Information Technology and the Nature of Managerial Work: From the Productivity Paradox to the Icarus Paradox?¹,²

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Abstract

Modern organizations are investing heavily in information technology (IT) with the objective of increasing overall profitability and the productivity of their knowledge workers. Yet, it is often claimed that the actual benefits of IT are disappointing at best, and that IT spending has failed to yield significant productivity gains—hence the productivity paradox. Evidence is fragmented and somewhat mitigated. This paper argues that the current state of empirical research results from a failure to understand the interplay between IT and managerial work. It addresses this issue by analyzing patterns of association between IT usage and the nature of managerial work in different organizational contexts. Fifty-nine semi-structured interviews were conducted with middle line managers in three large companies: a Bank, a Telecommunications company, and a Utility. In addition, daily activities and IT usage were logged. The data indicate that the relationship between the level of IT usage and the nature of managerial work was stronger in the two organizations that were reorienting their strategies (Bank, Telecommunications) than in the one pursuing its existing strategy (Utility). It was also found that the pattern of the relationship between IT usage and the nature of managerial work depended on the kind of strategic reorientation implemented by the firm. For instance, in the Bank, the level of IT usage was associated with the amount of time spent by managers on information-related activities (e.g., reading reports, gathering information) and on disturbance handling activities (e.g., resolving conflicts, managing crises). In the Telecommunications company, IT usage was associated with more time spent on information-related activities and less on negotiation-related activities (e.g., discussions with colleagues on resource sharing, discussions with subordinates on performance standards). This finding suggests that heavy IT users paid greater attention to and spent more time on the roles they performed best with the technology (information-related activities) and may in fact have been embarking on an over-specialization trajectory.

Keywords: IS evaluation, IS impacts, management roles, organizational strategies, IS usage

ISR Categories: AF09, DA08, EI02, EI0211, G
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Introduction

In recent years, firms have been investing substantial amounts of money in information technology (IT). In 1991, for instance, American service sector companies spent over $100 billion on hardware—more than $12,000 per information worker (Roach 1991)—and almost 40% of United States capital spending was being used to acquire IT. In 1996, American banks alone spent almost $18 billion on IT, while American and European financial institutions together invested over $75 billion (The Economist 1996). Much of this investment was directed at modifying office work and improving productivity (Applegate 1998; Brandt 1994; Drucker 1988, 1993). Yet, many authors claim that the benefits of IT are disappointing at best, and that IT spending has failed to yield significant productivity gains—hence the productivity paradox (Barua et al. 1991; Franke 1987; Loveman 1988; Parson et al. 1990; Roach 1985, 1991; Strassman 1990; Weill 1992). On the other hand, IT spending has also been linked to significant productivity improvements (Brynjolfsson and Hitt 1993, 1995; Osterman, 1986).

This paper addresses the productivity paradox by trying to understand the interplay between IT and the work process. More precisely, it reports the results of a study which examined the relationships between the level of IT usage and the nature of middle management work in different organizational contexts. The need for a change of focus in research emerges from two main observations that can be made regarding the empirical evidence provided for the productivity paradox. First, there may have been important measurement problems of either inputs or outputs in industry and economy-level studies. For example, IT stock may have been overestimated because many firms overstate the decline in the computer price deflator, thus artificially increasing the number of computers purchased in recent years compared with past figures (Brynjolfsson 1993). The purchase of complementary software or training might also artificially inflate short-term investments in computerization. Output measurement has also been problematic, in particular due to the absence of a natural unit of output allowing meaningful comparisons between different products and services (Panko 1991). Several authors argue that, rather than examining the relationship between the amount of IT investment and productivity, it might be more appropriate to consider the relationship between IT usage and the work process (Barua et al. 1991; Davis 1991; Kelley 1994; Panko 1991; Strassman 1990).

Second, the lack of convergent findings regarding the IT-productivity relationship might simply reflect the fact that IT has often been studied without taking into account the organizational context in which it was deployed and used. Several authors argue that the organizational context is in fact a fundamental determinant of outcomes associated with IT implementation (Barley 1986; Markus and Robey 1988; Pinsonneault and Kraemer 1993, 1997; Robey and Sahay 1996). Productivity improvement is just one of many IT investment objectives. For example, some organizations might use IT to help enhance the quality of services and increase their flexibility and responsiveness to changing environmental conditions, while others might use it to increase efficiency (Quinn and Baily 1994). Lumping together firms with different objectives may blur the analysis.

These two observations suggest that a complementary understanding of the productivity paradox might be obtained through studying IT usage in light of the organizational context, focusing on work process rather than on work output. The study reported in this paper follows this line of thought and takes a first step in that direction by analyzing the relationship between the level of IT usage and the nature of middle management work in different organizational contexts. It first assesses the literature on IT and managerial work, drawing on this body of work and on the strategic reorientation/convergence literature (Freeman and Cameron 1993) to present three propositions. It then reports the results of a field study conducted with 59 middle managers in three firms of similar size with different strategic contexts. The paper
ends by discussing the findings and presenting the limitations of the study.

Information Technology and Managerial Work

Interestingly, the empirical evidence concerning the relationship between IT and managerial work parallels that concerning the productivity paradox: it is mixed and inconclusive. In fact, IT has been found to be associated with both upgraded and deskilled work. For instance, Hoos (1960) suggested that Leavitt and Whisler's (1958) prediction that much middle management work would be deskilled was rapidly being realized. Several of the managers interviewed in that study felt that IT took away numerous decision-making opportunities and limited their exercise of initiative and judgment, as well as their span of control (Hoos 1960). IT was also found to be associated with greater centralization of decision authority at top management levels, standardization and regulation of middle management work, and an increased number of rules and procedures (Mann and Williams 1960). Similarly, the study of a radio and television company (Bjorn-Andersen and Pedersen 1980) found that IT was associated with loss of managers' discretion over their jobs (deciding whether or not to perform a particular task and when and how to perform it). Finally, professional and clerical workers in 38 work groups reported that desktop computerization was transforming their work and had generated higher expectations from supervisors, more work for the groups, increased time pressures, harder work, and longer hours. Work was thus becoming more "sweat intensive" (Zmuidzinas et al. 1990).

On the other hand, some studies found that IT usage was associated with upgraded work. To explain this finding, various authors have argued that by absorbing the information-intensive tasks, IT leaves middle managers with more time to concentrate on the conceptual and decision-making aspects of their jobs and allows them to perform more unstructured activities. For instance, IT was found to be associated with greater decentralization of decision-making authority, a broadening of middle managers' work, and greater flexibility and decision orientation (George 1986; Klatzky 1970; Whisler 1970). IT was also found to be associated with greater autonomy for middle managers in performing their jobs and with less standardized, predetermined decision procedures (Pfeffer and Leblebici 1977). Another study found that middle managers perceived office automation as enriching their jobs, making them more important to the organization, and increasing personal and departmental effectiveness (Millman and Hartwick 1987). In other instances, middle managers felt that IT improved their confidence in making decisions, helped them remove uncertainty from decisions, and, overall, increased their role in the organization (Buchanan and McCalman 1988). One study found that IT was perceived by middle managers as allowing them to become more involved in strategy implementation and in the development of the organizational structure and reward systems (Wooldridge and Floyd 1990). Finally, IT was also found to be associated with middle managers spending more time on people management and on the strategic aspects of their work (Dopson and Stewart 1993). In addition, these middle managers reported that IT provided better information faster, allowing them to deal with routine tasks more efficiently.

