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MANAGING AN ORGANIZATIONAL LEARNING SYSTEM BY ALIGNING STOCKS AND FLOWS*

Nick Bontis

Michael G. DeGroote School of Business, McMaster University, Hamilton, Ontario

Mary M. Crossan

John Hulland

Richard Ivey School of Business, University of Western Ontario, London, Ontario

ABSTRACT

This paper considers the relationship between the stocks and flows of learning across levels in an overall organizational learning system. A survey instrument based on the Strategic Learning Assessment Map (SLAM) was administered to 15 individuals representing senior-, middle- and non-management levels from each of 32 organizations, resulting in a total sample of 480 respondents. This research supports the premise that *there is a positive relationship between the stocks of learning at all levels and business performance*. Furthermore, the proposition that *the misalignment of stocks and flows in an overall organizational learning system is negatively associated with business performance* is also supported.

INTRODUCTION

Intense global competition has resulted in an increasingly complex and unpredictable business environment where markets can transform themselves almost instantaneously. Many firms that once prospered are now unable to keep up. Conversely, 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, p. 19).

There have been many reviews of the organizational learning literature, including Argyris and Schön (1978, 1996), Crossan et al. (1995), Daft and Huber (1987), Easterby-Smith (1997), Fiol and Lyles (1985), Huber (1991), Levitt and March

Address for reprints: Nick Bontis, Assistant Professor, Strategic Management, Michael G. DeGroote School of Business, McMaster University 1280 Main Street West MGD #207, Hamilton, Ontario, Canada L8S 4M4 (nbontis@mcmaster.ca).

(1988), and Shrivastava (1983). Crossan et al. (1999) proposed a comprehensive framework of organizational learning that seeks to integrate and extend previous organizational learning research. The current study builds on their work by refining and operationalizing their 4I framework of organizational learning. In addition, we propose and test several hypotheses about the relationship between various dimensions of organizational learning and performance using data collected from 32 organizations with 480 respondents in the Canadian mutual fund industry.

We begin by addressing the theoretical underpinnings of the measurement instrument. A brief overview of the Crossan et al. (1999) 4I framework is presented. We then discuss the central elements of the model to lay the groundwork for the development of hypotheses and operationalization of key constructs. The methodology, analysis, and results are then presented. Finally, we discuss the findings and present implications for research and managerial practice.

CONCEPTUAL BACKGROUND

Research on organizational learning has a legacy that spans over 30 years, with more recent exponential growth (Cohen and Sproull, 1996; Crossan and Guatto, 1996; Easterby-Smith, 1997). However, as Table I suggests, a diversity of perspectives have been used to look at organizational learning issues. In addition, the terms knowledge and learning are often used interchangeably, leading to further conceptual confusion. Crossan et al. (1999) have suggested that these different perspectives may actually be the result of studying subtly different phenomena.

We begin with a general overview of the organizational learning field to differentiate perspectives of organizational learning. A brief overview of the Crossan et al. (1999) 4I framework of organizational learning is then presented. We subsequently extend their theoretical treatment to focus on key constructs of the dynamic process they propose.

Perspectives of Organizational Learning

Although there have been many reviews of the organizational learning literature that have been quite instructive at pointing to different perspectives on levels of learning, the focus on cognition or behaviours, and the relationship between learning and performance, there has been less emphasis on the general nature of the phenomenon under study. Published organizational learning research has largely focused on the domain of decision making and choice, being strongly influenced by the work of James March (e.g., Cohen and Sproull, 1996).

The comprehensive view of organizational learning presented here can be distinguished from other perspectives that have focused on specific elements of the overall organizational learning system. Cohen and Sproull's (1996) collection of articles on organizational learning exemplifies the range of research endeavours that are captured within this field of study: learning from history (March et al., 1996), organization and local adaptation (Hutchins, 1996), communities-of-practice (Seely-Brown and Duguid, 1991), learning curves (Epple et al., 1996), stimulus–response (Weick, 1996), bounded rationality (Simon, 1991), technology diffusion (Attewell, 1996), personnel turnover (Carley, 1996), patterns of change (Lant and Mezias, 1992), executive succession (Virany et al., 1996), collective mind (Weick and Roberts, 1993), technological change (Henderson, 1996), social ecology

Table I. Definitions of organizational learning

Author(s)	*Definition*
Argyris and Schön (1978)	Organizational learning is a process of detecting and correcting errors
Cavaleri and Fearon (1996)	Organizational learning is the purposeful creation of shared meanings derived from the common experiences of people in organizations
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 and Weick (1984)	Organizational learning is knowledge about the interrelationships between the organization's action and the environment
Day (1994)	Organizational learning is comprised of the following processes: open-minded inquiry, informed interpretations and accessible memory
Fiol and 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 behaviours 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 and 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 and March (1988)	Organizations are seen as learning by encoding inferences from history into routines that guide behaviour
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 and 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 and Narver (1995)	At its most basic definition, organizational learning is the development of new knowledge or insights that have the potential to influence behaviour
Schwandt and Marquardt (2000)	Organizational learning represents a complex interrelationship between people, their actions, symbols, and processes within the organization
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

of jobs (Miner, 1991), organizational routines (Cohen and Bacdayan, 1996), culture (Cook and Yanow, 1996), continuous improvement (Winter, 1996), knowledge intensive firms (Starbuck, 1996), and learning through failure (Sitkin, 1996). Our intent is to present a macro perspective of organizational learning as it relates to the phenomenon of strategic renewal.

In addition to the conceptual confusion within the field of organizational learning, there is also conceptual confusion between the terms organizational learning, knowledge management, and intellectual capital. It is beyond the scope of this paper to address fully the similarities and differences of these fields of research. However, at a broad level of analysis, we propose the following conceptual links. We see intellectual capital as representing the 'stock' of knowledge that exists in an organization at a particular point in time (Bontis, 1996, 1998, 1999, 2002; Bontis et al., 1999; Choo and Bontis, 2002; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997). Thus, it represents what has been learned in a cognitive sense. Managing this stock of knowledge in a firm as it flows over time is the domain of knowledge management (Bierly and Chakrabarti, 1996; Choi and Lee, 1997; Connor and Prahalad, 1996; Demsetz, 1991; Foss, 1996; Kogut and Zander, 1992; Nonaka, 1994; Nonaka and Takeuchi, 1995). More specifically, the evolving stock of intellectual capital over time is dependent on knowledge management. Organizational learning broadens the discussion to incorporate behaviours as well as knowledge and provides a means to understand how the 'stocks' change (flow) over time.

