EXTERNAL VERSUS INTERNAL PERSPECTIVES IN DETERMINING A FIRM’S PROGRESSIVE USE OF INFORMATION TECHNOLOGY

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EXTERNAL VERSUS INTERNAL PERSPECTIVES IN DETERMINING
A FIRM'S PROGRESSIVE USE OF INFORMATION TECHNOLOGY

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ABSTRACT

The use of IT in a firm can vary depending on a number of factors such as a top executive's perceptions and the firm's industry. In this study, variables representing the organization's external and internal characteristics were examined to determine whether they affect the firm's progressive use of IT and, if so, which has the strongest effect. A questionnaire was mailed to the Chief Executive Officers and Chief Financial Officers of 300 small and medium-sized publicly-traded companies. Results indicate that internal factors (Chief Executive Officer's perception of IT importance and the information intensity of the product), more than the external factors, influenced the firm's progressive use of IT.

1. INTRODUCTION

Increasingly, it is clear that different industries are being affected in fundamentally different ways by information technology.

Cash, McFarian and McKenney, 1988, p. 76.

Much of the strategic potential of information technology (IT) is assumed to vary by industry. For example, the airline industry is considered to be highly dependent on the use of IT (Copeland and McKenney 1988). Airline reservation systems have been popular exemplars of how firms can preempt their competitors. For instance, the fall of Frontier and Braniff Airlines has been attributed to their laggard use of IT compared to their major competitors (Vitale, Ives and Beath 1986). But even in an industry such as the airlines where IT has clearly shaped the pattern of competition, a closer look suggests a tremendous variation in the use of IT, even among the successful players of the industry. Two such examples are American Airlines and Southwest Airlines.

Southwest is the nation's eighth largest independent airline. The company has grown steadily. For example, passenger traffic grew 16% in 1988, compared to an industry average of only 4%. However, this no-frill airline is no IT superstar. Customer service is "low tech"; for example, the frequent flyer program "Company Club" involves straightforward tracking of the number of trips flown with no tickins with other airlines, rental car agencies, hotels, etc. This is in striking contrast to the complex structure of American Airlines' frequent flyer program, "AA Advantage." While Southwest's IT portfolio largely consists of bread and butter applications, American Airlines excels itself as a technology leader in several areas including networks, expert systems, intelligent workstations, and so on (American Airlines 1989). As a firm with an industry's lowest cost structure, Southwest closely monitors its IT expenditures. On the other hand, American Airlines' investment in information systems totalled $1.2 billion in 1989 which put the firm on the top of the transportation industry and second overall in the 1989 Computerworld Premier 100 list (Ludlum 1989).

What explains and predicts these variations in IT use across firms? The current study examines what some of these factors might be. The two predecessors to this study (Jarvenpaa and Ives 1990, 1991) explored the effect of the chief executive officer's (CEO's) role in IT, an internal firm variable, on the firm's use of IT. This study builds on those earlier investigations by assessing the relative importance of both external industry-based and internal firm-based variables on the firm's use of IT. The current study also complements that of Jarvenpaa and Ives (1991) by focusing on small and medium-sized firms, whereas the earlier studies included only Fortune 500 Service and Industry firms.

2. THE RESEARCH MODELS

In spite of considerable discussion that IT can affect a firm's strategy as well as its outcomes (e.g., Parsons 1983, Benjamin et al. 1984), little empirical research currently exists that determines the nature and type of IT use in the firm and both its determinants and contributions. One problem is the definition of IT use on an organizational level. Several researchers have focused on IT investments (e.g., Harris and Katz 1988). Weill (1990), for example,
divides IT investments into operational, informational, and strategic segments. IT investments, however, only capture the allocated financial inputs to IT; they do not reflect whether they were converted into useful outputs (Weill and Olson 1989). We aimed for a broader construct that captured the conversion process and its outcomes. In this paper, IT use is examined in terms of how progressive a firm is in its use of IT.

We see the progressive use of IT as a composite construct, reflecting the firm's position on three dimensions: (1) the degree to which IT is used by the firm for strategic purposes, (2) the technological sophistication of IT in the firm, and (3) the relative positioning of the firm's use of IT in its industry. IT can be used strategically, as an operational support tool, or in some combination of both (Cash, McFarlan and McKenney 1988). One indicator of the progressive use of IT is the degree to which a firm's application portfolio is operationally versus strategically focused. The more the company's applications change its products or the way the firm competes in the industry, the more progressive we consider the firm to be in their use of information systems.

