MINT~RC

MANAGEMENT OF INNOVATION
AND NEW TECHNOLOGY
RESEARCH CENTRE

MANAGING AN ORGANIZATIONAL LEARNING SYSTEM BY ALIGNING STOCKS AND FLOWS OF KNOWLEDGE:

AN EMPIRICAL EXAMINATION OF INTELLECTUAL CAPITAL, KNOWLEDGE MANAGEMENT, AND BUSINESS PERFORMANCE

by

Nick Bontis,

Management of Innovation and New Technology
Research Centre

WORKING PAPER NO. 86
1999

McMASTER
• UNIVERSITY •

MICHAEL G. DeGROOTE
SCHOOL OF BUSINESS

MANAGING AN ORGANIZATIONAL LEARNING SYSTEM BY ALIGNING STOCKS AND FLOWS OF KNOWLEDGE:

AN EMPIRICAL EXAMINATION OF INTELLECTUAL CAPITAL, KNOWLEDGE MANAGEMENT, AND BUSINESS PERFORMANCE

by

Nick Bontis,

Management of Innovation and New Technology
Research Centre

WORKING PAPER NO. 86
1999

MANAGING AN ORGANIZATIONAL LEARNING SYSTEM BY ALIGNING STOCKS AND FLOWS OF KNOWLEDGE: AN EMPIRICAL EXAMINATION OF INTELLECTUAL CAPITAL, KNOWLEDGE MANAGEMENT, AND BUSINESS PERFORMANCE

by

NICK BONTIS
Assistant Professor of Strategic Management
Michael G. DeGroote School of Business, McMaster University, Canada
nbontis@mcmaster.ca
1280 Main Street West MGD #207
Hamilton, Ontario Canada L8S 4M4
Tel: (905) 525-9140 x23918
Fax: (905) 521-8995

MANAGING AN ORGANIZATIONAL LEARNING SYSTEM BY ALIGNING STOCKS AND FLOWS OF KNOWLEDGE: AN EMPIRICAL EXAMINATION OF INTELLECTUAL CAPITAL, KNOWLEDGE MANAGEMENT, AND BUSINESS PERFORMANCE

Abstract

There exists great interest in organizational learning among academics and practitioners. However, the organizational learning literature remains a mixture of qualitative theories, descriptive case studies, computer simulations and little empirical research. The goal of this paper is to advance the current state of theory development by taking an empirical approach which considers organizational learning as a dynamic system of behaviours across individual, group and organizational levels.

A distinction currently lacking in the literature is the difference between knowledge in organizations that is static (i.e., remains fixed within one individual or information system) versus knowledge that is dynamic (i.e., moves from one individual or information system to the next). This paper considers knowledge stocks and flows which interact with one another across levels in an overall organizational learning system.

A survey instrument was used to test these hypotheses based on the Strategic Learning Assessment Map (SLAM) (Crossan and Hulland, 1997; Crossan and Bontis, 1998). The survey was administered to 32 organizations in the mutual fund industry. Approximately 15 individuals representing senior-, middle- and non-management levels responded from each organization resulting in a total sample of 480 respondents. The final regression equation represented a highly explanatory model which also validates the hypotheses.

This research confirms the premise that *there is a positive relationship between knowledge stocks at all levels and business performance.* Furthermore, the proposition that *the misalignment of knowledge stocks and flows in an overall organizational learning system is negatively associated with business performance* is also confirmed.

Key words: **organizational learning, knowledge stocks, knowledge flows**

Abstract: 246 words

Text: 9,249 words, 30 pages

Intense global competition has resulted in an increasingly complex and unpredictable business environment where markets transform themselves instantaneously. Many firms that once prospered are now unable to keep up. Conversely, brand new companies can realize market capitalizations in the billions of dollars soon after birth. Amidst all of this turbulence, an organization's capacity to learn may be its only sustainable competitive advantage (De Geus, 1988; Stata, 1989). Wick and León put it more bluntly by warning managers that organizations must either "learn or die" (1993: 19).

The 4-i framework of organizational learning (Crossan, Lane and White, 1999) offers a theoretical lens through which learning processes are described across multiple levels of analysis. By generating and empirically testing theoretically-grounded hypotheses across a cross-sectional sample, this research aims to advance the field of organizational learning. The Strategic Learning Assessment Map (SLAM) provides researchers with a method for conceptualizing knowledge in organizations by using individuals' perceptions of organizational learning processes at multiple levels: individual, group and organization (Crossan and Hulland, 1997; Crossan and Bontis, 1998). The main research issue of this paper is to determine – across a sample of organizations – how perceptions of knowledge stocks and flows in an organizational learning system relate to each other, and ultimately how their inter-relationship is associated with business performance.

REVIEW OF LITERATURE

The academic research field of organizational learning has a legacy that spans over thirty years but has recently experienced exponential growth (Crossan and Guatto, 1996; Cohen and Sproull, 1996). A recent bibliographic review shows that as many academic papers in organizational learning were published in 1993 as in the whole decade of the '80s (Easterby-

Smith, 1997). However, the numerous definitions used by researchers (see Table 1) highlights a confusing area within this field.

Organizational learning is the phenomenon of interest within the learning school of strategic management. Mintzberg, Ahlstrand and Lambel argue that organizational learning theorists believe "the world is too complex to allow strategies to be developed all at once as clear plans or visions. Hence strategies must emerge in small steps, as an organization adapts, or learns" (1998: 6). In their comprehensive review of the strategic management literature Mintzberg, Ahlstrand and Lampel (1998) outline ten distinct schools of strategy. Researchers in the learning school believe that the complex and unpredictable nature of an organization's environment precludes deliberate control. Strategy making must therefore take an emerging role in which incremental learning occurs over time. This incrementalist perspective is in contrast to the planning school of thought which considers strategy making as a more systematic and formal process. Proponents of the learning school argue that strategies may initially be planned but are eventually unrealized and thus emerge over time (Mintzberg, 1994).

Mintzberg, Ahlstrand and Lampel (1998: 210-123) argue that two theories within the learning school have emerged as particularly insightful: i) Nonaka and Takeuchi's (1995) theory of knowledge creation, and ii) Crossan, Lane and White's (1999) 4-i framework of organizational learning. The former emphasizes the flow of knowledge in organizations along the same lines as Boisot's (1998) *social learning cycle*. The latter explains the importance of learning processes across multiple levels of analysis. These two theories help fill the void created by other streams of literature (i.e., evolutionary theory (Nelson and Winter, 1982), resource-based view (Wernerfelt, 1984; Barney, 1986; Teece, 1988) and intellectual capital (Stewart, 1997; Bontis, 1998; 1999)) which emphasize the stock of knowledge in organizations.

Nonaka and Takeuchi's (1995) theory of knowledge creation posits that knowledge is created in four different ways through the interaction between tacit and explicit knowledge (see Figure 2). The four modes are *socialization*; *externalization*; *internalization* and *combination*. In order to position the field of organizational learning within the strategic management literature, Crossan, Lane and White (1999) identify strategic renewal as the underlying phenomenon. Hurst (1995) argues that strategic renewal harmonizes continuity and change at the level of the enterprise. As Crossan, Lane and White describe, the competition for resources between exploration and exploitation creates a tension:

> This tension is seen in the feed-forward and feed-back of learning across the individual, group and organizational level. Feed-forward relates to exploration ... feed-back relates to exploitation (1999: 5).

Four meta-processes linking the tension across these three levels have been identified (Crossan, Lane and White, 1999). These are *intuiting* and *interpreting* at the individual level, *integrating* at the group level, and *institutionalizing* at the organization level (see Figure 4):

> At the individual level, intuiting captures the important process of developing new insights ... Through interpreting, individuals develop cognitive maps about the various domains in which they operate. ... Integrating involves the sharing of individual interpretations to develop a common understanding ...Finally, the process of institutionalizing involves embedding individual and group learning into the non-human aspects of the organization including systems, structures, procedures and strategy.

CONCEPTUALIZATION

The Strategic Learning Assessment Map (SLAM) framework integrates the key dimensions of the organizational learning literature by including: i) a multiple levels of analysis perspective; ii) a conceptual operationalization than can be measured, and iii) an integration of knowledge stocks and flows. While the varying levels and processes of organizational learning are important, it is their inter-relationship that is the most critical aspect of the SLAM framework (Crossan and Hulland, 1997). To illustrate the inter-relationships, the levels are arrayed against

one another in a 3 X 3 matrix (see Figure 6). The vertical axis represents knowledge input and the horizontal axis represents knowledge output. The arrows represent feed-forward (i.e., from individual to group to organization) and feed-back loops of learning (i.e., from organization to group to individual). Each cell represents a different learning process. For example, the bottom-centre cell with input (Organization) and output (Group), focuses attention on how institutional elements (e.g., the structure of the organization) impact who talks to who in a group setting. This construct describes the behaviours for such a learning process to occur. This cell is a sub-unit (one of three) of feed-back learning flows.

The conceptual basis for the interconnectedness of stocks and flows of knowledge at multiple organizational levels can be found in systems dynamics (Senge, 1990). As Senge points out, the key insight in a systems approach is that inter-relationships occur in loops rather than linear cause-and-effect chains. The SLAM framework addresses the inter-relationships across individual, group and organizational levels of analysis. The SLAM framework addresses the issue of both knowledge stocks and flows by identifying them at multiple levels. Along the diagonal of the 3 X 3 matrix, inputs equal outputs (refer back to Figure 6). When the rate of input and output is identical in a system, it is identified as being in a state of equilibrium in which there is a constant stock. Similarly, the SLAM has three cells that represent the stock of learning at the individual, group and organization levels of analysis. The off-diagonal areas represent the inter-relationships or flows of learning among the levels. The key dimension that distinguishes knowledge between a stock and a flow in the SLAM framework is determined by which level of analysis is the input and output. The combined use of the levels of analysis dimension while incorporating the stock – flow dimension is the unique feature of the SLAM.

The integration of these dimensions in the SLAM framework yields five key constructs: two learning flows and three knowledge stocks. It is important to note that the stock – flow distinction in the SLAM framework is based on the input and output levels of analysis. In other words, if the input and output of knowledge occur at the same level of analysis, it is defined as a stock. But if the input and output of knowledge occur at different levels, it is defined as a flow. The SLAM constructs are defined in Table 3.

DEVELOPMENT OF HYPOTHESES

The first set of hypotheses deal with the direct relationship between knowledge stocks at each of the three levels and business performance. The first hypothesis in this set examines the relationship between individual-level knowledge stocks and business performance. In an exploratory study that developed perceptual measures of intellectual capital stocks, a substantive and significant positive relationship was found in many model specifications between measures of human capital, structural capital and performance (Bontis, 1998). Bontis' (1998) measures of human capital could be considered as a proxy for individual-level knowledge stocks. As an extension of Bontis' (1998) research, a positive association between individual-level knowledge stocks and performance can be made.

Generally, most of the $55.3 billion investment in training and development in U.S. organizations is based on increasing the levels of individual knowledge stocks (ASTD, 1996). Human resource managers tend to recruit the best and brightest employees for the sole purposes of increasing their organization's human capital. All of this is done with the hope that such investment will boost business performance. Plott argues, "companies that invest more heavily on workplace learning are more successful, more profitable and more highly valued on Wall Street" (1998: 8). Superior individual knowledge allows a firm to train its workforce more effectively and devise a more productive system of organization (Spender, 1994, Døving, 1996).

In other words, stocks of knowledge at the individual level of analysis have a positive association with business performance. Based on the previous discussion:

H1 Individual-level knowledge stocks have a positive association with business performance. As individual-level knowledge stocks increase, so does business performance.

Given the positive outcomes from community-based learning behaviours (Seely Brown and Duguid; 1991), there is a need to test the association between knowledge developed by groups and performance. Group-level knowledge stocks represent the knowledge that is developed through language or dialogue when individuals work together. Competitive advantage can be generated from the firm's ability to support and foster group knowledge (Liebeskind, 1996). Therefore, as the level of group knowledge increases, so should business performance. In other words, stocks of knowledge at the group level of analysis have a positive association with business performance. Based on the previous discussion:

H2 Group-level knowledge stocks have a positive association with business performance. As group-level knowledge stocks increase, so does business performance.

Sustainable business performance is in large part derived from intangible assets such as organizational-level knowledge (Liebskind, 1996). Thus, superior organizational knowledge allows a firm to devise a more productive system of organization (Spender, 1994, Døving, 1996). Strategic management researchers have identified the importance of aligning systems, structure and strategy with the environment (Mintzberg, Ahlstrand and Lampel, 1998). Important components of organizational-level knowledge stocks include systems, structure and strategy.

Whereas Chandler (1962) is known to be the first to articulate the importance of a system of organization as a firm's structure, Learned et al. (1965) were the first to articulate the relative positioning of a firm's structure within its business environment. As a result, the original

purveyors of the design school proposed a model of strategy making that yields an organizational system which attains a fit between internal capabilities and external possibilities (Mintzberg, Ahlstrand and Lampel, 1998). Thus, the knowledge embedded in an organization's structure can be described as its institutionalized strategy. An organization's institutionalized strategy consists of the alignment of non-human storehouses of learning contained it its systems, structure, procedures, and culture relative to its environment. As the stock of this embedded knowledge increases, so should the firm's effective positioning in its environment. It follows then that competitive advantage may be generated from the organizational knowledge of the firm. In other words, stocks of knowledge at the organizational level of analysis have a positive association with business performance. Based on the previous discussion:

H3 Organizational-level knowledge stocks have a positive association with business performance. As organizational-level knowledge stocks increase, so does business performance.

