The Relationship Among Organization Structure, Information Technology and Information Processing in Small Canadian Firms

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Abstract
This study reports results obtained through a mail survey of 244 small business enterprises based in Québec. Using results from past research based on information-processing and information systems theory, we distinguish between the provision of internal and external information. Analysis of the data shows that contrary to expectations, structural organicity interacts negatively with IT to explain the provision of internal information. The specific structural dimension that contributes to this interaction effect is horizontal differentiation. Both results suggest that increasing deployment of IT improves the provision of internal information more rapidly when horizontal differentiation is low. No such interaction effect was found to explain the provision of external information.

Résumé
Cette étude présente les résultats d'une enquête portant sur 244 PME québécoises. Fondée sur les concepts de la théorie de la capacité informationnelle des entreprises et sur des hypothèses de recherche en systèmes d'information, cette étude établit une distinction entre la disponibilité de l'information interne et la disponibilité de l'information externe. L'analyse des données suggère que, contrairement à nos attentes, l'organicité structurelle des PME interagit avec les technologies de l'information pour expliquer la disponibilité de l'information du type interne. La dimension organique qui explique l'effet d'interaction est la différenciation horizontale. Nos résultats suggèrent par conséquent qu'une augmentation dans le déploiement des technologies de l'information accentue la disponibilité de l'information interne plus rapidement quand la différenciation horizontale est faible. Aucun effet d'interaction n'a pu être détecté pour expliquer la disponibilité de l'information du type externe.

Small businesses, perhaps more than other organizations, face particularly turbulent and uncertain environments (Child, 1972; Drucker, 1980). This may be explained by their limitations in securing financing and in exploiting opportunities (Timmons, 1990). Faced with increased uncertainty, an organization's response is to decrease it by developing uncertainty-reduction mechanisms. These mechanisms include organizational designs that favour the flow and processing of information the organization already possesses, and the creation or acquisition of new information.

According to the information-processing view of the firm (Connolly, 1977; Egelhoff, 1982; Galbraith, 1974; Kmetz, 1984; Tushman & Nadler, 1978) and relevant information systems literature (Bruns & McFarlan, 1987; Goodhue, Wybo, & Kirsch, 1992; Huber, 1990; Keen, 1991; Simon, 1973; Strassmann, 1990; Zuboff, 1985), two organizational design mechanisms can be used to facilitate the acquisition, analysis, and provision of information: organisational structure and information technology (IT). If, as some researchers say (Blili & Raymond, 1993; Carland, Hoy, Boulton, & Carland, 1984), small businesses perceive more uncertainty in their environment than do larger ones, they should require more information (Johnson & Kuehn, 1987). Thus, small businesses should require more information-

This research was supported by a grant from Fonds pour la Formation de Chercheurs et l'Aide à la Recherche (FCAR), research grant number 96-NC-13303. The research was conducted while the author was at Concordia University, Montreal, Quebec.
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rich organization structures and an IT capability that provides them with the information that they require. Failure to develop such capabilities handicaps small businesses (Timmons, 1990) in an environment over which they have little influence.

The effective small business must have a structural design that facilitates a rapid and an accurate assessment of its environment and an IT capability that allows for this information to be acted upon promptly. It is through the management of external information that businesses will be able to reduce the uncertainty that they perceive in their environment (Gordon & Narayanan, 1984; Sormunen, Daft, & Parks, 1985) and through the management of internal information that all other organizational resources are managed. Information and its management for small businesses has become a fundamental issue in their survival and development (Julien, 1996).

We notice that today's small businesses are investing more in IT (Carrière & Julien, 1992; Julien, 1995). They do so to increase their information-processing capacity and to remain competitive (Cafferata & Mensi, 1995; McMillan, 1987; Tornatzky & Fleischer, 1990). The issue, however, is not whether small businesses have computers, but how well they use them. It has been demonstrated that small businesses still do not have the necessary information-processing capability to satisfy their information requirements (El Louadi, 1994; Rothwell, 1984) nor do they have the necessary IT capability to acquire and process the information that they need (Lehman, 1986; Miller, 1986).

There also seems to be a consensus in the literature on the types of structures that are more appropriate in different types of environments: flexible and decentralized structures with open channels of communication are more appropriate in uncertain environments, whereas highly formalized, nonparticipative, tightly controlled, and inflexible structures are more appropriate in less uncertain environments (Duncan, 1972, 1973; Gresov, Drazin, & Van de Ven, 1989; Hrebiniak & Snow, 1980; Keller, Slocum, & Susman, 1974; Khandwalla, 1977; Randolph & Dess, 1984). Though small businesses may not have the same structural characteristics as larger organizations, they have been hypothesized to have simpler (Miller, 1986; Paulson & Stump, 1979) and less differentiated (Mintzberg, 1979) structures. Small business structures are less formal and the coordination of tasks is done under the direct supervision of the owner, founder, or entrepreneur. There is also little specialization, a low degree of bureaucratization (Leifer, 1988; Pugh, Hickson, & Hinings, 1969), and their information systems are generally primitive (Blili & Raymond, 1993). Hall, Haas, and Johnson (1967), however, seriously question the assumption that small organizations are less complex than large ones.

Thus, two fundamental mechanisms are often linked to an organization's information-processing capacity: organization structure and IT (Ogilvie, Pohlen, & Jones, 1988; Simon, 1973). In this paper, both mechanisms are considered because of their implication for organization information provision (IP), i.e., the net informational output of an organization's information processing system.

It is not clear, however, how different levels of these two mechanisms affect IP. The argument justifying our study stems from three empirical results.

First, environmental uncertainty creates more information requirements, which in turn call for more information provision. Second, in uncertain environments, some organization structures offer more appropriate configurations of work units to facilitate the effective communication and distribution of information. Third, one of the roles of IT is to provide the information and communication infrastructure needed by the organization. Today, IT may be conceived of broadly as encompassing the technologies that businesses use to acquire or create information and to make it available, thus contributing to IP. Our research question therefore is what is the effect on the degree of IP if widespread adoption of IT is observed in an organization that is mechanistic? Conversely, if we are in the presence of an organic, information-rich structure and IT is not properly deployed, what will the effect be on the requirements and provision of information? In other words, if organization structure and IT are related to IP, is there an interaction effect between them, and if so, what is its nature?

In the next section, we discuss the background of this research. The dimensions of organization structure and the concept of IP are discussed in the context of small businesses. We also review past literature on the relationships between organization structure and IP and between IT and IP. In the second section we put forth two hypotheses about the interaction between structure and IT to explain internal and external IP. In the third section we outline our methods. In the fourth and fifth sections, we analyse the data and discuss our results. We conclude with suggestions for future research and recommendations to small business managers.

Background

Dimensions of Structure

Structure is probably the most investigated organizational characteristic in both the IS and non-IS research communities. March and Simon defined organization structure as "the hierarchical relations among members of the organization." (1958, p. 170). Child (1972)

defined it in terms of the allocation of tasks and responsibilities between individual organization members and groups to ensure effective communication and integration of effort. As such, structure can be viewed as facilitating interaction and communication for the coordination and control of the organization's activities. The dimensions of structure have been conceptualized in several ways. For example, Harvey (1968) defined structure as the number of specialized subunits, the number of levels of authority, the ratio of managers and supervisors to total personnel, and the degree of program specification within the firm. Duncan (1971) defined five dimensions of structure: division of labour, impersonality, degree of participation in decision-making, hierarchy of authority, and formalization. Mintzberg (1979) suggested that organizational forms include the simple structures, the machine bureaucracies, the professional bureaucracies, the divisionalized forms, and the adhocracy forms.

At the more aggregate level, there are two schools of thought on the way organizations should be managed and structured. The classical management theory views organization structure as a hierarchy of authority where organization members operate under specific rules and regulations, and where functional roles and relationships are predefined. This view has come to be known as the mechanistic approach (Burns & Stalker, 1961). Human relations theorists focus on lateral relations between organization members and groups and increased participation of lower-level individuals in decision-making. Rules and regulations are more flexible and roles and relationships less formally defined than in the mechanistic approach. This is what has come to be described as the organic approach (Burns & Stalker, 1961).

In organization theory, two structural dimensions are considered important in the context of information dissemination (Smith, Grimm, Gannon, & Chen, 1991): decentralization and complexity (Hage, 1965). Decentralization is defined as the distribution of authority within the organization. Two important aspects of decentralization are hierarchy of authority and degree of participation in the decision-making process (Dewar, Whetten, & Boje, 1980; Fry & Slocum, 1984).