The level of technological sophistication is also an indicator of how progressive a firm is in its use of IT. The newer type of applications (e.g., electronic data interchange, expert systems, computer integrated manufacturing) and real-time processing mode reflect a higher level of technological sophistication and more progressive use of IT than traditional applications and batch processing.

The third component of a progressive use of IT reflects the relative dimension of the construct. Progress is often only definable within a particular context. That is, whether a firm is progressive depends on the firm's relative use of IT within its industry. Hence, a firm perceived as an industry leader in the use of IT is likely to be more progressive in its use of IT than a firm that is considered a laggard user of IT. Jarvenpaa and Ives (1991) found some tentative support for defining the progressive use of IT in a firm as a function of the senior management's perception of its use of IT as compared to its industry. Thus, our construct of the progressive use of IT attempts to capture the strategic use of information, the technological dimension, and a comparison of the firm's use of IT relative to other firms in the industry.

Next we attempt to identify the internal and external factors that affect a firm's progressive use of IT. We propose several models of organizational conditions that may affect a firm's progressive use of IT. The first model, focusing on an external perspective, is drawn from the institutional theory of organizations. Concentrating on an internal viewpoint, the second model is derived from theories of strategic choice. The first two models offer very distinct, specific explanations of potential antecedents of the progressive use of IT. The third model builds on these two and uses concepts from the resource dependence and information processing theories, including both internal and external factors.

2.1 Institutional Perspective

The institutional theory of organizations proposes that organizations are not single actors within their environments, but part of a larger picture influenced by social and regulatory measures. Institutionalized rules are formed from classifications of behavior built into society that reflect either societal assumptions or laws (Starbuck 1976). From an organizational perspective, institutional theory incorporates variables that are external to the firm.

Several versions of institutional theory exist. In this study, we emphasize an institutional system as a class of elements (Scott 1987). This version holds that institutionalized belief systems exist as a class of elements that are critical determinants for the creation of, or changes to, organizational structure. Institutionalized rules are therefore "in some measure beyond the discretion of any individual participant or organization" (Meyer and Rowan 1977). Thus, organizations are seen as acting on collective social values when designing their formal structure (Dowling and Pfeffer 1975), and are driven to incorporate prevailing, institutionalized views of organizational work into their procedures (Meyer and Rowan 1977).

Support has been found for the relationship between an organization's performance and its similarity to industry norms (Stinchcombe 1965). Often, organizations conform to institutional rules because their conformance is rewarded with increased legitimacy and resources (Meyer and Rowan 1977). For example, most, if not all, retail banks in the U.S. offer automatic teller services, which have become a standard service offering. Retail banks that do not offer ATM service may be damaging their legitimacy in the view of their industry. Thus, the progressive use of IT in an organization could be viewed as the result of normative influences (e.g., ATM service is expected).

If industry norms, an external factor, can predict organizational conditions, we would expect to find larger differences in the progressive use of IT for firms in different industries than among firms within the same industry (Figure 1). Therefore, we propose the following hypothesis.

Hypothesis 1: Firms from different industries adopt different levels of the progressive use of IT than firms from the same industry.

![Figure 1. Model 1 - The Institutional Perspective](image-url)
2.2 Strategic Choice Perspective

In contrast to the external focus of institutional theory, the strategic choice perspective addresses internal variables. Proponents of strategic choice argue that, although external conditions play a part in a firm's behavior, top managers have considerable latitude in choosing different strategies within the same industry (March and Simon 1958; Cyert and March 1963; Child 1972). Hambrick and Mason's "upper echelons" perspective (1984) builds on strategic choice theory by proposing that characteristics of an organization's dominant coalition are reflected in the organization's actions and outcomes. This line of inquiry presents fertile ground for additional work, supporting previous work on characteristics such as functional background (Dearborn and Simon 1958; Walsh 1988), managerial tenure (Finkelstein and Hambrick 1990), and CEO involvement and participation (Jarvenpaa and Ives 1991).