The previous discussion highlighted the hypothesized positive association between knowledge stocks at all levels and business performance. A more fine-grained look suggests that this may not be enough to sustain high levels of performance. Perhaps the relative level of knowledge flows with their corresponding stocks determines the utilization of knowledge stocks. The SLAM framework's operationalization of both knowledge stocks and flows allows researchers to tap into this issue. The following section describes this relationship further.

With the emphasis on the construction of hypotheses centred on knowledge stocks at multiple levels and their relation to business performance complete, a systems approach to organizational learning offers a shift in perspective. This section moves from an emphasis on the outcomes of stocks, to the processes of flows and the misalignment or gaps that exist when stocks and flows are not coordinated with one another.

For this research, misalignment is defined as the difference between levels of knowledge stocks and flows. The first set of hypotheses focused on the positive association between knowledge stocks at multiple levels and business performance. However, a more fine-grained hypothesis posits that this may not be enough to maintain high levels of business performance. The ability to enhance the relationship between knowledge stocks and business performance may lie in an organization's ability to accelerate its flow of knowledge across multiple levels of the organization in the form of feed-forward and feed-back learning flows. Perhaps, aligning these levels of stocks with their appropriate flows of learning can yield even greater performance. Conversely, a relative misalignment of stocks and flows may yield poorer performance.

A symptom of the inefficient management of a firm's overall organizational learning system is the misalignment between its knowledge stocks and flows. Take for example a hypothetical organization in which individuals are intellectually unencumbered. Suppose that these individuals can generate many novel insights and are able to break out of traditional mind-sets to see things in new and different ways. Assume that these new insights represent a firm's individual knowledge stock. Conceptually, Simon (1991) warns that bounded rationality limits the development of this stock to some upper level. Eventually, individuals will be generating new knowledge beyond the capacity of the firm to utilize it. Individuals in this hypothetical firm would become frustrated with the lack of appreciation of their intellectual input which would decrease their motivation to work yielding negative performance consequences.

In order for an organization to increase the absorptive capacity (Cohen and Levinthal, 1990; Lane and Lubatkin, 1998) of its individual knowledge stocks it must flow them to higher levels in the organization. In other words, when vast amounts of new ideas are developed by individuals, there is a need to communicate them to colleagues or superiors in order for

individuals to feel a sense of pride. It is the flowing of these ideas to peers which allows an organization to continue leveraging from its individual knowledge stocks. This constant flow acts as a reinforcing mechanism to the original stock. Stifling the flow of individual knowledge to fellow colleagues (i.e., through restricted communication channels, incompatible information systems, uncooperative superiors) results in bottlenecks in the overall learning system.

Bottlenecks within the overall organizational learning system result in negative consequences on desired organizational outcomes. Furthermore, individual knowledge stocks start to decay since individuals start to develop a negative perception of the value of their own knowledge. The misalignment between knowledge stocks and flows allows researchers to gauge the proportion of knowledge stocks that are actually been leveraged the organization. When a large proportion of knowledge stocks are been flowed throughout the organization, an organizational learning system is performing efficiently.

In addition to the grounded conceptualization of misalignment above a manufacturing/production system metaphor yields further insight. When levels of stocks are aligned with their appropriate levels of flows, a production system is efficiently converting its input into output. When stocks and flows are misaligned, a production system does not have the capacity to convert its raw materials into finished goods efficiently. This leads to bottlenecks in the system and lags in output. For example, assume that at one step along a hypothetical production line, a stock of work-in-process inventory is considered high. If the value-added processing of that work-in-process inventory is further delayed, an overall strain on the system is created and throughput time is negatively affected. Similarly, an organization may not have the capacity to absorb individual knowledge stocks since there may be bottlenecks that restrict the flow of that learning in the overall organizational learning system. Whereas plant managers are

responsible for coordinating materials flow, organizational managers are responsible for coordinating knowledge flow. Gibson, Greenhalgh and Kerr state that "the fundamental task of manufacturing management is to regulate the flow of materials through the network so that it is as smooth and coordinated as possible" (1995: 55). Manufacturing managers do this by aligning the stock and flow levels of work-in-process inventory (Brown, 1997). Similarly, organizational managers must align stock and flow levels of knowledge so that the overall organization learning system operates efficiently.

In this section, it is argued that the misalignment of knowledge stocks and flows has a negative association with business performance. In other words, levels of knowledge flows must be sufficient in relation to levels of knowledge stocks in order to positively influence business performance. It follows then, that organizational learning flows can act as a detriment to business performance if they are misaligned relative to knowledge stocks. In other words, even though firms can have identical levels of individual, group and organizational knowledge stocks, they can have different levels of feed-forward and feed-back learning flows. It is suggested that these misalignments of learning flows with stocks differentiates one company from another. Consequently, the greater misalignment between knowledge stocks and flows results in bottlenecks of learning for that organization. These bottlenecks have adverse affects on the efficiency of the overall organizational learning system. For this reason, a firm that reduces this misalignment can achieve greater relative performance. Based on the previous discussion:

H4 Misalignment between knowledge stocks and flows has a negative association with business performance. As the misalignment between knowledge stocks and flows increases, business performance decreases.

All of the aforementioned hypotheses (see Appendix A for a summary) assume that the knowledge that is stocked or flowed is accurate and appropriate. This is an important

consideration. The quality of an individual's knowledge must be evaluated prior to the decision of whether or not it should be flowed. Obviously, not all ideas should see the light of day. This poses a conceptual challenge for researchers since evaluating the merit of one's knowledge is extremely difficult. Furthermore, what is highly valued by one individual may not be highly valued by another. For this reason, it is important for researchers to employ individual's perceptions of knowledge. This approach acts as a calibrating mechanism in determining the appropriateness and quality of knowledge. The focus of the paper now turns to the methodology that is used to operationalize, model, test and evaluate these hypotheses.

OPERATIONALIZATION

Crossan and Hulland (1997) argue that development of an organizational learning instrument should proceed regardless of theoretical disagreement in the literature. Although the natural tendency for researchers is to build, and then subsequently test theory, Nunnally (1978) suggests that theory development is often advanced through the efforts of measurement. Markus and Robey (1988) emphasize the dilemma that organizational learning theorists face with researching multiple levels of analyses. They argue that the case study method is the preferred method of inquiry because it provides a greater understanding due to a qualitative perspective. However, given the plethora of case-based research in this field, this paper aims to study organizational learning phenomena quantitatively.

The operationalization of the SLAM framework is done through the use of Likert-type scales which tap into individual perceptions. There exists extensive precedence for the use of such a methodology. There are a variety of instruments in addition to the SLAM in which researchers have used Likert-type scales to operationalize knowledge and learning constructs. Most of these current instruments have been primarily developed in the course of consultancy work (Romme and Dillen, 1997). Items developed for the SLAM were generated using a multi-

staged process as suggested by Churchill (1979), Fornell and Larcker (1981), Anderson and Gerbing (1988), and Hinkin (1995). In order to develop sound measures, items were generated that were believed to capture the essence of the construct's domain as described in the literature review from the previous chapter. The language used in the items was targeted at a high school level of comprehension. Items were of medium-length as suggested by Andrews (1984). Several focus groups with managers ensured that the language was simple and comprehensible. The survey items used for this paper study can be found in Appendix B (Note: The 10 items in section G relate to leadership behaviours. This data will be used in subsequent research and is not part of this paper). In order to develop a survey that was as comprehensive as possible, items from other reliable instruments (Marquardt, 1996); (Nonaka, Byosiere, Borucki and Konno, 1994); (Hult, 1995) were also reviewed. To further evaluate the comprehensiveness of the survey instrument the American Society for Training and Development (ASTD) invited over twenty researchers to submit their organizational learning assessment instruments as a source for comparison (Van Buren, 1997). The SLAM incorporates all of the key dimensions and content areas prescribed by the ASTD guide.

The common weakness of using macro-economic indicators or proxies for organizational learning measures is that they focus on outcomes and are unlikely to capture the progress an organization makes at the cognitive stage. Garvin (1993) suggests that tracing such progress requires a survey methodology. The key unit of analysis in this research is the individual actor. Konecni states that "methodological individualism, the view that only the individual actor is real, is the only way to conduct social science research" (1977: 88). While most researchers realize the existence of groups and organization-level structures, the measurement of these constructs still focus on the single actor (Sampson, 1977). This focus leads to targeting the perceptual

attributes of individuals on higher-order structures such as groups or organizations (Knoke and Kuklinski, 1982; Wellmann and Berkowitz, 1988).

Although multiple levels of learning have been proposed, there is a need to calibrate the levels of stocks and flows through the eyes of the individuals who are part of the overall organizational learning system. The alternative would be to obtain objective assessments of each of the constructs, but the following anecdote highlights the shortcoming of this approach.

In an earlier administration of SLAM described by Crossan and Hulland (1997), members of a senior management group were discouraged by a low (FF) score, in spite of their repeated attempts to actively manage the feed-forward process. Crossan and Hulland provide the following description:

> They cited the example of their suggestion box system, which had generated many good ideas that they had subsequently acted upon. Then one member realized that while they had used the ideas, they had never informed the employees of this fact. Thus, while an objective measure focusing on the utilization of ideas might have shown a high feed-forward score, the perceptual measure based on the broader employee perspective indicated otherwise. More generally, an employee's perception that the company is not utilizing his or her ideas could have several negative consequences. It could actually erode individual-level knowledge stocks if employees downgrade their own sense of competence and confidence, or it could lead to a sense of disgruntlement or apathy about whether the company cares about what they think (1997: 14).

Crossan and Hulland (1997) argue that even though employees' ideas were utilized by the organization, individuals' perceptions are what really matter, since these perceptions will ultimately govern the degree and types of learning that occur. As Argyris and Schön (1978) suggest, the detection of discrepancies between experiences and beliefs forms the basis for effective learning. Crossan and Hulland extend the argument in support of perceptual measures as follows:

> One can examine individual's perceptions of how well groups are functioning, or how well the non-human aspects of the organization (i.e., systems, structure, strategy, and procedures) are aligned to enable the firm to perform. Although

> individual perceptions may deviate from actual practices, it is perceptions that individuals act upon, and hence it is perceptions that need to be managed to enhance organizational learning (1997: 15).

Ten business performance items address such issues as "our organization is successful" and "individuals are fulfilled by their work". Research has shown that perceived measures can be a reasonable substitute for objective measures of performance (Dess and Robinson, 1984) and have strong reliabilities and correlations with objective measures of financial performance (Venkatraman and Ramunujam, 1987; Geringer and Hébert, 1989, 1991; Hansen and Wernerfelt, 1989, Lyles and Salk, 1997). The items in this construct include "rating the future outlook of the business", "meeting customers' needs" and "assessing overall business performance".

Having completed the operationalization of the main hypothesized constructs of this study, the following section discusses the control variables that have been used in past research. Nason (1994) used organization size and age as control variables in his empirical study of organizational learning disabilities. Lyles and Salk (1997) also controlled for size and age in their study of learning in Hungarian international joint ventures. Gnyawali and Stewart (1998) and their colleague (Gnyawali, Stewart and Grant, 1997) went further and also controlled for work experience. Finally, economic analysis of competitive advantage focuses on how industry structure determines the profitability of firms in an industry (e.g., Porter, 1980). The mutual fund industry has been selected to control for industry effects. This industry is appropriate for this research because: i) it is a buoyant industry having experienced considerable growth over the last several years due to the popularity of mutual funds as long-term investment vehicles for the ageing population, and ii) it is considered a knowledge-intensive industry due to its low focus on capital expenditures and high focus on human-intensive portfolio management.

As per the previous discussion on recommended control variables, organizational size has been controlled for with three variables: i) mutual fund assets size; ii) number of mutual funds;

and iii) number of employees, all as at December 31, 1997 (the natural logarithm of each was used). The fourth control variable used in this research is the tenure in months of each respondent as a proxy for work experience.

The study was preceded by a test pilot. This test pilot was used to further develop the survey instrument and pre-test the hypotheses on a large sample of respondents in a single firm. The SLAM instrument was administered to a sample of 1,543 individuals within a large organization to test the reliability and validity of the survey items (Crossan and Bontis, 1998). This pilot study was also used to reconfirm the results of the Crossan and Hulland (1997) study.

Although the loading values of some items were off by insignificant amounts, the general profile of each construct was similar. The reliability, internal consistency, convergent validity and discriminant validity tests of the five main constructs (feed-forward learning flows, feed-back learning flows, individual knowledge stocks, group knowledge stocks and organizational knowledge stocks) were adequate. All of the hypotheses were validated with significant coefficients in the predicted directions. However, the test pilot suffered from an important limitation because sampling was conducted across one organization. Results from the test pilot showed an interesting bias that was not anticipated. A response bias existed for several measures based on level of management. In almost all cases, senior managers tended to inflate responses as compared to middle-managers and middle-managers tended to inflate responses as compared to non-management employees. Although this was a systematic occurrence across all constructs, there is no theoretical support in the organizational learning literature as to why it occurred.