Complexity is composed of three dimensions: horizontal differentiation, vertical differentiation, and spatial differentiation (Miller & Dröge, 1986). Horizontal differentiation reflects the degree of divisionalization (Pugh, Hickson, & Hinings, 1969). Vertical differentiation measures the number of hierarchical levels or the vertical span. Spatial differentiation reflects the number of operating sites (Blau, 1970; Miller & Dröge, 1986).

Depending on the multiple combinations these dimensions assume, they can determine whether an organization has a mechanistic or an organic design (Burns & Stalker, 1961; Tung, 1979).

For the remainder of this paper, an organic structure is defined as an organizational design in which there is a high degree of participation in decision-making, a low degree of hierarchy of authority, and a high degree of complexity. Examples of organic designs include project and matrix forms of structures (Burns & Stalker, 1961). A mechanistic structure is one in which decentralization and complexity are relatively low. Examples of mechanistic structures include Mintzberg's (1979) machine bureaucracies.

Structural organicity has been measured in the context of small business both in its aggregate form, using Khandwalla's (1977) scale, by Covin and Slevin (1988, 1989, 1990) and Naman and Slevin (1993), and its component dimensions by Jennings and Seaman (1990).

Small Businesses and Information Provision (IP)

All organizations need to have information about their environment and about the state of their internal affairs. Information and its availability have become so central in organizational studies that a number of management theorists have advocated viewing organizations as information-processing entities (Egelhoff, 1982; Galbraith, 1977; Tushman & Nadler, 1978). In this theory, the congruence between the information required and the information provided is considered to be an antecedent to organizational effectiveness.

A review of the literature pertaining to information in the context of small businesses reveals that (a) small businesses suffer from a significant gap between the amount of information they need and the amount of information available to them, (b) the kind of information they spend most of their time searching for is external in nature, and (c) they do not necessarily use IT as an information-providing mechanism.

Analysing 8 categories of information in a sample of 70 small businesses based in Québec, El Louadi (1994) found a significant difference between the requirement for and the provision of information. Johnson and Kuehn (1987) found that small businesses are more preoccupied with external information than are large businesses, and they devote more than 25% of their time searching for that type of information. Rothwell (1984) found that small enterprises have a limited capacity to get relevant and up-to-date information about, among other things, product development, organizational-development strategies, and consumer behaviour. In a sample of 66 small businesses, Brush (1992) found that the most important information related to customers, the market, and the competition. According to another study (Taylor & Banks, 1992), the most important information for small businesses relates to organizational productivity and regulatory constraints. Information on international

affairs was the least important. Lincoln and Warberg (1987) found that among 225 small businesses the information that was most frequently computerized was information on customers.

The survey conducted by Johnson and Kuehn (1987) also revealed that small businesses rely mostly on personal contacts for information. Other studies focus either on the importance of information or on the use of certain information technologies, especially computers.

Focusing specifically on microcomputers, Malone (1985) found that most of the small businesses he studied use computers for accounting and inventory purposes. This trend was also noted by Lincoln and Warberg (1987), and Lord (1984) who also noted computer use for invoicing and financial spreadsheets. Grisé, Noël, and Guay (1989), found that the most widely used computer applications were those for accounting and text-processing.

While small businesses particularly actively search for external information using a variety of sources and media, they lack the capacity to process it and do not seem to use IT for that purpose (Malone, 1985). Yet the results obtained by Carrière and Julien (1992) show an increasing rate of IT-related investment by small businesses in Québec.

Organization Structure and Information Provision

Galbraith (1974) and Tushman and Nadler (1978) suggested that organization structure reflects and stores information about the organization's perception of the environment. Duncan (1973) and Egelhoff (1982) empirically determined that structure exerts a strong influence on the flow of information in organizations. If some organization structures can be used as uncertainty-reduction mechanisms, it follows that some structural configurations might also affect an organization's information requirements. For example, one could posit that there are substantial differences in information requirements and provision between simple and complex structures and between highly centralized and decentralized organizations. Wilensky (1967) presumes that three mechanistic structural mechanisms hinder the free dissemination of information: hierarchy of authority, specialization, and centralization. When they studied the relationship between uncertainty and information importance, Gordon and Narayanan (1984) found a statistically significant association between perceived environmental uncertainty and structural organicity, but no significant correlation between structural organicity and information.

Some authors have also found evidence of a relationship between specific organizational dimensions and information flow. For example, O'Reilly and Roberts (1977) established a significant correlation between differentiation (a dimension of complexity and an organic attribute) within a workgroup, and its communication capacity. They reported that vertical differentiation was significantly related to perceptions of information accuracy within groups, but horizontal differentiation was not. Groups with greater horizontal differentiation, however, were perceived as having more open communication. Moreover, Daft and Lengel (1986) identified differentiation as a great contributor to equivocality, a construct similar to uncertainty in its relationship with information processing.

Lawrence and Lorsch (1967) and Grinyer and Yasai-Ardekani (1981), among others, have suggested that horizontal differentiation is a critical structural dimension, as it reflects decentralization of an organization's specialized decision-making processes. Particularly important for Smith et al. (1991) was that complexity may have a negative impact on the flow of information. As structural complexity (the number of levels and/or departments) increases, the probability that the information being transmitted will be distorted or totally lost also increases.

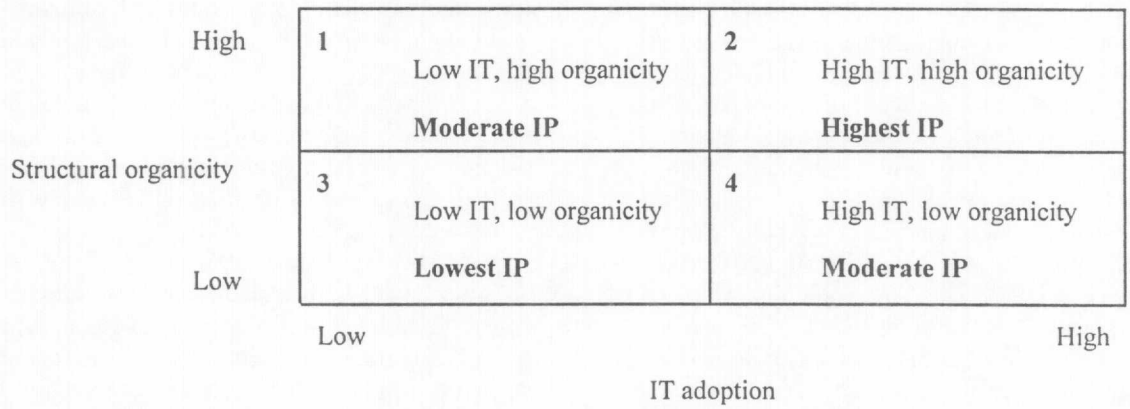
Gordon and Miller (1976) considered decentralization to be an uncertainty-reduction mechanism. Its opposite, centralization, presupposes a higher concentration of decisions with greater emphasis on data that would give decision-makers more control. Thus, instead of contributing to IP, centralization would be associated with greater information requirements. Note, however, that Chenhall and Morris (1986) found no relationship between decentralization and perceived usefulness of information. They also argued that the association between uncertainty and information requirements is moderated by decentralization.

Information Technology and Information Provision

Both industry observers (Gleckman, Carey, Mitchell, Smart. & Roush, 1993) and academicians (Bruns & McFarlan, 1987; Child, 1987; Keen, 1991; Zuboff, 1985) have recognized that one of the objectives of IT is to make information easily accessible. Strassmann (1990) emphasized that information systems are used primarily to address these internal and coordination needs, and Goodhue et al. (1992) supported the view that information systems are information-processing mechanisms. Furthermore, and according to Huber,

> use of advanced information technologies leads to more available and more quickly retrieved information, including external information, internal information, and previously encountered information, and thus leads to increased information accessibility (1990, p. 65).

Figure 1.
Hypothesized Interaction Effects Between Structural Organicity and IT Adoption.



According to Keen (1991), organizations use IT to increase direct information exchange between people, reduce the need for information intermediaries, provide simple access to well-organized information, and eliminate superfluous layers of staff and management. Daft and Lengel (1986) have been particularly influential in their emphasis on IT, especially computer-based information processing, as a means by which organizations reduce uncertainty. Dennis (1993) has shown that use of IT can improve the information exchange process in group decision-making. Others have claimed that IT makes new organizational designs and structures possible (Kaestle, 1990).

However, there are reasons to believe that small firms still use IT mainly for operational purposes (El Louadi, 1994; Malone, 1985), suggesting that small businesses are still automating their physical and clerical processes and integrating the use of computers into their products and services.

