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Information technology, strategic decision making approaches and organizational performance in different industrial settings

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Abstract

The present study considers potential performance effects associated with the communication enhancing capacity of information technology. Enhancement of an organization's communication capabilities may influence performance through improved strategic decision making, better coordination of strategic actions and by facilitating learning from strategic initiatives. Accordingly, the paper investigates the effects of internal communication through use of computer networks, Intranet, and external communication via the Internet in association with autonomous and participatory strategic decision making approaches and strategic planning. These relationships are tested in two different industrial settings characterized by low and high levels of dynamism and complexity to assess possible environmental contingencies. In less dynamic and complex industries, the results show a positive association between Intranet use and innovation, while Internet use has a positive association to profitability and to innovation in organizations adhering to a participatory decision approach. In more dynamic and complex industries, Intranet use combined with an autonomous decision approach is associated with high profitability and sales growth, while Internet use combined with participatory decision making is associated with higher innovation. Hence, the study finds evidence that innovation relates to use of the Internet and participation across industries, and that economic efficiency relates to use of Intranet and autonomy in dynamic and complex industries. © 2001 Elsevier Science B.V. All rights reserved.

Keywords: Information technology; Communication enhancement; Intranet; Internet; Autonomy; Participation; Strategic planning

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Various studies have investigated performance effects of information technology (IT) by analyzing direct relationships between economic returns and IT investment (Weill, 1992; Brynjolfsson, 1993; Brynjolfsson and Hitt, 1996). However, new evidence suggests that IT effectiveness is related to applications that strengthen the organizations' inherent management approaches and decision structures, and create competitive advantage by enhancing idiosyncratic information processing capabilities (DeSanctis and Poole, 1994; Powell and Dent-Mitcallef, 1997). It is argued that computerized communication technologies can support more flexible strategic decision making processes and lead to new ways of managing organizations (Bettis and Hitt, 1995). Such contentions imply that the communication enhancing capacity of IT may affect performance by facilitating an organization's specific strategic decision making approaches. The purpose of this paper is to examine this proposition and present the results of an empirical study. The study investigates the relationship between communication enhancing uses of IT, strategic decision making approaches, and organizational performance. The paper considers two IT applications: (1) use of computer networks to enhance internal communication across the organization (Intranet use), and (2) use of the Internet to facilitate communication with external entities (Internet use). Furthermore, the study investigates the influences of autonomy and participation, two decentralized strategic decision making approaches, and strategic planning, a centralized decision approach. Finally, the study takes possible environmental contingencies into account, by investigating the performance relationships of the IT constructs, and strategic decision making approaches in two distinct industrial environments characterized by low and high levels of dynamism and complexity. The paper outlines supportive literatures and develops the model framework for the empirical study. It then presents the results of the research project, draws tentative conclusions, and points to areas for further research.

1. Research background

The information technology and strategic management literatures can provide insights to explain possible performance effects of communication enhancing IT and confounding influences of strategic decision making approaches. In the following, we discuss relevant parts of the two literatures and develop hypotheses to guide an empirical study.

1.1. Information technology effects

A common view associates performance effects of IT with processing efficiencies gained from lower transaction costs. Computerized data handling increases volume, speed, efficiency, and capacity and thereby the productivity of information intensive transactional processes (Malone et al., 1987; Malone and Rockart, 1993). Integrated computer networks and data interfaces reduce the processing costs associated with gathering, disseminating, analyzing, storing, and retrieving information and data (Gurbaxani and Whang, 1991; Clemons et al., 1993). Lower transaction costs, make market structures more attractive, so it is more economical to extend organizational networks, outsource processes, etc. (Clemons et al., 1993; Brynjolfsson et al., 1994). The application of bar coding, electronic data interchange (EDI) electronic delivery systems, etc. enables more

efficient business-to-business commerce and Internet-based business-to-customer transactions.

Even though these types of transaction processing technologies clearly have the capacity to improve industry performance, it is not evident that they provide the means to support sustainable excess returns at the firm level, because the technologies often can be imitated. For example, bar coding and EDI are emerging as virtual industry standards that permit little process differentiation among companies. It also remains to be seen whether Amazon.com's business-to-customer model is more successful than Barnes and Nobles' imitating on-line outfit. In contrast, the ability of IT to support information exchange across functional, geographical, and time barriers may facilitate firm specific management approaches that are difficult to imitate and thereby support sustainable performance effects (Barney, 1991; Kettinger et al., 1994). If this is the case, the use of IT to enhance an organization's idiosyncratic communication capabilities should be associated with higher performance, and the performance relationship should be confounded by particular strategic decision making approaches adopted by the firm.

The actual use of IT to enhance communication should matter rather than the nominal amounts invested in particular technologies. From this vantage point, IT serves as an enabler of existing firm specific management approaches. This resonates with the thesis that IT is the product of human action as well as material assets (Orlikowski and Robey, 1991), and that IT effectiveness is a social phenomenon linked to existing organizational processes (DeSanctis and Poole, 1994). It is also consistent with recent observations that IT effects arise from the ability to lever intangible human and business resources (Powell and Dent-Mitcallef, 1997). Together, these contributions support the proposition that performance effects of IT are related to applications that enhance inherent management processes and decision structures reflected in an organization's strategic decision making approaches. As strategy is formed by a firm's important resource committing decisions (Mintzberg, 1978), the ability of IT to interact with different strategic decision making approaches should affect organizational performance.

More specifically, lower costs of IT enhanced communication can make mutual adjustment processes more efficient (Thompson, 1966; Galbraith, 1977; Mintzberg, 1983), and thereby support decentralization and less hierarchical organizational structures (Horvath and Fulk, 1994). The application of IT provides instantaneous and more accurate intelligence that combined with decentralized decision making enables faster and better decision outcomes (Huber, 1990). DeSanctis and Jackson (1994) provide partial support for this when they show that electronic communication facilitates horizontal coordination in decentralized organizational structures.

