone and McLean 1992). For example, research has shown that a CEO's perceptions and attitudes towards IT and the degree of importance attributed to IT, are strongly associated with an organization's progressive use of IT (Busch, Jarvenpaa, Tractinsky and Glick 1991; Jarvenpaa and Ives

[2] Strategic alignment is defined as the extent to which the IT strategy supports, and is supported by, the business strategy, while IS effectiveness refers to the performance of the IS organization.

1991). Meanwhile, greater and more appropriate use of IT is seen as an important factor in realizing higher levels of IT business value (Lucas 1993; McKeen and Smith 1993).

Consistent with the above studies, researchers argue that executives are ideally positioned to act as key informants in a qualitative assessment of IT impacts in their organizations (DeLone and McLean 1992). The basis for this argument is twofold. First, as direct consumers of IT, executives can rely on personal experience in forming an overall perception of IT impacts (McLean 1979; Rockart and Flannery 1983; Davis and Olson 1985). Second, as business executives have become increasingly involved in IT planning decisions, their perceptions have begun to reflect the opinions expressed by their peers and subordinates as to the performance of previous IT investments (Watson 1990). Equally, IS executives receive feedback on the performance of IT investments from other business executives in their organization. These arguments confirm that executives are an important source of information on IT impacts and provide support for the use of executive perceptions in measuring IT business value.

2.1 Problems with Perceptual Measures

The validity of perceptual measures remains the subject of some debate due to concerns that perceptions are open to exaggeration and promotion of self-interest. Research has succeeded in alleviating some of these concerns by showing, for example, that perceptual and objective measures of firm performance are highly correlated[3] (Dess and Robinson 1984; Venkatraman and Ramanujam 1987). This finding led Venkatraman and Ramanujam (1987) to conclude that, "perceptual data from senior managers . . . can be employed as acceptable operationalizations of [business economic performance]" (p. 118). Notwithstanding this, research in psychology and cognitive science has found that perceptions are subject to recency effects (Sorrentino and Higgins 1986; Steiner and Rain 1989). In

[3] In Venkatraman and Ramanujam (1987), for example, senior executives were asked to rate their firm's performance relative to that of their major competitors using a number of different performance measures, including sales growth, net income growth and ROI.

the context of executive perceptions of IT business value, recency effects would tend to bias an executive's perception in favor of recent IT impacts rather than considering all IT impacts equally over time. Consequently, if recency effects exist, we are more likely to find that executive perceptions correlate with recent objective measures of IT business value rather than with equal-weighted time-series measures.

Managerial attitudes towards IT and the IT culture within an organization can also play an important role in shaping executive perceptions (Boynton, Zmud and Jacobs 1994). For example, if executives have a positive and open attitude towards IT, negative IT impacts could be suppressed in forming an overall perception. In certain instances, this could result in a false positive perception of IT payoffs. Equally, if executives have a negative attitude towards IT, disproportionate weighting could be applied to negative IT impacts, biasing their overall perception downwards. In both these examples, executive perceptions of IT business value fail to provide a true assessment of actual IT payoffs.

In order to avoid these problems, we introduce a number of counter-measures into our research design. For example, to control for attitude bias, we use multiple respondents per organization. By using both IS and business executives within each organization, we also allow for the possibility that certain executives (particularly those in IT) might inflate their perceptions in order to create a favorable impression. Finally, in consideration of recency effects, we correlate perceptual measures of IT business value with objective measures derived from the most recent set of corporate financial data.

2.2 A Process-oriented Perspective on IT Business Value

The use of perceptual measures permits consideration of a wide variety of IT impacts across the organization. However, the disparate nature of an organization's IT investments and their associated impacts complicates the task of forming an overall firm-wide assessment of IT impacts. One way of simplifying this task is to adopt a classification scheme that groups measures which share similar

investment objectives, such as administrative cost reduction, productivity improvement and customer service enhancement (Kauffman and Kriebel 1988). This approach is supported by a growing number of researchers who advocate a process-oriented assessment of IT business value based on the argument that first order impacts of IT investment occur at the process-level (Crowston and Treacy 1986; Bakos 1987; Barua, Kriebel and Mukhopadhyay 1995; Mooney, Gurbaxani and Kraemer 1995). This perspective argues that IT creates value for the organization by improving individual business processes, or inter-process linkages, or both. Consequently, the greater the impact of IT on individual business processes and on inter-process linkages, the greater will be the contribution of IT to firm performance.

Process-level measures of IT business value offer a number of advantages. For example, multiple process-level measures facilitate a richer assessment of IT business value than that provided by a single firm-wide measure. From a managerial standpoint, process-level measures can aid in the detection of bottlenecks and other problem areas where value might be destroyed, rather than created. Finally, as business executives are typically assigned responsibility for business processes, they are ideally positioned to evaluate IT impacts at the process-level.