The theoretical underpinnings of the current research are based on the organizational learning framework developed by Crossan et al. (1999). Having viewed the organizational learning phenomenon from the perspective of strategic renewal, they offer a broad and comprehensive perspective. The following provides a brief overview of their 4I framework.

Overview of the 4I Framework

Crossan et al. conceive of organizational learning as a dynamic process of strategy renewal occurring across three levels of the organization: individual, group and organizational. Four key premises form the foundation for their framework. First, organizational learning involves a tension between assimilating new learning (exploration) and using what has already been learned (exploitation). Second, organizational learning is multi-level: individual, group, and organization. Third, these three levels of organizational learning are linked by four broad categories of social and psychological processes: intuiting, interpreting, integrating, and institutionalizing (4Is). Finally, cognition is seen to affect action (and vice versa).

The 4I framework is summarized in Figure 1. Each process is discussed at length in the Crossan et al. (1999) article. We do not intend to explore their work in detail here. Instead, we focus on key elements of their theory to lay the groundwork for the operationalization presented in this research.

One aspect of the Crossan et al. paper is of central importance here. They suggest that organizational learning is a dynamic process:

> Not only does learning occur over time and across levels, but it also creates a tension between assimilating new learning (feed-forward) and exploiting or using what has been learned (feed-back) . . . The concurrent nature of the feed-forward and feed-back processes creates a tension, which can be understood by arraying the levels against one another. (Crossan et al., 1999, p. 532)

Level	Process	Inputs/outcomes
Individual	Intuiting	Experiences Images Metaphors
	Interpreting	Language Cognitive map Conversation/dialogue
Group	Integrating	Shared understandings Mutual adjustment Interactive systems
Organizational	Institutionalizing	Routines Diagnostic systems Rules and procedures

Source: Crossan et al. (1999, p. 525).

Figure 1. The 4I framework of organizational learning

Strategic Learning Assessment Map

Crossan and Hulland (1997) simplified the 4I framework and the dynamic processes presented by Crossan et al. (1999) by focusing on the relationships between the three levels of learning. They combined the intuiting and interpreting processes under the individual level, used the integrating processes to inform the group level, and institutionalizing to inform the organization level. Similar to Crossan et al., they arrayed the levels against one another to capture the feed-forward and feedback processes as shown in Figure 2.

We refer to the stocks of learning as those that reside *within* a level: individual, group, and organization. These stocks can be distinguished from the flow of learning *across* levels to create feed-forward and feed-back. We recognize that learning within a level is a dynamic process that can be thought of as a flow. However, the conceptual clarity created by the stock/flow concepts is critical to distinguishing between learning within a level and learning that occurs across levels. This distinction is utilized as we move to hypothesis development in subsequent sections.

The Strategic Learning Assessment Map (SLAM) proposed by Crossan and Hulland contains five theoretical constructs: three learning stocks – individual, group and organization; and two learning flows – feed-forward and feed-back. Each of these five constructs is discussed in more detail below.

Individual Level Learning

At the individual level, 'intuiting' is the process of developing new insights. The process of intuiting recognizes the role of tacit knowledge (Polanyi, 1967) and expertise (Behling and Eckel, 1991; Prietula and Simon, 1989). Nonaka and Takeuchi's (1995) research into the conversion of tacit to explicit knowledge represents an important contribution in describing how intuition becomes more

		Output		
		Individual	**Group**	**Organization**
Input	**Individual**	Individual-level learning stocks (II)	FF_{IG}	FF_{IO}
	Group	FF_{GI}	Group-level learning stocks (GG)	FF_{GO}
	Organization	FB_{OI}	FB_{OG}	Organizational-level learning stocks (OO)

Source: Crossan and Hulland (1997).

Figure 2. The SLAM framework

explicit, and how it is shared with others. Nevis et al. (1995) have expressed the need for an experimental mindset to forster this innovative orientation.

While it is important to recognize how new insights develop through the process of intuiting, it is also important to understand how individuals take those novel insights and begin to crystallize them through the process of interpreting. Through interpreting, individuals develop cognitive maps (Huff, 1990) about the various domains in which they operate. These cognitive maps can be thought of as the stocks of individual learning. These stocks, which represent individual knowledge and competencies (Bertini and Tomassini, 1996), have tended to be one of the focal points of organizational learning. This is not surprising, as individual competencies represent the closest translation of learning from the educational domain to the organizational domain.

Individual competencies can be specific to a job context, and may not be transferable to another context. There are also generic competencies that have been identified as important for individual learning such as being able to accept negative feed-back without becoming defensive (Argyris and Schön, 1978), having an

orientation to self development (Pedler et al., 1991), acquiring external knowledge (Bertini and Tomassini, 1996), and having a scanning imperative (Nevis et al., 1995).

Interpreting requires more than competence and capability, however. It requires both motivation, and direction or focus. It is this nexus between what individuals can do (capability), what they want to do (motivation), and what they need to do (focus) that enhances individual learning (Watkins and Marsick, 1993).

In summary, the individual learning construct captures the processes of intuiting and interpreting. As described previously, it focuses on the generation of new insights, taking actions that are experimental in nature, breaking out of traditional mind-sets to see things in new and different ways, scanning the external environment, developing the competencies to do one's job, having a sense of pride and ownership in one's work, and being aware of the critical issues that affect one's work, all at the level of individual. Overall, it is defined as follows:

> *Individual Level Learning*: Individual competence, capability, and motivation to undertake the required tasks.

Group Level Learning

Glynn et al. (1994) state that: 'newer perspectives on learning focus on the more emergent nature of learning; information to be learned is constructed through the ongoing interactions among organization members' (p. 55). However, there are two different perspectives on the nature of learning between individuals. One is the information processing view posed by Daft and Huber (1987), which emphasizes the need to communicate or distribute information. In contrast, the second perspective takes a more interpretive view (Daft and Weick, 1984). Stata (1989) and Senge (1990) focus on mental models and shared images, while Seely-Brown and Duguid (1991) and Weick (1979) view learning as a 'social construction of reality'.