However, there are a few plausible explanations for management-level bias. Since empirical research in the organizational learning field is limited, explanations can be sought from other areas to understand this phenomenon. For example, Good, Page and Young (1996) found a

significant difference in measures of job-related attitudes between entry- and upper-level managers. Perhaps this same bias exists in measures of knowledge stocks and flows. An alternative explanation is that this may be an isolated case. The data for the test pilot was collected from only one organization. It is plausible that the circumstances in this particular organization yield different results between levels of management and that these differences are not necessarily present in every organization. In order to account for this response bias in the study, multiple respondents from senior-, middle- and non-management levels were targeted from each representative organization.

METHODOLOGY

A total of 73 mutual fund companies as of December 31, 1997 were registered with IFIC (Investment Funds Institute of Canada). The smallest (by asset size) ten of these companies was not considered because: i) the total number of employees was less than the number of respondents required (15) per organization, and ii) many of these companies had not been in operation for more than two years. This left the 64 largest mutual fund companies by asset size as determined by IFIC which were initially contacted to participate in this study.

Ideally, organization-level concepts should be measured at the organizational level (Rousseau, 1985). Logistically, surveys cannot be filled out by an organization so higher-level data must be inferred from a single respondent (Døving, 1996). Targeted respondents included the CEO of the mutual fund company or a reasonable substitute such as the President or VP of Human Resources. This method is used widely since organizations are ultimately a reflection of their top management (Hambrick and Mason, 1984). Once secured, this individual was asked to supply the names of 15 employees in the mutual fund company. In order to control for the management level bias exhibited during the test pilot, five of the 15 employees were randomly selected from each of senior-, middle- and non-management levels across all functional areas.

There is tremendous precedent in the management literature for surveying the highest member of an organization when studying organizational-level phenomena. Lyles and Schwenk (1992) suggest that the cognitive maps of top management members closely represent core aspects of all organizational members. In the case of this study, 15 respondents across three management levels were targeted in order to get a richer perspective over what a sole senior respondent could provide.

Dillman (1978) raises several concerns to be addressed when compiling a sample representative of a certain population. The first is whether each unit of the population has an equal (or at least known) opportunity of being included. Using IFIC as the population source reduces the missed cases to very small companies which do not have the critical size that is required to study the phenomena in question. The second concern is whether the appropriate respondent is surveyed within the sampled unit. The targeted respondents mentioned earlier are appropriate given the nature of the survey. In all cases, the key contact in each organization had the option of having other individuals complete the questionnaire if they deemed he or she to be more appropriate. The final concern is that of probable bias from refusals. By allowing the survey to be passed on to more appropriate personnel if available, the potential for non-response bias can be minimized (Tomaskovic-Devey, Leiter and Thompson, 1994). Regardless of outcome, non-response bias is checked at the organizational level by comparing publicly available information on organizations who responded versus those who did not for statistically different profiles.

While some researchers argue for the largest possible sample size at the risk of increasing non-sampling errors, others argue for a statistical calculation of the necessary sample size. Although this study commences its sampling frame from the population of IFIC which has a total

of 73 members, the minimum required sample size is governed by the requirements of the modeling technique selected. In this study PLS (Partial Least Squares) is used for exploratory factor analysis. One of the key benefits of using PLS as a technique is that it works well with smaller samples. In general, the most complex regression will involve: i) the indicators on the most complex formative construct, or ii) the largest number of antecedent constructs leading to an endogenous construct. Sample size requirements become at least ten times the number of predictors from i) or ii), whichever is greater (Barclay et al., 1995).

In this study, the sample size of 480 is high enough for PLS. This sample represents an average of 15 respondents in each of 32 organizations. Hofstede, Neuijen, Ohayv and Sanders explain that the sample size requirement is not calculated based "on the number of aggregate cases [32] but on the number of independent individuals [480]" (1990: 299). In this study, the sample size is more than adequate.

Prior to administering the survey it was pre-tested by five managers who commented on: i) the clarity of the questions; ii) the appropriateness of the questions; iii) the ease of completion, and iv) the length of time it took to complete the survey. The survey was then further revised and evaluated by several faculty at the Ivey School of Business before it was sent for ethics approval by the review board for non-medical research involving human subjects.

The survey was faxed to a fax number provided by the organization and accompanied by a brief cover letter explaining the importance of the research, options for response (i.e., either by fax, mail or e-mail), and suggestions for alternative respondents. Many of the TDM (Total Design Method) recommendations suggested by Dillman (1978) were adopted. Respondents had the option of receiving summary copies of the results. Once participation was secured, an on-site

visit was scheduled in order to determine the 15 randomly selected respondents and aid in administration of the survey where possible.

Information such as administration date of survey and respondent details were recorded so that bias tests could be completed. Surveys were scanned for completeness and coded initially in spreadsheet format prior to statistical analysis. Participation was secured from 32 mutual fund companies out of the 64 that were initially contacted for an overall response rate of 50%. The primary reason for the relatively high response rate can be attributed to the favourable letters of support from IFIC and other key senior mutual fund executives in the industry that helped generate a strong interest for this research. Table 4 lists the participating companies in this research study.

ANALYSIS AND RESULTS

The use of survey methodology in this study raises issues of bias. Three important considerations that may effect the integrity of the data include the impact of nonresponse bias, temporal bias and common method bias. Finally, a test of management level bias is conducted to confirm whether or not senior managers systematically respond differently to these items versus middle- and non-managers.

In this study, *nonresponse* bias at the individual level (within each company) was not an issue because the key contact ensured that the 15 respondents that were randomly selected completed the survey. However, since this study also focuses at the organizational-level of analysis, it is important to determine if there were any participation biases as the organizational level. Nonresponse bias at the organizational level was evaluated by comparing the mutual fund asset size of companies that participated in the study versus the rest of the sampling frame. This test is supported by Armstrong and Overton (1977). The results in Table 5 show that there clearly was a statistical difference between companies that participated in this study versus ones

that did not in terms of asset size ($t = 2.803$, $p < 0.01$). Participating companies had an average asset size of $7.16 billion while the rest averaged only $2.22 billion. To determine the reason for this bias, mutual fund companies that did not participate were asked to provide reasons – all but two volunteered explanations. Approximately two-thirds of the companies stated that they were not able to participate because "the need for 15 respondents was too great of a commitment" while the remaining third stated that they "were going through a restructuring".

Given the multi-respondent methodology used in this study, the need to secure the responses of 15 individuals in each organization was a deterrent for participation as expected. This was anticipated and an initial effort was made to remove the smallest ten mutual fund companies from the IFIC population for this reason. In retrospect, more than ten should have been removed from the population. The existence of nonresponse bias is not a major detriment to this research because the companies that did have a large enough employee base to participate had legitimate reasons for not doing so (e.g., restructuring of the organization). The five largest mutual fund companies in the population all participated. Only two companies in the top ten did not participate and both of them reported that they were going through a restructuring. In conclusion, the final sample of 32 is representative of the population of mutual fund companies that are large enough to sustain an organizational learning system.

Temporal bias was evaluated by comparing the first 16 organizations that were administered versus the last 16 on: i) their asset size, and ii) their average company response to item H01 "Our organization is successful". Survey administration for all 32 companies was completed over a period of three months between February and April of 1998. Since RRSP (Registered Retirement Savings Plan) season is the busiest time of year for mutual fund companies, it was important to discern whether or not the deadline (beginning of March for most

of Canada except in the East where the deadline was changed to the end of March because of a bad ice storm) had any significant impact.

The test for temporal bias (see Table 6) indicates that there is no statistical difference in asset size between the first 16 mutual fund companies that participated in the study and the last 16 ($t = 0.397$, $p = 0.695$). The first 16 mutual fund companies had an average asset size of $7.81 billion while the last 16 had an average asset size of $6.47 billion. There is no temporal bias based on asset size in this study.

The results in Table 7 show that there is no statistical difference in the average company response to item H01 "Our company is successful" between the first 16 mutual fund companies that participated in the study and the last 16 ($t = -0.376$, $p = 0.709$). The first 16 mutual fund companies had an average response of 5.49 (on a Likert-type scale from 1 to 7) while the last 16 had an average response of 5.60. There is no temporal bias based on the performance item H01.

Another major concern with using survey methodology is *common method* bias. This occurs when independent and dependent variables are provided by the same source. This is particularly dangerous when respondents are asked to fill out items that tap into independent and dependent variables within the same survey instrument. To help alleviate the problem of common method bias, more than one individual was used to account for independent and dependent variables for each organization. An average of 15 individuals across three management levels were surveyed from each organization. Since the final regression models used to test the hypotheses control for organization, common method bias should be mitigated.

However, to statistically test for common method bias, the data was rearranged (i.e., paired) so that every individual in each mutual fund company would provide responses to either the independent or dependent variables. By doing so, no single individual would be providing

responses to both independent and dependent variable items. Alternate binary numbers were assigned to each individual case in the data so that independent and dependent variable data were paired. Consequently, this reduced the sample from 480 to 240 cases. The correlation of factor scores were then compared to see if a significant difference exists.

Respondents were randomly selected by the internal contact person and classified into three levels: senior-, middle- and non-management. During the pre-study test pilot, there was evidence that a management level bias existed when the SLAM instrument was administered in that organization. Senior managers tended to have higher mean responses to most items as compared to middle and non-managers. An omnibus MANOVA test was used to determine the existence of *management level* bias (see Table 9). All five SLAM variables in addition to PERF were compared by management level. The multivariate test showed significant bias by management level (Wilks $F = 2.403$, $p < 0.005$). However, the univariate test showed that this difference exists only for IK ($F = 5.085$, $p < 0.01$), OK ($F = 3.902$, $p < 0.05$, and FF ($F = 5.099$, $p < 0.01$). A Bonferroni post-hoc test determined that there was a significant bias between senior management and middle management on the IK and FF variables in particular. However, since this represents only two out of a possible 18 biases (3 levels X 6 variables), the effect of management level is not deemed to have a substantial influence on the data. Management level bias seems to mitigate itself across large samples of organizations. The existence of this bias in the test-pilot was deemed an isolated event.

The evaluation of the measures and their corresponding constructs was accomplished via the use of several tests. A special effort was undertaken to maintain the integrity of the established items from the test pilot which had adequate psychometric properties. However, some items were reworded at the suggestion of reviewers and a handful of new ones were added.

All of the 60 items germane to this study (see Appendix B) were assigned to their respective scales using PLS (Partial Least Squares) as suggested by Barclay, Higgins and Thompson (1995). There were ten items that were assigned to each of six scales. Since the scales consisted of both established and newer items, evaluation of these measures began with *exploratory factor analysis* using PLS. PLS allows researchers to develop a systematic and holistic view when establishing measures to solve research problems. For confirmatory factor analysis, LISREL (Bollen, 1989, Jöreskog and Sörbom, 1993) has several relative strengths, whereas for exploratory factor analysis, PLS (Fornell and Bookstein, 1982, Hulland, 1998) is more appropriate.

The loadings for the all of the items are Table 10. Shimp and Sharma (1987) suggest that items with loading values less than 0.7 be removed to ensure construct validity. This procedure required the removal of items C02, C03, C04, D07, D08, D09, E05, E06, E07, F02, F05, F07, F08, F09, F10R, and H03. Once the non-valid items were removed each item was re-validated by testing its item-to-total correlation measure. All remaining items had measures of 0.35 or greater with their corresponding constructs as suggested by Saxe and Weitz (1982).

Constructs were tested for internal consistency using the Fornell and Larcker (1981) measure. Results of tests for convergent validity (Bagozzi, 1981) and discriminant validity (Bagozzi, 1981; Fornell and Larcker, 1981) can be found in Table 11 All constructs had adequate reliability (Carmines and Zeller, 1979) and internal consistency well above the 0.7 threshold as prescribed by Nunnally (1978). Cronbach's alpha values and internal consistency values were as follows: IK (0.91|0.93), GK (0.90|0.92), OK (0.90|0.92), FF (0.91|0.93), FB (0.77|0.86) and PERF (0.91|0.93). In terms of convergent validity, Fornell and Larcker (1981) support an average variance extracted above 50%. The average variance extracted for each construct was as

follows: IK (56.7%), GK (62.0%), OK (63.8%), FF (64.7%), FB (59.7%), and PERF (57.4%). In terms of discriminant validity, Fornell and Larcker (1981) suggest that the shared variance between any two constructs should be less than the variance extracted by either of the individual constructs. In other words, values along the diagonal of the correlation matrix in Table 11 must be greater than the corresponding values in each row or column. In this study, the discriminant validity of all constructs is adequate. Finally, the correlation values between MISALIGN and the rest of the variables show that only the correlation with PERF was insignificant.