While the final outcome associated with IT usage—upgraded or deskilled work—may differ, both sets of findings are explained by a similar argument. It is suggested that, because of its comparative advantage in handling and processing information, IT takes over most information-related activities (Dopson and Stewart 1993; George 1986; Hoos 1960; Klatzky 1970; Leavitt and Whisler 1958). Hence, the first proposition:

Proposition 1: The level of IT usage will be associated with spending less time on information-related activities.

A key question arises at this point: why is IT sometimes associated with deskilled work and sometimes with upgraded work? Several authors suggest that the answer to this
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question resides in the context in which IT was deployed and used (Markus and Robey 1988). Studies indicate that IT itself is not a determinant of organizational or individual outcomes, but rather an enabler whose effects are dependent on how it is implemented and used (Pinsonneault and Kraemer 1993, 1997; Robey and Sahay 1996). The nature of managerial work associated with IT usage is thus likely to be different depending on the organizational context.

Two generic models of organizational change, which have been developed in the literature, are useful in understanding the organizational context in which IT usage occurs (Freeman and Cameron 1993; Miller and Friesen 1980; Pettigrew 1985; Tushman and Romanelli 1985). These models emphasize the differences between evolutionary, incremental, or convergent change on the one hand, and revolutionary, metamorphic, or discontinuous change on the other. In a convergence context, incremental and adaptive change focuses on improving the efficiency of existing operations and achieving greater consistency among the organization’s internal activities. The desire to refine and adjust the organization’s systems and improve consistency actually hinders radical and discontinuous change (Freeman and Cameron 1993). On the other hand, a reorientation context is characterized by simultaneous and abrupt shifts in strategy, power distribution, structure, and control systems. In such a context, top managers mediate between internal and external institutional forces for inertia and the competitive or technological forces for fundamental changes (Freeman and Cameron 1993). Reorientation contexts are thus characterized by the desire to do different things and may include substantially modifying structures and work design.

IT is a tool that organizations use to facilitate change and generate opportunities for organizational change (Robey and Sahay 1996). As such, it is likely to be more closely associated with the nature of managerial work when an organization is in the process of reorienting its strategy than when it is in a convergence mode. In a reorientation context, IT can be used to facilitate major strategy and structural shifts and to produce managerial activities that are better aligned with the firm’s new strategy. In a convergence context, IT usage is likely to reinforce the current structure and strategy, as well as the current nature of managerial work. Hence, the second proposition:

**Proposition 2:** There will be a stronger relationship between the level of IT usage and the nature of managerial work in a reorientation context than in a convergence context.

One study found that a given technology (a geographical information system) had fundamentally different consequences depending on the organizational context in which it was implemented and used (Robey and Sahay 1996). The study concluded, along with others (Barley 1986; Orlikowski 1993), that different contextual elements interact with technical initiatives to produce different consequences. This suggests that technological initiatives can be expected to interact differently with managerial work, depending on the organizational context in which the interplay takes place. Hence, a given IT initiative would be associated differently with the nature of managerial work depending on the kind of strategic reorientation of the firm. For example, in an organization reorienting itself to create closer relationships with its clients, managers are likely to use IT to understand their customers better (e.g., segmentation, client profiles) and to spend a greater proportion of their work time on developing the organization’s customer base and tightening its relationship with clients, and less time on other aspects of their work. On the other hand, in an organization refocusing its strategy on a low cost approach, IT might be used by managers to control and streamline operations and increase efficiency, rather than to enhance the quality of the firm’s services. Managers will spend more time controlling operations and less on developing new business opportunities. In a convergence context, IT is not likely to be associated with the time allocation pattern of managers because the organization is not modifying its strategy or its structure. Hence, the third proposition:

**Proposition 3:** The pattern of the relationship between IT usage and the nature...
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of managerial work depends on the kind of reorientation the firm has undertaken.

Research Method

Concepts and measures

The present study revolves around two main concepts: the nature of managerial work and IT usage. More precisely, it examines the relationship between the level of IT usage and the time spent by middle managers on various managerial activities. Following previous work, middle managers are defined as managers above first-level supervisors but below department heads (Pinsonneault and Kraemer 1997).

While several studies have analyzed the relationship between IT and managerial work (Dopson and Stewart 1993; Hoos 1960; Millman and Hartwick 1987; Wooldridge and Floyd 1990), none has proposed a formal measure of this concept. However, in the management field, numerous conceptualizations of managerial work have been proposed. Among them, Mintzberg’s (1973) framework is the one most frequently used to study managerial work in general (Kotter 1982; Kurke and Aldrich 1983; McCall and Segrist 1980), and middle managerial work in particular (Tsui 1984) (see Appendix A for a summary of Mintzberg’s roles and examples of the activities within each role). In the present study, the nature of managerial work was assessed by measuring the number of minutes middle managers spent on different roles, as defined by Mintzberg, during a typical working day. IT usage refers to interactions with the computer and was measured by the number of minutes of hands-on usage during a typical working day.

Data collection

The relationship between IT usage and the nature of managerial work was explored through semistructured interviews with 59 middle managers in three comparable large firms (between 22,000 and 25,000 employees) in the service sector.

Selection of Participating Firms

The firms were selected on the basis of an interview with the vice-president of operations and the vice-president of information technology in each organization. A second interview was conducted with these respondents to understand the structure, environment, strategy, IT implementation process and orientation, and overall IT usage of each firm. Three large organizations were chosen for this study: one in a reorientation context (Bank), the second in a prereorientation context (Telecommunications), and the third in a convergence context (Utility).

When the study took place, the Bank had suffered major losses, mainly in some of its largest accounts, and a new president with a radically different vision from his predecessor had been appointed. The new president decided to reorient the Bank’s strategy from a traditional banking mode, with emphasis on large clients, accounts, and equity, to a new mode, segmenting its customer base and establishing a privileged relationship with all profitable customers. A vice-president was in charge of the reorientation project, although the president was actively and directly involved. The new customer orientation required substantial changes throughout the Bank. Tellers became “relationship bankers,” or customer sales representatives (CSRs), cross-selling products and services and offering advice to customers, using new computerized customer information files. Middle managers, essentially branch managers, became responsible on the one hand for reinforcing relationships with existing clients and establishing new ones, and on the other for monitoring and controlling the different accounts. From a mainly internal focus, the Bank shifted to a customer orientation. Intensive computerization, perceived by top management as leverage facilitating the Bank’s reorientation, was also carried out at all levels of the organization.
The Telecommunications company was in a "prereorientation" context. Significant changes were taking place in the telecommunications industry (increased competition, deregulation), but the company had not yet defined its new strategic orientation, although the need to do so was recognized throughout the firm. The company was actually trying to understand how the industry was changing and had focused essentially on boundary-spanning activities and gathering external information. The middle managers were the organization's gatekeepers in their respective domains, gathering data and endowing them with relevance for the firm.