Other studies investigate particular attributes of communication technologies that support learning and creativity. For example, Sproull and Kiesler (1986) find that use of e-mail speeds and extends the flow of information across organizations. Electronic communication is less formal, reduces organizational barriers, and conveys information that would otherwise not have been submitted. Similarly, experimental research finds that electronic communication enhances innovation particularly in larger dispersed groups (Gallupe et al., 1992). These results are consistent with Zuboff's (1988) description of the 'informed' organization, where use of IT can induce new innovative business initiatives. Cohen and Levinthal (1990) suggest that innovation depends on an organization's

ability to absorb knowledge and ideas from the external environment, as well as exchange of information between the firm's internal knowledge centers. In other words, both internal and external communication capabilities should affect innovative behavior and organizational performance.

In summary then, there appears to be at least three ways in which IT can impose direct performance effects and interact with an organization's strategic decision making approaches: (1) increase speed and accuracy that improve decision outcomes, (2) facilitate coordination and responsiveness, and (3) induce learning and innovative behaviors.

1.2. Strategic decision making approaches

Strategy is considered an outcome of planned as well as emergent strategic decision making (Hill and Jones, 1998). The strategic management paradigm sees strategy as formulated and implemented through a centralized strategic planning approach based on rational analysis (Schendel and Hofer, 1979). Strategy is also conceived as an emergent or decentralized approach where strategy is formed as a pattern of important organizational decisions (Mintzberg, 1978, 1994). The following briefly discusses the perspectives underlying these two approaches to strategic decision making.

The strategic planning approach conceives strategy as a formal process by which top management establishes decision rules to guide and coordinate the organization's longer term actions (Lorange and Vancil, 1977; Ansoff, 1988). Schendel and Hofer (1979) outline the strategic management paradigm by incorporating a number of rational steps in a centralized strategy development process, e.g. goal formulation, competitive analysis, strategy formulation, evaluation, implementation, and control. This approach is reflected in large parts of the strategy literature (Porter, 1980; Richards, 1986; Goold and Quinn, 1993).

The emergent or decentralized strategy approach is conceived as a political process managed by coalitions of organizational decision makers formed around emerging strategic issues (Narayanan and Fahey, 1982). It is also conceptualized as a social learning process, where managers can take actions based on experiences gained in different parts of the organization (Normann, 1985; Burgelman, 1988). Middle managers' resource committing decisions develop the capabilities that eventually shape the firm's strategic options (Bower, 1982; Noda and Bower, 1996). Managers can often take independent actions that influence the firm's strategic development, so strategy can emerge even without the engagement of top management (Mintzberg, 1994). In other words, decentralized strategic decision making practices can involve managers through autonomy that allows them to take actions that have strategic consequences, and through their participation in the firm's important strategic decisions.

1.3. Relationships between IT, strategy approaches and organizational performance

The emergence of new network technologies and expansion of the Internet can improve an organization's internal and external communication capabilities. Lower information processing costs make coordination and mutual adjustment processes more efficient, and therefore improve organizational performance (Horvath and Fulk, 1994; DeSanctis and Jackson, 1994). The performance effects of computer networks should be particularly

pronounced in organizations that adhere to decentralized strategic decision making, because IT increases the speed and quality of dispersed decisions (Huber, 1990).

Together, IT enhanced communication and management involvement through autonomy and participation should reduce inhibiting organizational barriers, facilitate creativity, and support opportunistic business development (Sproull and Kiesler, 1986; Zuboff, 1988; Gallupe et al., 1992). New network technologies and the Internet should also increase the organization's capacity to absorb external knowledge and support cross-fertilization of ideas via electronic communication (Cohen and Levinthal, 1990). Hence, use of IT can enhance the organization's internal and external communication capabilities and stimulate innovation. The effect on innovation should be enforced in organizations that adhere to decentralized strategic decision making, because exchange of information and involvement stimulate creativity and learning. These arguments lead to the following hypotheses.

Hypothesis 1.1. The use of computer networks to enhance internal communication (Intranet use) is associated with higher organizational performance.

Hypothesis 1.2. Decentralized strategic decision making enforces the positive relationship between use of computer networks to enhance internal communication (Intranet use) and organizational performance.

Hypothesis 2.1. The use of the Internet to facilitate external communication (Internet use) is associated with higher organizational performance.

Hypothesis 2.2. Decentralized strategic decision making enforces the positive relationship between the use of the Internet to enhance external communication (Internet use) and organizational performance.

It is argued that decentralized decision structures are more effective in dynamic environments, because the benefits of mutual adjustment practices are more significant when changes in market conditions are frequent and abrupt. Similarly, a more complex environmental setting requires specialized organizational units and dispersion of decision power to effectively handle decision making situations (Thompson, 1966; Mintzberg, 1983). In dynamic and complex industries, strategic decisions require that more information and data is processed at the decision nodes, but a decentralized decision structure reduces the need for hierarchical communication while computer networks facilitate lateral communication (Galbraith, 1977, 1994). Consequently, IT enhanced communication should be particularly effective in organizations that adhere to decentralized strategic decision making and operate in more dynamic and complex industries. This leads to the following hypotheses.

Hypothesis 3.1. The performance interaction between use of computer networks to enhance internal communication (Intranet use) and decentralized strategic decision making is more pronounced in more dynamic and complex environments.

Hypothesis 3.2. The performance interaction between use of the Internet to facilitate external communication (Internet use) and decentralized strategic decision making is more pronounced in more dynamic and complex environments.

The strategic management process engages the organization's functional managers in internal cross functional communication and discussions that help align strategic thinking and thereby reduce the potential of conflicts among dispersed decision makers (Ansoff, 1988). The communication of new knowledge and ideas from external entities can fertilize