Group learning involves the sharing of individual interpretations to develop a common understanding. We use the term group learning to represent this process rather than the more commonly used term of team learning (Senge, 1990; Mayo and Lank, 1996; Watkins and Marsick, 1993). In many cases there is no team, but simply a group of individuals who struggle to develop a shared understanding.

Dialogue (Isaacs, 1993) has been identified as a key aspect of the integrating process (Watkins and Marsick, 1993). In dialogue 'a group explores complex difficult issues from many points of view. Individuals suspend their assumptions but they communicate their assumptions freely' (Senge, 1990, p. 241). It is through the continuing conversation among members of the community that the shared understanding or collective mind (Weick and Roberts, 1993) develops.

In summary, group learning captures the process of integrating. It includes such elements as effectively working in groups, having productive meetings, having the right people to address the issues, and encompasses key elements of dialogue including being prepared to share both successes and failures, encouraging diversity, and effective conflict resolution. It is defined as follows:

> *Group Level Learning*: Group dynamics and the development of shared understanding.

Organization Level Learning

Several theorists have supported the need for an organization level (Cangelosi and Dill, 1965; Duncan and Weiss, 1979; Fiol and Lyles, 1985; Hedberg, 1981; Huber, 1991; Levitt and March, 1988; Shrivastava, 1983; Stata, 1989). However, there are different views regarding the nature of learning at the organization level. Some theorists view the organization as a collection of individuals (human perspective), while others view it as the systems, structures, and procedures of the organization (non-human perspective). For those who view it as a collection of individuals, a distinction is often made about exactly who is represented in that collection: all members of the organization, or only the senior management group, sometimes referred to as the dominant coalition (Duncan and Weiss, 1979).

Crossan et al. (1999) have suggested that the organization level is more than large-scale shared understanding. It represents the translation of shared understanding into new products, processes, procedures, structures and strategy. It is the non-human artifacts of the organization that endure even though individuals may leave. Furthermore, the organizational level captures the elements of strategic alignment. Ultimately, if organizational learning is to provide a sustainable competitive advantage (De Geus, 1988) it needs to be linked to a competitive premise. Since the competitive landscape is constantly shifting, organizations need the capacity to renew themselves in a strategic sense (Quinn, 1992).

Even with the best of intentions, individuals and organizations may learn the wrong things (Huber, 1991). Therefore, organizational learning is not simply whether individuals have learned something new, whether the organization is skilled at processing information (Huber, 1991), or whether the organization is skilled at developing new products (Nonaka and Takeuchi, 1995); it needs to be applied to a strategic context (Crossan et al., 1999).

Organization level learning involves embedding individual and group learning into the non-human aspects of the organization including systems, structures, procedures and strategy. In this case the stock of learning is what Huber (1991) referred to as the organizational memory (Walsh and Ungson, 1991). Furthermore, this embedded learning needs to be aligned so that systems, structures, and procedures support a strategic orientation that positions an organization well within its competitive environment (Andrews, 1971).

> *Organization Level Learning*: Alignment between the non-human storehouses of learning including systems, structure, strategy, procedures, and culture, given the competitive environment.

The three cells in each of the off-diagonal areas in Figure 2 can be combined to capture the feed-forward flow of learning from the individual to group and organization (upper right), and the feed-back flow from the organization to the individual and group (lower left).

The concurrent activities of feed-forward and feed-back are key elements of strategic renewal. Renewal harmonizes continuity and change at the level of the enterprise (Hurst, 1995). Organizational learning requires organizations to explore and learn new ways, while concurrently exploiting what has been already learned (March, 1991). As Crossan et al. (1999) note (p. 522): 'Recognizing and managing the tension between exploration and exploitation is one of the critical challenges of renewal and hence a central requirement in a theory of organizational learn-

ing.' Indeed, the learning that has contributed to previous success may impede adaptation and renewal (Miller, 1990).

Feed-forward Learning: Whether and how individual learning feeds forward into group learning and learning at the organizational level (e.g. changes to structure, systems, products, strategy, procedures, culture).

Feed-back Learning: Whether and how the learning that is embedded in the organization (e.g. systems, structure, strategy) affects individual and group learning.

The next section extends this theoretical model to develop hypotheses that examine the relationships between the five learning constructs and performance.

DEVELOPMENT OF HYPOTHESES

The first set of hypotheses deals with the direct relationship between learning at each of the three levels and business performance. Although relationships between the stocks of learning at each level and business performance have often been assumed, there is little empirical evidence to support this perspective.

Generally, most of the $55.3 billion investment in training and development in US organizations is based on increasing the levels of individual learning (ASTD, 1996). Human resource managers tend to recruit and develop the best and brightest employees for the sole purposes of increasing their organization's human capital as a means of achieving a competitive advantage. 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, p. 8).

Hypothesis 1: Individual-level learning is expected to have a positive association with business performance.

Group level learning activities such as dialogue (Isaacs, 1993) and communities of practice (Seely-Brown and Duguid, 1991) are expected to lead to better performance. Competitive advantage can be generated from the firm's ability to support and foster group knowledge (Liebeskind, 1996). Therefore, as the level of group learning increases, so should business performance.

Hypothesis 2: Group-level learning is expected to have a positive association with business performance.

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

Whereas Chandler (1962) identified the need to align strategy with structure, Learned et al. (1965) were the first to suggest that the firm's structure and strategy need to be aligned with the competitive environment. More broadly, all of the storehouses of learning need to be aligned including systems, structure, procedures, and culture. As the stock of this organizational level learning increases, so should business performance.

Hypothesis 3: Organizational-level learning is expected to have a positive association with business performance.