The Utility company was in a convergence context. It had been in a monopolistic situation for over 30 years and enjoyed a very stable customer base and environment. Its thrust was essentially to increase operational efficiency, for example by decreasing the number of shutdowns and improving internal consistency among the different units. The organization was overwhelmed by guidelines, standards, and procedures for managing budgets, human resources, and operations, which were written and distributed throughout the organization.

Selection of Respondents

In each firm, the middle managers who would participate in the study were identified during the interviews with the vice-president of operations and the vice-president of IT. To maximize sample homogeneity regarding the nature of work and to facilitate comparisons, middle line managers in the operations department of each firm were selected. Line managers were favored over staff professionals because the scope of their work is broader, and differences in the time allocation pattern for the various activities were thus likely to be easier to observe. Staff professionals typically focus on a few specific roles. Operations managers were selected because their work was highly comparable in the three firms. In all three cases, middle managers in the operations departments were responsible for units of comparable size (called divisions, sections, or branches, depending on the firm) providing direct services to clients. All middle managers had one supervisory level under them, managing the employees in direct contact with clients. Studies have suggested that the 10 roles are present in all managerial jobs and that their relative importance varies only with different functions and hierarchical levels (Mintzberg 1973; Kurke and Aldrich 1983). Hence, the middle managers who participated in this study should have had similar roles. The identified middle managers were called by a member of the research team, who briefly presented the research project, verified their eligibility, and identified the software applications used. All the managers contacted agreed to participate in the study.

Data Collection

The data on IT usage and on the time spent on different managerial activities were collected by means of two logs and were validated in follow-up interviews. Once respondents had agreed to participate in the study, they were given instructions on how to complete the IT logs. The logs were then sent to them along with written instructions. Respondents were asked to register each computer usage (number of minutes actively using the computer, the software used, and the purpose of each usage; see Appendix B) during a day that was representative of a typical working day. They were also asked to keep a detailed log of activities during the same day. Finally, they were asked to return the two logs to the researchers at the end of the day. The measure of IT usage was obtained by adding the number of minutes managers spent on each application. Follow-up interviews were conducted by a hypothesis and theory-blind research professional the day following receipt of the logs. The interviews were divided into three parts.

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3 No logs were taken on a Friday to prevent interviewing respondents on a Monday and asking them to recall events that occurred three days earlier. Using a hypothesis and theory-blind research professional to conduct the interviews assured that the classification of activities into roles was not biased toward or against the propositions.
The first part discussed the respondent's jobs and general responsibilities (e.g., the role and importance of the unit within the organization, how the unit had evolved in recent years, how many people worked in it). During the second part, the interviewer validated the data on IT usage. The third part was concerned with the time devoted to the managerial activities. Respondents first described the activities they had registered in the logs. They then read a summary of Mintzberg's definitions of managerial roles and the examples of activities of each role proposed by Mintzberg (1973), McCall and Segrist (1980), and Tsui (1984) (Appendix A). The interviewer further described and clarified each role. Based on the questionnaires developed by McCall and Segrist and by Tsui, the interviewer then grouped the different activities into the role categories in the presence of the manager, who was invited to express an opinion as the classification progressed. This procedure ensured that the activities were grouped consistently into the different roles across interviews. The interview ended with a freer discussion aimed at gauging the respondent's opinions about computer use. After each interview, the number of minutes spent on each activity was added by role to obtain the time managers spent on each role. The activities performed using IT were also carefully coded by the interviewer into the different roles based on their nature and purpose as reported by the respondents (described in the column “Purpose” of the IT log; see Appendix B).

The procedure was pretested by the research professional on a sample of five managers. One researcher then met with the five respondents to validate the logs and the classification of activities into roles. No erroneous classifications were found.

For analysis purposes, the time spent on different roles and using IT was divided by the number of minutes worked in a particular day. This ratio measure facilitates comparisons of time allocation patterns between managers and across organizations. For example, comparing a manager who spends one hour per day on information gathering with one who spends 30 minutes on the same activity might be misleading if the two managers do not work the same number of hours per day (for example, one hour in a 12-hour work day is less important than 30 minutes in a five-hour working day).

Table 1 presents the descriptive statistics for each of the three participating firms. Respondents had an average work experience of 22.58 years, including 11 years as managers. They had been in their current positions for over 2.5 years. T-tests indicate that the Bank managers had slightly less managerial experience than the managers in the Telecommunications company (t = -2.08, p < .048) and that they were newer to their current jobs (t = -2.47, p < .029). Active IT usage averaged 51 minutes per day, or about 10% of working hours, and ranged from zero minutes to a maximum of 4.5 hours per day. T-tests indicated that the Utility company managers used IT less than the Telecommunications firm managers (t = 2.46, p < 0.018), but that there was no significant difference otherwise. Overall, managers had slightly less than 10 years of experience using IT, with no significant difference across organizations.

Results

Figure 1 presents the approach used in the statistical analyses. The aggregate informational roles, rather than the component roles, were used here because the interest was in studying how IT usage was related overall to the informational roles, and how in turn the informational roles were related to the other roles, rather than how IT usage was related to each individual informational role.*

To test the relationships illustrated in Figure 1, the path analysis approach was used (Pedhazur 1982). To obtain the path coefficients, each endogenous (dependent) variable

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* In addition to the theoretical explanation provided above, the inclusion of the three informational roles would have made the path analysis very complex, adding 16 new paths as well as three independent variables in every regression of the model, which, given the limited sample size, was not recommended.
Table 1. Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Bank</th>
<th>Telecommunications</th>
<th>Utility</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Respondents (N)</strong></td>
<td>16</td>
<td>13</td>
<td>30</td>
<td>59</td>
</tr>
<tr>
<td><strong>Experience (Years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working</td>
<td>22.19</td>
<td>22.23</td>
<td>22.93</td>
<td>22.58</td>
</tr>
<tr>
<td>In the current job</td>
<td>1.48</td>
<td>5.48</td>
<td>2.03</td>
<td>2.64</td>
</tr>
<tr>
<td>Managerial</td>
<td>8.01</td>
<td>13.46</td>
<td>11.70</td>
<td>11.10</td>
</tr>
<tr>
<td><strong>Daily IT Usage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average (minutes)</td>
<td>57.87</td>
<td>80.39</td>
<td>36.33</td>
<td>51.78</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>72.27</td>
<td>48.41</td>
<td>56.16</td>
<td>60.86</td>
</tr>
<tr>
<td>Minimum/maximum</td>
<td>0 to 270</td>
<td>0 to 160</td>
<td>0 to 160</td>
<td>0 to 270</td>
</tr>
<tr>
<td>Average (proportional*)</td>
<td>.16</td>
<td>.18</td>
<td>.07</td>
<td>0.11</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>.21</td>
<td>.11</td>
<td>.11</td>
<td>0.14</td>
</tr>
<tr>
<td>Minimum/maximum</td>
<td>0 to .69</td>
<td>0 to .36</td>
<td>0 to .34</td>
<td>0 to .69</td>
</tr>
<tr>
<td><strong>Experience With IT (Years)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>9.67</td>
<td>14.19</td>
<td>8.54</td>
<td>9.92</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>6.79</td>
<td>9.69</td>
<td>8.17</td>
<td>8.18</td>
</tr>
<tr>
<td>Minimum/maximum</td>
<td>1 to 28</td>
<td>4 to 30.50</td>
<td>0 to 32</td>
<td>0 to 32</td>
</tr>
</tbody>
</table>

* Minutes of IT usage divided by minutes worked per day.