Hypotheses

Interestingly, the relationship between IT and IP parallels the one between structure and IP. If organic structures are considered richer in information because they have the potential to absorb uncertainty, IT has the potential to reduce internal organizational complexity (Keen, 1991). According to Miller's (1986) framework (Table 2, p. 242), there is a relationship between the type of structure organizations espouse (organic or mechanistic) and their use of IT. Miller argued that mechanistic structures are associated with well-developed informal information systems that are mainly used for control and cost reporting rather than disseminating information. In organic structures, information systems are used for informally scanning the environment and enhancing communications and the flow of information.

To summarize, this study is built on the propositions that IP increases with (a) structural organicity (i.e., higher decentralization and complexity), and (b) IT.

If the IT available in the organization does not make the information required available, the organization's structure, however organic, will be ineffective in the dissemination of information (cells 1 and 3 in Figure 1). However, because organicity is high in one case, we would expect IP to be higher in cell 1 than in cell 3. If IT is available but a mechanistic structure is in place (cell 3), the information will not be easily accessible to all organizational members, even though it is available. At best, members of the organization, while aware of the location of the information required, would probably not be able to get it.

Thus, an interaction effect should exist between organicity and IT in predicting IP. In light of this and our literature review, the following hypotheses are proposed:

H1: There will be an interaction effect between IT adoption and organicity on IP such that IP is lowest when both IT adoption and organicity are low and highest when both IT adoption and organicity are high.

H1A: There will be an interaction effect on internal IP between IT adoption and organicity.

H1B: There will be an interaction effect on external IP between IT adoption and organicity.

H2: There will be an interaction effect on IP between each of the structural variables (hierarchy of authority, participation in decision-making, vertical dif-

ferentiation, horizontal differentiation, and spatial differentiation) and IT adoption.

H2A: There will be an interaction effect on internal IP between each of the structural variables (hierarchy of authority, participation in decision-making, vertical differentiation, horizontal differentiation, and spatial differentiation) and IT adoption

H2B: There will be an interaction effect on external IP between each of the structural variables (hierarchy of authority, participation in decision-making, vertical differentiation, horizontal differentiation, and spatial differentiation) and IT adoption.

Methods

Unit of Analysis

The major focus of this study is on the amount of IP of small businesses. Several compelling reasons justify our selection of small businesses to test our hypotheses. The first stems from the difficulty encountered elsewhere (El Louadi, 1992) in measuring organization structure in large companies. Like James and Jones (1976), we do not think there is only one structure in a large organization. In effect, in studying large organizations, structure may become a problematic construct. This is specially so where there exist different semi-autonomous departments, divisions, and groups with different objectives and responsibilities, and where there tend to be multiple products and markets, hence multiple environments, and therefore multiple technologies and structures. This is an extension of what Tung (1979) would call the "washout effect": "the structures and managerial practices among different departments in large . . . organizations . . . vary" (p. 769). James and Jones (1976) even go to the extent of wondering whether the concept of an overall structure exists.

> Assuming that structure is a function of events, then the different departments, etc., should have different structures so that *with the exception of small organizations* that do not have differentiated subsystems, an overall organization structure would not logically exist (p. 77, emphasis ours).

The second reason is that, though small businesses may not have the same structural characteristics as larger organizations, they are hypothesized to be more organic because their structures are simpler (Miller, 1986; Paulson & Stump, 1979).

The third reason is that small businesses are hypothesized to perceive more uncertainty in the environment than larger ones and therefore to require more information. The environment that confronts small businesses is often very different from that confronting larger businesses. The larger an organization, the more able it is to use its power to control its environment and reduce its dependence on such constituencies as material suppliers, competitors, and financial resources. Conversely, small businesses rarely have much influence over their environment and depend very closely on the market, which makes them more vulnerable to its fluctuations (Timmons, 1990). To be effective, a small business must be structurally designed in such a way that it can assess its environment rapidly and accurately and act upon this information promptly.

The fourth reason we elected to use small businesses to test our hypotheses is that small businesses do not have the IP capacity to satisfy their needs (El Louadi, 1994) or the necessary IS capacity to acquire and process the information that they need (Lehman, 1986; Miller, 1986).

Finally, the model on which we based our design closely resembles that developed by Randolph and Dess (1984), which is valid only in the context of relatively small organizations or divisions of larger organizations, because just as there can be no average technology in large organizations (Randolph & Dess, 1984), there can be no average structure.

Sampling Frame

While for measuring organization-level constructs the use of multiple informants is preferable, in the face of resource constraints, the single informant approach allows for a larger number of firms to be surveyed. The bias created by this procedure is lessened by the small business nature of our sample. In effect, we believe that the structure that small businesses exhibit is the top managers' responsibility. To alleviate any confusion in the minds of the respondents, we worded our questionnaire so as to make clear that the entire organization is to be considered (see the Appendix).

The Sample

The survey was conducted in 1995 and targeted the population of Québec small businesses. The firms were randomly drawn from a commercial data bank maintained by a provincial government agency (CRIQ, 1995). Our starting random sample of firms of less than 300 employees consisted of 1,000 firms. Two consecutive mailings were done. We received 125 responses after the first mailing and 119 more after the follow-up mailing three weeks later, a total response rate of 24.4%. We feel that this response rate is adequate given the type of respondents the survey was tapping (see "Measures" section below).

The average number of full-time employees was 28

(*mdn* = 17, min. = 5, max. = 245, *SD* = 32.22). Their assets ranged from $0.01 to $120 million (average = 5.40, *mdn* = 1.50, *SD* = 13.91). Nearly 80% of the organizations in the sample were active in only one industry, 48 were engaged in two or more activities, and 59 were exporting their goods or services. Of these 244 small firms, 158 were manufacturers, 79 retailers or wholesalers, and 7 in the service sector. One hundred and forty-two of the respondents were at the highest hierarchical level (president or owner) of the organization, 83 were at the next level (reporting to the president or owner), and the rest were at the third level. There were no statistically detectable differences between the geographical regions, assets, number of full-time employees, or number of activities of respondents and nonrespondents.

As correlation and regression analyses were to be used, issues pertaining to outliers, normality, and linearity were closely examined. No univariate or multivariate outliers were found. With 244 observations, we detected no violations of the normality, linearity, or homoscedasticity assumptions.

The Measures

For this study, the following measures of organization structure, IP, and degree of IT adoption were used.

Organization Structure

In the questionnaire, respondents were asked to answer questions about hierarchy of authority and participation in decision-making on a scale from 1 (*absolutely wrong*) to 5 (*absolutely true*) (the questionnaire is reproduced in the Appendix). These items were first developed by Hage and Aiken (1967) and later validated by Dewar et al. (1980). The hierarchy of authority measure was composed of 5 items, which formed 1 factor with an eigenvalue of 3.13 and explained 62.6% of the variance. The reliability (Cronbach's alpha) of the scale was .85. The participation in decision-making measure was composed of 4 items with a reliability of .83 and no room for improvement. These items formed 1 factor with an eigenvalue of 2.71 and explained 67.6% of the variance.

Complexity

This was measured using Miller and Dröge's (1986) notions of vertical, horizontal, and spatial differentiation. These measures were obtained by asking the respondents to indicate the number of hierarchical levels, the number of different departments or services, and the number of operating sites attached to their organization (Blau, 1970; Miller & Dröge, 1986).

Because we wanted to conduct tests involving the organicity measure as well, we standardized each of the structural dimensions (with hierarchy of authority reverse-scored) and formed a linear combination of the individual, unweighted *z*-scores to obtain an overall organicity scale. We considered this approach to be preferable to an aggregate measure of organicity such as the one developed by Khandwalla (1977), which would not have provided us with information on the effects of each individual structural dimension. This procedure allowed us to use the organicity variable both at the aggregate and the disaggregate level.

Information Provision

In another section of the questionnaire, respondents were asked to rate the availability of 19 categories of internal and external information on a scale from 1 (*not at all*) to 5 (*a lot*). Internal information pertains to the organization's internal operations. It supports decisions that are typically made by operations managers with short time-horizons. External information relates to the organization's external environment. It pertains to the organization's customers, competitors, etc. (Ewusi-Mensah, 1981; Swanson, 1978). This measure was developed by El Louadi (1992). The reliability of most of the information category items was further reassessed in a small-business context by El Louadi (1993, 1994, 1995b).

The information variables were again subjected to reliability analyses. The external IP scale was composed of 10 items. The internal IP scale was composed of 9 items. These scales had reliability coefficients of .84 and .83, respectively.