Once the final set of valid and reliable items was determined, factor scores using principle components extraction with VARIMAX rotation were calculated for each construct so that hypothesis testing using regression analysis could be completed (Lastovicka and Thamodaran, 1991). VARIMAX has been shown to be among the best and most common orthogonal rotation procedures (Stewart, 1981). Conceptually speaking, the factor score represents the degree to which each respondent scores high on the group of items that load high on that factor. Thus, a respondent who scores high on the several items that have high loadings for a factor will obtain a high factor score on that factor. In many research applications, factor scores can become raw input data for subsequent multivariate analyses such as regression (Acito and Anderson, 1986). Factor scores are also useful for calculating differences between certain constructs. Fuguitt and Lieberson (1974) state that there are numerous examples in which researchers have taken the difference of constructs by calculating their *D-scores* or difference of factor scores.

A factor score for PERF (business performance) was calculated by using the remaining nine items from Table 10. The factor score was inserted as the dependent variable in the regression analysis. The factor score (based on perceptual measures) was correlated with a

financial measure of business performance to verify that it was appropriate. The financial measure used was ROR (return on revenue) which was calculated by taking *Net Profit After Tax* over *Net Revenue* for the fiscal year 1997. A positive and significant relationship exists between the PERF factor score and ROR ($r = 0.371, p < 0.01$).

The SLAM framework uses a stock – flow dimension to distinguish between knowledge that is static within a level versus knowledge that is dynamic across levels. This conceptualization has yielded three stocks and two flows that are inter-related across three levels of analysis. The alignment of stocks and flows is required for efficient conversion of input into output. Consequently, when stock and flow levels are misaligned, a system suffers from bottlenecks and is less efficient. Performance of throughput time in the overall system is undermined. To determine misalignment conceptually, it is necessary to consider the difference between levels of stock and flow. It follows then that to determine the misalignment empirically one value needs to be subtracted from another. In the case of this research, these values need to be in the same units. Total mean stocks and total mean flows are calculated by taking the mean value of corresponding factor scores. The difference is then calculated to determine whether these values are close together or far part. This misalignment value is used as a proxy which represents the inter-relationship between knowledge stocks and flows. The misalignment variable in the second model was calculated by taking the difference between the mean of the three knowledge stock factor scores (IK, GK and OK) and the mean of two knowledge flow factor scores (FF and FB). This difference was unidirectional since the mean values of stock measures (IK = 5.08, GK = 4.87, OK = 4.90) were higher than the mean values of flow measures (FF = 4.44, FB = 4.77). Thus, the corresponding value represents the difference between total stock and flow levels in the overall organizational learning system.

There is precedence for calculating differences between factor scores in management research. For example, researchers often calculate cultural distance between countries by subtracting the difference between values on certain dimensions such as masculinity (Hofstede, 1980). Similar comparisons have been done using the MBTI – Myers Briggs Type Indicator (Myers and McCaully, 1975) and personality traits (Devito, 1985). Researchers also calculate the difference of factor scores when they need to compare one variable with another (Johns, 1980). For example, Fuguitt and Lieberson (1974) report that *D-scores* (difference scores) have been used to compare the state of a variable from one point in time to another. Also, D-scores have been subtracted from one another as a proxy of conceptual difference or disassociation.

The five control variables that were inserted into the model include: i) ASSETS = natural logarithm of asset size in billions of Canadian dollars, ii) FUNDS = natural logarithm of number of mutual funds, iii) EMPLOYEES = natural logarithm of number of employees, iv) TENURE = natural logarithm of length of employment in months, and v) COMPANY = 31 dummy variables to account for 32 companies in the sample. The first four control variables are characterized by greater oscillations when series values are bigger in magnitude than when they are smaller. For this reason, a natural logarithmic transformation was calculated to make variation constant across levels of the series.

Having accounted for all control variables, Model 1 represents the base model in which knowledge stocks at the individual, group and organizational levels are simultaneously entered into the regression equation (see Table 12). This model is used to test the first set of hypotheses. The explanatory power of this model is high ($R^2 = 69.5\%$) and the overall model is significant ($F = 26.243$, $p < 0.001$). The standardized β coefficient for the term ■K is equal to 0.280 which is positive and significant ($t = 5.835$, $p < 0.001$). This result validates the first hypothesis which

states that there is a positive association between IK and PERF. The standardized β coefficient for the term GK is equal to 0.245 which is positive and significant ($t = 5.438$, $p < 0.001$). This result validates the second hypothesis which states that there is a positive association between GK and PERF. Finally, the standardized β coefficient for the term OK is equal to 0.302 which is also positive and significant ($t = 6.305$, $p < 0.001$). This result validates the third hypothesis which states that there is a positive association between OK and PERF.

Model 2 tests the fourth and final hypothesis. The explanatory power of this model is higher ($R^2 = 71.5\%$) than the first. It is also statistically significant ($F = 27.904$, $p < 0.001$). The standardized β coefficient for the term MISALIGN is equal to -0.158 which is negative and significant ($t = -4.991$, $p < 0.001$). This result validates the fourth hypothesis which states that there is a negative association between MISALIGN and PERF. Variance inflation factor (VIF) values were calculated for each variable inserted into the regression. All VIF values were less than 10 which is adequate and confirms that multicollinearity is not a problem.

Model 2 improved over Model 1 ($R^2 \Delta = 2.0\%$, Sig. of $F \Delta < 0.001$). Furthermore, all coefficients were significant and in their predicted directions validating all of the hypotheses (see Table 13). The results of Model 1 affirm that increases in knowledge stocks at all levels are associated with positive outcomes on business performance. However, the results of Model 2 reveal that it is also important to concurrently minimize the misalignment between knowledge stocks and flows.

DISCUSSION

The main research issue of this paper is to determine – across a sample of organizations – how perceptions of knowledge stocks and flows in an organizational learning system relate to each other and ultimately how their inter-relationship is associated with business performance.

The results of hypothesis testing confirms the premise that *there is a positive relationship between knowledge stocks at all levels and business performance.* Furthermore, the proposition that *the misalignment of knowledge stocks and flows in an overall organizational learning system is negatively associated with business performance* is also confirmed.

The key academic implications of this study are: i) the contribution made to organizational learning theory development by identifying stocks and flows of knowledge across three levels of analysis; ii) the empirical development of constructs that can be used to measure organizational learning behaviours; iii) the methodological drawbacks of aggregating data through summation; and iv) the importance of integrating related concepts.

There also exist many limitations in this research. For example, Chinese organizations force a reconsideration of generalizability. These organizations are largely antithetical to most concepts of organizational learning (Taylor, 1998). They are tightly controlled at the top, usually by the owner and several family members (Fukuyama, 1995). Furthermore, communication between and across levels is not encouraged and information is jealously guarded. Such low intra-organizational trust is a detriment to organizational learning. Ryder (1994) argues that French companies have stronger hierarchies than their Anglo-Saxon counterparts which also has implications regarding the openness of communication channels. On the other hand, research by Nonaka, Byosiere, Borucki and Konno (1994) examined the behaviours of knowledge creation among middle-managers in Japan and found quite a fertile setting for research. Although Japanese managers are known for high uncertainty avoidance (Hofstede, 1980), they counter this cultural characteristic by communicating openly among co-workers. Nonaka and Takeuchi (1995) argue that the Japanese are relatively weak in analytical skills, for which they compensate by frequent interaction among people. Easterby-Smith (1997) argues that most of the cross-

national literature on organizational learning takes the view that distinctive management secrets give Japanese companies an edge over their U.S. competitors. It is for this reason that U.S. companies must learn from their Japanese joint ventures and strategic alliances. Future research should consider these and other cultural implications when developing theories.

In this paper, business performance was the organizational outcome that was considered. Other endogenous constructs that have been considered in the literature include organizational innovativeness and organizational competitiveness (Nason, 1994). Although these outcomes are important, there may be more proximate outcomes that may mediate the relationship with performance. For example, immediate outcomes of organizational learning behaviours may include changes in values and assumptions (Argyris and Schön, 1978), skills (Fiol and Lyles, 1985), systems and structures (Levitt and March, 1988), core competencies (Prahalad and Hamel, 1990) and job satisfaction. Perhaps these and other outcomes mediate the relationship between organizational learning and performance. Future research should attempt to operationalize these constructs and examine these hypotheses within the context of the SLAM framework.

Another pressing issue in strategic management research in general – and in organizational learning research in particular – is the endogeneity of the performance construct. Generally, research business models treat performance as the dependent variable. But, performance may in fact act as an antecedent to phenomena such as organizational mortality, job satisfaction or the effective management of an organizational learning system. Mintzberg, Quinn and Voyer (1995) argue that learning and performance may in fact be tied together in a continuous loop. They argue that performance provides important feedback about the efficiency of a learning process and ultimately affects how an organization continues to learn.

The results of this study show that practitioners must refocus their efforts when managing organizational knowledge by considering both stocks and flows. This requires senior managers to bridge the chasm between departments of *information systems* (who primarily help with the development of organizational-level knowledge) and *HR management* (who primarily help with the development of individual-level knowledge). Furthermore, organizations should promote a more appropriate physical and psychological environment for sharing and dialogue among individuals which aids in the development of group-level knowledge. A final key element is that compensation and evaluation systems must be implemented that provide individuals with incentives to share and codify knowledge throughout their teams and departments.

Practitioners must understand the importance of reallocating investment to support both stocks and flows of knowledge. HR should carefully monitor where knowledge is stockpiled. Knowledge stocks often become obsolete because they are either never *unlearned* or never flowed efficiently throughout the organization. HR must develop a map of these inventories of knowledge so that appropriate flows can be re-routed to other groups so that the overall organizational learning system does not suffer from bottlenecks. Finally, HR is responsible for hiring and developing managers that can stimulate and support organizational learning behaviours. Senior managers who already recognize the value of their organization's intellectual capital must support their organizational learning systems so that they operate at optimal efficiency.

APPENDIX B: SURVEY ITEMS

SURVEY INSTRUCTIONS

- All information you provide on this survey is strictly confidential.
- No other party will receive a copy of your responses.
- Please complete all of the items in the survey as soon as possible and return in the sealed envelope provided.
- It should take you approximately 15 minutes to respond to every item.
- If you have any questions, please contact Nick Bontis at (519) 642-0066

A. Please provide the following personal details which will help with future communication and the analysis of the survey results. (Print legibly)

1. Department _____
2. Position _____
3. Management Level Senior ___ Middle ___ Non-mng ___
4. Length of employment (years and months) _____

B. The following items relate to your observations of individuals within your organization. Please circle only one response per item.

	Strongly Disagree						Strongly Agree
1. Individuals are current and knowledgeable about their work.	1	2	3	4	5	6	7
2. Individuals are aware of the critical issues that affect their work.	1	2	3	4	5	6	7
3. Individuals feel a sense of accomplishment in what they do.	1	2	3	4	5	6	7
4. Individuals generate many new insights.	1	2	3	4	5	6	7
5. Individuals feel confident in their work.	1	2	3	4	5	6	7
6. Individuals feel a sense of pride in their work.	1	2	3	4	5	6	7
7. Individuals have a high level of energy at work.	1	2	3	4	5	6	7
8. Individuals are able to grow through their work.	1	2	3	4	5	6	7
9. Individuals have a clear sense of direction in their work.	1	2	3	4	5	6	7
10. Individuals are able to break out of traditional mind-sets to see things in new and different ways.	1	2	3	4	5	6	7

C. The following items relate to your observations of groups within your organization (e.g., your department, your team, people you interact with most). Please circle only one response per item.

	Strongly Disagree						Strongly Agree
1. In meetings, we seek to understand everyone's point of view.	1	2	3	4	5	6	7
2. We share our successes within the group.	1	2	3	4	5	6	7
3. We share our failures within the group.	1	2	3	4	5	6	7
4. Ideas arise in meetings that did not occur to any one individual.	1	2	3	4	5	6	7
5. We have effective conflict resolution when working in groups.	1	2	3	4	5	6	7
6. Groups in the organization are adaptable.	1	2	3	4	5	6	7
7. Groups have a common understanding of departmental issues.	1	2	3	4	5	6	7
8. Groups have the right people involved in addressing the issues.	1	2	3	4	5	6	7
9. Different points of view are encouraged in group work.	1	2	3	4	5	6	7
10. Groups are prepared to rethink decisions when presented with new information.	1	2	3	4	5	6	7

D. The following items relate to your organization's structure, culture, vision and strategic direction. Please circle only one response per item.

	Strongly Disagree						Strongly Agree
1. We have a strategy that positions us well for the future.	1	2	3	4	5	6	7
2. The organizational structure supports our strategic direction.	1	2	3	4	5	6	7
3. The organizational structure allows us to work effectively.	1	2	3	4	5	6	7
4. Our operational procedures allow us to work efficiently.	1	2	3	4	5	6	7
5. The organization's culture could be characterized as innovative.	1	2	3	4	5	6	7
6. We have a realistic yet challenging vision for the organization.	1	2	3	4	5	6	7
7. We have the necessary systems to implement our strategy.	1	2	3	4	5	6	7
8. Our organizational systems contain important information.	1	2	3	4	5	6	7
9. We have company files and databases that are up-to-date.	1	2	3	4	5	6	7
10. We have an organizational culture characterized by a high degree of trust.	1	2	3	4	5	6	7

E. The following items relate to how you and your group influence the organization. Please circle only one response per item.