In terms of a top management characteristic, this study focuses on the CEO's perception of IT importance (Figure 2). The CEO deserves attention because that person has, at a minimum, position power, and as the formal leader of an organization, the CEO's beliefs will carry weight both within and outside of the firm. Although Hambrick and Mason's theory concentrates on the top management team rather than any individual, targeting the CEO and his or her perceptions is not contradictory. Rather, the CEO is likely to have received much of his or her information from the top management team or other intermediaries (Starbuck 1985), and thus at least partly represents the top management team's beliefs.

Prior research demonstrates some support for the need to evaluate the CEO's attitudes and beliefs. For example, Jarvenpaa and Ives (1991) found that a CEO's perception of IT importance was significantly associated with the progressive use of IT in the firm. To evaluate Model 2, we hypothesize that:

Hypothesis 2: The greater the CEO's perception of IT importance, the greater the firm's progressive use of IT.

Figure 2. Model 2 - The Strategic Choice Perspective

2.3 Expanded Model

Models 1 and 2 reflect simple relationships, focusing on a specific aspect of either internal or external organizational conditions. We next put forth a more complex model (see Figure 3) that includes both internal and external organizational factors. For example, Johnston and Carrico (1988) argue that it is the interaction of industry conditions with the firm's internal characteristics that determine the deployment of IT. They believe that a firm's IT use is dependent on industry factors such as increased competitive pressures as well as internal factors such as the presence of significant information content in the production process. Additionally, the internal and external organizational factors could have both direct and indirect effects on the progressive use of IT, rather than just an indirect effect demonstrated through the CEO's perceived importance of IT. For example, when a firm changes CEOs, the use of IT by that firm is likely, for some period of time, to be directly affected by factors other than the current CEO's perception. The following discussion of Model 3 addresses the external variables first and then the internal variable.

Figure 3. Model 3 - The Expanded Model
External Variables: In addition to industry membership and the CEO's influence in the firm, there are many arguments for differences in the progressive use of IT among firms. For example, the large variations between Southwest's and American Airlines' use of IT might be attributed to differences in internal firm variables such as fare structures and the use of hub-and-spoke versus point-to-point operations. Conversely, IT use may be dependent on factors such as the firm's interfaces with external constituents and competitors and their use of IT. For instance, while the proposed high speed railway in Texas poses a clear threat to Southwest Airlines (Hackney 1990), it is not considered to be in direct competition with American Airlines' interests. In contrast, the alliance between Texas Air's System One and EDS was a major threat to American Airlines (Miller and Shapiro 1987).

Proponents of resource dependence would argue that the relative munificence of the environment most strongly affects an organization's strategies and processes (Pfeffer and Salancik 1978; Daft, Sormunen and Parks 1988). Munificence is defined as the ready availability and accessibility of resources (e.g., raw material, employees, capital, and customers) in the environment. For example, steel manufacturing is a low munificence industry at the present time. On the other hand, wholesale distributors of computer hardware, software, and peripherals have a high level of munificence, which allows for greater flexibility in allocating resources internally. Firms in industries with greater munificence are more likely to have the resources required for a more progressive use of IT. Thus, we hypothesize that

Hypothesis 3: The greater the industry munificence, the greater the CEO's perception of IT importance and the greater the progressive use of IT within the firm.

Johnston and Carrico (1988) found that businesses characterized by high information flow with their suppliers, distributors, customers and partners were usually leaders in the strategic use of IT. For example, American Airlines is strategically aligned with Citibank, whose customers are awarded one Frequent Flyer mile for every dollar charged to a Citibank credit card. Both firms gain in the process: American through increased customer loyalty, and Citibank through access to a new customer base (Konsynski and McFarlan 1990). These ties might be expected to influence both the CEO's perception of IT importance and the firm's progressive use of IT.

IT-based competitive moves among industry players can also influence a CEO's perceptions and the progressive use of IT. For example, Parsons (1983) describes how a strategic information system can help a firm reap additional market share and profits. Such first mover advantages tend to be temporary, however, as excess profits and lost opportunities motivate the competitors to imitate. American Airlines, for example, offered the first frequent flyer program in the industry, which provided an additional incentive for travelers to choose American. That action on the part of American Airlines was soon followed by most of the major airlines, along with some of the smaller, regional firms, as they attempted to recover their lost market shares. Because the use of IT by external entities has the potential to significantly affect the firm's use of IT, the following hypothesis was developed.