Degree of IT Adoption

In the third section of the questionnaire, we asked questions concerning the degree of adoption of IT using a 23-item list of information technologies adapted from Carrière and Julien (1992), El Louadi (1993, 1994), and Floyd and Wooldridge (1990). Most of these IT items were identified as the most important in terms of their impact on businesses (*World News Report*, 1994). The respondents were asked to rate each technology on a scale from 1 (*not operational and not under consideration*) to 5 (*operational on a widespread basis*). In keeping with Churchill's (1979) recommendations, a reliability analysis was performed first. The analysis suggested the elimination of items 10 (optical disk drives) and 12 (robots) to increase reliability from .86 to .87 and the average correlation between the items from .22 to .24.

Table 1
Statistical Properties of the Variables

Measure	*M*	*SD*	Min.	Max.	α[a]
Decentralization					
Hierarchy of the authority	2.21	.94	1	5	.83
Participation in decision-making	3.52	.99	1	5	.85
Complexity					
Vertical differentiation	2.69	.91	1	5	–
Horizontal differentiation	3.27	.92	1	9	–
Spatial differentiation	1.77	1.21	1	7	–
Organicity[b]	–0.02	0.54	–1.2	1.47	–
IT adoption	2.79	0.82	1	4.57	.87
Information provision (IP)					
Internal	3.19	.80	1	5	.84
External	2.84	.75	1	5	.83

[a] Cronbach's alpha coefficient.
[b] The average of individual, unweighted, and standardized *z*-scores for the variables composing the linear combination (i.e., hierarchy of authority, participation in decision-making, vertical differentiation, horizontal differentiation, and spatial differentiation).

Close examination of the frequency tables revealed that these two items represent technologies that were not available in more than 80% of the sample. Based on these considerations, we decided to remove items 10 and 12. Factor analysis was then performed, in the hope that it would generate factors that were easily interpretable. We tried 5-, 4-, 3-, and 2-factor solutions with all the extraction methods available in the SPSS package (Norusis, 1988), and varimax (orthogonal) rotation. None of the solutions performed satisfactorily in terms of item-loading significance (Kim & Mueller, 1978; Thurstone, 1947), minimum number of items per factor (Mulaik, 1972), simplicity and parsimony (Kim & Mueller, 1978), or stability across extraction methods (Harris, 1967).

We therefore decided to keep all 21 items and to form a 1-factor scale. The statistical properties of the variables in later statistical analyses are reported in Table 1.

Analysis

To test whether there is an interaction effect between organicity and IT adoption, two models were fitted following Cohen's (1968) recommendations. In Cohen's procedure, all lower-order main effects are partialled out from any higher-order interaction effects. This is accomplished by testing the incremental R^2 between an equation containing all lower-order terms (the reduced model) and an equation containing these lower-order terms plus the hypothesized higher-order effects (the complete model).

In this case, the reduced model is:

$$IP = \beta_0 + \beta_1 (Organicity) + \beta_2 (IT) + \epsilon$$

The complete model is:

$$IP = \beta_0 + \beta_1 (Organicity) + \beta_2 (IT) + \beta_3 (Organicity \times IT) + \epsilon$$

where the dependent variable can be internal or external IP.

With respect to the interaction hypothesis, the significance of the interaction terms is tested by calculating the F ratio corresponding to the difference between the reduced model and the complete model. If the F ratio is statistically significant, the hypothesis of an interaction effect is not rejected. If the F ratio is not significant, the complete model does not have better explanatory power than the reduced model and the interaction hypothesis is

Table 2
Correlation Matrix Among the Independent Variables (198 n 244)

	2	3	4	5	6	7
1. Hierarchy of authority	–.09	.13	–.03	.07	–.42***	–.23***
2. Participation in decision-making	-	.08	.14*	.05	.51***	.16*
3. Vertical differentiation		-	.58***	.25***	.67***	.33***
4. Horizontal differentiation			-	.40***	.74***	.48***
5. Spatial differentiation				-	.58***	.22**
6. Organicity					-	.48***
7. IT adoption						-

*$p < .05$ **$p < .005$ ***$p < .0001$

rejected. The same procedure is used when there is more than one interaction term as is the case when all the structural dimensions are included.

The structural independent variables are known to be highly intercorrelated (Dewar et al.,1980; Hage & Aiken, 1967). High intercorrelations among the independent variables may introduce unwanted multicollinearity in the regression models. Multicollinearity exists when two or more independent variables used in the equation contribute redundant information. If multicollinearity exists and is not acknowledged, the regression analysis may be incorrectly interpreted. Multicollinearity should be taken seriously in the context of interaction regression analysis and isolated when it is suspected, because multiplicative (interaction) terms will exhibit strong correlations with their component parts, introducing inflated standard errors for the regression coefficients. We therefore computed the overall correlation matrix among all the independent variables of the model. The result is shown in Table 2.

Interestingly, the decentralization dimensions–hierarchy of authority and participation in decision-making–do not correlate with each other. This result may be explained by the new designs that organizations have been adopting in recent years (Byrne, Brandt, & Port, 1993), or by the behaviour of scales designed for large organizations when used in a small-business context (El Louadi, 1995a). By contrast, all complexity dimensions are significantly intercorrelated.

To address the multicollinearity threat, we followed Cronbach's (1987) suggestion to centre the component variables prior to forming the multiplicative terms. Centering is a procedure whereby the mean of each independent variable is subtracted from its score.

Results

Interaction Between IT Adoption and Organicity

Hypotheses H1A and H1B involve organicity as an aggregate variable and IT adoption. We ran a regression analysis of the amount of IP with respect to both organicity and IT adoption. Because the organicity scale was in *z*-form, we also standardized the IT adoption scale. The results obtained of the regression analysis are shown in Table 3.

These results show that the degree of IT adoption has a main (direct) effect on the amount of information provided whether it is internally or externally oriented (β_2 = .26 and .27, $p < .0001$, respectively). Surprisingly however, organicity contributes only to internal IP (β_1 = .15, $p < .05$ and β_2 = .03, *ns*). It is also in the case of internal information that an interaction effect is detected between the two variables (β_3 = -.12, $p < .05$). When we include the interaction term (organicity x IT), the increase in R^2 is found to be significant at $p < .05$. These results tend to confirm hypothesis H1A but not hypothesis H1B.

Interaction Between IT Adoption and the Various Structural Dimensions

Hypotheses H2A and H2B involve IT adoption and the various structural dimensions measured in this study. The regression took IP to be the dependent variable and all the structural dimensions (i.e., hierarchy of authority, participation in decision-making, and all three differentiation dimensions), as well as IT to be the independent variables. The results are shown in Table 4.

As in the case of the first regression model (Table

Table 3
Regression of IP on Organicity, IT, and the Interaction Term

	Internal IP		External IP	
	Reduced[a]	Complete[b]	Reduced[c]	Complete[d]
Multiple R	36	.38	.29	.29
R^2	13	15	.08	.08
ΔF		3.85*		.19
F	18.23***	13.58***	10.62***	7.12 (*ns*)
Intercept (β_0)	3.20	3.24	2.84	2.85
	(.05)	(.05)	(.05)	(.05)
Organicity (β_1)	.13*	.15*	.03	.03
	(.09)	(.09)	(.09)	(.09)
IT (β_2)	.28***	.26***	.27***	.27***
	(.05)	(.05)	(.05)	(.05)
Organicity x IT (β_3)		−.12*		−.03
		(.08)		(.08)

Notes. Unstandardized regression coefficients are reported, with standard errors in parentheses.
[a]$df = 2,240$ [b]$df = 3,239$ [c]$df = 2,240$ [d]$df = 3,239$
*$p < .05$ **$p < .005$ ***$p < .0001$

3), the regression coefficient corresponding to IT adoption, β_6, is positive and significant in all cases.

In this model, three structural dimensions seem to be directly related to the internal IP variable: participation in decision-making ($\beta_2 = .13$, $p < .07$), vertical differentiation ($\beta_3 = -.18$, $p < .05$), and horizontal differentiation ($\beta_4 = .32$, $p < .05$).

The interaction effect between IT adoption and hierarchy of authority is very close to being significant ($\beta_7 = .14$, $p < .07$), but not close enough not to reject, at least partially, hypothesis H2A. The regression coefficient corresponding to the interaction between horizontal differentiation and IT adoption is negative and significant ($\beta_{10} = -.28$, $p < .05$).1 Therefore, only hypothesis H2A, concerning horizontal differentiation, is considered to be borne out by the present data, and hypothesis H2B is rejected.