	Strongly Disagree						Strongly Agree
1. Lessons learned by one group are actively shared with others.	1	2	3	4	5	6	7
2. Individuals have input into the organization's strategy.	1	2	3	4	5	6	7
3. Groups propose innovative solutions to organization-wide issues.	1	2	3	4	5	6	7
4. Recommendations by groups are adopted by the organization.	1	2	3	4	5	6	7
5. We do not "reinvent the wheel".	1	2	3	4	5	6	7
6. Individuals compile information for everyone to use.	1	2	3	4	5	6	7
7. Individuals challenge the assumptions of the group.	1	2	3	4	5	6	7
8. The company utilizes the intelligence of its workforce.	1	2	3	4	5	6	7
9. The "left hand" of the organization knows what the "right hand" is doing.	1	2	3	4	5	6	7
10. Results of the group are used to improve products, services and processes.	1	2	3	4	5	6	7

F. The following items relate to how systems and procedures influence you and your group. Please circle only one response per item.

1. Policies and procedures aid individual work.	1	2	3	4	5	6	7
2. Reward systems recognize the contribution made by groups.	1	2	3	4	5	6	7
3. Group decisions are supported by individuals.	1	2	3	4	5	6	7
4. Company goals are communicated throughout the organization.	1	2	3	4	5	6	7
5. Our recruiting practices enable us to attract the best talent.	1	2	3	4	5	6	7
6. Company files and databases provide the necessary information to do our work.	1	2	3	4	5	6	7
7. Information systems make it easy for individuals to share information.	1	2	3	4	5	6	7
8. Training is readily available when it is needed to improve knowledge and skills.	1	2	3	4	5	6	7
9. Cross-training, job rotation and special assignments are used to develop a more flexible workforce.	1	2	3	4	5	6	7
10. When making decisions for the future, we do not seem to have any memory of the past.	1	2	3	4	5	6	7

G. The following items relate to how management (e.g., your supervisor, your superior, your manager's manager) influences the organization. Please circle only one response per item. †

	Strongly Disagree						Strongly Agree
1. Management works as a team.	1	2	3	4	5	6	7
2. Management listens to our ideas.	1	2	3	4	5	6	7
3. Management encourages experimentation and innovation.	1	2	3	4	5	6	7
4. Management is able to mobilize the efforts of the group.	1	2	3	4	5	6	7
5. Management helps to create a shared mindset.	1	2	3	4	5	6	7
6. Management has articulated a clear strategic direction.	1	2	3	4	5	6	7
7. Management supports the learning and development of individuals.	1	2	3	4	5	6	7
8. Management demonstrates the leadership qualities required to excel.	1	2	3	4	5	6	7
9. Management supports research and development of new knowledge in the organization.	1	2	3	4	5	6	7
10. Management ensures that new knowledge is disseminated to all parts of the organization.	1	2	3	4	5	6	7

H. The following items relate to individual, group and organizational performance . Please circle only one response per item.

1. Our organization is successful.	1	2	3	4	5	6	7
2. Our organization meets its clients' needs.	1	2	3	4	5	6	7
3. Our organization's future performance is secure.	1	2	3	4	5	6	7
4. Our organization is well-respected within the industry.	1	2	3	4	5	6	7
5. Our group makes a strong contribution to the organization.	1	2	3	4	5	6	7
6. Our group performs well as a team.	1	2	3	4	5	6	7
7. Our group meets its performance targets.	1	2	3	4	5	6	7
8. Individuals are satisfied working here.	1	2	3	4	5	6	7
9. Individuals are generally happy working here.	1	2	3	4	5	6	7
10. Individuals are satisfied with their own performance.	1	2	3	4	5	6	7

† The 10 items in section G relate to leadership behaviours. This data will be used in subsequent research.

TABLE 1: DEFINITIONS OF ORGANIZATIONAL LEARNING

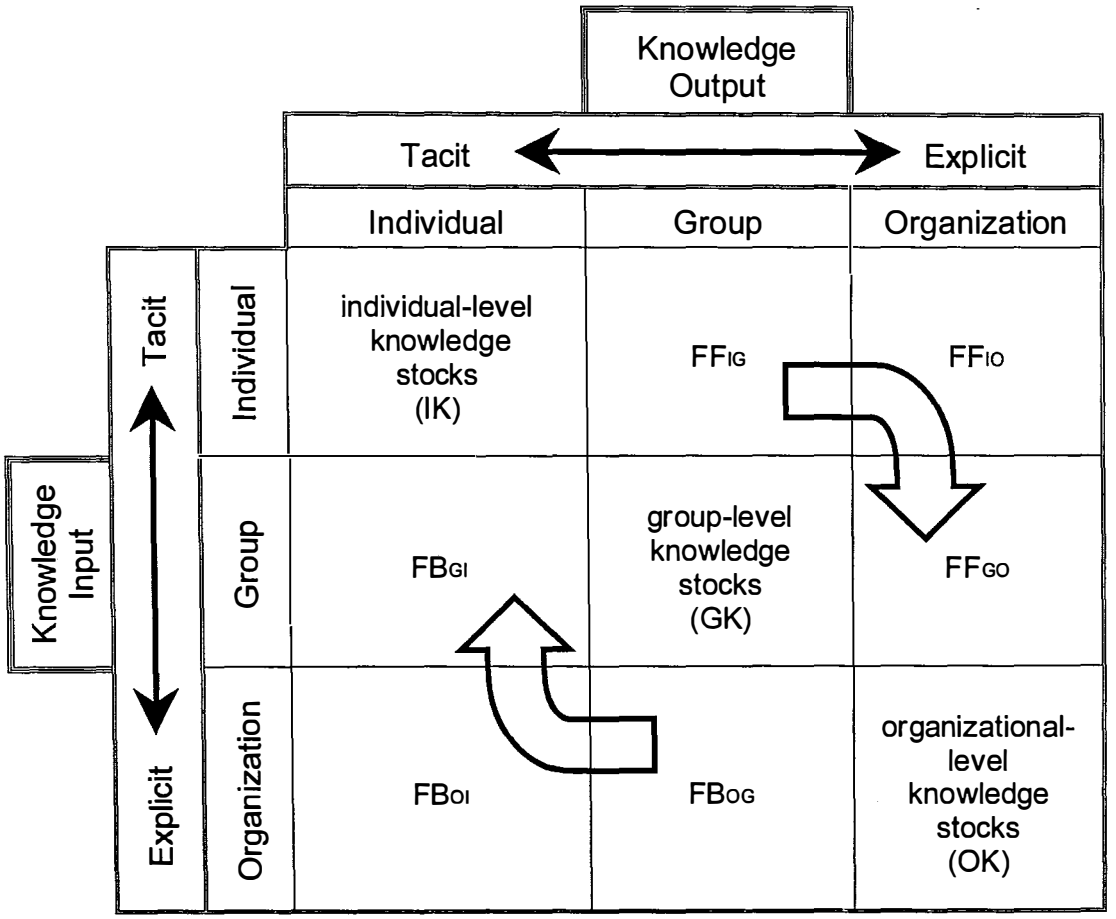
AUTHOR(S)	DEFINITION
Argyris & Schön (1978)	Organizational learning is a process of detecting and correcting errors.
Crossan et al. (1995)	Learning is a process of change in cognition and behaviour, and it does not necessarily follow that these changes will directly enhance performance.
Daft & Weick (1984)	Organizational learning is knowledge about the interrelationships between the organization's action and the environment.
Day (1991)	Organizational learning is comprised of the following processes: open-minded inquiry, informed interpretations and accessible memory.
Fiol & Lyles (1985)	Organizational learning means the process of improving actions through better knowledge and understanding.
Garvin (1993)	A learning organization is an organization skilled in creating, acquiring and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights.
Huber (1991)	An entity learns if, through its processing of information, the range of its potential behaviors is changed.
Kim (1993)	Organizational learning is defined as increasing an organization capacity to take effective action.
Lee et al. (1992)	The organizational learning process is viewed as a cyclical one in which individuals' actions lead to organizational interactions with the environment. Environmental responses are interpreted by individuals who learn by updating their beliefs about cause-effect relationships.
Levinthal & March (1993)	Organizational learning copes with the problem of balancing the competing goals of developing new knowledge and exploiting current competencies in the face of the dynamic tendencies to emphasize one or the other.
Levitt & March (1988)	Organizations are seen as learning by encoding inferences from history into routines that guide behavior.
Marquardt (1996)	An organization which learns powerfully and collectively and is continually transforming itself to better collect, manage, and use knowledge for success.
Meyer-Dohm (1992)	Organizational learning is the continuous testing and transforming of experience into shared knowledge that the organization accesses and uses to achieve its core purpose.
Miller (1996)	Learning is to be distinguished from decision making. The former increases organizational knowledge, the latter need not. Learning may in fact occur long before, or long after, action is taken.
Mills & Friesen (1992)	A learning organization sustains internal innovation with the immediate goals of improving quality, enhancing customer or supplier relationships, or more effectively executing business strategy, and the ultimate objective of sustaining profitability.
Nadler et al. (1992)	Learning requires an environment in which the results of experiments are sought after, examined and disseminated throughout the organization.
Senge (1990)	Learning organizations are organizations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspirations are set free and where people are continually learning how to learn together.
Slater & Narver (1994)	At its most basic definition, organizational learning is the development of new knowledge or insights that have the potential to influence behaviour.
Stata (1989)	Organizational learning is the principal process by which innovation occurs. In fact, I would argue that the rate at which individuals and organizations learn may become the only sustainable competitive advantage, especially in knowledge-intensive industries.

FIGURE 4: THE 4-i FRAMEWORK OF ORGANIZATIONAL LEARNING

Level	Process	Inputs	Outcomes
individual	**intuiting**	individual experiences images	personal insights
	interpreting	language metaphor	shared dialogue
group	**integrating**	negotiated action interactive systems	cognitive maps
organizational	**institutionalizing**	routinized actions rules and procedures	knowledge systems

Crossan, Lane and White (1999)

FIGURE 6: THE SLAM FRAMEWORK



$$\text{Knowledge stocks} = \Sigma\,(IKS + GKS + OKS)$$

$$\text{Feed-forward learning flows} = \Sigma\,(FF_{IG} + FF_{IO} + FF_{GO})$$

$$\text{Feed-back learning flows} = \Sigma\,(FB_{GI} + FB_{OI} + FB_{OG})$$

Adapted from Crossan and Hulland (1997) and Crossan and Bontis (1998)

TABLE 3: DEFINITIONS OF SLAM CONSTRUCTS

IK	individual-level knowledge stocks	Individual capability and motivation to do the job, human capital
GK	group-level knowledge stocks	Group dynamics and shared understanding, team learning through dialogue, knowledge embedded in social interactions
OK	organizational-level knowledge stocks	Alignment of non human storehouses of learning including systems, structure, strategy, procedures and culture; knowledge embedded in structural capital, organizational routines
FF	feed-forward learning flows	Whether or how individual learning feeds forward into group learning and learning at the organizational level in terms of changes to structure, systems, products, strategy, procedures and culture, etc.
FB	feed-back learning flows	Whether or how the learning that is embedded in the organizational systems, structure, strategy, etc. impacts group and individual learning

Adapted from Crossan and Hulland (1997) and Crossan and Bontis (1998)

TABLE 4: LIST OF PARTICIPATING COMPANIES

AIC Limited	MD Management Ltd.
Atlas Asset Management Inc.	Mutual Group
BPI Capital Management Corp.	Navigator Fund Company Ltd.
C.I. Mutual Funds	Pro Fund Ltd.
Canada Trust Investment Group Inc.	Peter Cundill & Associates
CIBC Securities Inc.	Royal Mutual Funds Inc.
Elliot & Page Ltd.	Scotia Funds Group
Fidelity Investments Canada Ltd.	Scudder Canada Investor Services Ltd.
Financial Concept Group Ltd.	State Street
Global Strategy Financial Inc.	Stone & Co. Ltd.
GT Global	Synergy Asset Management Ltd.
Hongkong Bank Canada Securities Inc.	Talvest Fund Management Corp.
Infinity Funds Investment Counsel	Templeton Management Ltd.
Investors Group	Trimark Investment Management Inc.
Mackenzie Financial Corp.	University Avenue Funds
London Life Fund Management Ltd.	Working Venture Inc.