Hypothesis 4: The greater the use of IT by a firm's suppliers, distributors, customers and competitors when dealing with the firm, the greater the CEO's perception of IT importance and the greater the progressive use of IT within the firm.

Internal Variable: Information processing theory concentrates on the processes through which the environment influences an organization's actions and outcomes (Simon 1973; Galbraith 1973). This perspective explains how an organization captures, manipulates, and routes the data required to perform organizational tasks. In the past, the physical component of a product has been more important than its information component (Porter and Millar 1985). IT, however, has enabled the bundling of a product's physical and information aspects, hence resulting in increased information intensity of services and products (Ives and Mason 1990).

The degree to which information is present in a firm's product or service reflects the level of information intensity of that product. For instance, an airline ticket is a mix of information and physical components. The purchaser contracts for a transportation service, which includes both information (i.e., origin and destination points, time and day of the flight, location of a reserved seat) as well as a physical component (a seat in the plane). Contrast that with the petroleum industry, whose products have a minimal information component.

Another aspect of information intensity relates to the firm's production process. Whether the product or service is informational or physical, the production process can vary in the total volume and speed of information handling needed to produce a product or service. Using the production of petroleum as an example, an oil and gas company may incorporate automated drilling tools that are replacements for their mechanical predecessors. This would result in an increase in the information intensity of the production process because more information (i.e., where to drill) of increased accuracy is now processed faster.

For either the product or production process, greater information intensity should lead the CEO to perceive IT as a major competitive tool and therefore increase the importance attached to IT. Also, according to Porter and Millar (1985), the greater the information intensity, the greater the potential for strategic uses of IT in a firm. Hence, we hypothesize that
Hypothesis 5: The greater the information intensity in the product and its production process, the greater the CEO's perception of IT importance and the greater the progressive use of IT.

3. RESEARCH METHODOLOGY

The hypotheses derived from the research models were tested by surveying the Chief Executive Officers and the Chief Financial Officers (or the upper level executive to whom the IT function appeared to report) of 300 firms. Two survey instruments (available from the first author upon request) with five point Likert scales were developed and pre-tested on several executives and graduate students.

3.1 The Sample

The sampling population of 14,382 business segments was obtained from a database (COMPSTAT II 1986) that contains financial information on all publicly-traded firms and their business segments as required by the Financial Accounting Standards Board (FASB). New York Stock Exchange and American Stock Exchange firms are included, as well as the major NASDAQ companies traded over the counter. For this study, the population was restricted to industries with at least twenty firms that operated in only one industry sector. Firms that reported operations in more than one business segment were excluded because it seemed highly likely that the progressive use of IT would vary across their business segments. We wanted to avoid the confounding that multiple sector firms would have produced for the study's variables. From this population of industries, fifteen industries were randomly selected from the COMPSTAT database. Sampled industries were quite diverse, including credit unions, cosmetics manufacturers, medical products suppliers, and trucking companies (see Table 1). Twenty U.S. firms were randomly selected from each industry. This two stage sampling procedure increases variation across industries while ensuring sufficient observations within each industry.

Because the organization was the unit of analysis, two key informants were selected: the CEO and the CFO. The CFO was chosen as the second informant because IT functions often report to the top financial executive, and therefore the CFOs are usually knowledgeable about IT plans and operations.

To improve the likelihood that the intended informant would personally respond, it was emphasized in the cover letter that the survey only took ten minutes to complete. We also asked the informant to fill in his or her title which provided an additional check. Ten responses were rejected because individuals other than the CEO responded.

To obtain an acceptable return rate, two mailings were necessary. Of the 300 sampled firms, valid responses were completed and returned by 139 companies (46%). Responses totaled 162, of which 62 were CEO responses (38%) and 100 (62%) were from other executives. Because the organization was the unit of analysis, the responses for the twenty-three firms in which both executives replied were averaged to provide one response for the organization. Since we were unable to test inter-rater reliability, some supplemental analyses were performed to ensure that the results were not biased by the position of the informant. The outcome of these analyses will be discussed at the end of the Results section.

3.2 The Instrument

The two instruments were identical except for two questions (items 1 and 14) that asked about the CEO's views of IT. One questionnaire asked for the CEO's personal perception; the other asked the CFOs their opinion of what the CEO's perceptions were. Although objective ways of defining the variables would have been desirable, Hess and Robinson (1984) have provided some preliminary support that subjective performance measures can sometimes be appropriate surrogates for objective measures. The measures were generally developed a priori from earlier research (Jarvenpaa and Ives 1991; Glick, ogilvie and Miller 1990; Porter and Millar 1985), although one variable and its measures (the use of IT by competitors, customers, suppliers and distributors) were developed specifically for this study.