2.3 The Value Chain

While there are many acknowledged ways of depicting the processes within an organization, the value chain is perhaps one of the most widely used (Porter 1985). The value chain divides an organization into a sequence of primary activities (inbound logistics, operations, outbound logistics, marketing and sales, and service) and support activities. The deployment of IT at each step along the value chain enhances the value-creating potential of the organization (Porter 1985). Table 1 provides some examples from the research literature of ways in which IT creates value within the value chain. By analyzing the impacts of IT at each point, we can construct a potentially useful framework within which to identify process-level measures of IT business value (Barua, Kriebel and Mukhopadhyay 1995).

Insert Table 1 about here

3. Research Model and Hypotheses

Our research model, shown in Figure 1, depicts a number of hypothesized relationships involving IT business value. Besides measuring IT business value at the process-level, we also include a firm-level measure of return on IT investment. Finally, we include strategic alignment and IS effectiveness in an attempt to gain further insights into how organizations can achieve higher levels of IT business value.

Insert Figure 1 about here

3.1 Return on IT Investment

Depending on the importance of a particular business process, individual process-level measures might be used to infer the existence of IT business value at the firm-level. However, a more precise argument would conclude that an aggregation of multiple process-level measures across the organization should yield some insights as to whether the organization as a whole is realizing a return on its IT investment. Specifically, if executives perceive value from IT investment at various points along an organization's value chain, there is a valid basis for arguing that these perceptions should filter through to an overall firm-level perception of return on IT investment. To formally evaluate this notion, we include a firm-level measure of return on IT investment, giving rise to the following hypothesis:

H1: At an aggregate process-level, IT business value is positively associated with returns to IT investment at the firm-level.

3.2 Strategic Alignment

Although IT business value and strategic alignment are often regarded as separate issues, researchers argue that organizations' inability to realize sufficient value from their IT investments is due in part to an absence of strategic alignment (Henderson and Venkatraman 1993; Woolfe 1993; Broadbent, Weill and St. Clair 1995; Prairie 1996). While researchers have found that strategic

alignment is positively related to firm performance (Chan, Huff, Barclay and Copeland 1997), no attempt has been made to empirically determine whether there is a relationship between strategic alignment and IT business value. Providing an answer to this question is important, for if payoffs from IT investment are a function of strategic alignment, then any attempt to measure or otherwise influence these payoffs must consider the extent to which IS and business strategies are aligned. Similarly, if an organization attempts to reposition or change its strategic alignment, some consideration must be given to the subsequent shift in the payoffs from IT investment. These arguments produce the following hypotheses:

H2: Strategic alignment is positively associated with IT business value.

H3: Strategic alignment is positively associated with returns to IT investment.

Research also indicates that strategic alignment is positively associated with IS effectiveness, in the sense that an IS organization will be better able to serve the needs of its business clients if the IS and business strategies are in alignment (Sabherwal and Kirs 1994; Chan, Huff, Barclay and Copeland 1997). IS effectiveness also provides an important check on the management practices that are used to achieve strategic alignment. Examples include IS outsourcing (Kambil and Turner 1994), involving business executives in IS planning (Broadbent and Weill 1993), promoting dialogue between IS and business executives (Keen 1991), or the creation of a shared IT vision and mutual recognition of business and IS objectives (Reich and Benbasat 1996). These arguments result in the follow hypothesis:

H4: Strategic alignment is positively associated with IS effectiveness.

3.3 IS Effectiveness

IS effectiveness is clearly an important factor in achieving greater levels of IT business value (DeLone and McLean 1992; Chan, Huff, Barclay and Copeland 1997). Consistent with the notion of conversion effectiveness (Weill 1988), an IS organization that is committed to providing a quality and

reliable service and that delivers IT solutions that support the long term goals of the business, will facilitate higher levels of IT business value. These arguments produce the following hypotheses:

H5: IS effectiveness is positively associated with IT business value.

H6: IS effectiveness is positively associated with returns to IT investment.

Finally, our research model allows us to determine if IS effectiveness mediates the relationship between strategic alignment and IT business value. As a mediating variable, attempts to use strategic alignment to achieve higher levels of IT business value, will be conditional on the performance of the IS organization. Alternatively, an ineffective IS organization could frustrate attempts to achieve higher levels of IT business value.

4. Data Collection and Methodology

Data for this study came from a 1995 survey of IS and business executives (see Appendix). A previous version of the survey was tested and validated in a 1994 study of IT business value (Mooney 1997). The survey was divided into two sections. The first section contained items on IS effectiveness, strategic alignment and return on IT investment, while the second section focused on IT business value.