TABLE 5: PARTICIPATION BIAS

Group Statistics

	DATE	Mean	Std. Deviation	Std. Error Mean
ASSETS $ billions	Participating	7.16417	8.95418	1.66275
	Not Participating	2.21780	3.49606	.59094

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
ASSETS $ billions	Equal variances assumed	15.747	.000	3.007	62	.004	4.94637	1.64492
	Equal variances not assumed			2.803	35.059	.008	4.94637	1.76464

TABLE 6: TEMPORAL BIAS (ASSET SIZE)

Group Statistics

	Companies	Mean	Std. Deviation	Std. Error Mean
ASSETS $ billions	First 16	7.81147	7.98314	2.06124
	Last 16	6.47064	10.15162	2.71313

Independent Samples T-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
ASSETS $billions	Equal variances assumed	.016	.900	.397	27	.695	1.34082	3.37870
	Equal variances not assumed			.394	24.698	.697	1.34082	3.40731

TABLE 7: TEMPORAL BIAS (PERFORMANCE ITEM H01)

Group Statistics

	Companies	Mean	Std. Deviation	Std. Error Mean
H01	First 16	5.4937	.8337	.2084
	Last 16	5.5962	.7020	.1755

Independent Samples T-Test

		Levene's Test for Equality of Variances		t-test for Equality of Means				
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
H01	Equal variances assumed	.057	.813	-.376	30	.709	-.1025	.2725
	Equal variances not assumed			-.376	29.155	.710	-.1025	.2725

TABLE 8: COMMON METHOD BIAS

VARIABLE	CORRELATION WITH PERF (n = 480) [1]	CORRELATION WITH PERF (n = 240) [2]	ABSOLUTE DIFFERENCE
IK	0.684	0.693	0.009
GK	0.662	0.666	0.004
OK	0.739	0.730	0.009
FF	0.675	0.670	0.005
FB	0.693	0.689	0.004

[1] Correlation of factor scores between independent variables (IK, GK, OK, FF, FB) and dependent variable (PERF) using total data.
[2] Correlation of factor scores using paired data.

TABLE 9: MANAGEMENT LEVEL BIAS

MANOVA OMNIBUS MULTIVARIATE TEST

TEST	VALUE	F	DF	ERROR OF DF	SIG. OF F
WILKS	0.936	2.403	12	864.0	0.005*

UNIVARIATE TEST

VARIABLE	F	SIG. OF F	VARIABLE	F	SIG. OF F
IK	5.085	0.007*	FF	5.099	0.006*
GK	2.806	0.062	FB	1.504	0.223
OK	3.902	0.021*	PERF	1.518	0.220

BONFERRONI POST-HOC TEST

VARIABLE	A LEVEL	B LEVEL	DIFFERENCE (A – B)	STANDARD ERROR	SIGNIFICANCE
IK	senior	mid	0.3479	0.1150	**0.0079***
	senior	non	0.1595	0.1107	0.4510
	mid	non	-0.1884	0.1095	0.2577
GK	senior	mid	0.2498	0.1159	0.0951
	senior	non	0.1016	0.1119	1.0000
	mid	non	-0.1482	0.1111	0.5487
OK	senior	mid	0.2158	0.1154	0.1864
	senior	non	-0.0381	0.1113	1.0000
	mid	non	-0.2539	0.1101	0.0648
FF	senior	mid	0.3412	0.1160	**0.0103***
	senior	non	0.2686	0.1124	0.0518
	mid	non	-0.0725	0.1101	1.0000
FB	senior	mid	0.1982	0.1162	0.2660
	senior	non	0.0796	0.1125	1.0000
	mid	non	-0.1186	0.1109	0.8566
PERF	senior	mid	0.1414	0.1162	0.6731
	senior	non	-0.0750	0.1124	1.0000
	mid	non	-0.2164	0.1110	0.1555

* The mean difference is significant at the 0.025 level (one-tailed).

TABLE 10: ITEM STATISTICS

Item #	Mean μ	Std. Dev σ	Loading λ [1]	Error ε	Item to Total Correlation [2]
B01	5.3604	1.0264	0.7003	0.50 4	0.626
B02	5.1854	1.1363	0.744	0.4451	0.6750
B03	5.172	1.1420	0.735	0.4584	0.6647
B04	4.8163	1.1351	0.7388	0.4541	0.6726
B05	5.1646	1.033	0.7573	0.4264	0.6880
B06	5.3208	1.141	0.8081	0.3471	0.7471
B07	5.3152	1.1 22	0.7783	0.3 43	0.71 0
B08	5.2025	1.2454	0.7635	0.4171	0.6 85
B0	4.6812	1.1882	0.747	0.4406	0.6823
B10	4.5875	1.2 42	0.7501	0.4374	0.6847
C01	5.041	1.3022	0.75 2	0.4237	0.6705
C02	5.3661	1.2480	0.6 22	0.5208	removed
C03	4.7 08	1.3342	0.6862	0.52 2	removed
C04	4. 386	1.2528	0.6237	0.6110	removed
C05	4.5768	1.3200	0.7648	0.4151	0.6728
C06	4.8664	1.2851	0.7661	0.4130	0.677
C07	4.6430	1.2 04	0.7666	0.4123	0.6821
C08	4.7077	1.4076	0.8122	0.3404	0.72 4
C0	5.133	1.2734	0.8341	0.3043	0.7572
C10	5.1237	1.2500	0.805	0.3505	0.7218
D01	5.13 6	1.485	0.8210	0.3260	0.7403
D02	4.77 2	1.4013	0.8566	0.2663	0.7874
D03	4.7042	1.3723	0.835	0.3013	0.7646
D04	4.6088	1.3473	0.7467	0.4425	0.6567
D05	4. 563	1.406	0.7660	0.4132	0.6772
D06	5.1757	1.33 0	0.7 30	0.3711	0.7141
D07	4.3145	1.5013	0.68 6	0.5244	removed
D08	5.1886	1.3356	0.66 7	0.5515	removed
D0	4.8354	1.5154	0.6255	0.6087	removed
D10	4. 582	1.4 84	0.7637	0.4168	0.6738
E01	4.4412	1.3466	0.7530	0.4330	0.670
E02	4.3570	1.5045	0.8388	0.2 65	0.7678
E03	4.4013	1.3706	0.8177	0.3314	0.7423
E04	4.4758	1.3348	0.8448	0.2862	0.7774
E05	4.441	1.4072	0.5847	0.6581	removed
E06	4.7317	1.3154	0.6 12	0.5222	removed
E07	4.7104	1.2067	0.6400	0.5 04	removed
E08	4.7254	1.4458	0.7850	0.3838	0.7018
E0	3. 13	1.4506	0.7342	0.460	0.6515
E10	4.7347	1.3364	0.8505	0.2766	0.7848
F01	4.67 2	1.3425	0.7707	0.4060	0.56 3
F02	4.4674	1.5753	0.6616	0.5622	removed
F03	4.8776	1.0 48	0.8065	0.34 5	0.6225
F04	4.8323	1.54 3	0.7671	0.4116	0.5618
F05	4.5504	1.4551	0.6670	0.5551	removed
F06	4.6 33	1.3418	0.7454	0.4443	0.54 4
F07	4.7 50	1.46 4	0.6463	0.5823	removed
F08	4.7845	1.4757	0.6 52	0.5133	removed
F0	4.0636	1.6331	0.652	0.5737	removed
F10R	4.56 5	1.6775	0.1281	0. 836	removed
H01	5.5741	1.256	0.8003	0.35 6	0.7447
H02	5.2818	1.1 88	0.7266	0.4720	0.65 0
H03	4.7782	1.3555	0.6 75	0.5135	removed
H04	5.3 04	1.3873	0.7166	0.4864	0.6356
H05	5.8316	1.12 3	0.744	0.4452	0.67 5
H06	5.6450	1.2303	0.7438	0.4468	0.6713
H07	5.5167	1.155	0.7534	0.4324	0.6830
H08	5.0480	1.4008	0.8215	0.3252	0.758
H0	5.1 67	1.38	0.8172	0.3321	0.7538
H10	5.384	0. 8 6	0.7201	0.4815	0.6367

[1] All items with loading values less than 0.7 were removed (see Appendix B for definition of survey items).

[2] All remaining items have item to total correlation values greater than 0.35.

TABLE 11: CONSTRUCT STATISTICS

	IK	GK	OK	FF	FB	PERF
Arithmetic [1] Mean (all items)	5.0807	4.9167	4.8694	4.4990	4.6381	5.3647
Arithmetic [2] Mean (used items)	5.0807	4.8705	4.9031	4.4356	4.7706	5.4299
Cronbach's α [3] Reliability	0.9146	0.8978	0.9043	0.9093	0.7669	0.9093
Internal [4] Consistency	0.9290	0.9194	0.9247	0.9276	0.8556	0.9253
Convergent [5] Validity	0.5670	0.6201	0.6375	0.6474	0.5971	0.5799

Correlation Matrix and Discriminant Validity Assessment

IK	**0.7530** [6]					
GK	0.694 [7]	**0.7875**				
OK	0.658	0.649	**0.7985**			
FF	0.643	0.691	0.721	**0.8046**		
FB	0.589	0.657	0.738	0.727	**0.7727**	
PERF	0.684	0.662	0.739	0.675	0.693	**0.7615**
MISALIGN	0.308	0.197	0.058	-0.336	-0.373	0.035 [8]

[1] Arithmetic mean of all items in each construct. Likert-type items are scaled from 1 to 7.

[2] Arithmetic mean of items used once low items with low loadings have been removed.

[3] Cronbach's alpha (1951). All measures above the 0.70 threshold as per Nunnally (1978).

[4] Fornell and Larcker (1981) measure of internal consistency greater than 0.70 threshold. See Equation 4.1.

[5] Fornell and Larcker (1981) measure of convergent validity greater than 0.50 threshold. See Equation 4.2.

[6] Fornell and Larcker (1981) measure of discriminant validity which is the square root of the average variance extracted compared to the construct correlations. Bold values are greater than those in corresponding rows and columns as per Fornell and Larcker.

[7] Off-diagonal values are correlations. All correlation values are significant at 0.01 level (2-tailed).

[8] Correlation between MISALIGN and PERF is not significant at 0.01 level (2-tailed). All others are significant.

CONSTRUCT DEFINITIONS

IK – individual-level knowledge stocks,
GK – group-level knowledge stocks,
OK – organizational-level knowledge stocks,
FF – feed-forward learning flows,
FB – feed-back learning flows,
PERF – business performance,
MISALIGN – misalignment between knowledge stocks and flows

CONTROL VARIABLE MEANS

Asset size = $7.16 billion
Number of funds = 18.6
Number of employees = 216
Length of employment (per respondent) = 56.9 months

TABLE 12: REGRESSION HIGHLIGHTS

	Model 1				Model 2			
	B	β [1]	t [2]	VIF [3]	B	β [1]	t [2]	VIF [3]
Constant	-0.166		-0.493		-0.062		-0.190	
Controls [4]								
IK	0.285	0.280	5.835	2.695	0.335	0.329	6.930	2.816
GK	0.251	0.245	5.438	2.370	0.259	0.253	5.806	2.373
OK	0.307	0.302	6.305	2.679	0.288	0.283	6.081	2.697
MISALIGN					-0.299	-0.158	-4.991	1.246

MODEL	R^2	ADJ. R^2	R^2 Δ	F-STAT	SIG. F	SIG. F Δ
1	0.695	0.669		26.243	< 0.001	
2	0.715	0.689	0.020	27.904	< 0.001	< 0.001

[1] Standardized beta (β) coefficients are all substantive, significant and in the predicted direction.

[2] All coefficients are significant at p-value < 0.001.

[3] No multicollinearity problems are evident in the data (VIF values < 10).

[4] Control variables (asset size, number of funds, number of employees and length of employment) are insignificant.

NOTES

Model 1 predictors include: ln of asset size,
ln of number of funds,
ln of number of employees,
ln of length of employment,
dummy variables for 32 companies, plus
first block of hypothesized variables:

IK – individual-level knowledge stocks,
GK – group-level knowledge stocks and
OK – organizational-level knowledge stocks

Model 2 predictors include: Model 1, plus

MISALIGN – misalignment between knowledge stocks and knowledge flows

Dependent variable is PERF – business performance

TABLE 13: VALIDATION OF HYPOTHESES

HYPOTHESIS	β	t [1]	VALIDATION
H1	0.329	6.930	✓
H2	0.253	5.806	✓
H3	0.283	6.081	✓
H4	-0.158	-4.991	✓

[1] All β coefficients are significant a t p-value < 0.001.

TABLE 14: KEY RESEARCH FINDINGS

ACADEMIC IMPLICATIONS	MANAGERIAL IMPLICATIONS
Contributions made to organizational learning theory: • consideration of learning at all levels • consideration of stocks and flows of learning • misalignment of stocks and flows is detrimental to the efficiency of organizational learning system • development of GK and OK is iterative process • FF and FB may be further decomposed	Cross functioning: • create organizational structure process map to assign cross-functional team membership • increases FF • decreases MISALIGN
Construct validation: • empirical research in organizational learning is possible through survey instruments • latent constructs can be measured and used in hypothesis testing	Collaborative technology: • foster sharing of ideas • increases flow of knowledge • use of Lotus Notes, electronic mail systems, and corporate intranets
Aggregating data: • it is inappropriate and empirically dangerous to aggregate individual data cases into corresponding group or organizational levels through summation	Valuing codified knowledge: • departing employees with key knowledge is equivalent to intellectual capital walking out the door
Integrating concepts: • it is important to bridge the areas of organizational learning, knowledge management and intellectual capital into an integrative framework	Just-in-time training: • training and development tools must be current and accessible to all employees • IS and HR departments must bridge this gap
Research limitations: • generalizability, time, levels, functional background Future research directions: • antecedent variables, transformational leadership, taxonomy of organizational learning types	Role of HR management: • acting as a partner between management levels • bridging the gap with IS • continually measure and monitor organizational learning system

REFERENCES

Acito, F. and R. Anderson. (1986). "A simulation study of factor score indeterminacy", *Journal of Marketing Science*, 23.