Summary of the Results

Regression analysis reveals that, when IT adoption is present in the equation, organicity is linearly associated only with internal IP (Table 3). Regression analysis also shows that a significantly negative interaction effect exists between IT adoption and organicity, though only in the case of internal IP. This negative regression coefficient means that the marginal rate of change in the amount of internal IP decreases as IT adoption and organicity increase simultaneously. To better illustrate the meaning of the negative regression coefficient of the interaction term, let us use the minimum and maximum values for organicity found in our sample (min. = -1.2 and max . = 1.47, see Table 1). With these values, the regression equations for internal IP are:

IP = 3.42 + .14 IT when organicity is at its minimum (organicity = -1.2)

and

IP = 3.46 + .009 IT when organicity is at its maximum (organicity = 1.47).

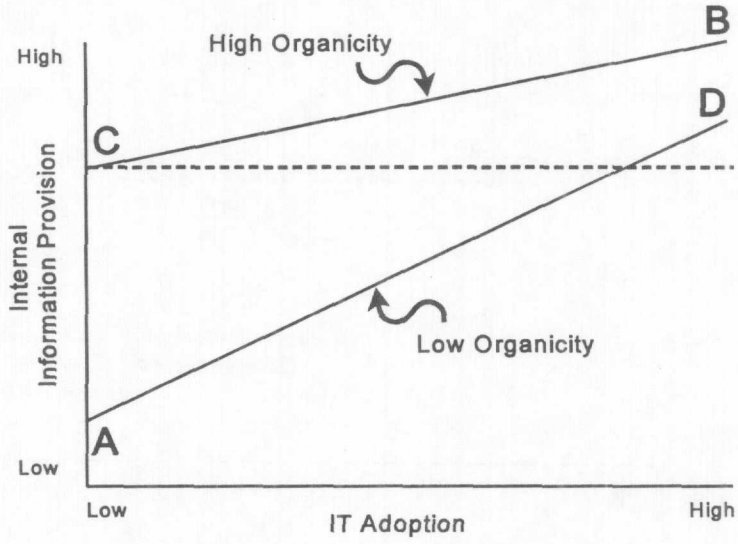
The interaction effect between organicity and IT adoption is such that the amount of IP is lowest when organicity is low and is not widely deployed (point A in Figure 2). Figure 2 also shows that the amount of inter-

Table 4
Regression of IP on the Individual Structural Dimensions, IT, and All Interaction Terms

	Internal IP		External IP	
	Reduced[a] model	Complete[b] model	Reduced[c] model	Complete[d] model
Multiple R	.37	.43	.33	.38
R^2	.14	.19	.11	.14
ΔF		2.18***		1.39
F	4.70***	3.64***	3.63**	2.63
Intercept (β_0)	3.21 (.05)	3.22 (.05)	2.83 (.05)	2.83 (.05)
Hierarchy (β_1)	.04 (.06)	.02 (.06)	–.11 (.06)	–.12 (.06)
Participation (β_2)	.14* (.05)	.13[e] (.05)	.10 (.05)	.10 (.05)
Vertical differentiation (β_3)	–.15[f] (.05)	–.18* (.06)	–.04 (.05)	–.04 (.06)
Horizontal differentiation (β_4)	.13 (.03)	.32* (.04)	.08 (.03)	.07 (.04)
Spatial differentiation (β_5)	– (.03)	.02 (.05)	.02 (.03)	–.10 .05 (.05)
IT adoption (β_6)	.28*** (.08)	.25** (.08)	.29*** (.08)	.33*** (.08)
Hierarchy x IT (β_7)		.14[e] (.07)		.13 (.07)
Participation x IT (β_8)		.11 (.08)		.10 (.05)
Vertical differentiation x IT (β_9)		. 08 (.09)		–.00 (.09)
Horizontal differentiation x IT (β_{10})		–.28* (.04)		.03 (.04)
Spatial differentiation x IT (β_{11})		–.04 (.06)		–.18 (.06)

Notes. Unstandardized regression coefficients are reported, with standard errors in parentheses.
[a]$df = 6,180$ [b]$df = 11, 175$ [c]$df = 6,180$ [d]$df = 11,175$ [e]$p = .07$ [f]$p = .09$
$*p < .05$ $**p < .005$ $***p < .0005$

Figure 2.
The Interaction Effect of IT Adoption and Structural Organicity on Internal Information Provision.



nal IP is greatest when organicity is high and IT is widespread (point B in Figure 2). Interestingly, the amount of IP in the case of low IT and high organicity (point C in Figure 2) is less than that in the case of high IT and low organicity (point D and the dashed line in Figure 2).

We tested interaction effects between each of the organic structural dimensions and IT adoption. Table 4 shows that only the interaction term involving IT adoption and horizontal differentiation is significant (β_{10} = -.28, $p < .05$). Again, it is significant only when the dependent variable is internal. Thus, it can safely be inferred that the significance of the interaction effect involving the organicity variable in Table 3 is due to horizontal differentiation. Incidentally, it is horizontal differentiation that contributes the most to the linear combination forming the organicity variable (see Table 2, r = .74). Therefore, it could be hypothesized that if organicity interacts with IT adoption, it is largely due to horizontal differentiation, and consequently, that the informational association of organicity is more a matter of differentiation than of decentralization.

When represented graphically (Figure 3), the interaction effect between horizontal differentiation and IT adoption exhibits the same patterns as Figure 2. Similar to the results shown in Figure 2, the amount of IP in the case of low IT and high horizontal differentiation (point C in Figure 3) is less than that in the case of high IT and low horizontal differentiation (point D and dashed line in Figure 3).

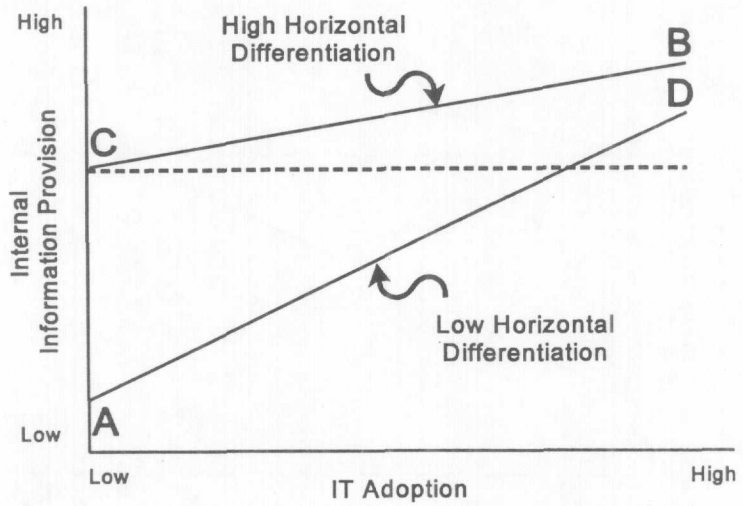
Discussion

At the aggregate level, the results of this study clearly suggest that an interaction effect between structural organicity and IT adoption on internal IP exists. This interaction effect is not detected when tested on external IP.

The interaction effect on internal IP between organicity and IT adoption is such that increases in IT have a stronger association with IP when organicity is low, and the association between IT and internal IP is greatest when organicity is lowest. Therefore, in the context of internal IP, if one of the two mechanisms has to be lower, it is preferable that it be organicity.

The interaction effect involving IT seems to be caused by only one dimension of structural organicity, horizontal differentiation. What this interaction effect means is that the amount of internal information provided is greater when horizontal differentiation is high, even when IT is not widely deployed. However, when IT is widespread, there is not much difference in the amount of internal IP between high and low horizontal differentiation. However, where horizontal differentiation is low, major gains can be obtained in terms of internal IP as IT

Figure 3.
The Interaction Effect of IT Adoption and Horizontal Differentiation on Internal Information Provision.



adoption increases. Thus, increases in IT have a stronger association with IP when horizontal differentiation is low.

Overall, the results of this study seem to suggest, somewhat surprisingly, that in the context of small businesses it is horizontal differentiation that makes organicity a contributor to organizational IP. From among all the structural indicators, horizontal differentiation was the one we least expected to have such an effect, because small businesses are not reputed to be particularly differentiated horizontally (Mintzberg, 1979). One explanation for this result may have been provided in the early work of Blau and Child on structural differentiation (Blau, 1970; Blau & Schoenherr, 1971; Child, 1973). Blau found that increasing size promotes structural differentiation, but at a decreasing rate. Increases in organization size are accompanied by initially rapid and subsequently more gradual increases in the number of functional divisions and the number of sections per division. Though it is certainly tenable that the degree of horizontal differentiation is significantly lower in small businesses than in larger ones, the variability in horizontal differentiation is greater in small businesses.