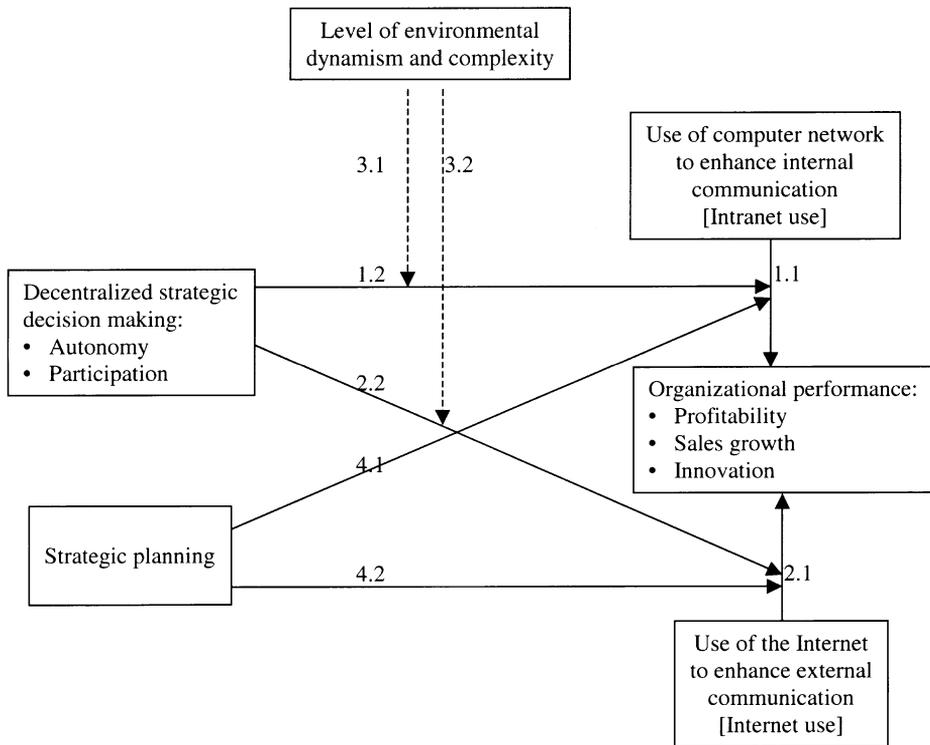


Fig. 1. Research model and hypotheses.

the strategic planning discussions and may lead to better strategic alternatives. These arguments underpin the following hypotheses.

Hypothesis 4.1. The use of computer networks to enhance internal communication (Intranet use) and strategic planning interact and have a positive association with organizational performance.

Hypothesis 4.2. The use of the Internet to enhance external communication (Internet use) and strategic planning interact and have a positive association with organizational performance.

These hypotheses are incorporated into a research model (Fig. 1). The Section 2 describes an empirical study performed to test the hypotheses.

2. Method

Archival data on communication enhancing uses of IT and different strategic decision making approaches were not readily available. Therefore, the research program set out to develop construct measures based on questionnaire responses obtained from corporate executives operating in pre-selected industrial settings.

2.1. Sample selection and data collection

Two distinct industrial groups were identified, one representing companies in more dynamic and complex manufacturing industries and another representing companies operating in less dynamic and complex industries. An extensive analysis of dynamism and complexity indices of four digit SIC industries included in Compustat was used to determine the industrial groups. Consumer goods in meatpacking, flour and cereals, sugar products, beverages, various food items, men's and women's clothing, and household furniture were identified as low dynamism and complexity industries. Electronic computers, data storage devices, computer terminals, calculators, industrial machinery, and measuring and analytical instruments were identified as industries with high levels of dynamism and complexity. Hence, the initial research sample consisted of US-based companies operating in these two industry groups extracted from Compustat.

Annual reports were obtained from the companies included in the two industry groups, and analyzed to ensure that the sample consisted of single business firms and corporate divisions. 360 business entities were identified from this process, 242 of which were single business firms and 188 corporate business divisions. A questionnaire was mailed to the sales executive in each of the 360 business entities during the fall of 1997. The mailing was supplemented by a soliciting phone call, and a second mailing to non-respondents after two months. Sales executives were used as prime respondents, because as members of the top management team, they have high awareness of the communication enhancing use of IT in their organizations and have intimate knowledge about the companies' strategic decision making processes (Floyd and Wooldridge, 1992).

2.2. Measures and instrumentation

Use of computer networks to enhance internal communication (Intranet use) refers to data processing and information exchange that allow managers within the organization to communicate among each other. The measure indicates the extent to which managers use electronic mail, computer networks, and other electronic means to communicate across the organization. Use of the Internet to enhance external communication (Internet use) refers to the extent to which managers use the Internet or other data interfaces to obtain work related information and communicate with customers, suppliers and other partners. The specific item scales adopted in the measures were developed through discussions with executives in four firms operating in the selected industries about the IT-related communication practices in their organizations

Decentralized strategic decision making approaches are measured on the basis of Aiken and Hage's centralization constructs (Price, 1972), while the scales are adapted to reflect strategic decisions, e.g. new market activities, product/service developments, and changes in practices and policies (Miller, 1987). Decentralized strategic decision making is measured by two constructs, autonomy and participation. Autonomy reflects the extent to which managers, one level below the top management team can take strategic actions on their own. Participation reflects the extent to which managers are involved in the firm's strategic decisions. Strategic planning reflects the organization's adherence to the rational process elements of the strategic management paradigm (Schendel and Hofer, 1979). The

measure is based on recently developed and tested scales indicating the organization's emphasis on mission statement, long-term goals, plans, and control (Boyd and Reuning-Elliott, 1997).

Organizational performance is based on self-assessments of the organization's profitability and sales growth relative to close competitors (Dess and Robinson, 1984), and the level of innovation in the organization. Innovation reflects the ability to be a first user of new ideas, devices, systems, policies, programs, processes, products, and services (Price, 1972; Damanpour, 1991; Scott and Bruce, 1994).

Environmental dynamism reflects frequent changes in business conditions and is measured by the variability in net sales and operating income in the focal industries over a 10 year period (Keats and Hitt, 1988). Environmental complexity reflects the diversity of supplier and buyer relationships in the focal industries (Dess and Beard, 1984). The item scales were incorporated in a questionnaire and construed to obtain unbiased responses (Dillman, 1978). Appendix A provides a detailed description of the measures. Initial interviews with executives in four firms operating in the sampled industries supported the development of a draft questionnaire that subsequently was pre-tested by 20 managers in the four firms. The pre-test showed satisfactory inter-rate reliability and only led to minor changes in the wording of the questionnaire. A revised version of the questionnaire was mailed to the 360 executives identified in the initial sample.