Anderson, J. and D. Gerbing. (1988). "Some methods for respecifying measurement models to obtain unidimensional construct measurement", *Journal of Marketing Research*, 19.

Andrews, Frank M. (1984). "Construct Validity and Error Components of Survey Measures: A Structural Modeling Approach", *Public Opinion Quarterly*, 48, 409-442.

Argyris, Chris and Donald Schön. (1978). *Organizational learning: A theory of action perspective.* Reading, MA: Addison Wesley.

Armstrong, J. and T. Overton. (1977). "Estimating Nonresponse Bias in Mail Surveys", *Journal of Marketing Research*, 14.

ASTD. (1996). "Expenditures on Employer-Provided Training", *American Society of Training and Development*, July.

Bagozzi, R. (1981). "Evaluating structural equation models with unobservable variables and measurement error", *Journal of Marketing Research*, 18.

Barclay Donald, Christopher Higgins, and Ronald Thompson. (1995). "The Partial Least Squares (PLS) Approach to Causal Modeling", *Technology Studies*, 2, 2.

Barney, Jay B. (1986a). "Organizational culture: Can it be a source of sustained competitive advantage?", *Academy of Management Review*, 11, 3, 656-665.

Boisot, M. (1998). *Knowledge Assets: Securing competitive advantage in the information economy*, New York: Oxford University Press.

Bollen, K. (1989). *Structural Equations with Latent Variables*, New York: Wiley.

Bontis, Nick. (1998). "Intellectual Capital: An Exploratory Study that Develops Measures and Models," *Management Decision*, 36, 2.

Bontis, Nick. (1999). "Managing Organizational Knowledge by Diagnosing Intellectual Capital: Framing and Advancing the State of the Field", *International Journal of Technology Management*, forthcoming.

Brown, R. (1997). "Inventory Control Theory", In J. Greene (Ed.), *Production and Inventory Control Handbook*, New York: McGraw-Hill.

Carmines, E. and R. Zeller. (1979). *Reliability and Validity Assessment.* Sage Paper Series on Quantitative Applications No. 07-017. Beverly Hills, CA: Sage Publications Inc.

Chandler, Alfred D. (1962). *Strategy and Structure*, Cambridge: MIT Press.

Chatzkel, J. (1998). "Measuring and Valuing Intellectual Capital: From Knowledge Management to Knowledge Measurement", *Journal of Systemic Knowledge Management*, December.

Churchill, Gilbert A. Jr. (1979). "A Paradigm for Developing Better Measures of Marketing Constructs", *Journal of Marketing Research*, 16, 64-73.

Cohen, M. and D. Levinthal (1990). "Absorptive capacity: A new perspective on learning and innovation", *Administrative Science Quarterly*, 35, 128-152.

Cohen, M. and L. Sproull. (1996). *Organizational Learning.* London: Sage.

Crossan, M. and J. Hulland. (1997). "Measuring Organizational Learning", *Academy of Management 1997*, Boston, MA.

Crossan, M. and N. Bontis. (1998). The strategic management of organization learning", *Academy of Management 1998*, San Diego, CA.

Crossan, M. and T. Guatto. (1996). "Organizational Learning Research Profile", *Journal of Organizational Change Management*, 9, 1.

Crossan, M., Lane, H. W., Roderick E. White. (1999). "An Organizational Learning Framework: From intuition to institution", *Academy of Management Review*, forthcoming.

De Geus, A. (1988). "Planning as learning", *Harvard Business Review*, March/April.

Dess, G. and R. Robinson. (1984). "Measuring organizational performance in the absence of objective measures: The case of the privately-held firm and conglomerate business unit", *Strategic Management Journal*, 5.

Devito, A.J. (1985). "Review of the Myers-Briggs type indicator", In James V. Mitchell Jr., (Ed.), *The ninth mental measurements yearbook*, Vol. II. Lincoln, NB: The Buros Institute of Mental Measurements.

Dierickx, I. and K. Cool. (1989). "Asset stock accumulation and sustainability of competitive advantage," *Management Science*, 35, 1504-1513.

Dillman, Don A. (1978). *Mail and Telephone Surveys: The Total Design Method*. New York: Wiley & Sons Inc.

Døving, E. (1996). "In the Image of Man: Organizational Action, Competence and Learning", In D. Grant and C. Oswick (Eds.), *Metaphors and Organizations*, London: Sage.

Easterby-Smith, M. (1997). "Disciplines of the Learning Organization: Contributions and Critiques", *Human Relations*, 50, 9.

Fiol C. and M. Lyles. (1985). "Organizational Learning", *Academy of Management Review*, 10, 4.

Fornell, C. and D. Larcker. (1981). "Evaluating Structural Equation Models with Unobservable Variable and Measurement Error", *Journal of Marketing Research*, 18, 39-50.

Fornell, C. and F. Bookstein. (1982). "Two structural equation models: LISREL and PLS applied to consumer exit-voice theory", *Journal of Marketing Research*, 18.

Fuguitt, G. and S. Lieberson. (1974). "Correlation of ratios or difference scores having common terms", *Sociological Methodology*, 6.

Fukuyama, F. (1995). *Trust*, London: Penguin Books.

Garvin, D.A. (1993). "Building a Learning Organization", *Harvard Business Review*, July-August.

Geringer, J. and L. Hébert (1989). "Control and performance of international joint ventures", Journal of International Business Studies, 20.

Geringer, J. and L. Hébert (1991). "Measuring performance of international joint ventures", Journal of International Business Studies, 22.

Ghoshal, S. and C. Bartlett. (1990). "The multinational corporation as an interorganizational network", *Academy of Management Review*, 15.

Gibson, P., Greenhalgh, G. and R. Kerr. (1995). *Manufacturing Management Principles and Concepts*, London: Chapman and Hall.

Gnyawali, D. and A. Stewart. (1998). "Addressing measurement challenges in organizational learning research: Use of a rich organizational simulation", *Proceedings of the Academy of Management Mid-Year Conference on Organizational Learning*, Washington D.C.

Gnyawali, D., Stewart, A. and J. Grant. (1997). "Creation and utilization of organizational knowledge: An empirical study of the roles of organizational learning on strategic decision making", *Conference Proceedings of the Academy of Management 1997*, Boston, MA.

Good, L., Page, T. and C. Young. (1996). "Assessing hierarchical differences in job-related attitudes and turnover among retail managers", *Journal of the Academy of Marketing Science*, 24, 2.

Hambrick, D. and P. Mason. (1984). "Upper Echelons: The organization as a reflection of its top executives", *Academy of Management Review*, 9, 2.

Hansen, G. and B. Wernerfelt. (1989). "Determinants of firm performance in relative importance of economic and organizational factors", *Strategic Management Journal*, 10, 5.

Hinkin, T.R. (1995). "A review of scale development practices in the study of organizations", *Journal of Management*, 21, 5.

Hofstede, G, Neuijen, B., and D. Ohayv. (1990). "Measuring Organizational Cultures: A Qualitative and Quantitative Study across Twenty Cases", *Administrative Sciences Quarterly*, 35, 2.

Hofstede, G. (1980). *Culture's consequences: International differences in work-related values*, Beverly Hills, CA: Sage.

Hulland, J. (1998). "Use of Partial Least Squares (PLS) in Strategic Management Research: A review of four recent studies", *Strategic Management Journal*, in press.

Hult, G. (1995). *An international organizational learning study of the internal marketing system*, Ph.D. Dissertation, Memphis: University of Memphis.

Hurst, D. (1995). *Crisis and Renewal*, Boston: Harvard Business School Press.

Johns, G. (1981). "Difference score measures of organizational behavior variables: a critique", Organizational Behavior and Human Performance, 27, 443-463.

Jöreskog, K.G. and D. Sörbom. (1993). *LISREL 8: User's Reference Guide.* Hillsdale, NJ: Lawrence Erlbaum.

Knoke, D. and J. Kuklinski. (1982). *Network analysis*, Beverly Hills, CA: Sage.

Konecni, V. (1977). "The role of adversive events in the development of intergroup conflict", In W. Austin and S. Worchel (Eds.), *Social Psychology of Intergroup Relations*, Monterrey, CA: Brooks/Cole. Washington D.C.

Lane, P. and M. Lubatkin. (1998). "Relative absorptive capacity and interorganizational learning", *Strategic Management Journal*, 19.

Lastovicka, J. and K. Thamodaran. (1991). "Common factor score estimates in multiple regression problems", *Journal of Marketing Research*, 28.

Learned, E., Christensen, C., Andrews, K., and Guth, W. (1965). *Business policy: Text and cases*. Homewood, IL: Irwin.

Levitt, B. and J. March. (1988). "Organizational Learning", *Annual Review of Sociology*, 14.

Liebeskind, J. (1996). "Knowledge, strategy, and the theory of the firm", *Strategic Management Journal*, 17, (Winter Special Issue).

Lyles, M. and C. Schwenk. (1992). "Top management, strategy, and organizational knowledge structures", *Journal of Management Studies*, 29, 2.

Lyles, M. and J. Salk. (1997). "Knowledge acquisition from foreign partners in international joint ventures: An empirical examination in the Hungarian context", In P. Beamish and J. Killing (Eds.), *Cooperative Strategies: European Perspectives*, San Francisco: New Lexington Press.

Markus, L. and D. Robey. (1988). "Information technology and organizational change: Causal structure in theory and research", *Management Science*, 34, 5.

Marquardt, M. (1996). *Building the Learning Organization.* New York: McGraw-Hill.

Mintzberg, H. (1994). The rise and fall of strategic planning, New York: Free Press.

Mintzberg, H., Ahlstrand, B. and J. Lambel. (1998). *Strategy Safari: A guided tour through the wilds of strategic managemen*t, New York: The Free Press.

Mintzberg, H., Quinn, J.B. and J. Voyer. (1995). *The Strategy Process*, Englewood Cliffs: NJ: Prentice-Hall.

Myers, I. and A. McCaully. (1975). *The Myers-Briggs type indicator*. Palo Alto: Consulting Psychological Association.

Nason, S. (1994). *Organizational learning disabilities: An international perspective*, Ph.D. Dissertation, Los Angeles: University of Southern California.

Nelson, Richard R. and Sidney G. Winter. (1982). *An Evolutionary Theory of Economic Change.* Cambridge, MA: Belknap Press.

Nonaka, I., Byosiere, P., Borucki, C. and N. Konno. (1994). "Organizational Knowledge Creation Theory: A first comprehensive test", *International Business Review*, 3, 4.

Nonaka, Ikujiro and Hirotaka Takeuchi. (1995). *The Knowledge-Creating Company.* New York: Oxford University Press.

Nunnally, J.C. (1978). *Psychometric Theory.* 2nd edition. New York: McGraw-Hill.

Plott, C. (1998). "Learning is linked to profitability", *Corporate University*, July/August.

Porter, M.E. (1980). *Competitive Strategy.* New York: Free Press.

Prahalad, C.K. and Gary Hamel. (1990). "The Core Competence of the Corporation", *Harvard Business Review*, May-June, 79-91.

Romme, G. and R. Dillen. (1997). "Mapping the landscape of organizational learning", *European Management Journal*, 15, 1.

Rousseau, D. (1985). "Issues of level in organizational research: Multi-level and cross-level perspectives", In L.L. Cummings and B.M. Shaw (Eds.), *Research in Organizational Behaviour*, Greenwich, CT: JAI Press.

Ryder, J. (1994). "Learning organization versus organisation apprenante", *Working Paper No. 10/02*, Groupe ESC Lyon.

Sampson, E. (1977). "Psychology and the American ideal", *Journal of Personality and Social Psychology*, 35.

Saxe, R. and B. Weitz. (1982). "The SOCO Scale: A measure of the customer orientation of salespeople", *Journal of Marketing Research*, 19.

Seely Brown, J. and P. Duguid. (1991). "Organizational learning and communities of practice: toward a unifying view of working, learning and innovation", *Organization Science*, 2, 1.

Senge, Peter M. (1990). *The Fifth Discipline: The Art and Practice of the Learning Organisation.* New York: Doubleday Currency.

Shimp, T. and S. Sharma. (1987). "Consumer ethnocentrism construction and validation of the CETSCALE", *Journal of Marketing Research*, 24.

Simon, Herbert A. (1991). "Bounded rationality and organizational learning", *Organization Science*, 2,1.

Spender, J.-C. (1994). "Organizational knowledge, collective practice and Penrose rents", *International Business Review*, 3, 4.

Stata, R. (1989). "Organizational Learning – The Key to Management Innovation", *Sloan Management Review.* Spring.

Stewart, D. (1981). "The application and misapplication of factor analysis in marketing research", *Journal of Marketing Research*, 18.

Stewart, Thomas A. (1997). *Intellectual Capital: The New Wealth of Organizations.* Doubleday/Currency: New York.

Taylor, S. (1998). "The cultural constraints of the learning organization concept", *Proceedings of the Academy of Management Mid-Year Conference on Organizational Learning*, Washington D.C.