IS effectiveness was measured using three items (user satisfaction, quality of service and helpfulness of IS staff). Both strategic alignment and return on IT investment used single item measures. Respondents were asked to rate the performance of their IS unit relative to other IS units on a 10-point Likert scale, where 1 indicated “weak” and 10 indicated “strong”.

Whereas our original 1994 survey used 40 items to measure IT business value, we favored a more parsimonious set of items for this study. In deciding what items to include, we gave careful consideration to the various process-level impacts identified in our earlier review (Table 1). We also sought to include a selection of the best items from our original survey. This produced a list of 15 items,

with three items being used to measure the impact of IT at each of five points along the value chain (supplier relations and inbound logistics, production and operations, product and service enhancement, sales and marketing support, and customer relations and outbound logistics). While these 15 items do not address every conceivable impact of IT on the value chain, they nevertheless provide a useful starting point for our research. Respondents were asked to rate the extent to which they believed IT contributed to firm performance for each process-level measure. Respondents were asked to restrict their responses to realized, rather than expected IT impacts. Individual survey items were rated using a 10-point Likert scale, where 1 indicated "no realized impact" and 10 indicated "high realized impact".

Corporate financial data for 1994 covering revenues, operating income, IS spending and number of employees were obtained from a survey of firm-wide IT management practices. Although part of a separate study, this survey was administered at the same time as the IT business value survey. Where necessary, responses were supplemented with data from Compustat and Information Week's 1994 annual IT spending survey. These data were then used to compile objective measures of IT business value, namely productivity (sales per employee), sales per IT dollar and net income per IT dollar.

4.1 Data

Our sample frame consisted of 164 CSC/Index member corporations.[4] Survey packets were mailed to the CIO of each corporation in early 1995. Each CIO was asked to forward a copy of the IT business value survey to key business executives within their organization. Respondents were asked to reply directly to the authors. Responses were received from 196 executives (180 business executives, 16 IS executives) in 42 corporations denoting a 26% response rate. These corporations represent a variety of industry sectors and contain both manufacturing and service firms. As an indication of size, revenues

[4] CSC/Index was a corporate sponsor of this project.

for these 42 firms averaged $5.2 billion in 1994, while IS spending averaged $85 million. Table 2 provides some general descriptive statistics on our data.

Insert Table 2 about here

An analysis of variance failed to distinguish between responses from IS and business executives, suggesting that both groups share similar perceptions of IT impacts within their organizations. We also found greater consistency in responses within firms than between firms, again confirming that executives from the same firm had similar perceptions. As earlier indicated, this form of analysis allows us to control for certain types of problems that are believed to exist with perceptual measures. Finally, to check for response bias, we compared the 42 corporations in our sample with the Fortune 500 using a set of key financial variables from Compustat. The results of that analysis confirm that any findings from this study can be generalized to Fortune ranked firms.

4.2 Instrument Evaluation

Using EQS v5.2, a structural equation modeling (SEM) tool similar to LISREL, we undertook a confirmatory factor analysis (CFA) in order to evaluate the measurement properties of the IT business value items. Allowing for correlated factors, the standardized factor loadings for the CFA (maximum likelihood estimation) are shown in Table 3.

Insert Table 3 about here

The fit statistics for the CFA are high indicating good fit to the data (χ^2 = 163.82, df = 80, p<0.001; NFI = 0.96; NNFI = 0.97; CFI = 0.98; GFI = 0.90; RMR = 0.05).[5] Furthermore, the standardized factor loadings are consistently above a suggested minimum of 0.60 (Bagozzi and Yi

[5] Using the method described in MacCallum, Browne and Sugawara (1996), the power of this CFA is 0.832.

1988). The results of this CFA confirm that the hypothesized five-factor structure behind the IT business value items (corresponding to five distinct parts of the value chain) is appropriate.[6]

Tests for convergent and discriminant validity were also performed. To confirm that validity exists, the shared variance between each two factor pairing should be less than the corresponding variance extracted for each factor. The results of this analysis appear in Table 4. Entries along the main diagonal represent variance extracted by the items measuring each factor. All other entries denote shared variance, found by repeatedly pairing factors and squaring the estimated correlation between them. As an assessment of the variance extracted for each dimension, we followed the recommendation that the mean variance extracted should exceed 0.50 (Fornell and Larcker 1981). An overall comparison of the shared variances for each dimension pairing with their respective variance extracted confirms that discriminant and convergent validity are present. Composite reliability estimates were also calculated for each factor (Werts, Linn and Jöreskog 1974), in each case exceeding a suggested minimum of 0.80.