Having examined the relationship between the stocks of learning at each level and business performance, we now incorporate the flows to examine the relationship between stocks, flows and performance. More specifically, we examine the misalignment between the stocks and flows of learning. For this research, misalignment is defined as the difference between levels of stocks and flows. Crossan et al. (1999, p. 533) describe the stock flow relationship as follows:

> Conceiving of learning as a dynamic flow raises the possibility that these flows can be constrained. Consider for a moment the parallels between production flow and learning flow. Production flow needs to ensure that the level of work-in-process inventories do not exceed the capacity of any part of the system to absorb and process it. Concepts like throughput, capacity utilization, cycle time, and bottlenecks have aided in understanding what it takes to balance a production line to ensure smooth flow. A dynamic theory of organizational learning recognizes that there may be bottlenecks to the ability of the organization to absorb (Cohen and Levinthal, 1990) the feed-forward of learning from the individual to the group and organization. Investment in individual learning, and pressures for new product innovation may become stockpiled if the organization has limited capacity to absorb the learning. However, in the production process, work-in-process inventory does not care whether it is stockpiled, but in the learning process, individuals (and their ideas) do. As a result, individuals may become frustrated, disenchanted, and may even leave the organization.

Gibson et al. 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, p. 55). Manufacturing managers do this by aligning the stock and flow levels of work-in-process inventory (Brown, 1997). Similarly, organizational managers need to align stock and flow levels of learning so that the overall organization learning system operates efficiently and effectively.

Misalignment between the stocks of learning and feed-forward flow suggests there is learning that is not being absorbed by the organization. For example, where the stock of individual learning exceeds the feed-forward flow, individuals may become disenfranchised in their attempts to apply their learning in the organization, and hence performance will suffer. As a second example, while there may be high stocks of group learning, organizational structures may impede the right people from talking with one another. Finally, even though there may be high stocks of individual learning, reward systems may discourage individuals from taking actions that leverage their learning.

In summary, we suggest that the misalignment between the stocks of learning at each level and the flows has a negative association with business performance. In other words, even though firms can have identical levels of individual, group and organization learning 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 misalignment between the stocks and flows results in learning bottlenecks for the organization. These bottlenecks have adverse effects on the efficiency and effectiveness 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:

Hypothesis 4: Misalignment between the stocks and flows of learning is expected to have a negative association with business performance.

METHODOLOGY

In order to test the hypotheses linking organizational learning, misalignment, and performance, it was necessary to first develop a measurement instrument that can be used to assess all five of the SLAM constructs described previously. We followed the complex and multi-staged approach suggested by Schwab (1980), Churchill (1979), and Hinkin (1995). The following three general steps were employed to ensure reliable and valid measures: (1) comprehensive item generation; (2) pilot study testing of the items and subsequent item refinement; and (3) full study use of the revised instrument. Each of these three stages is discussed in greater detail below. In addition, the control measures and sample used to test the hypotheses are described.

Item Generation

In order to develop sound measures for a construct, one must first specify the construct's domain. Items are then generated that are believed to capture the essence of that domain. This process of item generation must be comprehensive enough to ensure that the measures, when examined together, have adequate context validity (Hinkin, 1995; Nunnally, 1978). The theoretical grounding supporting the development of the five constructs yielded a separate set of items for each. The following describes the process of operationalization employed for one of the five constructs (individual learning), but a similar process was employed for the other constructs.

As noted previously, the individual learning construct can be broadly defined as: individual competence, capability, and motivation to undertake required tasks. The underlying theory suggests that the processes of intuiting and interpreting are critical and that these processes require both specific and generic competencies, as well as the motivation to carry out the required tasks. Items were generated to capture these theoretical facets. For example, the items 'individuals generate many new insights' and 'individuals take actions that are experimental in nature' relate to the theoretical discussion of the process of intuiting that suggested the importance of generating new insights and the need for individuals to undertake experiments. That individuals would feel motivated by their work was captured by items

such as 'individuals feel a sense of accomplishment in what they do' and 'individuals have a high level of energy at work'. The need for specific competencies to do one's job was captured by the items 'individuals are current and knowledgeable about their field of work' and 'individuals are aware of the critical issues that affect their work'. The need for general competencies such as being able to accept negative feedback, and being able to break out of traditional mind-sets to see things in new and different ways, were captured by items that virtually restated the theory.

In many instances, the items generated reflect the theory very closely. However, in some cases this was not possible. For example, the theoretical concept of dialogue does not translate well into measures that are meaningful for many managers. To overcome this problem, the theoretical concept was broken down into component parts that included items such as 'different points of view are encouraged' and 'we have effective resolution of conflict'.

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 clear. In order to develop a survey that was as comprehensive as possible, items from other reliable instruments (Hult, 1995; Marquardt, 1996; Nonaka et al., 1994) were also reviewed. To further evaluate the comprehensiveness of the survey instrument the American Society for Training and Development (ASTD) invited over 20 researchers to submit their organizational learning assessment instruments as a source for comparison (Van Buren, 1997). The SLAM measurement instrument incorporates all of the key dimensions and content areas prescribed by the ASTD guide.

Pilot Studies

A total of three separate pilot studies were used in order to evaluate the measures. An initial pilot study involving mid- to senior-level management participants in an executive development programme representing a diverse cross-section of service and manufacturing industries was used to refine a preliminary version of the questionnaire (Crossan and Hulland, 1997). A total of 104 questionnaires were completed. The sets of items representing each of the five constructs were examined separately using coefficient alpha to identify both clearly deficient and potentially promising items. Where clear deficiencies were noted for a particular construct, new items were generated based on theory. These refinements led to the construction of a new questionnaire that included 94 measures (with at least eight items per construct).

This new questionnaire was administered to a random sample of 1924 individuals drawn from an organization with 3600 employees. The organization, a utility company that was preparing for de-regulation within its industry, was interested in where and how it should invest scarce training and development resources to enhance its capacity to learn. A response rate of 54.9 per cent was achieved with the return of 1056 completed surveys. In general, the items employed demonstrated good reliability and validity. Nonetheless, further refinements were made to the instrument at this point to eliminate weak items.

Finally, a pilot study by Crossan and Bontis (1998) administered an expanded version of the SLAM instrument to a sample of 1543 individuals across several

levels of management within one large organization. Results between levels of management were found to be statistically different in terms of the responses generated. However, the measures themselves were observed to be highly reliable and valid across these groups. Thus, the items used in this third pilot study were retained for use in the current study.