3. Analyzes and results

One hundred and eighty five questionnaires were returned from the 360 business entities solicited corresponding to a response rate of 51.4%. Ninety-seven of the responses came from entities operating in industries with low levels of dynamism and complexity, and the remaining 88 responses came from industries with high levels of dynamism and complexity. The data was analyzed for non-response biases on total sales, sales growth and profitability. No biases were found. The validity of the model constructs was assessed by exposing all the item responses to factor analysis. The analysis supported distinct constructs of Intranet use, Internet use, autonomy, participation, and strategic planning. Chronbach's alpha was 0.83 for the Intranet construct, 0.82 for Internet use, 0.70 for autonomy, 0.85 for participation and 0.84 for strategic planning, which was considered satisfactory (Nunnally and Bernstein, 1994).

Descriptive statistics are provided in Tables 1 and 2 for the two sub-samples consisting of entities in the low and high dynamism industry groups, respectively. There is a significant positive relationship between Intranet use and innovation, and between Internet use and profitability in the less dynamic and complex industries (Table 1). In the more dynamic and complex industries there are significant positive relationships between both the IT constructs, Intranet use and Internet use, and the performance measures of profitability and innovation (Table 2).

A comparison of statistics from the two sub-samples reveals a difference in the level of Intranet and Internet use in the two industry groups. Variance analysis confirms that entities operating in the industries with less dynamism and complexity have significantly

Table 1

Descriptive statistics of major variables and correlation analysis based on sample from less dynamic and complex industries ($n = 97$) ($^+P < 0.10$; $*P < 0.05$; $**P < 0.01$)

	Mean	S.D.	1	2	3	4	5	6	7
(1) Intranet use	9.87	3.30							
(2) Internet use	4.65	1.69	0.37**						
(3) Autonomy	12.84	4.15	0.10	0.16					
(4) Participation	9.56	3.26	-0.00	-0.08	0.05				
(5) Strategic planning	17.83	5.12	0.18 ⁺	0.09	0.07	0.06			
(6) Profitability	3.86	1.15	0.12	0.24*	-0.08	0.09	0.30**		
(7) Sales growth	3.99	1.13	0.03	0.09	0.05	0.29**	0.19*	0.39**	
(8) Innovation	11.01	1.81	0.24*	-0.01	0.14	0.30**	0.20*	0.18 ⁺	0.11

lower use of Intranet and Internet compared to entities operating in the more dynamic and complex industries.

The hypotheses were tested by exposing the construct measures from the two subsamples to multiple regression analyzes with the three organizational performance indicators, profitability, sales growth and innovation, as dependent variables, and the two IT-constructs, Intranet use and Internet use, as independent variables. The regression analyzes were extended by including interaction terms between the two IT-constructs and the three strategy constructs, autonomy, participation, and strategic planning, as independent variables to assess confounding influences of these strategic decision making approaches. The strategy constructs, autonomy, participation, and strategic planning were included in the regressions as control variables to capture the direct effects of the strategy approaches.

The study considered a number of other control variables. Organizational size can affect performance, as large organizations typically possess more resources. The natural logarithm of total assets was used as control variable, because the sample is somewhat skewed toward larger companies. The percentage of international sales was considered as control variable to assess potential effects of more complex global organizations. Capital intensity may affect the extent to which companies invest in IT. This potential effect was assessed by using the ratio of fixed assets to total equity as control variable. The performance measures reflect the respondents' standing compared to close competitors. Therefore,

Table 2

Descriptive statistics of major variables and correlation analysis based on sample from more dynamic and complex industries ($n = 88$) ($^+P < 0.10$; $*P < 0.05$; $**P < 0.01$)

	Mean	S.D.	1	2	3	4	5	6	7
(1) Intranet use	12.79	2.29							
(2) Internet use	7.44	1.67	0.51**						
(3) Autonomy	13.92	4.04	0.34**	0.22*					
(4) Participation	19.22	3.48	0.23 ⁺	0.08	0.27*				
(5) Strategic planning	17.23	4.38	0.15	0.09	0.16	0.34**			
(6) Profitability	3.58	1.26	0.27*	0.21*	0.36**	0.16	0.37**		
(7) Sales growth	3.68	1.40	0.20 ⁺	0.10	0.36**	0.25*	0.38**	0.73**	
(8) Innovation	10.88	1.79	0.19 ⁺	0.22*	0.36**	0.44**	0.36**	0.42**	0.48**

Table 3

Multiple regression analyzes based on sample from less dynamic and complex industries ($n = 97$) (Standardized regression coefficients) ($^+P < 0.10$; $*P < 0.05$; $**P < 0.01$)

Dependent variable	Profitability		Sales growth		Innovation	
	General	Fitted	General	Fitted	General	Fitted
<i>Independent variables</i>						
Ln(Assets)	0.34**	0.37**	0.03	–	–0.04	–
Intranet use	–0.08	–0.07	–0.08	–0.08	0.29*	0.29**
Internet use	0.25 ⁺	0.18⁺	0.10	0.10	–0.07	–0.04
Autonomy	–0.12	–	0.04	0.01	0.10	–
Participation	0.08	–	0.29*	0.29**	0.27*	0.26*
Strategic planning	0.20 ⁺	0.07	0.29 ⁺	0.18⁺	0.11	–
<i>Interaction terms</i>						
Intranet use by autonomy	0.05	–	–0.21 ⁺	–0.21⁺	0.12	–
Internet use by autonomy	–0.00	–	0.18	–	0.08	–
Intranet use by participation	0.08	–	0.03	–	–0.24*	–0.19⁺
Internet use by participation	–0.06	–	–0.11	–	0.25*	0.23*
Intranet use by planning	–0.22 ⁺	–0.25*	0.12	–	0.07	–
Internet use by planning	–0.03	–	0.09	–	–0.05	–
Multiple R^2	0.55	0.52	0.44	0.40	0.51	0.46
Adjusted R^2	0.20	0.23	0.07	0.09	0.15	0.17
F -significance	0.00	0.00	0.11	0.03	0.01	0.00
F -significance of ∇R^2	0.57	0.02	0.26	0.09	0.26	0.06

the research design eliminates the need for control variables on industry specific effects from munificence, product differentiation, advertising intensity, etc.