These significant interaction effects do not extend to external information processing. In the case of external IP, only the direct effect of IT adoption is significant, whether organicity is used in its aggregate form or its dimensional form. This result may be explained by the possibility that organization structure is not as significant an information processing mechanism as the information-processing theory of the firm (Galbraith, 1974; Tushman & Nadler, 1978) assumes it to be, especially with regard to external information.

If this were true, the results would either contradict previous information-processing theory assumptions or imply that the implications of this theory do not fully apply in a small business context. This analysis is derived from the suggestion contained in the data that organization structure has neither a significant direct effect on external IP nor an interaction effect between organization structure and IT on external IP.

Conclusion

One of the challenges of contemporary organizations is to cope with increasingly turbulent, complex, and uncertain environments. One uncertainty-reduction mechanism that is available to organizations is information processing. The types of information that organizations need to process are internal and external. Organizations need to process internal information to stay informed about their resources and how these resources are used. As such, information becomes the most important organizational resource, if only because it informs organizational members about all the other

important resources. Organizations also need to process external information to keep up with the occurrences, trends, and evolutions in their environments.

Based on the assumption that increased IP is associated with greater adoption of IT, on the one hand, and structural organicity, on the other, this study sought to explore the combined effect of IT adoption and structural organicity on the amount of IP.

Two hypotheses were enumerated that predicted an interaction effect between IT and organic dimensions of organization structure. The interaction effect was tested on the amount of information provided.

The results support the view that organic structures are more favourable to the amount of information provided in organizations. While assertions found in the literature hypothesized the existence of relationships between organicity in its aggregate form or its individual structural dimensions and IP, this study could not confirm all of them.

The interaction effect we expected between structural organicity and IT adoption was observed, but we did not expect it to be caused mainly by horizontal differentiation. Yet, Figure 3 shows that when it is not possible to have both high IT adoption and high horizontal differentiation (the highest level of internal IP), the next best organizational design is to have high IT adoption but low horizontal differentiation.

Suggestions for Future Research

Structural organicity and IT are important IP mechanisms in organizations. Though IT seems to be doing its share, both IT adoption and horizonal differentiation seem to be important variables in defining a small organization's capacity to make internal information more available to its members. Clearly, the results of this study have provided some answers, but they have also opened up avenues for future research. Researchers might consider abandoning aggregate structural measures of organicity such as Khandwalla's (1977) and concentrate on individual dimensions, as we did in this study, in order to better understand how organization structure contributes to IP.

There is also a need to understand why structure and IT do not interact to contribute to the provision of external information. With the exception of IT adoption, no significant main or interaction effects explained the amount of external information provided. Externally oriented information is the type of information that bridges the gap between organizations and their environment. This kind of information is likely to become more important as organizational environments become more complex, dynamic, and uncertain. Future research could further investigate the real contribution that organization structure brings into making externally oriented information more accessible to small businesses.

Finally, we expected the contribution of IT to be stronger in the case of high horizontal differentiation than in the case of low horizontal differentiation. High horizontal differentiation is believed to create more information requirements which, in turn, call for more information to be provided. This increase in IP is facilitated by the presence of more IT. Consequently, it would have been more plausible that horizontal differentiation be indirectly associated with IP, with information requirements acting as a mediating variable. The fact that the opposite was found in this study calls for a closer examination of the real relationship between horizontal differentiation, IT, and the provision of both internal and external information.

Future research should address these issues, possibly employing a research design using more than one informant per company.

Implications for Small Business Managers

Recommendations to managers and decision-makers can only be useful if they address issues that are under their administrative control (Argyris, 1972).

Both structure and IT adoption are organizational mechanisms that are amenable to managerial modifications. However, we assume that practising managers have more leverage over IT choices than over structure. The question is: if we want more IP, which lever should we act upon first, IT or structure?

This study suggests that if given the choice—or the constraint—IT adoption has greater impact on the provision of information (see Table 3). Therefore, a mechanistic organization will increase its IP faster by investing in IT first, because the effect on IP will be perceived faster than if the organization attempted to increase the organicity of its structure.

On the other hand, moving to a more organic structure without considering adopting more IT will be the least effective way to increase IP. Thus, if two organizations, A and B, are similar in mechanisticity, degree of IT adoption, and amount of IP, and if organization A increases its IT adoption while organization B increases its organicity, organization A will see an increase in its IP before organization B. This result is also clear in Figure 2.

The impact that the same degree of IT adoption can have on organizations and their IP is greater within a mechanistic organization than within an organic organization (see Figure 2, where the A-D slope is always greater than the C-B slope). Hence, if companies are constrained by structural choices, the introduction of

more IT can help both types of organizations but helps mechanistic organizations more dramatically.[2] Thus, if organizations A and B are similar in degree of IT adoption and amount of IP, but organization A is mechanistic and organization B is organic, and if both organizations increase their IT by the same amount, the increase in IP will be greater for organization A than it will be for organization B.

Finally, if organizations A and B, which are similar in their IT adoption and their existing IP–even though organization A is more mechanistic than organization B–both increase their organicity, the increase in IP will be greater for organization A than it will be for organization B.

The fastest increase in IP occurs when a low-IT and low-organicity organization increases both its IT and its organicity simultaneously; it then moves from point A to point B, i.e., from the lowest level of IP to the highest.

References

Argyris, C. (1972). *The applicability of organizational sociology.* Cambridge, MA: Cambridge University Press.

Blau, P.M. (1970). A formal theory of differentiation in organizations. *American Sociological Review, 35*, 210-218.

Blau, P.M., & Schoenherr, R.A. (1971). *The structure of organizations.* New York: Basic Books.

Blili, S., & Raymond, L. (1993). Information technology: Threats and opportunities for small and medium-sized enterprises. *International Journal of Information Management, 13*, 439-448.

Bruns, W.J., & McFarlan, F.W. (1987). Information technology puts power in control systems. *Harvard Business Review, 87*, 89-94.

Brush, C.G. (1992). Marketplace information scanning activities of new manufacturing ventures. *Journal of Small Business Management, 30*, 41-53.

Burns, T., & Stalker, G. (1961). *The management of innovation.* Chicago, IL: Quadrangle Books.

Byrne, J.A., Brandt, R., & Port, O. (1993, February 8). The virtual corporation: The company of the future will be the ultimate in adaptability. *Business Week*, pp. 98-102.

Cafferata, R., & Mensi, R. (1995). The role of information in the internationalization of SMEs: A typological approach. *International Small Business Journal, 13*, 35-46.

Carland, J.W., Hoy, F., Boulton, W.R., & Carland, J.A.C. (1984). Differentiating entrepreneurs from small business owners: A conceptualization. *Academy of Management Review, 9*, 354-359.

Carrière, J-B., & Julien, P-A. (1992). *Profil technologique de la PME manufacturière Québécoise* [Technological profile of small businesses in the Quebec manufacturing industry]. Rapport Final. Montréal, QC: Association des manufacturiers du Québec.

Chenhall, R.H., & Morris, D. (1986). The impact of structure, environment, and interdependence on the perceived usefulness of management accounting systems. *The Accounting Review, 61*, 16-35.

Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. *Sociology, 6*, 1-22.

Child, J. (1973). Predicting and understanding organization structure. *Administrative Science Quarterly, 18*, 171.

Child, J. (1987). Information technology, organization, and responses to strategic challenges. *California Management Review, 30*, 33-50.

Churchill, G.A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research, 16*, 64-73.

Cohen, J. (1968). Multiple regression as a general data-analytic system. *Psychological Bulletin, 70*, 426-443.

Cohen, J., & Cohen, P. (1983). *Applied multiple regression/correlation analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Erlblaum Associates.

Connolly, T. (1977). Information processing and decision making in organizations. In B.M. Staw & G.R. Salancik (Eds.), *New directions in organizational behavior.* Homewood, IL: St Clair Press.

Covin, J.G., & Slevin, D.P. (1988). The influence of organization structure on the utility of an entrepreneurial top management style. *Journal of Management Studies, 25*, 217-23.

Covin, J.G., & Slevin, D.P. (1989). Strategic management of small firms in hostile and benign environments. *Strategic Management Journal, 10*, 75-87.

Covin, J.G., & Slevin, D.P. (1990). New venture strategic posture, structure, and performance: An industry life cycle analysis. *Journal of Business Venturing, 5*, 123-135.

Cronbach, L.J. (1951). Coefficient alpha and internal structure of tests. *Psychometrika, 16*, 297-334.