Full Study

Appendix A describes sample items used to measure the five constructs in the full study. A total of ten items were used to measure each construct. In addition, ten business performance items were included that address such issues as corporate success and employee satisfaction. Research has shown that perceived measures of performance can be: (1) a reasonable substitute for objective measures of performance (Dess and Robinson, 1984); and (2) have a significant correlation with objective measures of financial performance (Geringer and Hébert, 1989; Hansen and Wernerfelt, 1989; Lyles and Salk, 1997; Venkatraman and Ramanujam, 1987). The items used to measure this construct include 'rating the future outlook of the business', 'meeting customers' needs' and 'assessing overall business performance'.

In order to control for industry-specific effects, the current study focuses on firms in the mutual fund industry. This industry is appropriate for studying the phenomena of organizational learning because it is: (1) 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 (2) characterized by few capital expenditures and an emphasis on human-intensive portfolio management.

Control Variables

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 Gnyawali et al. (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). All of these variables are included in the current study as potentially important controls.

Organizational size is controlled for here by three variables: (1) mutual fund assets size; (2) number of mutual funds offered by a firm; and (3) number of employees. Controlling for size is required to counter the argument that an organization with several hundred employees will naturally have a more difficult time in shaking knowledge among individuals and groups than a firm with only a few employees. A fourth control variable employed here is the tenure in months of each respondent as a proxy for their work experience. Respondent experience at their current company (as opposed to overall or industry experience) is used in order to tap into perceptions of firm-specific knowledge and learning processes that occur within their own work-groups and organizations. Finally, in order to control for management-level bias, multiple respondents from senior-, middle- and non-management levels were sampled within each representative organization. Thus, control variables for respondents' organizational levels were also included.

Sample

A total of 73 mutual fund companies were registered with the IFIC (Investment Funds Institute of Canada) as of 31 December 1997. The smallest nine of these companies (by asset size) were not considered because: (1) the total number of employees was less than the number of respondents required (15) per organization, and (2) many of these companies had not been in operation for more than two years. This left 64 companies that were initially contacted to participate in the current study.

Targeted respondents included the CEO of the mutual fund company or a reasonable substitute such as the President or VP of Human Resources (Hambrick and Mason, 1984). Once secured, this individual was asked to supply the names of 15 employees in the company. In order to control for management level, five of the 15 employees were randomly selected from each of senior-, middle- and non-management levels across all functional areas. Lyles and Schwenk (1992) suggest that the cognitive maps of top management members closely represent core aspects of all organizational members. In this study, 15 respondents across three management levels were targeted in order to get a richer perspective of organizational learning within firms.

The survey was initially sent to a contact person within each organization. A brief cover letter explained the importance of the research, options for response (i.e., either by fax, mail or e-mail), and suggestions for alternative respondents. 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.

Participation was secured from 32 mutual fund companies out of the 64 that were initially contacted, for an overall response rate of 50 per cent at the organizational level. Thus, a total of 480 completed surveys were received, and subsequently coded and used for analysis. The primary reason for the relatively high response rate can be attributed to favourable letters of support written by the industry association (IFIC) and other key senior mutual fund executives in the industry that helped generate strong interest for this research.

ANALYSIS AND RESULTS

Before conducting formal tests of the hypotheses, several tests for potential sources of bias in the collected data were completed. In general, there is little evidence of systematic response bias. However, it should be noted that there is a clear 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 in assets. When asked why they did not participate in the study, the non-responding firms indicated that they were not able to participate because 'the need for 15 respondents was too great a commitment' or that they 'were going through a restructuring'. Although this may limit the generalizability of the current study's findings somewhat, it is important to remember that organizational learning is expected to face greater impediments in larger organizations. Thus, the current results are likely to yield conservative estimates of the relationships between organizational learning and performance.

In contrast, there is little evidence here of a survey administration order bias (Armstrong and Overton, 1977). A comparison of the first 16 organizations to respond versus the last 16 indicated no significant differences. It was important to test for such a difference in this case since the survey was administered during the February to April period of 1998. The month of February represents the busiest time of year for mutual fund companies operating in Canada, and the potential for differential responsiveness during this period was correspondingly high.

Measurement Model

Tests for reliability and validity of the 60 measurement items relating to the five constructs as well as performance were evaluated using PLS (Partial Least Squares) as suggested by Barclay et al. (1995). Because both established and newer items were employed in the current study, use of PLS was deemed appropriate (Fornell and Bookstein, 1982; Hulland, 1999). PLS is similar to LISREL and other covariance structure analysis (CSA) techniques in that it combines data and theory to simultaneously estimate paths and loadings. However, unlike CSA techniques, PLS attempts to maximize the variance explained in a model's endogenous constructs. One of the key benefits of using PLS as a technique is that it works well with smaller samples. PLS is also better suited to more exploratory research contexts.

The estimated loadings for the total set of measurement items are summarized in Table II. Shimp and Sharma (1987) suggest that items with loading values less than 0.7 be removed to ensure construct validity (see also Carmines and Zeller, 1979; Hulland, 1999). Once these items were removed, each item was re-validated by testing its item-to-total correlation measure.

With the exception of the feed-back flow construct, the deleted items did not show any particular pattern. For the feed-back construct, the items relating to reward systems, recruiting, and training were deleted. The retained items related more to information sharing than the human resource management systems that enable learning. The retained items also included the impact of other organization artifacts such as policies and procedures, and the use of databases. Aside from this change in the feed-back construct's content domain, the deleted items did not alter the meaning of any of the other constructs.

A matrix of loadings and cross-loadings (Appendix, Table A.II) was used to test discriminant validity. To evaluate the discriminant validity of measures, one compares the loading of an item with its associated factor (i.e., construct) to its cross-loadings. All remaining items had higher loadings with their corresponding factors in comparison to their cross-loadings. The results of this test show that there is some confidence in the discriminant validity of the remaining measures and their corresponding constructs.