Data was collected from the mail survey for all of the variables, with the exception of industry munificence. The data for munificence were obtained from the archival measure developed and validated by Glick, ogilvie and Miller. This measure is based on growth in sales, operating income, net assets, capital expenditures, return on assets, and number of firms in the industry.

4. RESULTS

4.1 Construct Validity and Reliability

Common factor analysis was used to assess the construct validity of the scales (Kerlinger 1986). To avoid unstable solutions due to too many items per observation, the entire pool of fifteen items was split into our a priori scales. Then, several runs of factor analysis were performed by running items for two scales at a time. Decisions concerning the item composition of the scales were based on oblique rotations of the factor analyses, using the following criteria: (1) items should have loadings of .5 or higher on a scale, (2) there should be no item cross-loadings, (3) an item's loading on a scale should conform to our a priori thinking, and (4) each item should add to its scale's reliability.
In general, the factor analyses supported the proposed scales. Exceptions were Item 15, which failed to meet criteria 1, 2, and 4, and was therefore excluded from further analysis; Items 3 and 10, which were loaded on separate factors and retained as separate, single-item variables; and Items 4 and 7, which had loadings lower than .5 on their scales (.39 and .43 respectively) but were retained because they met all other criteria. Unweighted summing was used to combine the items into the scales. Thus, four confirmed composite scales and two individual items were used for further analysis: the CEO's perception of IT importance, the progressive use of IT, the use of IT by constituents (i.e., suppliers, distributors and customers), the use of IT by competitors (Item 3), the information intensity of the production process, and the information intensity of the product (Item 10). Table 2 presents the item composition and factor loadings for each of the composite scales.

Cronbach's alpha was used to assess inter-item reliability of the final, multi-item scales. As reported in Table 3, the reliability coefficients range from .57 to .96. Although the lower reliabilities are acceptable for exploratory research, there is clearly room for improvement. With marginal reliabilities, all tests of hypotheses are conservative. Non-significant findings may be due to low reliabilities.

### 4.2 Variable Correlations

As indicated in the correlations shown in Table 3, the CEO's perception of IT importance, information intensity of the production process, and information intensity of the product were significantly associated with the criterion variable of the progressive use of IT within the firm. The CEO's perception of IT importance is correlated with the information intensity of the product and production process.
Table 2. Composition of the Factors

<table>
<thead>
<tr>
<th>Factor</th>
<th>Items</th>
<th>Factor Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1: CEO Perceptions of IT Importance</td>
<td>1. Item 1 - CEO's prevailing thinking about IT spending&lt;br&gt;$1 = \text{expense to be controlled}, \ 2 = \text{resource to be allocated fairly}, \ 3 = \text{strategic investment}$&lt;br&gt;2. Item 14 - CEO's perception of IT's importance to success of firm&lt;br&gt;$1 = \text{IT has little potential utility}, \ 2 = \text{IT is single most critical factor}$</td>
<td>.52 &lt;br&gt; .88</td>
</tr>
<tr>
<td>Factor 2: Progressive Use of IT</td>
<td>1. Item 2 - Use of IT compared to the industry&lt;br&gt;$1 = \text{industry leader}, \ 2 = \text{laggard}$&lt;br&gt;2. Item 8 - Sophistication level of IT platforms&lt;br&gt;$1 = \text{real time systems, EDI, expert systems}, \ 2 = \text{large databases, interactive processing}, \ 3 = \text{batch processing}$&lt;br&gt;3. Item 9 - Strategic nature of existing applications&lt;br&gt;$1 = \text{several applications have tremendous strategic value}, \ 2 = \text{several applications are somewhat strategic}, \ 3 = \text{no applications have strategic value}$</td>
<td>.73 &lt;br&gt; .85 &lt;br&gt; .54</td>
</tr>
<tr>
<td>Factor 3: Constituents' Use of IT</td>
<td>1. Item 4 - Use of IT by major suppliers&lt;br&gt;$1 = \text{to a great degree}, \ 2 = \text{not at all}$&lt;br&gt;2. Item 5 - Use of IT by major distributors&lt;br&gt;$1 = \text{to a great degree}, \ 2 = \text{not at all}$&lt;br&gt;3. Item 6 - Use of IT by corporate customers&lt;br&gt;$1 = \text{to a great degree}, \ 2 = \text{not at all}$&lt;br&gt;4. Item 7 - Use of IT by consumer customers&lt;br&gt;$1 = \text{to a great degree}, \ 2 = \text{not at all}$</td>
<td>.39 &lt;br&gt; .60 &lt;br&gt; .54 &lt;br&gt; .43</td>
</tr>
<tr>
<td>Factor 4: Production Process Information Intensity</td>
<td>1. Item 11 - Degree to which information is used in the production process&lt;br&gt;$1 = \text{to a great degree}, \ 2 = \text{not at all}$&lt;br&gt;2. Item 12 - Timeliness of information used in the production process&lt;br&gt;$1 = \text{up to the minute}, \ 2 = \text{updated daily}, \ 3 = \text{updated less than weekly}$&lt;br&gt;3. Item 13 - Accuracy of information used in the production process&lt;br&gt;$1 = \text{completely accurate}, \ 2 = \text{large margin for error}$</td>
<td>.50 &lt;br&gt; .59 &lt;br&gt; .70</td>
</tr>
</tbody>
</table>