Figure 1. Statistical Approach: The Generic Model
was regressed on its independent variables (e.g., regressing leader on entrepreneur, disturbance handler, resource allocator, negotiator, informational roles, and IT usage). The path coefficients are the regression coefficients. The error term associated with an endogenous variable is equal to the square root of \((1-R^2)\) for a given regression. Using path analysis enables the relationship between the variables of a model to be broken down into different components: direct effects (e.g., the relationship between the level of IT usage and the time devoted to the leader role, in Figure 1) and indirect effects (e.g., the relationship between the level of IT usage and the time devoted to the leader role as mediated by the time spent on the informational, entrepreneur, disturbance handler, resource allocator, and negotiator roles). The sum of the direct and indirect effects of an independent variable constitutes its total effect, or effect coefficient, and represents its overall relationship with the dependent variable.

The statistical analysis followed a two-step procedure. First, the path coefficients for the generic model (Figure 1) were calculated. Second, as suggested by prior research (Duncan 1975; Heise 1969; Pedhazur 1982), path coefficients that did not meet statistical significance criteria or did not significantly increase the chi square were deleted where theoretically justified. The path coefficients for the new model were then recalculated. The following statistical test was used to determine whether the nested model fit the data better than its "parent model" (the model from which the nested model was derived) (Specht 1975):

\[
W = - (N-d) \log_e \left( \frac{(1-M_1^2)(1-M_2^2)}{(1-M_1^2)} \right)
\]

\(W\) has a chi square distribution
\(N\) sample size
\(d\) difference between the numbers of over-identifying restrictions of the two models
\(M_1\) \(1-(1-R_1^2)(1-R_2^2)(1-R_3^2)(1-R_4^2)\ldots\) (or the parent model)
\(M_2\) \(1-(1-R_1^2)(1-R_2^2)(1-R_3^2)(1-R_4^2)\ldots\) (for the nested model)

\[^{a}\text{A model might also include spurious and unanalyzed components, but these are of no interest to the present study and will not be included in the analysis.}\]

Because regression coefficients change when a variable is deleted from an equation, it was sometimes necessary to repeat the second step in order to delete new coefficients that had become non-significant. Following Pedhazur, this second step was performed until an optimal model was obtained—in other words, a model in which no path coefficient could be deleted without significantly losing fit to the data. The procedure was applied first to the whole sample, then to each of the three organizational subsamples. The final models, along with the direct, indirect and total effect coefficients of IT usage and of the informational roles, are presented in Figures 2, 3, 4, and 5 for the sample as a whole, and for the Telecommunications, Bank, and Utility companies separately. Tables 2, 3, 4, and 5 present the means, standard deviations, and correlation coefficients for the sample as a whole, and for the Telecommunications, Bank, and Utility companies separately.

The data do not support Proposition 1. The data presented in the four figures do not support the first proposition, which stated that as the level of IT usage increases, the time spent by middle managers on informational roles decreases. When the data are analyzed using the whole sample, no significant relationship is found between the level of IT usage and the time devoted to information-related activities (see Figure 2). From this first result, one would be tempted to conclude that, for the sample studied, there was no relationship between the level of IT usage and the time spent on managerial activities. However, a more detailed analysis produced some additional and interesting results. Indeed, when each firm is analyzed independently, relationships between the level of IT usage and the time spent on informational roles are found in two of the three companies (Figures 3, 4, and 5). Interestingly, and contrary to Proposition 1, IT was found to be associated with spending more time on the informational roles in the Telecommunications company (1.037, \(p < .026\)) and in the Bank (0.884, \(p < .003\)). No effect was found in the Utility (Figure 5).

The data provide preliminary support for Proposition 2, which stated that the
### Standardized coefficients (significance)

### Total effect of information technology on:

- Total effect = Direct effect + Indirect effect

### Total effect of the informational roles on:

- Total effect = Direct effect + Indirect effects

<table>
<thead>
<tr>
<th>Decisional Roles</th>
<th>Total effect</th>
<th>Direct effect</th>
<th>Indirect effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneur</td>
<td>$-0.335$</td>
<td>$-0.335$</td>
<td>$0.000$</td>
</tr>
<tr>
<td>Disturbance handler</td>
<td>$-0.224$</td>
<td>$-0.224$</td>
<td>$0.000$</td>
</tr>
<tr>
<td>Resource allocator</td>
<td>$-0.305$</td>
<td>$-0.305$</td>
<td>$0.000$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interpersonal Roles</th>
<th>Total effect</th>
<th>Direct effect</th>
<th>Indirect effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leader</td>
<td>$-0.469$</td>
<td>$-0.937$</td>
<td>$(-0.335 \times -0.708) + (-0.305 \times -0.309)$ + $(-0.303 \times -0.451)$</td>
</tr>
<tr>
<td>Liaison</td>
<td>$-0.298$</td>
<td>$-0.590$</td>
<td>$(-0.224 \times -0.665) + (-0.128 \times -0.445)$ + $(-0.171 \times -0.504)$</td>
</tr>
</tbody>
</table>

**Figure 2. Overall Sample**
Figure 3. Telecommunications Company
### Total effect of information technology on:

<table>
<thead>
<tr>
<th>Role</th>
<th>Total effect</th>
<th>Direct effect</th>
<th>Indirect effect</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Informational Roles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneur</td>
<td>0.857</td>
<td>0.857</td>
<td>0.000</td>
</tr>
<tr>
<td>Negotiator</td>
<td>0.884</td>
<td>0.884</td>
<td>0.000</td>
</tr>
<tr>
<td>Disturbance Handler</td>
<td>-0.495</td>
<td>0.000</td>
<td>0.857 * -0.578</td>
</tr>
<tr>
<td><strong>Decisional Roles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneur</td>
<td>-0.430</td>
<td>0.000</td>
<td>0.884 * -0.385</td>
</tr>
<tr>
<td>Negotiator</td>
<td>-0.159</td>
<td>0.000</td>
<td>0.884 * -0.180</td>
</tr>
<tr>
<td>Disturbance Handler</td>
<td>-0.272</td>
<td>1.009</td>
<td>0.857 * -1.495</td>
</tr>
<tr>
<td><strong>Interpersonal Roles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leader</td>
<td>0.078</td>
<td>0.000</td>
<td>(0.857 * -1.495 * -1.018) + (0.857 * -0.505 * 0.460) + (1.009 * -1.018)</td>
</tr>
<tr>
<td>Liaison</td>
<td>-1.160</td>
<td>0.000</td>
<td>(0.884 * -0.548 * -1.135) + (0.884 * -0.180 * 0.527)</td>
</tr>
<tr>
<td><strong>Total effect of the information roles on:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Decisional Roles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entrepreneur</td>
<td>-0.578</td>
<td>-0.578</td>
<td>0.000</td>
</tr>
<tr>
<td>Disturbance Handler</td>
<td>-1.495</td>
<td>-1.495</td>
<td>0.000</td>
</tr>
<tr>
<td>Negotiator</td>
<td>-0.548</td>
<td>-0.548</td>
<td>0.000</td>
</tr>
<tr>
<td><strong>Interpersonal Roles</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leader</td>
<td>1.290</td>
<td>0.000</td>
<td>(-1.495 * -1.018) + (-0.505 * 0.460)</td>
</tr>
<tr>
<td>Liaison</td>
<td>-1.354</td>
<td>-2.165</td>
<td>(-0.578 * -2.264) + (-1.495 * 0.758) + (-0.505 * -1.259)</td>
</tr>
</tbody>
</table>