Insert Table 4 about here

Considering the outcome of our factor analysis and validity checks, we include IT business value in our research model as a second order latent variable (χ^2 = 187.994, df = 85, p<0.001; NFI = 0.95; NNFI = 0.97; CFI = 0.97; GFI = 0.90; RMR = 0.07). Each of the five factors from our CFA are shown as first order latent variables. Structural modeling permits the simultaneously evaluation of multiple hypotheses, while it can also produce detailed information on the overall performance of the research model. Figure 2 indicates how our research model appears in SEM notation. Reflective indicators are used to identify IS effectiveness, strategic alignment, IT business value and return on IT investment.

[6] As an aside, we performed an exploratory factor analysis on the 15 items (ML extraction). Using a combination of the scree plot and the eigenvalue ≥ 1 rule, a five factor structure emerged, explaining 90% of the total variance. The items loading on each factor were, without exception, the same as those tested in the CFA.

Insert Figure 2 about here

5. Data Analysis and Results

The first part of our analysis involves an assessment of the extent to which perceptual measures correlate with objective measures of IT business value. Before executive perceptions can be deemed a valid means of measuring IT business value, perceptual measures must be shown to correlate with generally accepted objective measures of IT business value. As shown in Table 5, Pearson correlations between the three objective measures (productivity, sales per IT dollar, income per IT dollar) and the single perceptual measure of return on IT investment are highly significant. This suggests that executive perceptions can indeed be used to measure IT business value.

Insert Table 5 about here

As a further check, we used median IS spending per employee to divide our dataset into "low spenders" and "high spenders". In computing Pearson correlations for each group, significant correlations were found for "high spenders" only. A possible explanation for this is that executives in low IS spending organizations might find it difficult to form an accurate perception of IT impacts due to the low level of IT visibility, consistent with low levels of IT diffusion.[7] While outside the scope of this paper, this would appear to be an interesting area for further research. In any event, the results of this correlation analysis support the use of executive perceptions in measuring IT business value. We now turn to an evaluation of our research model (Figure 2) in an attempt to show how executive perceptions of IT business value are influenced by various organizational factors.

5.1 Analyzing the Research Model

In structural modeling, fit statistics are used to evaluate the research model. A model is said to "fit" the data if the difference between the actual and reproduced covariance matrices is within a

[7] "High spenders" spend, on average, four times more per employee than "low spenders".

predefined range. Since there is little consensus as to what constitutes the best overall measure of model fit, we report a menu of fit statistics (Bollen 1989; Marsh, Balla and McDonald 1988; Tanaka 1993; Hoyle and Panter 1995). However, if a model is "successful" at explaining the relationships behind the data, there should be some degree of consistency across the various fit indices.

Insert Table 6 about here

The fit statistics for Figure 2 are reproduced in Table 6. The high degree of fit, compared with the suggested minimum fit, confirm that the configuration of our research model is appropriate. As a further test, we examined statistical power using the procedure outlined in Saris and Stronkhorst (1984). This procedure involves generating rival models, which contain the original model plus one other link not included in the original model. If the original model is "correct", then these misspecified models should be rejected with a high degree of power. In this way, we generated three rival models and, in each case, power was found to exceed 0.95, clearly above the minimum 0.80 suggested by Cohen (1988). Again, this provides vital support for our model.

5.2 Hypothesis Testing

A preliminary analysis of our data yielded evidence of multivariate non-normality. Mardia's normalized coefficient was 22.2, while a rule of thumb for multivariate normality would suggest a normalized coefficient of 3. For this reason, we used robust maximum likelihood (ML) estimates to evaluate our research model. The use of robust estimation gives standard errors that are correct where distributional assumptions surrounding the data are unspecified (Bentler and Dijkstra 1985; Bentler 1995). Another way of avoiding distributional assumptions involves the use of bootstrapping techniques (Efron and Tibshirani 1993). While certain estimation procedures assume underlying distributional properties, for example multivariate normality, an application of the bootstrap requires no such assumptions. The adoption of the bootstrap can be particularly useful as ML procedures underestimate

standard errors when the population distribution is skewed (Boonsma 1983; Ichikawa and Konishi 1995). For these reasons, robust ML estimation and bootstrapping were used in hypothesis testing.

Insert Table 7 about here

Each hypothesis is evaluated using the path estimates shown in Table 7. In each case, the significance level is high ($p<0.001$), meaning that we fail to reject any of the hypotheses. Bootstrapping provides further support for our hypotheses — the bootstrap path estimates are virtually identical to the standardized ML estimates. The variance explained is also high — the model explains approximately 44% of the variance in IT business value and 66% of the variance in the perceptual measure of return on IT investment. Again, bootstrapping confirms the robustness of these estimates.