Cronbach, L.J. (1987). Statistical tests for moderator variables: Flaws in analyses recently proposed. *Psychological Bulletin, 102*, 414-417.

Daft, R.L., & Lengel, R.H. (1986). Organizational information requirements, media richness and structural design. *Management Science, 32*, 554-571.

Dennis, A. (1993). Information-processing in group decision-making: You can lead a group to information, but you can't make it think. *Proceedings of the 53rd Annual Meeting of the Academy of Management*, Atlanta, GA, 283-287.

Dewar, R.D., Whetten, D.A., & Boje, D. (1980). An examination of the reliability and validity of the Aiken and Hage scales of centralization, formalization, and task routineness. *Administrative Science Quarterly, 15*, 120-128.

Drucker, P. (1980). *Managing in turbulent times.* New York: Harper & Row.

Duncan, R.B. (1971). *The effects of perceived environmental uncertainty on organizational decision unit structure: A cybernetic model.* Unpublished doctoral dissertation. Yale University, New Haven, Connecticut.

Duncan, R.B. (1972). Characteristics of organizational environment and perceived environment uncertainty. *Administrative Science Quarterly, 17*, 313-327.

Duncan, R.B. (1973). Multiple decision-making structures in adapting to environmental uncertainty: The impact on organizational effectiveness. *Human Relations*, *26*, 273-291.

Egelhoff, W.G. (1982). Strategy and structure in multinational corporations: An information-processing approach. *Administrative Science Quarterly*, *27*, 435-458.

El Louadi, M. (1992). *Organizational responses to perceived environmental uncertainty: An information-processing view*. Unpublished doctoral dissertation, University of Pittsburgh, Pennsylvania.

El Louadi, M. (1993). L'impact des technologies de l'information sur la performance des PME: Le secteur bancaire [The impact of information technologies on small business performance: The banking industry]. *Proceedings of the International Congress on Small Businesses*, Tunis, Tunisia, 204-215.

El Louadi, M. (1994). Les besoins informationnels et les technologies de l'information dans les PME québécoises, [Information requirements and information technology in Québec small enterprises], *Proceedings of the 11th annual conference of the Canadian Council for Small Business and Entrepreneurship*, Winnipeg, Manitoba, Canada, 49-60.

El Louadi, M. (1995a). On applying organization theory measures in a small business context: The case of Hage's formalization, complexity, and centralization scales. *Proceedings of the 40th International Council for Small Business Annual Conference*, Sydney, Australia, 221-232.

El Louadi, M. (1995b). Information-rich strategies as uncertainty-reduction mechanisms. *Proceedings of the 1995 Annual Conference of the Administrative Sciences Association of Canada*, *16*, 45-55.

Ewusi-Mensah, K. (1981). The external organization environment and its impacts on management information systems. *Accounting, Organizations and Society*, *6*, 301-316.

Floyd, S.W., & Wooldridge, B. (1990). Path analysis of the relationship between competitive strategy, information technology, and financial performance. *Journal of Management Information Systems*, *7*, 47-64.

Fry, L.W., & Slocum, J.W., Jr. (1984). Technology, structure, and workgroup effectiveness: A test of a contingency model. *Academy of Management Journal*, *27*, 221-246.

Galbraith, J. (1974). Organization design. *Interfaces*, *4*, 28-36.

Galbraith, J. (1977). *Organization design*. Reading, MA: Addison-Wesley.

Gleckman, H., Carey, J., Mitchell, R., Smart, T., & Roush, C. (1993, June 14). The technology payoff. *Business Week*, pp. 57-68.

Goodhue, D.L., Wybo, M.D., & Kirsch, L.J. (1992). The impact of data integration on the costs and benefits of information systems. *MIS Quarterly*, *16*, 293-311.

Gordon, L.A., & Miller, D. (1976). A contingency framework for the design of accounting information systems. *Accounting, Organization and Society*, *1*, 59-69.

Gordon, L.A., & Narayanan, V.K. (1984). Management accounting systems perceived environmental uncertainty and organization structure: An empirical investigation. *Accounting, Organization and Society*, *9*, 33-47.

Gresov, C., Drazin, R., & Van de Ven, A.H. (1989). Work-unit task uncertainty, design and morale. *Organization Studies*, *10*, 45-62.

Grinyer, P.H., & Yasai-Ardekani, M. (1981). Strategy, structure, size, and bureaucracy. *Academy of Management Journal*, *24*, 471-486.

Grisé, A, Noël, L., & Guay, L. (1989). *L'informatisation du Québec: Profil de la demande* (no. 16) [Computerization in Québec: Profile and demand]. Québec City, Québec: Les Publications du Québec.

Hage, J. (1965). An axiomatic theory of organization. *Administrative Science Quarterly*, *10*, 289-320.

Hage, J., & Aiken, M. (1967). Relationship of centralization to other structural properties. *Administrative Science Quarterly*, *12*, 72-91.

Hall, R.H., Haas, E., & Johnson, N.J. (1967). Organizational size, complexity, and formalization. *American Sociological Review*, *32*, 903-912.

Harris, C.W. (1967). On factors and factor scores. *Psychometrika*, *32*, 363-379.

Harvey, E. (1968). Technology and the structure of organizations. *American Sociological Review*, *33*, 247-259.

Hrebiniak, L.G., & Snow, C.C. (1980). Industry differences in environmental uncertainty and organizational characteristics related to uncertainty. *Academy of Management Journal*, *23*, 750-759.

Huber, G.P. (1990). A theory of the effects of advanced information technologies on organizational design, intelligence, and decision making. *Academy of Management Review*, *15*, 47-71.

James, L.R., & Jones, A.P. (1976). Organizational structure: A review of structural dimensions and their conceptual relationships with individual attitudes and behavior. *Organizational Behavior and Human Performance*, *16*, 74-113.

Jennings, D.F., & Seaman, S.L. (1990). Aggressiveness of response to new business opportunities following deregulation: An empirical study of established financial firms. *Journal of Business Venturing*, *5*, 177-189.

Johnson, J.L., & Kuehn, R. (1987). The small business owner/manager's search for external information. *Journal of Small Business Management*, *25*, 53-60.

Julien, P.A. (1995). New technologies and technological information in small business. *Journal of Business Venturing*, *10*, 459-477.

Julien, P.A. (1996). Information control: A key factor in small business development. *Proceedings of the 41st ICSB World Conference*, *V*, Stockholm, Sweden, 129-149.

Kaestle, P. (1990). A new rationale for organizational structure. *Planning Review*, *18*, 20-27.

Keen, P.G.W. (1991). Redesigning the organization through information technology. *Planning Review*, *19*, 4-9.

Keller, R.T., Slocum, J.W., & Susman, G.I. (1974). Uncertainty and type of management system in continuous process organizations. *Academy of Management Journal*, *17*, 56-68.

Khandwalla, P.N. (1977). *The design of organization*. New York: Harcourt Brace Jovanovich.

Kim, J., & Mueller, C.W. (1978). *Factor analysis: Statis-*

tical methods and practical issues. Beverly Hills, CA: Sage.

Kmetz, J.L. (1984). An information-processing study of a complex workflow in aircraft electronics repair. *Administrative Science Quarterly, 29*, 255-280.

Lawrence, P.R., & Lorsch, J.W. (1967). *Organization and environment.* Boston, MA: Harvard Business School, Division of Research.

Lehman, J.A. (1986). Organizational size and information system sophistication. *Journal of Management Information Systems, 2*, 78-86.

Leifer, R. (1988). Matching computer-based information systems with organizational structures. *MIS Quarterly, 12*, 63-73.

Lincoln, D.J., & Warberg, W.B. (1987). The role of microcomputers in small business marketing. *Journal of Small Business Management, 25*, 8-17.

Lord, M. (1984, November). Le micro-ordinateur dans la PME [Micro computers in small businesses]. *Commerce*, pp. 74-83.

Malone, C. (1985). Computerizing small business information systems. *Journal of Small Business Management, 23*, 11-17.

March, J.G., & Simon, H.A. (1958). *Organizations.* New York: John Wiley.

McMillan, C.J. (1987). The automation triangle: New paths to productivity performance. *Business Quarterly, 52*, 61-67.

Miller, D. (1986). Configurations of strategy and structure: Towards a synthesis *Strategic Management Journal, 7*, 233-249.

Miller, D., & Dröge, C. (1986). Psychological and traditional determinants of structure. *Administrative Science Quarterly. 31*, 539-560.

Mintzberg, H. (1979). *The structuring of organizations.* Englewood Cliffs, NJ: Prentice-Hall.