*Note these factor loadings are from the analyses comparing the indicated scale with the Progressive Use of IT. The factor loadings for the Progressive Use of IT are from the comparison with the CEO Perception of IT Importance.

4.3 Testing of the Hypotheses

Institutional Perspective: Model 1 (i.e., Hypothesis 1) was tested with an analysis of variance. No significant effect was found ($F(14, 124) = .92, p < .54$), indicating that the progressive use of IT by a firm is not significantly related to the industry of the firm. This finding implies that the institutional effects on the progressive use of IT in a firm are not very strong, and therefore other determinants need to be examined.$^5$

As stated earlier, we decided to investigate for Model 3 the effects of various factors on both the CEO's perception of IT importance and the firm's progressive use of IT. We extended that thinking to Model 1 and investigated the effect of industry on the CEO's perception of IT importance. CEOs are known to justify further enhancements and expenditures for IT by comparing their own firms against industry norms. The results of the analyses of variance indicated that industry significantly affected the CEO's perception of IT importance ($F(14, 124) = 2.10, p < .016, \text{adjusted } R^2 = .16$). Thus, according to the results of this study, industry affects the CEO's perception, but not the progressive use, of IT in a firm.

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Table 3. Pearson Product Moment Correlation Coefficients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Progressive Use of IT</td>
<td>9.4</td>
<td>2.6</td>
<td>.77</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. CEO Perception of IT</td>
<td>6.6</td>
<td>1.8</td>
<td>.43</td>
<td>.63</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Munificence</td>
<td>503.3</td>
<td>196.8</td>
<td>.07</td>
<td>.01</td>
<td>.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Constituents' Use of IT</td>
<td>8.3</td>
<td>2.8</td>
<td>.01</td>
<td>.12</td>
<td>.04</td>
<td>.57</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Competitor's Use of IT</td>
<td>3.2</td>
<td>0.9</td>
<td>.08</td>
<td>.14</td>
<td>.02</td>
<td>.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Product Information Intensity</td>
<td>7.0</td>
<td>1.2</td>
<td>.32</td>
<td>.34</td>
<td>.18</td>
<td>.11</td>
<td>.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Production Process Information Intensity</td>
<td>10.4</td>
<td>2.6</td>
<td>.36</td>
<td>.26</td>
<td>.01</td>
<td>.04</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .05, **p < .01
a - Cronbach's alpha in parentheses
b - Reliability for munificence was obtained from Glick et al. (1990).
c - Cronbach's alpha is not applicable to this variable because it is a single item scale.