Total effect of the informational roles on:

**Decisional Roles**
- Entrepreneur: Direct effect = -0.578, Indirect effect = 0.000
- Disturbance Handler: Direct effect = -1.495, Indirect effect = 0.000
- Negotiator: Direct effect = -0.548, Indirect effect = 0.000

**Interpersonal Roles**
- Leader: Direct effect = 1.290, Indirect effect = (-1.495 * -1.018) + (-0.505 * 0.460)
- Liaison: Direct effect = -1.354, Indirect effect = (-0.578 * -2.264) + (-1.495 * 0.758) + (-0.505 * -1.259)

Figure 4. Bank

MIS Quarterly/September 1998
Chi square = 20.153, 14df, p<0.10

Standardized coefficients (significance)

Unstandardized coefficients

\[ \text{Residuals} \]

**Total effect of information technology on:**

\[ \text{Total effect} = \text{Direct effect} + \text{Indirect effect} \]

**Total effect of the informational roles on:**

\[ \text{Total effect} = \text{Direct effect} + \text{Indirect effects} \]

<table>
<thead>
<tr>
<th>Decisional Roles</th>
<th>Total effect</th>
<th>Direct effect</th>
<th>Indirect effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entrepreneur</td>
<td>-0.335</td>
<td>-0.335</td>
<td>0.000</td>
</tr>
<tr>
<td>Disturbance handler</td>
<td>-0.224</td>
<td>-0.224</td>
<td>0.000</td>
</tr>
<tr>
<td>Resource allocator</td>
<td>-0.305</td>
<td>-0.305</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>-0.128</td>
<td>-0.128</td>
<td>0.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interpersonal Roles</th>
<th>Total effect</th>
<th>Direct effect</th>
<th>Indirect effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leader</td>
<td>-0.469</td>
<td>-0.937</td>
<td>((-0.335 \times -0.708) + (-0.303 \times -0.451) + (-0.305 \times -0.309))</td>
</tr>
<tr>
<td></td>
<td>-0.294</td>
<td>-0.589</td>
<td>((-0.224 \times -0.665) + (-0.171 \times -0.504) + (-0.128 \times -0.465))</td>
</tr>
<tr>
<td>Liaison</td>
<td>-0.262</td>
<td>-0.661</td>
<td>((-0.335 \times -0.436) + (-0.303 \times -0.453) + (-0.305 \times -0.379))</td>
</tr>
<tr>
<td></td>
<td>-0.129</td>
<td>-0.326</td>
<td>((-0.224 \times -0.321) + (-0.171 \times -0.397) + (-0.128 \times -0.448))</td>
</tr>
</tbody>
</table>

Figure 5. Utility Company
### Table 2. Means, Correlation, Standard Deviation: Overall Sample

<table>
<thead>
<tr>
<th></th>
<th>Standard Mean</th>
<th>Deviation</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Information Technology</td>
<td>0.112</td>
<td>0.137</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Informational Roles</td>
<td>0.477</td>
<td>0.180</td>
<td>0.257</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Entrepreneur</td>
<td>0.103</td>
<td>0.119</td>
<td>0.099</td>
<td>0.332*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Resource Allocator</td>
<td>0.081</td>
<td>0.075</td>
<td>0.054</td>
<td>-0.298*</td>
<td>-0.142</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Disturbance Handler</td>
<td>0.085</td>
<td>0.101</td>
<td>-0.164</td>
<td>-0.297*</td>
<td>-0.096</td>
<td>-0.207</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Negotiator</td>
<td>0.044</td>
<td>0.057</td>
<td>-0.084</td>
<td>-0.122</td>
<td>-0.073</td>
<td>0.093</td>
<td>0.109</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Leader</td>
<td>0.091</td>
<td>0.112</td>
<td>-0.123</td>
<td>-0.429**</td>
<td>-0.214</td>
<td>0.197</td>
<td>0.068</td>
<td>-0.163</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Liaison</td>
<td>0.076</td>
<td>0.088</td>
<td>0.064</td>
<td>-0.262</td>
<td>-0.034</td>
<td>0.024</td>
<td>-0.147</td>
<td>-0.048</td>
<td>-0.009</td>
<td></td>
</tr>
<tr>
<td>9. Figurehead</td>
<td>0.007</td>
<td>0.037</td>
<td>-0.160</td>
<td>-0.184</td>
<td>0.212</td>
<td>-0.024</td>
<td>-0.152</td>
<td>-0.129</td>
<td>0.044</td>
<td>-0.129</td>
</tr>
</tbody>
</table>

1 Means represent the number of minutes spent on a managerial role (or using IT) in a day divided by the total number of minutes worked in that day.

* p < .05; ** p < .01; *** p < .001.

### Table 3. Means, Correlation, Standard Deviation: Telecommunications Company

<table>
<thead>
<tr>
<th></th>
<th>Standard Mean</th>
<th>Deviation</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Information Technology</td>
<td>0.183</td>
<td>0.105</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Informational Roles</td>
<td>0.465</td>
<td>0.179</td>
<td>0.612*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Entrepreneur</td>
<td>0.130</td>
<td>0.111</td>
<td>-0.091</td>
<td>-0.351</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Resource Allocator</td>
<td>0.106</td>
<td>0.106</td>
<td>-0.031</td>
<td>-0.366</td>
<td>-0.126</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Disturbance Handler</td>
<td>0.092</td>
<td>0.118</td>
<td>-0.308</td>
<td>-0.322</td>
<td>-0.201</td>
<td>-0.372</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Negotiator</td>
<td>0.045</td>
<td>0.055</td>
<td>-0.325</td>
<td>0.153</td>
<td>-0.275</td>
<td>-0.390</td>
<td>0.041</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Leader</td>
<td>0.059</td>
<td>0.080</td>
<td>-0.172</td>
<td>-0.556*</td>
<td>-0.134</td>
<td>0.343</td>
<td>0.319</td>
<td>-0.469</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Liaison</td>
<td>0.098</td>
<td>0.071</td>
<td>-0.363</td>
<td>-0.343</td>
<td>0.138</td>
<td>0.166</td>
<td>-0.364</td>
<td>0.321</td>
<td>-0.207</td>
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</tr>
<tr>
<td>9. Figurehead</td>
<td>0.002</td>
<td>0.008</td>
<td>-0.236</td>
<td>-0.227</td>
<td>0.633*</td>
<td>-0.123</td>
<td>-0.076</td>
<td>-0.082</td>
<td>0.057</td>
<td>-0.097</td>
</tr>
</tbody>
</table>

1 Means represent the number of minutes spent on a managerial role (or using IT) in a day divided by the total number of minutes worked in that day.

* p < .05; ** p < .01; *** p < .001.