The control variables were evaluated by performing the regression analyzes with and without the control variables and observing whether meaningful effects on the regression coefficients occurred (Kleinbaum et al., 1998). Only organizational size had an effect and was retained as control variable in the subsequent regression analyzes, whereas the other control variables were discarded. The significance of interaction terms in the regression analyzes were evaluated on the basis of t -statistics, while the aggregate inclusion of interaction terms was assessed by an F -statistic indicating whether the variance explained increases significantly (Aiken and West, 1991; Kleinbaum et al., 1998). Based on the results of the general regression analyzes, the regression equations were re-specified into finally fitted models. Tables 3 and 4 show the results of the regression analyzes.

All the fitted models are statistically significant at the 5% confidence. The adjusted R^2 statistic range between .17 and .33, which is consistent with contemporary management studies.

Use of Intranet to enhance internal communication has a significant positive relationship to innovation, and the interaction between Internet use and participation has a significant positive relationship to innovation in industries with low levels of dynamism and complexity (Table 3). There is also indication of a direct positive association between Internet use and profitability in this industrial setting. These results provide partial support for hypotheses 1.1, 2.1 and 2.2.

Table 4

Multiple regression analyzes based on sample from more dynamic and complex industries ($n = 88$) (Standardized regression coefficients) ($^+P < 0.10$; $*P < 0.05$; $**P < 0.01$)

Dependent variable	Profitability		Sales growth		Innovation.	
	General	Fitted	General	Fitted	General	Fitted
<i>Independent variables</i>						
Ln(Assets)	0.16	0.16	0.04	–	0.16	0.21*
Intranet use	0.16	0.20⁺	0.20	0.13	0.04	–
Internet use	0.06	–	–0.06	–	0.13*	0.22*
Autonomy	0.10	0.04	0.20	0.14	0.00	–
Participation	0.01	–	0.06	–	0.09	0.16
Strategic planning	0.29*	0.33**	0.17 ⁺	0.30**	0.35*	0.23*
<i>Interaction terms</i>						
Intranet use by autonomy	0.38*	0.24*	0.41*	0.26*	0.19	–
Internet use by autonomy	–0.16	–	–0.22	–	0.05	–
Intranet use by participation	–0.23	–	0.12	–	0.07	–
Internet use by participation	0.07	–	0.05	–	0.32 ⁺	0.30*
Intranet use by planning	0.10	–	–0.08	–	0.03	–
Internet use by planning	–0.01	–	0.26	–	–0.26	–
Multiple R^2	0.58	0.55	0.57	0.53	0.67	0.61
Adjusted R^2	0.23	0.26	0.22	0.25	0.35	0.33
F -significance	0.00	0.00	0.00	0.00	0.00	0.00
F -significance of ∇R^2	0.39	0.04	0.21	0.03	0.05	0.01

In more dynamic and complex industries, use of Intranet to enhance internal communication has a significant direct relationship to profitability, while the interaction terms between Intranet use and autonomy are positively associated with profitability as well as sales growth. As is the case in the low dynamism setting, use of the Internet to enhance external communication and interaction between Internet use and participation have significant positive relationships to innovation in more dynamic and complex industries (Table 4). These results provide partial support for hypothesis 1.1, 1.2, 2.1, and 2.2, as well as hypotheses 3.1 and 3.2.

The interaction terms between strategic planning and Intranet use and Internet use do not show any significant positive associations to performance as hypothesized. In fact, the study finds a significant negative interaction effect on profitability between Intranet use and strategic planning. Hence, the study finds no support for hypotheses 4.1 and 4.2, and the evidence even contradicts hypothesis 4.1.

4. Discussion and implications

The analyzes indicate that use of information technology to enhance an organization's internal and external communication capabilities is positively associated with organizational performance in different industrial environments. However, the performance relationships differ between the industrial settings characterized by low and high levels

of dynamism and complexity. In the less dynamic and complex industries, use of Intranet and the Internet has significant direct relationships to organizational performance. There are indications that Intranet use is positively associated with profitability in the more dynamic and complex industries, and Intranet use combined with autonomous strategic decision making is positively related to profitability and sales growth in this industrial setting. These findings are consistent with the propositions that IT enhanced internal communication capabilities improve speed, information accuracy, and hence strategic decision outcomes (Huber, 1990), and improve coordination of strategic actions (Galbraith, 1994; Fulk and DeSanctis, 1995).

Use of the Internet has a positive association with profitability in the less dynamic and complex industries, but this relationship is not reproduced in the more dynamic and complex industrial setting. IT generally has a lower application and more varied use among firms operating in the less dynamic and complex industries, which may explain why high users of IT have statistically significant relationships between the Internet constructs and profitability in this sub-sample. Use of the Internet to enhance external communication, and the interaction terms between Internet use and participation, have significant positive associations with innovation in both the industrial settings under investigation. These results support the contention that IT enhanced external communication capabilities facilitate an organization’s ‘absorptive capacity’ and learning processes across industrial environments (Cohen and Levinthal, 1990). The results from the study are summarized in Fig. 2 and Table 5.

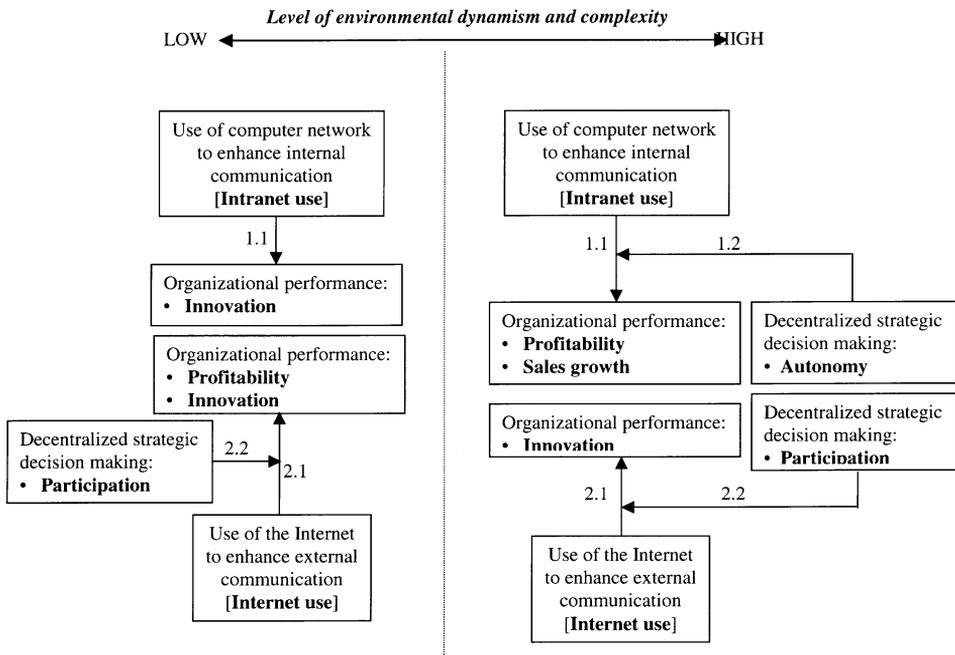


Fig. 2. Research results and test of hypotheses.