Mulaik, S.A. (1972). *The foundations of factor analysis.* New York: McGraw-Hill.

Naman, J.L., & Slevin, D.P. (1993). Entrepreneurship and the concept of fit: A model and empirical tests. *Strategic Management Journal, 14*, 137-153.

Norusis, M.J. (1988). *SPSS-X Advanced statistics guide* (2nd ed.) Chicago, IL: SPSS.

Ogilvie, J.R., Pohlen, M.F., & Jones, L.H. (1988). Organizational information processing and productivity improvement. *National Productivity Review, 7*, 229-237.

O'Reilly, C.A., & Roberts, K.H. Task group structure, communication, and effectiveness in three organizations. *Journal of Applied Psychology, 62* (6), 674-681.

Paulson, S.K., & Stump, A.L. (1979). Small business and the theory of small bureaucracies. *American Journal of Small Business, 3*, 37.

Pugh, D.S., Hickson, D.J., & Hinings, C.R. (1969). An empirical taxonomy of structures of work organizations. *Administrative Science Quarterly, 14*, 115-126.

Randolph, W.A., & Dess, G.G. (1984). The congruence perspective of organization design: A conceptual model and multivariate research approach. *Academy of Management Review, 9*. 114-127.

Rothwell, R. (1984). The role of small firms in the emergence of new technologies. *Omega, 12*, 1.

Sharma, S., Durand, R.M., & Gur-Arie, O. (1981). Identification and analysis of moderator variables. *Journal of Marketing Research, 18*, 291-300.

Simon, H.A. (1973). Applying information technology to organization design. *Public Administration Review, 33* (3), 268-278.

Smith, K.G., Grimm, C.M., Gannon, M.J., & Chen, M-J. (1991). Organizational information processing, competitive responses, and performance in the us domestic airline industry. *Academy of Management Journal, 34*, 60-85.

Sormunen, J., Daft, R.L., & Parks, D. (1985). Environmental uncertainty and the frequency and mode of chief executive scanning. *Paper presented at the Annual Conference of the Academy of Management*, San Diego.

Strassmann, P. (1990). *The business value of computers.* New Canaan, CT: Information Economics Press.

Swanson, E.B. (1978). The two faces of organizational information. Accounting, *Organizations and Society, 3*, 237-246.

Taylor, G.S., & Banks, M.C. (1992). Entrepreneurs, small business executives, and large business executives: A comparison of the perceived importance of current business issues. *Journal of Small Business Management, 30*, 24-40.

Thurstone, W.S. (1947). Multiple factor analysis. Chicago, IL: University of Chicago Press.

Timmons, J.A. (1990). *New venture creation: Entrepreneurship in the 1990s.* Homewood, IL: Irwin.

Tornatzky, L.G., & Fleischer, M. (1990). *The processes of technological innovation.* Lexington, MA.

Tung, R.L. (1979). Dimensions of organizational environments: An exploratory study of their impact on organization structure. *Academy of Management Journal, 22*, 672-693.

Tushman, M.L., & Nadler, D.A. (1978). Information processing as an integrating concept in organization design. *Academy of Management Review, 3*, 613-624.

Wilensky, H.L. (1967). *Organizational intelligence.* New York: Basic Books.

World News Report (1994, May 2). World News Agency, p. 46.

Zuboff, S. (1985). Automate/Informate: The two faces of intelligent technology. *Organizational Dynamics, 14*, 4-18.

Notes

1. Because horizontal differentiation and IT are related to IP both directly and indirectly through their interaction with each other, we chose not to consider them as moderator variables because in strictly purist terms, a moderator variable should not be directly related to the criterion variable (Cohen & Cohen, 1983). In this respect, Sharma, Durand, and Gur-Arie (1981) draw a distinction between a pure moderator (one which relates to the criterion only through the interaction term) and a quasi-moderator vari-

able (one which relates to the criterion both directly and through the interaction term). In that sense, both IT and horizontal differentiation qualify for their definition of quasi-moderator variables.

2. We are grateful to an anonymous reviewer for this clarification.

Appendix

I. General Information:

1. **What is your hierarchical position in the organization?**
   mark **1** if president or equivalent;
   2 if employee who reports directly to a person whose position is 1;
   3 if employee who reports directly to a person whose position is 2;
   etc.

2. **Please answer the following:**

   a. number of departments or services in your company: ____
   b. number of hierarchical levels in your company: ____
   c. number of operating sites (including plants, subsidiaries, etc.) ____

3. **Approximate amount of total assets:**

   ____ millions of $

II. To what extent are the following statements true in the context of your company?

Please answer all questions, circle only one number for each item

Scale: absolutely wrong 1 2 3 4 5 absolutely true

1. there can be little action taken here until a supervisor approves a decision 1 2 3 4 5
2. a person who wants to make his/her own decisions would be quickly discouraged 1 2 3 4 5
3. even small matters have to be referred to someone higher up for a final answer 1 2 3 4 5
4. every employee has to ask his/her boss before he/she does almost anything 1 2 3 4 5
5. every employee must have his/her boss's approval for the decisions he/she makes 1 2 3 4 5

III. How frequently do people in your organization participate in the following activities?

Please answer all questions, circle only one number for each item

Scale: never 1 2 3 4 5 always

1. the adoption of new programs 1 2 3 4 5
2. the adoption of new policies 1 2 3 4 5
3. the decision to hire new staff 1 2 3 4 5
4. the decisions on the promotion of any of the professional staff 1 2 3 4 5

IV. You can receive information about various topics in your organization. For each topic listed below, mark your response that best indicates the amount of information you *receive* regarding that topic.

Please answer all questions

You receive information on:

Scale: not at all 1 2 3 4 5 a lot

1. your customers 1 2 3 4 5
2. personnel availability in the market 1 2 3 4 5
3. your company's situation in the industry 1 2 3 4 5
4. your competitors 1 2 3 4 5

5. your suppliers	1 2 3 4 5
6. governments and regulations	1 2 3 4 5
7. international affairs	1 2 3 4 5
8. new technological developments	1 2 3 4 5
9. the reputation of your products and/or services	1 2 3 4 5
10. the distribution of your products and/or services	1 2 3 4 5

You receive information on:

1. the managerial and technical training of your employees	1 2 3 4 5
2. the implication of your employees in order to achieve your company's objectives	1 2 3 4 5
3. the inter-personal relations among your employees	1 2 3 4 5
4. technical characteristics of your divisional units (departments, divisions, services, etc.)	1 2 3 4 5
5. the areas of conflict between different units	1 2 3 4 5
6. the areas of conflict within different units	1 2 3 4 5
7. the financial situation of your company (budgets, accounts receivable, etc)	
8. production costs in your company	1 2 3 4 5
9. the production capacity in your company (utilization, excess capacity, defects, etc.)	1 2 3 4 5

V. The adoption of information technology can be thought of in five stages along a continuum. Please indicate the stage of adoption in your company for each of the technologies listed below.

Please circle the appropriate number (one number for each technology item) according to the following scale:

Scale:

5. Operational on a widespread basis
4. Operational in some sites of the company
3. Being implemented on a widespread basis
2. Being considered but is not implemented or operational yet
1. Not operational and not under consideration

1.	mini computer (mainframe)	1 2 3 4 5
2.	desk computer (Macintosh, PC, etc.)	1 2 3 4 5
3.	electronic messaging (*e-mail*)	1 2 3 4 5
4.	local area network(s) (LAN)	1 2 3 4 5
5.	wide-area network(s)	1 2 3 4 5
6.	laser printers	1 2 3 4 5
7.	other printers	1 2 3 4 5
8.	portable computers/laptops	1 2 3 4 5
9.	plotters	1 2 3 4 5
10.	optical disk drives	1 2 3 4 5
11.	fax	1 2 3 4 5
12.	robots	1 2 3 4 5
13.	computer assisted design (CAD)	1 2 3 4 5
14.	human resources management system (e.g., payroll, etc.)	1 2 3 4 5
15.	inventory management systems	1 2 3 4 5
16.	electronic spreadsheets (e.g., Lotus, Quattro, etc.)	1 2 3 4 5
17.	project management systems	1 2 3 4 5
18.	text editors (e.g., WordPerfect, Word, etc.)	1 2 3 4 5
19.	databases (e.g., Ingres, dBase, etc.)	1 2 3 4 5
20.	accounting management systems	1 2 3 4 5
21.	expert systems	1 2 3 4 5
22.	telephone answering machines	1 2 3 4 5
23.	modems	1 2 3 4 5