The relationship between the level of IT usage and the nature of managerial work is stronger in a reorientation context than in a convergence context. As discussed above, while no significant relationship was found between IT usage and the time spent on information-related activities in the Utility (which was in a convergence context), significant positive relationships were found in the Telecommunications firm and the Bank (which were in a prereoration and a reorientation context, respectively). The level of IT usage was significantly related to the time allocated to four roles in the Telecommunications company (informational,
Managerial Work

Table 4. Means, Correlation, Standard Deviation: Bank

<table>
<thead>
<tr>
<th>Role</th>
<th>Mean 1</th>
<th>Standard Deviation</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Information Technology</td>
<td>.132</td>
<td>.194</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Informational Roles</td>
<td></td>
<td></td>
<td>.492</td>
<td>.211</td>
<td>.857**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Entrepreneur Allocates</td>
<td>.103</td>
<td>.137</td>
<td>-.418</td>
<td>-.578</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Resource Handler</td>
<td>.067</td>
<td>.065</td>
<td>-.258</td>
<td>-.290</td>
<td>-.442</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Disturbance Handler</td>
<td>.051</td>
<td>.077</td>
<td>-.272</td>
<td>-.630</td>
<td>.297</td>
<td>.540</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Negotiator</td>
<td>.059</td>
<td>.073</td>
<td>-.364</td>
<td>-.505</td>
<td>.179</td>
<td>.302</td>
<td>.594</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Leader</td>
<td>.099</td>
<td>.089</td>
<td>-.367</td>
<td>-.057</td>
<td>-.241</td>
<td>.427</td>
<td>-.270</td>
<td>.161</td>
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<td></td>
</tr>
<tr>
<td>8. Liaison</td>
<td>.067</td>
<td>.109</td>
<td>-.164</td>
<td>-.128</td>
<td>.008</td>
<td>-.198</td>
<td>-.361</td>
<td>-.282</td>
<td>-.033</td>
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<tr>
<td>9. Figurehead</td>
<td>.008</td>
<td>.026</td>
<td>-.204</td>
<td>-.179</td>
<td>.623</td>
<td>-.437</td>
<td>-.038</td>
<td>-.148</td>
<td>-.482</td>
<td>.041</td>
</tr>
</tbody>
</table>

Means represent the number of minutes spent on a role (or using IT) in a day divided by the total number of minutes worked in that day.

* p < .05; ** p < .01; *** p < .001.

Table 5. Means, Correlation, Standard Deviation: Utility Company

<table>
<thead>
<tr>
<th>Role</th>
<th>Mean 1</th>
<th>Standard Deviation</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Information Technology</td>
<td>.070</td>
<td>.111</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Informational Roles</td>
<td></td>
<td></td>
<td>.477</td>
<td>.175</td>
<td>-.333</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Entrepreneur Allocates</td>
<td>.090</td>
<td>.118</td>
<td>.245</td>
<td>-.203</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Resource Handler</td>
<td>.074</td>
<td>.059</td>
<td>.235</td>
<td>-.279</td>
<td>-.107</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Disturbance Handler</td>
<td>.094</td>
<td>.099</td>
<td>-.046</td>
<td>-.190</td>
<td>-.164</td>
<td>-.289</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Negotiator</td>
<td>.037</td>
<td>.052</td>
<td>-.158</td>
<td>-.080</td>
<td>-.144</td>
<td>.540**</td>
<td>.062</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Leader</td>
<td>.102</td>
<td>.133</td>
<td>.053</td>
<td>-.548**</td>
<td>-.206</td>
<td>.203</td>
<td>-.177</td>
<td>-.190</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Liaison</td>
<td>.067</td>
<td>.087</td>
<td>.336</td>
<td>-.297</td>
<td>-.168</td>
<td>-.036</td>
<td>.041</td>
<td>-.070</td>
<td>.087</td>
<td></td>
</tr>
<tr>
<td>9. Figurehead</td>
<td>.009</td>
<td>.048</td>
<td>-.145</td>
<td>-.216</td>
<td>.129</td>
<td>.107</td>
<td>-.209</td>
<td>-.161</td>
<td>.102</td>
<td>-.183</td>
</tr>
</tbody>
</table>

Means represent the number of minutes spent on a managerial role (or using IT) in a day divided by the total number of minutes worked in that day.

* p < .05; ** p < .01; *** p < .001.

Moreover, in the Bank and in the Telecommunications firm, the level of IT usage is not only related to the informational roles, but is also, and significantly, related to the time spent on the decisional and interpersonal roles. More precisely, the level of IT usage is negatively related to the time spent on these negotiator, leader, liaison) and to six roles in the Bank (informational, negotiator, leader, liaison, entrepreneur, disturbance handler), but it had no significant relationship with any of the managerial roles in the Utility company. These results provide support for Proposition 2.
Managerial Work

roles, overall, in both companies (see Figures 3 and 4: -0.171 with negotiator; -0.205 with leader; -0.522 with liaison in the Telecommunications company; -0.159 with negotiator; 0.034 with leader; -0.643 with liaison; -0.340 with entrepreneur; -0.103 with disturbance handler in the Bank). Therefore, in these two firms, IT usage was associated with spending more time on the informational roles and less time on the decisional and interpersonal roles except for the leader role in the Bank. In the Utility company, no relationship was found between the level of IT usage and the time spent on any of the managerial roles (see Figure 5).

The data support Proposition 3, which stipulated that the pattern of the relationship between IT usage and the nature of managerial work depends on the kind of reorientation upon which the firm has embarked. It should be remembered that the Telecommunications company was in a "prereorientation" phase, where top management had recognized that the environment was changing rapidly and drastically, but had not yet defined a new strategic thrust. The main issue was to understand the changing environment; the results obtained reflect this. IT usage was positively associated with the time devoted to the informational roles by middle managers (1.037, p < .026) and negatively related to one decisional role (negotiator, -0.171), and two interpersonal roles (leader, -0.205; liaison, -0.522). The interviews suggested that the larger amount of time spent on the informational roles associated with IT usage was a result of top management's efforts to reorient middle management work. Top managers made it very clear through memos and direct conversations with middle managers that obtaining, interpreting, and distributing information on competitors and on the environment was crucial, in view of the Telecommunications company's environment. During the interviews, all middle managers emphasized the fact that, due to the firm's changing environment, it was their responsibility to obtain such information in their respective domains and that they used IT to do so. For example, a manager who was responsible for the installation, maintenance, and repair of telecommunications cables used IT (i.e., direct access to different stock exchanges, access specialized journals and databases) to analyze the behavior of the firm's competitors and to benchmark his unit's performance with that of other firms. This manager indicated that he did not perform these tasks at all before the introduction of IT because the information sources were not readily available and because he was not expected to do so.

The Bank was already well into a strategic reorientation. Its new customer focus, with emphasis on tighter relationships with clients and closer monitoring of accounts, and its accompanying structural and operational changes had just been implemented. Branch managers (the respondents in this study) were much more involved in the development of new markets, the consolidation of existing client groups, and the monitoring of different accounts than before the reorientation. Here again, the relationship between IT usage and the nature of managerial work reflects the new strategic thrust of the organization, different from the Telecommunications firm. While the level of IT usage was also positively associated with the time spent on informational roles (0.884, p < .003), it was negatively related to the time spent on three of the decision-making roles (negotiator, -0.159; entrepreneur, -0.340; and disturbance handler, -0.103), and on one interpersonal role (liaison, -0.643). On the other hand, the level of IT usage was positively related to the time spent on one of the interpersonal roles (leader, total effect = 0.034).