Table 4. Standardized Regression Coefficients
(N = 112, * p < .05,** p < .01)

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>CEO Perception</th>
<th>Progressive Use of IT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEO Perception</td>
<td>---</td>
<td>.37**</td>
</tr>
<tr>
<td>Production Process Information Intensity</td>
<td>.20**</td>
<td>---</td>
</tr>
<tr>
<td>Production Information Intensity</td>
<td>.32*</td>
<td>.22*</td>
</tr>
<tr>
<td>F Ratio</td>
<td>4.59</td>
<td>6.40</td>
</tr>
<tr>
<td>Adjusted R²</td>
<td>.14</td>
<td>.23</td>
</tr>
</tbody>
</table>

Strategic Choice Perspective: We found some support for Model 2 (Hypothesis 2), which predicted that the CEO's perception of IT importance would have a significant relationship with the progressive use of IT in a firm. The CEO's perception correlated .43 (p < .01) with the progressive use of IT in the firm. This provides further support for applying the strategic choice perspective to the use of IT in a firm, and strengthens earlier findings that the CEO's perception of IT importance has a significant effect on a firm's progressive use of IT (Jarvenpaa and Ives 1991).

Expanded Model: Stepwise regression analyses were performed in order to investigate Model 3 and develop a more parsimonious model if possible. Table 4 indicates the results of the regression analyses. Hypothesis 3, which posited effects from industry munificence, had no significant support. This result indicated that the munificence of an industry has little effect on the use of IT by a firm.

The relationships of the use of IT by either constituents or competitors (Hypothesis 4) to both criterion variables were not significant. This suggests that the relationships may be weak or non-existent. It is possible, however, that by aggregating the use of IT by suppliers, distributors, and customers, we gathered data on heterogeneous items, providing an inadequate operationalization of what could prove to be an interesting construct. This possibility is supported by the variable's low reliability of .57. Another possibility is that the existence of IT in inter-organizational functions is not yet prevalent enough to result in strong effects.

The information intensity of both the product and production process (Hypothesis 5) was strongly and significantly related to the CEO's perception of IT importance, and the product information intensity also affected the progressive use of IT in the firm. It seems apparent that the greater the intensity of information in the production process or
product, the greater the need for information accuracy and timeliness, and therefore the greater the need for the progressive use of IT.

**Potential Threats to Validity:** Four potential threats to the validity of these results suggest some caution in their interpretation. First, all but one of the variables was collected from the same instrument (possibly resulting in common method variance). Second, non-respondent bias may be present. Third, we used the four-digit SIC classification assigned by COMPSTAT to define the industries and to assign an environmental munificence score to each firm. Although firms within a 4-digit SIC may be producing similar goods and services, they may not be direct competitors. Thus, our industry results must be interpreted in terms of the broad SIC rather than a more narrowly defined competitive arena in a specific market niche. Fourth, the estimated effects might be biased by differences between CEOs and CFOs. Although we treated all of our respondents as key informants, it is possible that the estimated relationships are stronger (or weaker) in the CFO's data than in the data from CEOs. For example, the CFO's more intimate knowledge of IT may contribute to stronger, perhaps more accurate, observed relationships between information intensity and the progressive use of IT. To test for this potential bias, we constructed interactions between the informant's position (CEO versus other) and all substantive variables in our final regressions. To the extent that the informant's position biases the estimated relationships, significant interactions will indicate differences in the strength of the effects for the different positions.

Consistent with our belief that the informant's position did not bias the results, there were no significant interaction effects in the regressions of CEO's perception of IT importance and the progressive use of IT. The only significant effect beyond the substantive effects in Table 4 is the main effect of position on the CEO's perception of IT importance (incremental $R^2 = .04, p < .02$). Although it is interesting to note that the CFOs rate the CEO's perception of IT importance lower than the CEOs themselves report it, this effect does not bias any of the substantive effects in Table 4. Thus, we have no evidence that the informant's position had biasing effects on the estimated relationships reported in Table 4.

5. **DISCUSSION**

In this study, we set out to explore the effect of internal and external factors on the use of IT in a firm. With the exception of the effect of industry on the perception of the CEO, no significant relationships were found between the external factors (munificence, constituents' use of IT, and competitor's use of IT) and either the CEO's perception of IT importance or the progressive use of IT in the firm. However, two internal variables (information intensity of the product and information intensity of the production process) had significant relationships with the CEO's perception of IT importance. Further, the information intensity of the product was significantly related to the firm's progressive use of IT above and beyond the effects of the perception of the CEO. In addition, the CEO's perception of IT importance had the strongest effect on the progressive use of IT in the firm, accounting for 20% of the variance. This leads to a tentative conclusion that internal factors rather than external factors are the strongest predictors of a firm's progressive use of IT. Based on the regression results, we revised Model 3 as follows (Figure 4). The diagram includes the standardized regression coefficient for each relationship.