Table 5
Testing the hypothesized performance relationships

#	Hypothesis	Outcome (industrial setting)
(1.1)	The use of computer networks to enhance internal communication (Intranet use) is associated with higher organizational performance	Partially supported
(1.2)	Decentralized strategic decision making enforces the positive relationship between use of computer networks to enhance internal (in dynamic industries) communication (Intranet use) and organizational performance	Supported
(2.1)	The use of the Internet to facilitate external communication (Internet use) is associated with higher organizational performance	Partially supported
(2.2)	Decentralized strategic decision making enforces the positive relationship between the use of the Internet to enhance external communication (Internet use) and organizational performance	Supported
(3.1)	The performance interaction between use of computer networks to enhance internal communication (Intranet use) and decentralized strategic decision making is more pronounced in highly dynamic and complex environments	Supported
(3.2)	The performance interaction between use of the Internet to facilitate external communication (Internet use) and decentralized strategic decision making is more pronounced in highly dynamic and complex environments	Not supported (across industries)
(4.1)	Use of computer networks to enhance internal communication (Intranet use) and strategic planning interact and have a positive association with organizational performance	Not supported (in less dynamic industries)
(4.2)	Use of the Internet to enhance external communication (Internet use) and strategic planning interact and have a positive association with organizational performance	Not supported (across industries)

These findings give new and potentially important insights to the performance effects of communication enhancing uses of information technology particularly as industries become more knowledge intensive and exposed to dynamic competition (Thomas, 1996). The results indicate that economic performance effects may arise from the use of the Internet in industries characterized by low levels of dynamism and complexity, whereas internal communication through Intranet is associated with higher profitability in more dynamic and complex settings. Furthermore, Intranet use combined with adherence to an autonomous strategic decision making approach has a significant positive relationship to profitability and sales growth in the highly dynamic and complex industries. Conversely, innovative behaviors are found to be associated with use of the Internet to enhance external communication combined with adherence to a participatory strategic decision making approach across the industrial settings investigated. In summary, the study observes direct and positive performance relationships to Intranet and Internet use across industrial settings, but the performance relationships are generally enforced when combined with decentralized strategic decision making approaches in the more dynamic and complex industrial settings. Although, this observation is of a general character, it seems to indicate that effective use of IT is associated with decentralized strategic decision structures in increasingly dynamic and complex industries.

One of the obvious limitations of the study is that it cannot impose a strict causality on the IT-performance relationship, i.e. it is unclear whether use of IT leads to better performance, or economic results provide the incentives to invest in IT. However, the IT constructs in this study reflect actual use of communication enhancing IT, which does not necessarily have a straight relationship to IT investment in the first place. Furthermore, the study considers IT an integral part of an organization's characteristics in accordance with an 'adaptive structuration' perspective (DeSantis and Poole, 1994). Consequently, the findings should be relevant whether organizational performance is IT driven, or is achieved through IT enhancement of existing organizational processes.

The study is somewhat hampered by the fact that it analyzes the statistical significance of a relatively large number of predictors based on a limited number of observations. In some instances this leads to large discrepancies between the regressions' multiple and adjusted R^2 , particularly in the regression on sales growth in the low dynamism environment. Obviously, the results in this particular regression analysis should be taken with a grain of salt. Nonetheless, the paper presents some interesting preliminary analyzes of the performance association of communication enhancing uses of IT, and interactions with different contemporary strategic decision making approaches. Whereas, most of the regression results appear statistically robust, more research is needed to test the generalizability of the findings. There might also be a need to examine the mechanics of the alleged performance relationships further. Whereas the study theorizes about the performance relationships, it does not provide detailed descriptions of how Intranet and Internet uses improve operational outcomes and business development in the different industrial settings. Another appropriate venue for future research efforts may be to assess how use of IT and strategic decision structures should be adapted as industrial environments generally change towards increasingly dynamic and complex settings.

The major contribution of this study is to investigate relevant aspects of the relationship between organizational performance, communication enhancing uses of IT, and strategic

decision making approaches in different industrial environments. The study provides preliminary insights on the important interactions between communication enhancing uses of IT and decentralized strategic decision making approaches, and how these IT-performance effects differ across industrial settings.

5. Conclusions

This study investigates the direct performance relationships of information technology used to enhance internal and external communication capabilities, and the confounding influences of different strategic decision making approaches. The paper reports an empirical test of a model that integrates use of Intranet to enhance internal communication and use of the Internet to enhance external communication with decentralized strategic decision making in the form of autonomy and participation, and strategic planning approaches. The model is tested on the basis of samples collected from two distinct industrial settings characterized by relatively low and high levels of dynamism and complexity.

The study indicates that there are significant positive associations between the use of communication enhancing information technology and organizational performance across industrial environments, but the performance relationships differ across industrial settings. In industries characterized by low levels of dynamism and complexity, use of the Internet to enhance external communication has a direct and positive relationship to profitability. Use of Intranet to enhance internal communication has a direct relationship to innovation, while Internet use combined with participatory strategic decision making is associated with higher innovation in the same industrial setting. In industries characterized by high levels of dynamism and complexity, use of Intranet to enhance internal communication in association with autonomous strategic decision making has a positive association with profitability and sales growth. Use of the Internet to enhance external communication shows a direct and positive relationship to innovation, and the performance relationship of Internet use is enforced in organizations that adhere to participatory strategic decision making also in this industrial setting. The study finds no positive interactions between communication enhancing uses of IT and the strategic planning approach. Autonomous strategic decision making seems to improve the economic effects of Intranet use, while participatory strategic decision making seems to support the innovative outcome of Internet use particularly in the dynamic and complex industrial settings.