Descriptive statistics for each construct are shown in Table III. All constructs had adequate reliability (Carmines and Zeller, 1979) and internal consistency well above the 0.7 threshold prescribed by Nunnally (1978). In terms of convergent validity, Bagozzi (1981) and Fornell and Larcker (1981) suggest using an average variance extracted threshold of 50 per cent – a value found for all six constructs in the current study. In addition to the matrix of loadings and cross-loading described earlier, discriminant validity can also be tested using a method proposed by Fornell and Larcker (1981). They 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

Table II. Estimated loadings for the total set of measurement items

Item no. #	*Mean* μ	*Std. dev* σ	*Loading* λ^1	*Error* ε	*Item to total correlation*[2]
B01	5.3604	1.0264	0.6922	0.5208	removed
B02	5.1854	1.1363	0.7346	0.4604	0.6403
B03	5.1729	1.1420	0.7422	0.4492	0.6683
B04	4.8163	1.1351	0.7304	0.4664	0.6661
B05	5.1646	1.0339	0.7572	0.4266	0.6817
B06	5.3208	1.1419	0.8130	0.3390	0.7490
B07	5.3152	1.1922	0.7808	0.3904	0.7199
B08	5.2025	1.2454	0.7707	0.4060	0.7134
B09	4.6812	1.1882	0.7521	0.4344	0.6808
B10	4.5875	1.2942	0.7479	0.4406	0.6827
C01	5.0419	1.3022	0.7781	0.3946	0.6920
C02	5.3661	1.2480	0.7070	0.5002	0.6022
C03	4.7908	1.3342	0.6737	0.5461	removed
C04	4.9386	1.2528	0.6265	0.6075	removed
C05	4.5768	1.3200	0.7546	0.4306	0.6705
C06	4.8664	1.2851	0.7500	0.4375	0.6839
C07	4.6430	1.2904	0.7272	0.4712	0.6723
C08	4.7077	1.4076	0.7801	0.3914	0.7170
C09	5.1339	1.2734	0.8237	0.3215	0.7617
C10	5.1237	1.2500	0.7914	0.3736	0.7273
D01	5.1396	1.4859	0.7932	0.3708	0.7405
D02	4.7792	1.4013	0.8302	0.3107	0.7878
D03	4.7042	1.3723	0.8254	0.3187	0.7643
D04	4.6088	1.3473	0.7543	0.4310	0.6557
D05	4.9563	1.4069	0.7332	0.4624	0.6779
D06	5.1757	1.3390	0.7688	0.4090	0.7125
D07	4.3145	1.5013	0.6758	0.5434	removed
D08	5.1886	1.3356	0.6653	0.5573	removed
D09	4.8354	1.5154	0.6124	0.6250	removed
D10	4.9582	1.4984	0.7596	0.4231	0.6756
E01	4.4412	1.3466	0.7454	0.4444	0.6647
E02	4.3570	1.5045	0.8087	0.3459	0.7670
E03	4.4013	1.3706	0.7943	0.3691	0.7378
E04	4.4758	1.3348	0.8307	0.3100	0.7730
E05	4.4419	1.4072	0.5748	0.6696	removed
E06	4.7317	1.3154	0.6887	0.5257	removed
E07	4.7104	1.2067	0.6463	0.5823	removed
E08	4.7254	1.4458	0.7830	0.3870	0.7017
E09	3.9139	1.4506	0.7289	0.4687	0.6448
E10	4.7347	1.3364	0.8449	0.2861	0.7844
F01	4.6792	1.3425	0.7085	0.4980	0.5673
F02	4.4674	1.5753	0.6689	0.5526	removed
F03	4.8776	1.0948	0.7368	0.4572	0.6234
F04	4.8323	1.5493	0.7327	0.4632	0.5622
F05	4.5504	1.4551	0.6786	0.5395	removed
F06	4.6933	1.3418	0.7162	0.4871	0.5453
F07	4.7950	1.4694	0.6136	0.6235	removed
F08	4.7845	1.4757	0.6906	0.5230	removed
F09	4.0636	1.6331	0.6324	0.6001	removed
F10R	4.5695	1.6775	0.1627	0.9735	removed

Table II. *Continued*

Item no. #	*Mean* μ	*Std. dev* σ	*Loading* λ^1	*Error* ε	*Item to total correlation*[2]
H01	5.5741	1.2569	0.8205	0.3268	0.7710
H02	5.2818	1.1988	0.7559	0.4286	0.6899
H03	4.7782	1.3555	0.7030	0.5058	0.6384
H04	5.3904	1.3873	0.7332	0.4624	0.6767
H05	5.8316	1.1293	0.7193	0.4827	0.6482
H06	5.6450	1.2303	0.7204	0.4810	0.6402
H07	5.5167	1.1559	0.7331	0.4625	0.6578
H08	5.0480	1.4008	0.8136	0.3380	0.7376
H09	5.1967	1.3899	0.8098	0.3442	0.7265
H10	5.3849	0.9896	0.6957	0.5160	removed

Notes
[1] All items with loading values less than 0.7 were removed (see Appendix, Table A.I for definition of survey items).
[2] All remaining items have item to total correlation values greater than 0.35.

matrix in Table III must be greater than the corresponding values in each row or column. In general, the results in this table show that this is the case, although the feed-forward and feed-back constructs appear to be strongly correlated with one another. However, since these measures are subsequently combined to form a measure of misalignment and are not themselves used directly, this is not a major concern here.

To evaluate the validity of the perceptual items used to measure business performance, a comparison can be made between the factor score for those items and an objective measure of performance. The objective measure of performance used was return on revenue (ROR) which was calculated by dividing Net Profit After Tax by Net Revenue for the fiscal year 1997 for each firm. A positive and significant relationship was found between the performance factor score and ROR ($r = 0.371$, $p < 0.01$). However, we were not able to use the more objective ROR measure in our analysis for two main reasons. First, accounting information for all 32 participating mutual fund companies was not available. Second, some of the mutual fund companies in the sample are wholly-owned subsidiaries of larger financial organizations, and although their parent organizations have publicly available financial data, the mutual fund subsidiaries do not publish such figures.