5.3 Testing IS Effectiveness for Mediation

We had earlier mentioned that our model would allow us to determine if IS effectiveness mediates the relationship between strategic alignment and IT business value. If a variable mediates the relationship between an independent variable (strategic alignment) and a dependent variable (IT business value), the direct path between both independent and dependent variables will be insignificant, while the indirect paths via the mediator will be significant. Once the mediator is removed, the direct path becomes significant.

Insert Figure 3 about here

As shown in Figure 3, without the influence of the mediator variable, the path between strategic alignment and IT business value is highly significant ($p<0.001$). However, once the mediator variable is introduced, the significance of the direct path is greatly reduced, while both indirect paths are highly significant. We also performed a chi-square difference test involving two rival models, one of which includes IS effectiveness as a mediator variable, while the other does not (Figure 3). The results of that

test (χ^2 = 143.1, df = 2, p<0.001) confirm that IS effectiveness does indeed mediate the relationship between strategic alignment and IT business value.

5.4 IT Business Value within the Value Chain

In comparing IT impacts at various points along the value chain, customer relations emerged as the most important locus of perceived value (Figure 4). This finding comes at a time when researchers are beginning to expound the benefits of organizations practicing the "customer is king" cliché (Hammer and Champy 1993) and is supported by Brynjolfsson and Hitt (1996a), who report that "customer focus is the best predictor of IT value" (p. 50).

Insert Figure 4 about here

6. Managerial Implications

While 45% of organizations require their IS units to calculate ROI on IT investments, less than half that number have actually adopted any type of formal ROI measure (Information Week 1997). According to IS executives, difficulties associated with measuring the economic impacts of IT represent the greatest obstacle to measuring ROI.

In showing that perceptual measures correlate with objective measures of IT business value, this paper clearly establishes that executive perceptions, while not a panacea, nevertheless constitute a valid means of assessing IT impacts. However, this does not imply that perceptual measures are a perfect substitute for traditional economic measures of IT business value. Rather, perceptual measures can be used to complement objective measures, but in a way that affords greater insights into how and where IT business value is being realized. For instance, perceptual measures can be used to assess various intangible impacts, which might otherwise fall foul of objective measures. At a time when organizations are heavily investing in IT in an effort to realize intangible impacts (Information Week 1998), the

potential for executive perceptions to directly identify and evaluate these impacts illustrates the key role that perceptual measures can play in providing a comprehensive assessment of IT business value.

6.1 Linking IS Effectiveness, Strategic Alignment and IT Business Value

Business executives have consistently ranked strategic alignment as one of the most important issues facing organizations today (Computer Sciences Corporation 1996; Price Waterhouse 1996). In establishing a relationship between strategic alignment and IT business value, our research reveals that the implications of strategic alignment extend beyond competitive advantage (Broadbent and Weill 1993). Specifically, our findings reaffirm that strategic alignment is a mechanism through which an organization can derive greater payoffs from its IT investment. Consequently, there is an argument that as business and IS executives reorganize their IT resources around the business strategy, some attempt should be made to assess the resulting shift in IT payoffs.

Our research also reveals that the performance of the IS organization can have a direct bearing on IT business value. Not only will an effective IS organization focus resources on supporting the needs of the business, but it can also leverage its knowledge of the technology in a way that adds value to the business. Finally, our research indicates that IS effectiveness mediates the relationship between strategic alignment and IT business value. This finding reinforces the importance of IS planning to strategic alignment and illustrates that an effective IS organization is necessary in order to convert strategic alignment into higher levels of IT business value.

7. Conclusion

This paper makes a number of valuable contributions to the literature on IT business value. Our initial decision to focus on perceptual measures was a direct response to calls for a more inclusive and comprehensive assessment of IT business value. Our findings help to establish perceptual measures as a

valid means of measuring IT business value — countering a widely held belief among IS researchers, that executive perceptions are biased and self-serving.

In an attempt to determine how organizations can achieve a higher return on their IT investment, we constructed a conceptual model of IT business value. An empirical analysis of this model yielded support for arguments in the literature that an absence of strategic alignment can result in reduced payoffs from IT investment. Our research also demonstrated that the performance of the IS organization can have a direct bearing on IT business value. This effect can become even more pronounced as an organization's ability to convert strategic alignment into IT business value is conditional on the management practices in place within the IS organization.

As organizations focus their efforts on achieving intangible impacts in areas such as product innovation and customer relations, evaluating these impacts will become a top priority. While this paper provides some general insights into how such an evaluation might proceed, there is a growing need for additional research in this area. We encourage researchers to extend our research on executive perceptions in a way that will allow organizations to easily evaluate return on IT investments.