These findings provide some evidence that the use of IT to enhance internal and external communication capabilities, may give rise to competitive advantage across industrial settings characterized by different levels of dynamism and complexity. However, Intranet and Internet use combined with decentralized strategic decision structures seem to furnish excess performance particularly in more dynamic and complex industrial settings.

Appendix A. Item scales used in the study

A.1. *Intranet use*

- (1) To what extent do managers use electronic mail, etc. to communicate with different

people across the organization? (2) To what extent do managers access information and data from other parts of the firm via the computer network? (3) To what extent do managers use electronic means to exchange information with manufacturing, engineering, and other functional areas? ((1) All the time — (5) never.)

A.2. Internet use

(4) To what extent do managers use the Internet or similar external data networks to obtain work related information? (5) To what extent do managers use the Internet or other data interfaces to communicate with customers, suppliers, and other partners? ((1) All the time — (5) never.)

A.3. Strategic planning

(6) What emphasis does your organization put on the development of a mission statement? (7) What emphasis does your organization put on long-term plans? (8) What emphasis does your organization put on annual goals? (9) What emphasis does your organization put on short-term action plans? (10) What emphasis does your organization put on on-going evaluations of strategic objectives? ((1) No emphasis — (5) very strong emphasis.)

A.4. Autonomy

(11) Managers do not start important market activities unless top management has approved the decision, (12) managers only market to new major customer segments with approval from top management, (13) top management must approve new product and service developments before they can be initiated, (14) managers cannot introduce new practices without approval from top management, (15) approval from top management is always needed before new internal capabilities can be developed ((1) Definitely true — (5) definitely false.)

A.5. Participation

(16) To what extent do managers participate in decisions about major changes in the firm's/division's market position? (17) To what extent do managers participate in decisions about the firm's/division's moves into new major customer segments and market areas? (18) To what extent do managers participate in decisions about new major products and service introductions? (19) To what extent do managers participate in decisions about the development of new important capabilities? (20) To what extent do managers participate in decisions to adopt new policies and practices? ((1) Always — (5) never.)

A.6. Organizational performance

A.6.1. Profitability

(21) Please assess how profitable your firm/division has been relative to your close competitors over the past three years. ((1) Top 20% — (5) lowest 20%.)

A.6.2. Sales growth

(22) Please assess how sales growth has been in your firm/division relative to your close competitors over the past three years. ((1) Top 20% — (5) Lowest 20%.)

A.6.3. Innovation

(23) To what extent do suggestions to do things differently arise in your organization?
 (24) To what extent is the way work is done in your organization being changed? (25) To what extent are new ideas converted into viable business opportunities in your organization? ((1) Always — (5) never.)

A.7. Industrial environments

A.7.1. Dynamism

Dynamism index = $S^{-1} + O^{-1}$, where instability in net sales (S) is calculated as the standard error of the annual net sales regression slope coefficient divided by the mean value of net sales; 1986–1995, and instability of operating income (O) is calculated as the standard error of the annual operating income regression slope coefficient divided by the mean value of operating income; 1986–1995 (Data source: Compustat, Dow Jones, 1996).

A.7.2. Complexity

Complexity index = $C^{-1} + D^{-1}$, where input concentration (C) is calculated as an index reflecting the extent to which other industries supply inputs to the industry; 1987 ($C_I = (\sum_{\forall j} I_{ij}^2) / (\sum_{\forall j} I_{ij})^2$; concentration of input in industry i , I_{ij} = the dollar value in producers' prices of commodities from industry j used by industry I), and product diversity (D) is calculated as an index reflecting the extent to which the industry supplies products to other industries; 1987 ($D_i = (\sum_{\forall j} P_{ij}^2) / (\sum_{\forall j} P_{ij})^2$; diversity of output in industry i , P_{ij} = the dollar value in producers' prices of commodities sold from industry i to industry j) (Data source: US Bureau of Economic Analysis, Benchmark Input–Output Accounts of the US 1987, 1994).

References

- Aiken, L.A., West, S.G., 1991. Multiple Regression: Testing and Interpreting Interactions. Sage, Newbury Park, CA.
- Ansoff, H.I., 1988. The New Corporate Strategy. Wiley, New York.
- Barney, J., 1991. Firm resources and sustained competitive advantage. *Journal of Management* 17, 99–120.
- Bettis, R.A., Hitt, M.A., 1995. The new competitive landscape. *Strategic Management Journal* 16, 7–19.
- Bower, J.L., 1982. Managing the Resource Allocation Process. Harvard Business School Press, Boston, MA.
- Boyd, B.K., Reuning-Elliott, E., 1997. A measurement model of strategic planning. *Strategic Management Journal* 19, 181–192.
- Brynjolfsson, E., 1993. The productivity paradox of information technology. *Communications of the ACM* 36, 67–77.
- Brynjolfsson, E., Hitt, M., 1996. Paradox lost? Firm-level evidence on the returns to information systems spending. *Management Science* 42, 541–558.
- Brynjolfsson, E., Malone, T.W., Gurbaxani, V., Kambil, A., 1994. Does information technology lead to smaller firms? *Management Science* 40, 1628–1644.