Interviews indicated that IT was used by branch managers to support and reinforce the informational roles (e.g., gathering market information, monitoring customer accounts) and, in turn, to support leader roles (e.g., customer segmentation, new market development, leading employees to reinforce customer relationships). One manager described this new strategy, together with the effect it had on his IT usage and on his job. He emphasized the fact that, as branch manager, he had two main responsibilities: first, to ensure that the customer sales representatives (CSRs, formally referred to as bank tellers) established and
maintained strong customer relationships and that they sold the bank's products and services efficiently; and second, to monitor closely the accounts opened by the CSRs. As he said: "I will be promoted on the basis of my branch's market share growth and profitability, and my job is on the line if my branch gets a few bad accounts." The data also indicate that the time spent on the entrepreneur role by branch managers was negatively associated with the level of IT usage. This may seem contradictory to the bank's overall strategy, but in fact it is not. It simply reflects the fact that IT gave managers direct access to data that facilitated the monitoring and control of CSR sales efforts. The more managers used IT, the more they felt comfortable delegating business development to CSRs (the entrepreneur role).

The Utility company was in a very stable, long-lasting convergence context in which attention was given to improving the efficiency of existing procedures and operations and improving consistency across units. In this company, the level of IT usage was not significantly related to the time spent on any particular role.

A close look at the results provides more support for Proposition 3. As shown in Figures 2, 3, 4, and 5, the data was also used to analyze the relationships between the time spent on information-related activities and the time spent on other roles (total effects of informational roles). These results help in understanding the "dynamics of time allocation among roles." In the case of the Utility, it was found that a larger proportion of time spent on the informational roles was negatively related to the proportion of time spent on five other roles (three decisional roles: entrepreneur, disturbance handler, and resource allocator; two interpersonal roles: leader and liaison). In other words, in that organization, the more time spent on information handling, the less time spent on the other roles. The results are somewhat different in the two other firms.

In the Telecommunications company, for instance, the informational roles have a significant, positive relationship with one of the decisional roles (negotiator), but are not related to the other roles in that category. Also, the time spent on informational roles has a significant negative relationship with the time spent on two of the three interpersonal roles (leader and liaison). In other words, in that firm, an increase in the time spent on informational roles is related to a reduction in the time spent on the interpersonal roles, but to an increase in the time spent on one decisional role (negotiator). These results indicate that information will be handled in relation to decision making—in other words, as discussed earlier, as managers obtain more information, they are in a better position to negotiate, probably obtain, and commit resources within the organization (negotiator role).

In the Bank, the increased amount of time spent on informational roles is related to the time spent on other roles in a different fashion. On the one hand, it is negatively related to the time spent on the decisional roles and on one interpersonal role (liaison), and positively related to the time spent on one interpersonal role (leader). As previously indicated, this is consistent with the strong customer orientation introduced by the Bank's management.

These results strongly suggest that when strategic changes are underway at the organization level (reorientation contexts), IT is used mainly to reinforce and support the specific roles perceived as critical by managers.

**Discussion**

Overall, the study provides support for the reorientation/convergence framework and for the fact that relationships between the level of IT usage and the nature of managerial work are fundamentally dependent on the context in which IT is implemented and used. Indeed, while significant relationships were found between IT usage and managerial roles in the two organizations operating within a strategic reorientation (Telecommunications and Bank), no relationship was found in the firm operating within a convergence context (the Utility). It may be argued that the lack of significant relationships in the Utility company was due to insufficient IT usage (36.33, 57.87, and 80.39
minutes of daily IT usage in the Utility, the Bank, and the Telecommunications company, respectively). However, path analyses using the model shown in Figure 1 were conducted with the 15 highest users from the Utility company (average IT usage of this subsample: 77.86 minutes per day, standard deviation: 59.63 minutes, no statistical difference between IT usage in the three firms). The results indicated that, even then, the level of IT usage was not significantly related to any managerial role, suggesting that the lack of a relationship in that company was not due to insufficient usage.

The results in this study support the claim made by several authors to the effect that research on IT usage must take into account the organizational context in which it is deployed and used. Lumping together firms with different strategic orientations in an aggregate-level study would have blurred the analysis. The results also show the importance of focusing on work process rather than work output. For instance, it might be beneficial in the Telecommunications company for middle managers to focus on informational activities at the expense of other roles, and in the Bank for middle managers to spend more time on the informational and leader roles. However, this appears to be difficult to include in a study assessing productivity at the industry or economy level. This paper argues that a better understanding of how IT usage is related to the nature of managerial work and the context in which it is deployed will help untangle the productivity paradox.

In the above discussion, the limitations of the study have been borne in mind. First, although the study provides some indications of the importance of the organizational context in determining the strength of the relationship between the level of IT usage and the nature of managerial work, the small sample size (both in terms of number of respondents and number of firms) precludes generalization of the findings to other industries and to managers other than middle managers. More research is needed to test this result further. Ideally, a quasi-experimental study comparing IT usage in a 2 X 2 factorial approach (high and low IT usage, reorientation and convergence), or a survey with a large enough sample to allow for such analysis, should be conducted before drawing further conclusions. Second, data on IT usage and time allocation between roles were gathered during a single working day. It should be noted, though, that great care was taken to ensure that this day was typical for the respondents. Third, the study was cross-sectional rather than longitudinal—that is, it did not compare how managers allocated their work time before and after IT implementation, but examined the relationships between the level of IT usage and the time spent on various roles by managers. Finally, alternative hypotheses for explaining the results obtained cannot be completely ruled out. One such hypothesis may be that the Bank and the Telecommunications firm are in information-intensive industries, while the Utility is not, and that this environmental characteristic plays a more important role than strategic orientation. However, it appears that this is not the case here. A t-test was performed in order to determine whether there was a significant difference in the average time spent on information roles by managers from the three firms, and the results clearly indicate that no such difference exists (t = .011, p < .992)

From the Productivity Paradox to the Icarus Paradox?

In the two organizations in a reorientation context, IT usage was associated with a concentration of work time by middle managers on the few roles they perceived as critical to their success. In the Bank, IT usage was positively associated with the time spent on informational and leader roles; in the Telecommunications firm, IT was positively associated with the time spent on informational roles. The data indicate that this concentration resulted from both the strategic reorientation of the firm and IT usage, the latter being an enabler facilitating the concentration.
Contrary to expectations, higher levels of IT usage were associated with spending more time on informational roles in the Bank and in the Telecommunications company. The interviews indicated that managers focused their attention and spent their time on the informational roles because they felt their performance in these roles was enhanced by using IT. For instance, most managers in the Telecommunications firm emphasized the fact that they were using IT because they felt it provided better information, enhancing their decision making and, in turn, leading them to use IT even more. However, they claimed that, after a while, they realized they were spending too much time searching for available information and not enough time on the other activities of their jobs. Several managers from the Bank described a similar experience of IT usage. Given the importance of managing and monitoring the accounts held in their branches (managers stated in the interviews that "their jobs were on the line" as soon as a few accounts became delinquent), they were constantly looking for new information on these accounts. For example, a manager told us that he had to refrain consciously from using IT because he felt he was neglecting the rest of his job, and this had begun to affect his branch's performance. He told us that frontline employees (CSRs) had said they felt was not supporting and coaching them adequately in learning their new jobs.