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Table 1. Identifying the Dimensions of IT Business Value: A Review of the Research Literature

Supplier Relations (Inbound Logistics):
Use IT to coordinate supplier linkages and reduce search costs (McFarlan 1984; Bakos 1991).
Improved forms of communication (EDI), quality control (TQM) and delivery techniques (EDI/JIT) can lead to the establishment of a competitive advantage (Cash and Konsynski 1985; Srinivasan, Kekre and Mukhopadhdyay 1994; Mukhopadhyay, Kekre and Kalathur 1995).
Improved supplier relations can have implications for the efficiency of the production process (Porter 1985).
Production & Operations:
Use IT to deliver enhanced manufacturing techniques through computer-aided design (Kelley 1994).
Improvements in the production process can lead to economies of scale in the deliver of products and services (Porter 1985; Malone 1987; Banker and Kauffman 1991).
Incorporating IT into the end product (Porter and Millar 1985; Ives and Mason 1990), and the use of advanced manufacturing processes can enable a greater range of products and services (Pennings and Buitendam 1987).
Product & Service Enhancement:
IT can be used in developing new products and services (Parsons 1983; Brooke 1991; Barua, Kriebel and Mukhopadhdyay 1995).
IT can enable products and services to be uniquely differentiated in a wide variety of ways (Bakos and Treacy 1986; Brooke 1992).
Sales & Marketing Support:
The development of new products and services can enable an organization to identify and serve new market segments (Pine, Peppers and Rogers 1995).
IT can be used to track market trends and responses to marketing programs (Porter and Millar 1985).
Customer Relations (Outbound Logistics):
IT can be used to establish, sustain and improve relationships with customers (Ives and Learmonth 1984).
Improving customer relations can result in an improvement in market share (Parsons 1983; Porter 1985).

Table 2. Descriptive Statistics (for complete description of items, see Appendix)

		Mean	Std. Dev.
Section (A) "IS Organization"			
IS Effectiveness			
ISE1	Quality of Service	6.53	1.57
ISE2	User satisfaction	5.90	1.75
ISE3	Helpfulness of IS staff	6.67	1.69
Strategic Alignment			
SA	Linkage of IS strategy to business needs	6.22	2.18
Return on IT Investment			
ROIT	Return on investment/expenses for IS	6.08	1.95
Section (B) "IT Business Value"			
Supplier Relations (Inbound logistics)			
SR1	Development of close relationships	4.43	1.85
SR2	Gain leverage over suppliers	4.56	1.95
SR3	Monitor quality of items received	4.42	1.93
Production and Operations			
PO1	Improve throughput	5.60	2.16
PO2	Achieve economies of scale	5.27	1.94
PO3	Improve utilization of machinery	5.37	2.09
Product and Service Enhancement			
PSE1	Reduce cycle time for development	4.86	2.15
PSE2	Reduce time-to-market	4.84	2.21
PSE3	Reduce development time	4.81	2.22
Sales and Marketing Support			
SMS1	Track market response to discounts	4.15	2.13
SMS2	Track market response to promotional pricing	4.22	2.18
SMS3	Facilitate response to competitors	3.86	2.01
Customer Relations (Outbound Logistics)			
CR1	Provide admin. Support to customers	6.21	2.20
CR2	Facilitate flexibility and responsiveness	6.04	2.04
CR3	Position customers to rely on systems	5.32	2.19
Objective Measures of IT Business Value (1994: US$)			
Productivity (Sales per employee)		473,797	679,269
Sales per IT dollar		67.64	41.36
Net Income per IT dollar		10.02	13.08

Table 3. Confirmatory Factor Analysis - Standardized Factor Loadings

Survey Items (See Appendix)	Supplier Relations	Production & Operations	Product & Service Enhancement	Sales & Marketing Support	Customer Relations
SR1	0.964	-	-	-	-
SR2	0.928	-	-	-	-
SR3	0.894	-	-	-	-
PO1	-	0.933	-	-	-
PO2	-	0.934	-	-	-
PO3	-	0.805	-	-	-
PSE1	-	-	0.990	-	-
PSE2	-	-	0.972	-	-
PSE3	-	-	0.967	-	-
SMS1	-	-	-	0.977	-
SMS2	-	-	-	0.982	-
SMS3	-	-	-	0.880	-
CR1	-	-	-	-	0.886
CR2	-	-	-	-	0.898
CR3	-	-	-	-	0.760
Variance Explained	86.3%	79.7%	95.3%	89.8%	72.3%

Table 4. Convergent and Discriminant Validity, with Reliability Estimates

Dimensions of IT Business Value	1.	2.	3.	4.	5.
1. Supplier Relations	0.705				
2. Production & Operations	0.176	0.645			
3. Product & Service Enhancement	0.253	0.440	0.820		
4. Sales & Marketing Support	0.256	0.233	0.329	0.705	
5. Customer Relations	0.358	0.280	0.324	0.160	0.582
Composite Reliabilities	0.878	0.844	0.932	0.878	0.806

Diagonal elements indicate variance extracted while off-diagonal elements indicate shared variance.