- Burgelman, R.A., 1988. Strategy making as a social learning process: the case of internal corporate venturing. *Interfaces* 18, 74–85.
- Clemons, E.K., Reddi, S.P., Row, M.C., 1993. The impact of information technology on the organization of economic activity: The move to the middle: Hypothesis. *Journal of Management Information Systems* 10, 9–35.
- Cohen, W.M., Levinthal, D.A., 1990. Absorptive capacity: A new perspective on learning and innovation. *Administrative Science Quarterly* 35, 128–152.
- Damanpour, F., 1991. Organizational innovation: A meta-analysis of effects of determinants and moderators. *Academy of Management Journal* 34, 555–590.
- DeSanctis, G., Jackson, B.M., 1994. Coordination of information technology management: Team-based structures and computer-based communication systems. *Journal of Management Information Systems* 10, 85–110.
- DeSanctis, G., Poole, M.S., 1994. Capturing the complexity in advanced technology use: Adaptive structuration theory. *Organization Science* 5, 121–147.
- Dess, G.G., Beard, D.W., 1984. Dimensions of organizational task environments. *Administrative Science Quarterly* 29, 52–73.
- Dess, G.G., Robinson, R.B., 1984. Measuring organizational performance in the absence of objective measures: The case of privately-held firm and conglomerate business unit. *Strategic Management Journal* 5, 265–273.
- Dillman, D.A., 1978. *Mail and Telephone Surveys: The Total Design Method*. Wiley, New York.
- Floyd, S.W., Wooldridge, B., 1992. Middle management involvement in strategy and its association with strategy type. *Strategic Management Journal* 13, 153–167.
- Fulk, J., DeSanctis, G., 1995. Electronic communication and changing organizational forms. *Organization Science* 6, 337–349.
- Galbraith, J.R., 1977. *Organization Design*. Addison-Wesley, Reading, MA.
- Galbraith, J.R., 1994. *Competing with Flexible Lateral Organizations*. 2nd ed. Addison-Wesley, Reading, MA.
- Gallupe, R.B., Dennis, A.R., Cooper, W.H., Nunamaker, J.F., 1992. Electronic brainstorming and group size. *Academy of Management Journal* 35, 350–369.
- Gould, M., Quinn, J.J., 1993. *Strategic Control: Establishing Milestones for Long Term Performance*. Addison-Wesley, Reading, MA.
- Gurbaxani, V., Whang, S., 1991. The impact of information systems on organizations and markets. *Communications of the ACM* 34, 59–73.
- Hill, C.W.L., Jones, G.R., 1999. *Strategic Management: An Integrative Approach*. 4th ed. Houghton Mifflin, Boston, MA.
- Horwarth, A.T., Fulk, J., 1994. Information technology and the prospects for organizational transformation, in B. Kovacic (ed.), *New approaches to organizational communication*, Albany, NY: State University of New York Press.
- Huber, G.P., 1990. A theory of the effects of advanced information technologies on organization design, intelligence, and decision making. *Academy of Management Review* 15, 47–71.
- Keats, B., Hitt, M.A., 1988. A causal model of linkages among environmental dimensions, macro organizational characteristics, and performance. *Academy of Management Journal* 31, 570–598.
- Kettinger, W.J., Grover, V., Guha, S., Segars, A.H., 1994. Strategic information systems revisited: a study in sustainability and performance. *MIS Quarterly* 18, 31–58.
- Kleinbaum, D.G., Kupper, L.K., Muller, K.E., Nizam, A., 1998. *Applied Regression Analysis and Other Multivariate Methods*. 3rd ed. Duxbury Press, Pacific Grove, CA.
- Lorange, P., Vancil, R.F., 1977. *Strategic Planning Systems*. Prentice-Hall, Englewood Cliffs, NJ.
- Malone, T.W., Rochardt, J.F., 1993. How will information technology reshape organizations? Computers as coordination technology, in S.P. Bradley, J. Hausman and R.L. Nolan (eds.), *Globalization, technology, and competition: the fusion of computers and telecommunications in the 1990s*, Boston: Harvard Business School Press.
- Malone, T.W., Yates, J., Benjamin, R.I., 1987. Electronic markets and electronic hierarchies. *Communication of the ACM* 30, 484–497.
- Miller, D., 1987. The structural and environmental correlates of business strategy. *Strategic Management Journal* 8, 55–76.
- Mintzberg, H., 1978. Patterns in strategy formation. *Management Science* 24, 934–948.
- Mintzberg, H., 1983. *Structures in Five: Designing Effective Organizations*. Prentice-Hall, Englewood Cliffs, NJ.
- Mintzberg, H., 1994. The fall and rise of strategic planning. *Harvard Business Review* 72, 107–114.

- Narayanan, V., Fahey, L., 1982. The micro-politics of strategy formulation. *Academy of Management Review* 7, 25–34.
- Noda, T., Bower, J.L., 1996. Strategy making as iterated processes of resource allocation. *Strategic Management Journal* 17, 159–192.
- Normann, R., 1985. Developing capabilities for organizational learning. In: Pennings, J.M. (Ed.). *Organizational Strategy and Change: New Views on Formulating and Implementing Strategic Decisions*. Jossey-Bass, San Francisco.
- Nunnally, J.C., Bernstein, I.H., 1994. *Psychometric Theory*. 3rd ed. McGraw-Hill, New York.
- Orlikowski, W.J., Robey, D., 1991. Information technology and the structuring of organizations. *Information Systems Research* 2, 143–169.
- Porter, M.E., 1980. *Competitive Strategy*. Free Press, New York.
- Powell, T.C., Dent-Mitcallef, A., 1997. Information technology as competitive advantage: The role of human, business, and technology resources. *Strategic Management Journal* 18, 375–406.
- Price, J.L., 1972. *Handbook of Organizational Measurement*. Heath, Lexington, MA.
- Richards, M.D., 1986. *Setting Strategic Goals and Objectives*. 2nd ed. West Publishing, St. Paul, MN.
- Schendel, D., Hofer, C., 1979. *Strategic Management: A New View of Business Policy and Planning*. Little Brown, Boston, MA.
- Scott, S.G., Bruce, R.A., 1994. Determinants of innovative behavior: A path model of individual innovation in the workplace. *Academy of Management Journal* 37, 580–607.
- Sproull, L., Kiesler, S., 1986. Reducing social context cues: Electronic mail in organizational communication. *Management Science* 32, 1492–1512.
- Thomas, L.G., 1996. Dynamic resourcefulness and the hypercompetitive shift. *Organization Science* 7, 221–242.
- Thompson, J.D., 1966. *Organizational Action: Social Science Administration Theory*. McGraw-Hill, New York.
- Weill, P., 1992. The relationship between investment in information technology and firm performance: a study of the valve manufacturing sector. *Information Systems Research* 3, 307–333.
- Zuboff, S., 1988. *In the Age of the Smart Machine*. Basic Books, New York.