Misalignment

For each organization, separate factor scores were determined for each of the five organizational learning constructs. The II, GG, and OO factors scores were then averaged to give a combined learning stock score for the firm. Similarly, the feed-forward and feed-back factor scores were averaged, yielding a combined learning flow score for each firm. The misalignment variable was then constructed by subtracting the combined learning flow score from the combined learning stock score. The resulting misalignment value was generally positive, since the mean values for the learning stock measures tended to be higher than those for the flow measures. There is precedence for calculating differences between factor scores when

Table III. Construct statistics

	II	*GG*	*OO*	*FF*	*FB*	*PERF*
Arithmetic mean (all items)[1]	5.0807	4.9189	4.8660	4.4933	4.6313	5.3647
Arithmetic mean (used items)[2]	5.1355	4.9324	4.9031	4.4356	4.7706	5.3625
Cronbach's α reliability[3]	0.9090	0.9021	0.9043	0.9078	0.7660	0.9081
Internal consistency[4]	0.9244	0.9184	0.9164	0.9215	0.8147	0.9237
Convergent validity[5]	0.5763	0.5849	0.6106	0.6270	0.5236	0.5742
Correlation matrix and discriminant validity assessment						
II	**0.7592**[6]					
GG	0.704[7]	**0.7648**				
OO	0.659	0.652	**0.7814**			
FF	0.654	0.696	0.723	**0.7918**		
FB	0.597	0.667	0.741	0.734	**0.7236**	
PERF	0.676	0.666	0.769	0.688	0.712	**0.7578**
MISALIGN	0.302	0.193	0.072	–0.336	–0.373	0.005[8]

Notes

[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 loadings <0.70 have been removed.

[3] Cronbach's alpha. 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.

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

[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:

II – individual-level learning stocks
GG – group-level learning stocks
OO – organizational-level learning stocks
FF – feed-forward learning flows
FB – feed-back learning flows
PERF – business performance
MISALIGN – misalignment between learning stocks and flows.

Control variable means:

Asset size = $7.16 billion
Number of funds = 18.6
Number of employees = 216
Tenure (length of current employment per respondent) = 56.9 months.

researchers need to compare one variable with another (e.g., Fuguitt and Lieberson, 1974; Johns, 1981).

Tests of Hypotheses

The paths β_1, β_2, and β_3 in Figure 3 represent the effects (respectively) of the individual-level, group-level, and organizational-level learning stocks on performance. The β coefficients of these paths can be used directly to test Hypotheses 1, 2 and

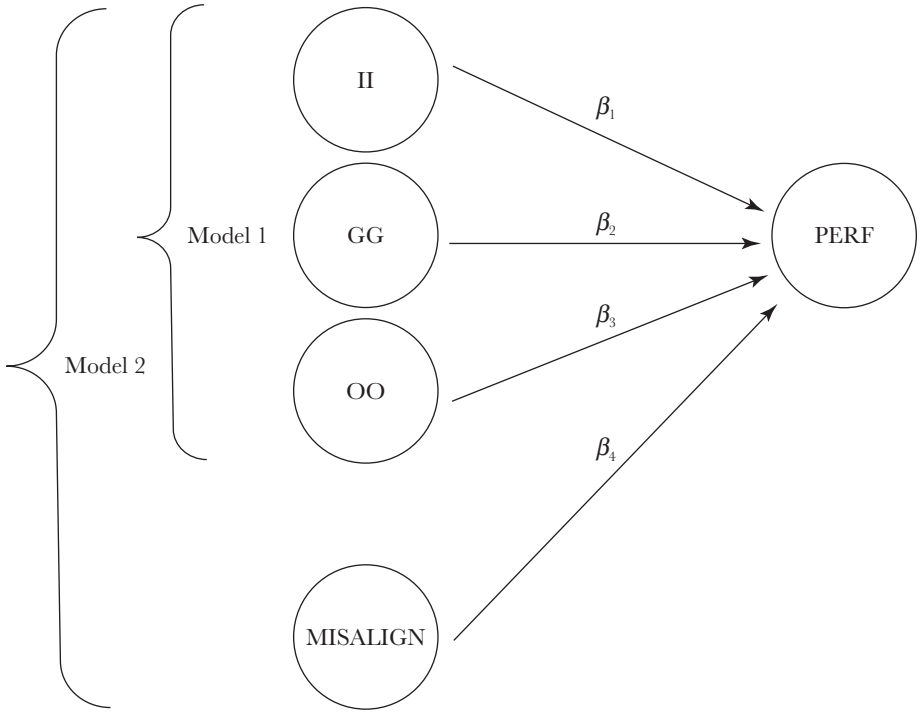

Figure 3. PLS model

3. Similarly, β_4 represents the effect of misalignment (between learning stocks and flows) on performance, and can be used to test Hypothesis 4.

Three distinct PLS models were built using the organizational learning constructs, performance, and the control variables. In all three models, performance was used as the dependent construct. Six control variables were used in these models. These variables include: (1) the natural logarithm of each mutual fund firm's asset size, in billions of Canadian dollars ('Assets'); (2) the natural logarithm of the number of mutual funds managed by each firm ('Funds'); (3) the natural logarithm of the number of employees in each firm ('Employees'); and (4) the natural logarithm of each individual's length of employment (in months) in his/her firm ('Tenure'). These four control variables are all characterized by greater heteroscedasticity when series values are larger in magnitude than when they are smaller. For this reason, natural logarithmic transformations were used to stabilize the variance. Two additional dummy variables were added to control for the management levels of individual respondents. These variables were included for both senior-level and middle-level managers.

The results obtained for these models are reported in Table IV. The base model examines the relationship between performance and the six control variables when the organizational learning stock and misalignment constructs are excluded. It can be seen from the table that this model has strong explanatory power, and is significant in its own right. None of the three size control variables has a significant relationship with performance in this model, nor do either of the management level control variables. In contrast, the employee's length of employment with the

Table IV. PLS model results

	Base model		*Model 1*		*Model 2*	
	β^1	t^2	β^1	t^2	β^1	t^2
Controls						
Level 1	–0.068	0.898	0.010	0.007	0.011	0.569
Level 2	0.016	0.215	0.005	0.204	0.009	0.144
Tenure	–0.157	2.078**	–0.077	1.377	–0.062	0.970
Assets	0.066	0.007	0.063	0.618	0.046	0.268
Employees	–0.011	0.291	0.028	0.164	0.004	0.127
Funds	0.199	1.011	0.102	1.209	0.105	1.508
Variables						
II			0.214	2.375**	0.273	2.839***
GG			0.193	3.411***	0.202	3.759***
OO			0.487	10.178	0.453	8.237***
MISALIGN					–0.143	3.255***
Results						
R^2	0.558		0.668		0.686	
F-stat	99.52		104.76		102.46	
Significance	0.001		0.001		0.001	

Notes

[1] Standardized beta (β) coefficient.