A greater concentration on a small number of roles may seem beneficial at first, as managers focus on one or two areas crucial to the firm's operations and strategy. However, it may also contain the seeds for an over-specialization beyond strategic necessity, in which the manager's decision making and flexibility are impaired. Although there is no empirical evidence to explain what appears to be an over-concentration on a few roles, a preliminary explanation based on the Icarus paradox is offered:

The fabled Icarus of Greek mythology is said to have flown so high, so close to the sun, that his artificial wings melted and he plunged to his death in the Aegean Sea. The power of Icarus' wings gave rise to the abandon that so doomed him. The paradox, of course, is that his greatest asset led to his demise. And that same paradox applies to many outstanding companies today: their victories and their strengths often seduce them into the excesses that cause their downfall (Miller 1990, p. 3).

The Icarus fable used to explain the rise and fall of several modern organizations may well be relevant in explaining the relationship found between the level of IT usage and the nature of middle managerial work. Miller posits that organizations achieve outstanding performances by focusing on a few distinctive competencies and winning strategies. They react to their success by putting still more emphasis on the same competencies and by using the same strategies—in other words, by embarking on a trajectory that will ultimately lead to their own demise. Similarly, it was found that managers tend to exploit more intensively the one or two activities at which they are best, and this induces them to neglect their other activities (Miller and Chen 1996).

The mechanism observed in this study resembles the dynamics of the Icarus paradox. As is the case for successful organizations in Miller's analysis, the middle managers studied here may well have been launching themselves into a specialization trajectory. They focused on the activities and roles that were identified as important by senior management—mostly the informational roles—hence limiting their involvement in the other dimensions of their work. Miller argues that, in such a situation, managers develop the specialized knowledge of how things are done rather than why they are done the way they are. Organizations reinforce this pattern by hiring specialized workers and failing to recruit and retain people with different talents and skills. Managerial work might thus become ever more specialized and eventually fall into a specialization spiral, just as organizations launch themselves into a similar specialization spiral illustrated by the Icarus paradox.

This does not imply that specialization is dysfunctional by nature. Rather, it suggests that greater specialization of middle line managers' jobs contradicts the very essence of their
mission, which lies not in specialization but in the integration of a wide range of managerial functions (Kotter 1982; Kurke and Aldrich 1983; Mintzberg 1973; Stewart 1989; Tsui 1984).

The data gathered in this study do not allow for a formal testing of the hypothesis that managers' job may have been launched into a specialization trajectory similar to that described by Miller. However, the results are intriguing enough to lead to pursuit of investigations in that direction.

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# Appendix A

## Mintzberg’s Role Typology

<table>
<thead>
<tr>
<th>Roles</th>
<th>Description and Examples of Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Informational</strong></td>
<td></td>
</tr>
</tbody>
</table>
| Monitor     | Managers scanning the environment for information, interrogating liaison contacts and subordinates, and receiving unsolicited information.  
Examples of Activities*:  
- Keeping up with information on the progress of operations in the firm  
- Gathering information about trends outside the organization  
- Gathering information about customers, competitors, associates, etc.  
- Touring facilities for observational purposes  
- Reading reports on activities in this and other companies  
- Scanning the environment for opportunities |  
| Disseminator| Managers sharing and distributing information to subordinates or to other managers.  
Examples of Activities:  
- Briefing subordinates of the organization on the results of activities (e.g., trips, conversations, meetings)  
- Distributing information on a specialized events (i.e., conference, meeting)  
- Diffusing information to subordinates on standards or procedures for decision making  
- Forwarding mail into the organization for informational purposes |  
| Spokesman   | Managers sending information to people outside the unit, informing and satisfying the influential people who control the organizational unit.  
Examples of Activities:  
- Serve as an expert to people outside the unit  
- Answer inquiries about the unit  
- Presiding at meetings as a representative of the organization  
- Informing others of the organization’s future plans  
- Answering letters or inquiries on behalf of the organization  
- Keeping other people informed about the organization’s activities |  
| **Decisional** |                                                                                                                                                                               |
| Entrepreneur| Managers initiating a project and trying to improve the work unit by adapting it to the work environment.  
Examples of Activities:  
- Planning and implementing change  
- Initiating controlled change in the unit  
- Solving problems by instituting needed changes in the organization |  
| Disturbance handler| Managers responding to external pressures and disturbances.  
Examples of Activities:  
- Resolving conflicts between subordinates (e.g., resource demand, personality clashes)  
- Managing an unexpected problem in operations (e.g., breakdown)  
- Managing potential resources losses (e.g., important customer leaving) |
Managerial Work

Resource allocator
Managers deciding who will get what in the organizational unit and authorizing important decisions.

Examples of Activities:
- Distributing budget resources
- Making decisions about time parameters for upcoming programs
- Allocating monies within the unit
- Deciding which programs to provide resources (manpower, dollars, etc.)
- Allocating equipment or materials

Negotiator
Managers committing organizational resources in "real time" and exchanging resources within and outside the unit.

Examples of Activities:
- Negotiating the price and services offered with a consultant team
- Negotiating with subordinates for the setting of performance standards
- Discussing with colleagues for sharing common resources (e.g., personnel, funds, material, offices, computers)

Interpersonal

Figurehead
Managers performing duties of a ceremonial nature.

Examples of Activities:
- Representing the unit in clients’ activities
- Writing and signing letters of recommendations for employees
- Entertaining important clients (e.g., touring of the facilities)

Leader
Managers being responsible for the work of people in the unit, including hiring, training, motivating, and encouraging employees.

Examples of Activities:
- Evaluating the quality of subordinate job performance
- Resolving conflicts between subordinates
- Allocating manpower to specific jobs or tasks
- Seeing to it that subordinates are alert to problems that need attention
- Maintaining supervision over changes in the organization
- Directing the work of subordinates

Liaison
Managers making contacts outside the vertical chain of command.

Examples of Activities:
- Attend meetings in other units
- Attend social functions as a representative
- Maintaining a personal network of contacts (visits or phone calls)
- Developing new contacts by answering requests for information
- Developing contacts with important people outside the organization

* The list of activities used in the interviews was based on McCall and Segrist's (1980) and Tsui's (1984) questionnaires of managerial roles and on Mintzberg (1973).
Appendix B

Example of an IT Usage Log

IT usage Log

Every time you use an computerized application, please indicate what application you used, for what purpose, and for how many minutes you *actively used it (that is, you interacted with the application)*.

Respondent: ________________________________

Date: ________________________________

<table>
<thead>
<tr>
<th>Application</th>
<th>Purpose</th>
</tr>
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<tbody>
<tr>
<td>Example: Number of minutes: _____</td>
<td>________________________________</td>
</tr>
<tr>
<td>1st usage Number of minutes: _____</td>
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<tr>
<td>2nd usage Number of minutes: _____</td>
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<td>19th usage Number of minutes: _____</td>
<td>________________________________</td>
</tr>
<tr>
<td>20th usage Number of minutes: _____</td>
<td>________________________________</td>
</tr>
</tbody>
</table>

Please fax the log at the end of the day to the following number: 340-5634.