Teece, David J. (1988). "Technological Change and the Nature of the Firm", In G. Dosi, C. Freeman, R. Nelson, G. Silverberg, and L. Soete (Eds.), *Technical Change and Economic Theory*, London: Frances Pinter.

Tomaskovic-Devey, D., Leiter, D. and S. Thompson. (1994). "Organizational survey nonresponse", *Administrative Science Quarterly*, 39.

Van Buren, M. (1997). *ASTD's Guide to Learning Organization Assessment Instruments, Alexandria*, VA: ASTD.

Venkatraman, N. and V. Ramanujam. (1987). "Planning System Success: A Conceptualization and an Operational Model", *Management Science*, 33, 6, 687-705.

Wellman, B. and S. Berkowitz. (1988). *Social Structures: A network approach*, Cambridge, MA: Cambridge University Press.

Wernerfelt, Birger. (1984). "A Resource-Based View of the Firm", *Strategic Management Journal*, 5, 171-180.

Wick, C. and L. León. (1993). *The Learning Edge: How smart managers and smart companies stay ahead*, New York: McGraw-Hill.

MANAGEMENT OF INNOVATION AND NEW TECHNOLOGY
WORKING PAPER SERIES

1. R.G. Cooper and E.J. Kleinschmidt, "How the New Product Impacts on Success and Failure in the Chemical Industry", February, 1992.

2. R.G. Cooper and E.J. Kleinschmidt, "Major New Products: What Distinguishes the Winners in the Chemical Industry", February, 1992.

3. J. Miltenburg, "On the Equivalence of JIT and MRP as Technologies for Reducing Wastes in Manufacturing, March, 1992.

4. J.B. Kim, I. Krinsky and J. Lee, "Valuation of Initial Public Offerings: Evidence from Korea", February, 1992.

5. M. Basadur and S. Robinson, "The New Creative Thinking Skills Needed for Total Quality Management to Become Fact, Not Just Philosophy", April, 1992.

6. S. Edgett and S. Parkinson, "The Development of New Services Distinguishing Between Success and Failure", April, 1992.

7. A.R. Montazemi and K.M. Gupta, "Planning and Development of Information Systems Towards Strategic Advantage of a Firm", April, 1992.

8. A.R. Montazemi, "Reducing the Complexity of MIS Innovation Through Hypermedia and Expert Systems", May, 1992.

9. M. Basadur and Bruce Paton, "Creativity Boosts Profits in Recessionary Times - Broadening the Playing Field", June, 1992.

10. Robert G. Cooper and Elko Kleinschmidt, "Stage-Gate Systems for Product Innovation: Rationale and Results", June, 1992.

11. S.A.W. Drew, "The Strategic Management of Innovation in the Financial Services Industry: An Empirical Study", July, 1992.

12. M. Shehata and M.E. Ibrahim, "The Impact of Tax Policies on Firms' R & D Spending Behavior: The Case of R & D Tax Credit", July, 1992.

13. Willi H. Wiesner, "Development Interview Technology: Implications for Innovative Organizations", July, 1992.

14. Isik U. Zeytinoglu, "Technological Innovation and the Creation of a New Type of Employment: Telework", August, 1992.

15. John W. Medcof, "An Integrated Model for Teaching the Management of Innovation in the Introduction to Organizational Behaviour Course", October, 1992.

16. Min Basadur, "The Why-What's Stopping Analysis: A New Methodology for Formulating Ill-Structured Problems", October, 1992.

17. Stephen A.W. Drew, "Strategy, Innovation and Organizational Learning an Integrative Framework, Case Histories and Directions for Research", November, 1992.

18. Stephen A.W. Drew, "Innovation and Strategy in Financial Services", November, 1992.

19. Scott Edgett, "New Product Development Practices for Retail Financial Services", November, 1992.

20. Robert G. Cooper and Elko J. Kleinschmidt, "New Product Winners and Losers: The Relative Importance of Success Factors - Perception vs. Reality", November, 1992.

21. Robert G. Cooper and Elko J. Kleinschmidt, "A New Product Success Factors Model: An Empirical Validation", November, 1992.

22. Robert G. Cooper & Elko J. Kleinschmidt, "Stage Gate Systems: A Game Plan for New Product Success", November, 1992.

23. Min Basadur, "Optimal Ideation-Evaluation Ratios", March, 1993.

24. Christopher K. Bart, "Gagging on Chaos", March, 1993.

25. Yufei Yuan, "The Role of Information Technology in Business Innovation", July, 1993.

26. Isik Urla Zeytinoglu, "Innovation in Employment: A Telework Experiment in Ontario", July, 1993.

27. John Miltenburg and David Sparling, "Managing and Reducing Total Cycle Time: Models and Analysis", August, 1993.

28. R.G. Cooper, C.J. Easingwood, S. Edgett, E.J. Kleinschmidt and C. Storey, "What Distinguishes the Top Performers in Financial Services", September, 1993.

29. B.E. Lynn, "Innovation and Accounting Research", September, 1993.

30. Min Basadur and Peter Hausdorf, "Measuring Additional Divergent Thinking Attitudes Related to Creative Problem Solving and Innovation Management", November, 1993.

31. R.G. Cooper and E.J. Kleinschmidt, "Determinants of Time Efficiency in Product Development", December, 1993.

32. Christopher K. Bart, "Back to the Future: Timeless Lessons for Organizational Success", February, 1994.

33. Ken R. Deal and Scott J. Edgett, "Determining Success Criteria for New Financial Products; A Comparative Analysis of CART, Logit and Discriminant Analysis", February, 1995.

34. Christopher K. Bart and Mark C. Baetz, "Does Mission Matter?", February, 1995.

35. Christopher K. Bart, "Controlling New Products: A Contingency Approach", February, 1995.

36. Christopher K. Bart, "Is Fortune Magazine Right? An Investigation into the Application of Deutschman's 16 High-Tech Management Practices", February, 1995.

37. Christopher K. Bart, "The Impact of Mission on Firm Innovativeness", February, 1995.

38. John W. Medcof, "Transnational Technology Networks", April, 1995.

39. R.G. Cooper and E.J. Kleinschmidt, "Benchmarking the Critical Success Factors of Firms' New Product Development Programs", April, 1995.

40. John W. Medcof, "Trends in Selected High Technology Industries", July, 1995.

41. Robert C. Cooper & E.J. Kleinschmidt, "Benchmarking Firms' New Product Performance & Practices", September, 1995.

42. Min Basadur and Darryl Kirkland, "Training Effects on the Divergent Thinking Attitudes of South American Managers", November, 1995.

43. Min Basadur, "Organizational Development Interventions for Enhancing Creativity in the Workplace", November, 1995.

44. Min Basadur, "Training Managerial Evaluative and Ideational Skills in Creative Problem Solving: A Causal Model", December, 1995.

45. Min Basadur, Pam Pringle and Simon Taggar, "Improving the Reliability of Three New Scales Which Measure Three New Divergent Thinking Attitudes Related to Organizational Creativity", December, 1995.

46. N. P. Archer and F. Ghasemzadeh, "Project Portfolio Selection Techniques: A Review and a Suggested Integrated Approach", February, 1996.

47. Elko J. Kleinschmidt, "Successful new product development in Australia: An empirical analysis", February, 1996.

48. Christopher K. Bart, "Industrial Firms & the Power of Mission," April, 1996.

49. N. P. Archer and F. Ghasemzadeh, "Project Portfolio Selection Management through Decision Support: A System Prototype," April, 1996.

50. John W. Medcof, "Challenges in Collaboration Management in Overseas Technology Units," April, 1996.

51. Susan L. Kichuk and Willi H. Wiesner, "Personality and Team Performance: Implications for Selecting Successful Product Design Teams," May, 1996.

52. Susan L. Kichuk and Willi H. Wiesner, "Selection Measures for a Team Environment: The Relationships among the Wonderlic Personnel Test, The Neo-FFI, and the Teamwork KSA Test, " May, 1996.

53. Susan L. Kichuk and Willi H. Wiesner, "Personality, Performance, Satisfaction, and Potential Longevity in Product Design Teams," June, 1996.

54. John W. Medcof, "Learning, Positioning and Alliance Partner Selection," June, 1996.

55. Scott J. Edgett, "The New Product Development Process for Commercial Financial Services," July, 1996.

56. Christopher K. Bart, "Sex, Lies & Mission Statements," September, 1996.

57. Stuart Mestelman and Mohamed Shehata, "The Impact of Research and Development Subsidies on the Employment of Research and Development Inputs," November, 1996.

58. Mark C. Baetz and Christopher K. Bart, "Developing Mission Statements Which Work," November, 1996.

59. Fereidoun Ghasemzadeh, Norm Archer and Paul Iyogun, "A Zero-One Model for Project Portfolio Selection and Scheduling," December, 1996.

60. R. G. Cooper, S. J. Edgett, E. J. Kleinschmidt, "Portfolio Management in New Product Development: Lessons from Leading Firms," February 1997.

61. R. G. Cooper, S. J. Edgett, E. J. Kleinschmidt, "Portfolio Management in New Product Development: Lessons from Leading Firms -- Part II," February 1997.

62. C. K. Bart, "A Comparison of Mission Statements & Their Rationales in Innovative and Non-Innovative Firms," February 1997.

63. R. Bassett, N. P. Archer and W. G. Truscott, "Data Webs: An Evaluation of an Innovative Information Management Tool that Integrates Databases with the World Wide Web," April 1997.

64. S. Taggar, "Intelligence, Personality, Creativity and Behaviour: The Antecedents of Superior Team Performance," April 1997.

65. R. Deaves and I. Krinsky, "New Tools for Investment Decision-Making: Real Options Analysis," May 1997.

66. J. W. Medcof (ed.), "Trends and Events in Selected High Technology Industries," May, 1997. (On the WEB only)

67. C. K. Bart, "Product Innovation Charters: A State-of-the-Art Review," May, 1997.

68. John W. Medcof, "Strategic Contingencies and Power in Networks of Internationally Dispersed R&D Facilities", August, 1997.

69. John W. Medcof, "Research Intensity and the Identification of High Technology Industries," September, 1997.

70. Christopher K. Bart and John C. Tabone, "Mission Statements in the Not-for-profit Health Care Sector: A State of the Art Review," September, 1997.

71. Elko J. Kleinschmidt, "In-house and Partnership New Product Development in Austria: An Empirical Analysis on Outcome and Explanatory Factors," October, 1997.

72. Robert G. Cooper, Scott J. Edgett and Elko J. Kleinschmidt, "R&D Portfolio Management Best Practices: Methods Used & Performance Results Achieved," January, 1998.

73. Christopher K. Bart and Simon Taggar, "A Model of the Impact of Mission Rationale, Content, Process and Alignment on Firm Performance," March, 1998.

74. Christopher K. Bart, John Parkinson and Simon Taggar, "The Implementation of Strategy: Behavioural vs Budgetary Approaches and the Effect of Participation," March, 1998.

75. John W. Medcof, "The Resource Based View and the New Competitive Landscape: Characterizing Positions of Dynamic Capability," May, 1998.

76. F. Ghasemzadeh and N. P. Archer, "Project Portfolio Selection Through Decision Support," June, 1998.

77. Y. Yuan, N. Archer, and R. Bassett, "The Impact of Electronic Commerce Innovations on Marketing Management," June, 1998.

78. Kenneth S. Chan, James Chowhan, Stuart Mestelman, Mohamed Shehata, "Value Orientations and Income and Displacement Effects," July 1998.

79. Min Basadur, Laurent Lapierre, "Predicting Creative Problem Solving Behaviors within Teams," September, 1998.

80. Min Basadur, "Simplex: Modelling the Phases and Stages of the Innovation Process in Open-System Organizations", October, 1998.

81. Ken Deal, Ben Long and Bryan Scott, "New Pricing Product Design for Competitive Advantage", November, 1998.

82. Min Basadur, Mark A. Runco and Luis A. Vega, "Understanding How Creative Thinking Skills, Attitudes and Behaviors Work Together in Real World Managerial Problem Solving," November, 1998.

83. Min Basadur, "The Basadur Simplex Creative Problem-Solving Profile Inventory: Development, Reliability and Validity", December, 1998.

84. Min Basadur, "Improving the Psychometric Properties of the Basadur Simplex Creative Problem Solving Profile Inventory," December, 1998.

85. Min Basadur, "Discovering the Right Questions about the Management of Technology Using Challenge Mapping," December, 1998.

The activities of the Management of Innovation and New Technology Research Centre are generously supported by:

- The DeGroote family
- DuPont Canada Inc
- Nortel
- Royal Bank
- The Society of Management Accountants of Ontario

McMASTER
UNIVERSITY
MICHAEL G. DeGROOTE
SCHOOL OF BUSINESS

INFORMATION . . .

For information about the Management of Innovation and New Technology Research Centre or innovation research activities at the Michael G. DeGroote School of Business:

Director; Dr. C. K. Bart, Ph.D., C.A.
MINT - Research Centre
Michael G. DeGroote School of Business
McMaster University, 1280 Main St. W.
Hamilton ON Canada L8S 4M4

Phone: 905-525-9140, Ext. 24105
Fax: 905-521-8995
email: mint@mcmaster.ca
www: http://mint.mcmaster.ca/