Table 5. Pearson Correlations between Objective and Perceptual Measures of IT Business Value

	Perceptual Measure of Return on IT Investment		
	All Executives (N=196)	"Low Spenders" (N=98)	"High Spenders" (N=98)
Objective Measures			
Productivity (Sales per employee)	0.222 ***	0.098	0.294 ***
Sales per IT dollar	0.214 ***	0.183	0.287 ***
Net Income per IT dollar	0.230 ***	0.108	0.308 ***
IS Spending per Employee (US$)			
Mean	$8,154	$3,033	$13,275
Standard Deviation	8,156	1,110	8,917
Minimum	832	832	4,565
Maximum	66,316	4,446	66,316

All objective and perceptual measures were subjected to Kolmogorov-Smirnov tests of normality.

The distinction between high and low spenders is based on median IS spending per employee of $4,506

*** $p < 0.01$

Table 6. Fit Statistics

	Required for Good Fit	Fit Statistics (ML Estimation)
Chi-square χ^2 (degrees of freedom)	–	273.44
Degrees of freedom	–	157
p value	$p > 0.05$	< 0.001
Normed Fit Index (NFI)	≥ 0.90	0.94
Non-normed Fit Index (NNFI)	≥ 0.90	0.97
Comparative Fit Index (CFI)	≥ 0.90	0.97
Goodness-of-Fit Index (GFI)	≥ 0.90	0.88
Root Mean Squared Residual (RMR)	0.05	0.05

Table 7. Hypothesis Testing

Hypothesis Description		Robust ML Estimates Unstandardized	Robust ML Estimates Standardized	Bootstrap Estimates
H1	IT Business Value → Return on IT	0.476 ***	0.275	0.276
H2	Strategic Alignment → IT Business Value	0.082 *	0.158	0.156
H3	Strategic Alignment → Return on IT	0.236 ***	0.263	0.262
H4	Strategic Alignment → IS Effectiveness	0.511 ***	0.678	0.678
H5	IS Effectiveness → IT Business Value	0.374 ***	0.544	0.547
H6	IS Effectiveness → Return on IT	0.468 ***	0.394	0.392

Variance Explained (R^2)	Robust ML Estimates	Bootstrap Est.
IS Effectiveness	0.460	0.464
IT Business Value	0.438	0.449
Return on IT Investment	0.658	0.662

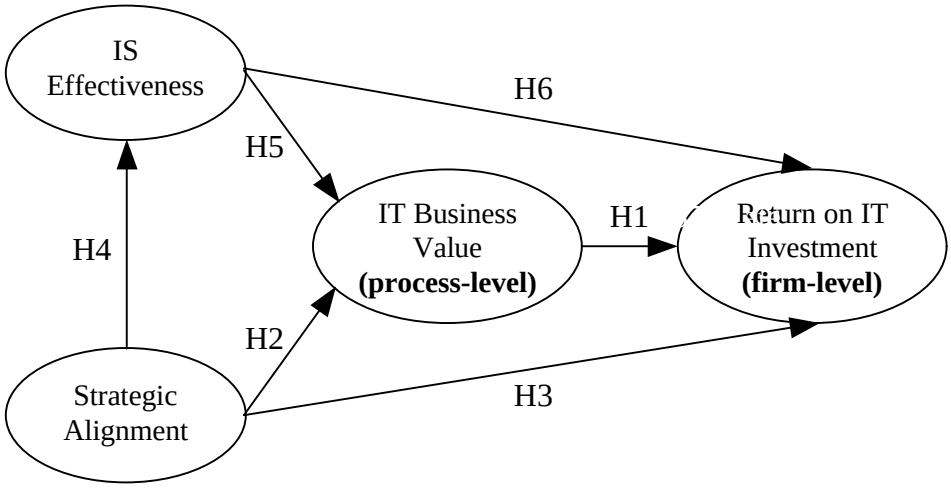
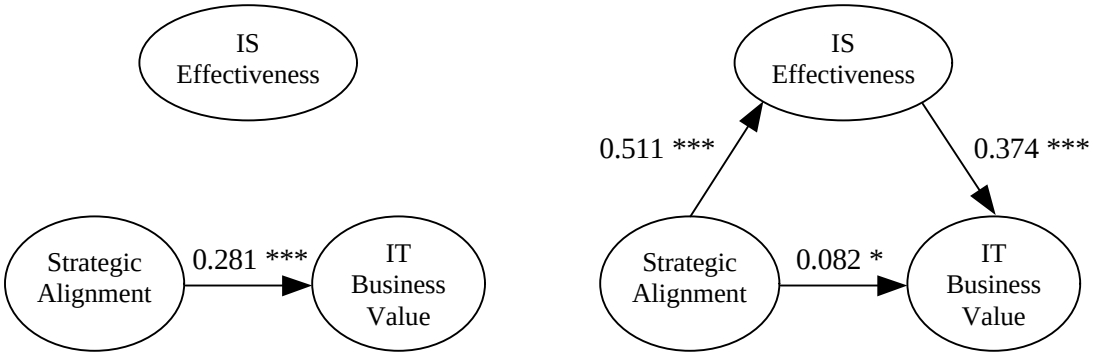