What are the implications if internal variables are greater predictors of the progressive use of IT than external variables? From a theoretical standpoint, the ability to predict the firm's use of IT from internal factors supports a linkage to information processing theory. This in turn suggests that IS researchers might produce more fruitful results when developing ideas from information processing theory rather than from institutional or resource dependence theories.

In addition, the strategic choice perspective was supported by the results of this study. That result indicates that additional research on the CEO (and other members of the top management team) and his or her effect on IT would probably be productive.

From a managerial viewpoint, the results of this study imply that the firm has a great deal of control over the use of IT and that environmental conditions have a lesser effect. As found by Jarvenpaa and Ives (1991) as well as by this study, the CEO's perception and subsequent psychological involvement in IT may influence the organization's opinion of and approach to IT use. By targeting single business unit firms as opposed to the diverse organizations researched by Jarvenpaa and Ives (1991), this study provides support for the ability to generalize that finding across organizational size and type.

There are other internal variables of interest when researching the use of IT in a firm. For example, the effects of specific organizational strategies may have a relationship with the progressive use of IT. Organizational strategy and structure effects may also help explain why industry had no effect on the progressive use of IT. That is, organizations within the same industry may pursue substantially different strategies which could possibly be reflected in the firm's use of IT. One approach might be to investigate differences in the progressive use of IT by firms in the same industry as a function of the degree to which they pursue different strategies such as defender, prospector (Miles and Snow 1978), low cost producer and differentiator (Porter 1980).
Another internal variable of interest is that of managerial discretion (Hambrick and Finkelstein 1987). High level executives possess varying amounts of discretion both within and across industries. For example, because of the intensely regulated nature of the industry, CEOs of utility companies have considerably less latitude of action than CEOs of retail companies. Top executives may also have different levels of resource discretion within industries. In an industry with low munificence, a CEO with a high degree of latitude who considers IT to be important may be able to allocate greater resources to the IT function than a CEO who does not have a similar degree of resource discretion.

6. CONCLUSION

This study and its predecessors (Jarvenpaa and Ives 1990, 1991) have provided preliminary insights into the factors that affect a firm's progressive use of IT. Because our study indicated significant relationships between the internal variables and the progressive use of IT, it seems prudent in future to pursue additional research addressing internal firm variables. We cannot conclude, however, that external factors are of no importance. The lack of a significant relationship between external factors and the progressive use of IT in the firm could reflect inadequacies in selecting and operationalizing the external factors used in this study. For example, the measure of constituents' use of IT had low reliability. This may be simply because suppliers, distributors, and customers do not use, and do not need to use, the same level of IT as the firm. Alternatively, suppliers, distributors, and customers of the same firm may vary widely in their use of IT and therefore should be addressed as separate entities rather than as part of one broad construct. Researchers in future may also be able to define more appropriate external factors while building on the internal factors that found support in this work.

7. ACKNOWLEDGMENT

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8. REFERENCES


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9. ENDNOTES

1. In some cases, we were unable to identify the CFO and selected another top executive as the respondent. Of the one hundred non-CEO responses, fourteen represented other functional areas. For the sake of convenience, we will continue to refer to this group as the CFOs.

2. All items were scaled high-to-low (e.g., 1 represented the highest value; 5 the lowest) with the exception of items 1 and 14, which were reversed. For the statistical test, the items were transformed so that all corresponded to a low-to-high schema where 1 represented the lowest value consistent with the variable name.

3. This type of iteration is commonly done with large surveys. See Seashore et al. (1983) and Van de Ven and Ferry (1980) for further discussion.

4. Item 15 was intended to measure the firm's information intensity level. It addressed the amount of time that would elapse before major business losses would occur should the firm's computers be irrevocably damaged (1 = losses would begin immediately, 5 = losses would not occur).

5. Power tables at an alpha level of .1 (Cohen 1977) indicate that the statistical power of this test is in accordance with MIS research standards (Baroudi and Orlikowski 1989). For a medium effect size (f = .25), the power is about .5, and for a large effect size (f = .4), the power is about .9. The fact that the null hypothesis was not rejected even at an alpha level of .5 suggests that, using the data in our study, industry effect on the progressive use of IT in a firm is either small or non-existent.