Figure 1. Conceptual Model of IT Business Value (Perceptual Measures)

Figure 2. Operational Model of IT Business Value



* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Figure 3. IS Effectiveness as a Mediator Variable

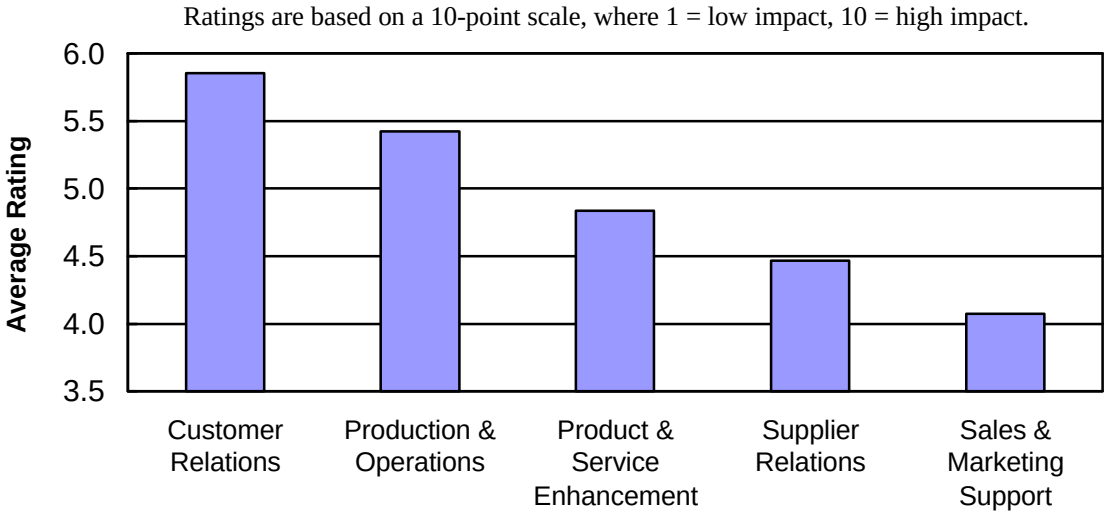


Figure 4. Executive Perceptions of Realized IT Impacts within the Value Chain

APPENDIX

Section A: Rating of IS Services

Compared to other IS units with which you are familiar, how do you rate the IS services of your IS unit in terms of the following dimensions?

	Weak				Average					Strong
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

IS Effectiveness

ISE1	Overall quality of service
ISE2	Users' satisfaction with IS
ISE3	Helpfulness of IS staff to users

Strategic Alignment

SA	Linkage of IS strategy to functional needs of the business

Return on IT Investment

ROIT	Return on investment/expenses for IS in general

Section B: Rating of IT Business Value

To what extent does information technology contribute to overall performance of your firm along each of the following dimensions? Please restrict your appraisal to realized, not expected benefits.

	Low Realized Impact								High Realized Impact	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**

Does Information Technology . . .

Supplier Relations (Inbound Logistics)

SR1	Facilitate the development of close relationships with suppliers
SR2	Help your corporation to gain leverage over its suppliers
SR3	Enhance the ability to monitor the quality of products/services received from suppliers

Production & Operations

PO1	Improve the levels of production or throughput
PO2	Reduce the level of production/service delivery required for economies of scale
PO3	Improve the utilization of machinery

Product & Service Enhancement

PSE1	Reduce the cycle time for development of new products/services
PSE2	Reduce the time-to-market for new products/services
PSE3	Reduce the development time for new products/services

Sales & Marketing Support

SMS1	Track market response to discounts
SMS2	Track market response to promotional or introductory pricing
SMS3	Facilitate targeted response to competitor's pricing strategies

Customer Relations (Outbound Logistics)

CR1	Enable your corporation to provide administrative support to customers
CR2	Facilitate a higher level of flexibility and responsiveness to customer needs
CR3	Position customers to rely increasingly on your corporation's electronic support systems