[2] T-statistic, significance values; *p-value <0.1, **p-value <0.05, ***p-value <0.01.

Base model predictors include:

Level 1 – dummy variable for senior-management level
Level 2 – dummy variable for middle-management level
Tenure – natural logarithm of work experience in months
Assets – natural logarithm of assets size in billions of dollars
Employees – natural logarithm of number of employees
Funds – natural logarithm of number of mutual funds

Model 1 predictors also include:

II – individual-level learning stocks
GG – group-level learning stocks
OO – organizational-level learning stocks

Model 2 predictors also include:

MISALIGN – misalignment between learning stocks and knowledge flows

The dependent variable in each model is business performance. An alternative model was used to examine the effects of inserting both feed-forward and feed-back learning flows into the PLS model. These variables were not initially part of hypothesis development but were tested nevertheless. Results indicated that the FF coefficient was not significant. Furthermore, the GG coefficient lost its substantiveness. It was significant ($p < 0.01$) in Model 1 but became less significant ($p < 0.1$) in the alternative model. These results support the argument that the flow variables (i.e., FF and FB) should not be part of the overall PLS model.

firm ('Tenure') is significantly and negatively related to her/his perception of the mutual fund firm's performance.

Models 1 and 2 both include the six control variables, along with the organizational learning constructs (both models) and the misalignment measure (model 2 only). Both models represent significant explanatory improvements over the base model. Model 1 is significantly better than the base model, based on a Chow test of the improvement in the R^2 value ($F_{(3,470)} = 51.91$, $p < 0.001$). In this model, all three of the organizational learning stocks have a significant, positive effect on performance. These results provide strong support for Hypotheses 1, 2 and 3.

Table V. Support of hypotheses

Hypothesis	*Predicted direction*	β	t^1	*Support*
H1	+	0.273	2.839	Yes
H2	+	0.202	3.759	Yes
H3	+	0.453	8.237	Yes
H4	–	–0.143	3.255	Yes

Note: [1] All β coefficients are significant at p-value <0.01 and in their appropriate direction supporting all four hypotheses.

Model 2 generates additional explanatory power by adding the misalignment variable. A Chow test comparing model 2 to model 1 ($F_{(1,469)} = 26.89$, $p < 0.001$) indicates that the former represents a statistically significant improvement over the latter. All four of the key path coefficients in this model are significant. As was the case for model 1, the three organizational learning stock constructs are significantly and positively associated with performance, consistent with Hypotheses 1, 2 and 3. Furthermore, misalignment is significantly and negatively related to performance, as predicted by Hypothesis 4. Thus, all four hypotheses are supported by the results from these analyses, as summarized in Table V. Organizational learning stocks at all levels are positively associated with business performance outcomes. However, it is also important to minimize the misalignment between organizational learning stocks and flows to improve overall performance.

DISCUSSION

There are three aspects of this research that merit further discussion. The first deals with the interpretation of the current findings given the underlying theory and methodology employed. This naturally leads into a discussion of the potential limitations of this research. Finally, we address the implications of our findings for future research and management practice.

Interpretation

Interpretation of our findings involves two central considerations. The first relates to our decision to use individual perceptions to measure learning stocks and flows. The second is an extension of the use of individual perceptions to address the subjective nature of the organizational learning phenomenon.

Various arguments have been made for the use of individual measures. For example, Konecni states that 'methodological individualism, the view that only the individual actor is real, is the only way to conduct social science research' (1977, p. 88). While most researchers realize the existence of groups and organization-level structures, the measurement of these constructs still focuses 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). However, our decision to use individual perceptual measures was more deep-rooted, since we needed 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 have been to try to obtain objective assessments of each of the constructs. However, 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 their employees' poor perceptions of the company's feed-forward learning process, despite their repeated attempts to make full use of employees' ideas. 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. We contend that even though employees' ideas were utilized by the organization, individuals' perceptions are what matter most, since these perceptions will ultimately govern the degree and types of learning that occur within organizations.

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 stocks of learning at the individual-level 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.

Using perceptual measures also avoids the question of how much learning is optimal. It can be argued that there are always more ideas than an organization can absorb, and indeed many ideas may not be beneficial to the organization. The organization will always need to engage in a process of filtering and vetting ideas. However, the use of perceptual measures enables the researcher to ascertain the degree to which individuals feel this filtering and vetting process is working. We contend that this process needs to be managed, and individuals need to feel that the process is effective.

The subjective nature of the phenomenon suggests that the relationships between the stocks and flows of learning are quite critical. Beyond the support found here for the hypothesis about the effect of misalignment between the stocks and flows on overall performance, it seems plausible to speculate that efforts to enhance the flows of learning may in fact increase the reported levels of learning stocks even in the absence of any investment in those stocks. For example, a firm that is able to enhance its feed-forward levels of learning may find that employees see themselves as more competent and capable.

The foregoing discussion raises an important consideration about the nature of knowledge and learning. We suggest that the system in which an individual or group employs learning affects both the actual and perceived level of learning in that system. The same individual could move to a different context and report a higher level of learning. In our view, this is not a flaw in instrumentation, but an important characteristic of the nature of the phenomenon under study.

Limitations

There are several limitations of the current study that need to be addressed. This research study took place within one industry to control for potential industry effects across organizations. When such a research design is utilized, the generali-

zability of the results needs to be addressed. It is expected that the results could be generalizable across other knowledge-intensive, service-oriented industries. The pilot studies for this research were undertaken in a variety of settings such as banking, insurance, utilities, and retailing. The psychometric properties of the measures we use here were also strong in these other settings. Thus, the generalizability of the measures we use appears to be quite good.

A more limiting factor regarding the generalizability of this research deals with national/cultural issues. For example, the nature of organizational learning may be different in the Chinese culture (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 detrimental 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 et al. (1994) examined the behaviours of knowledge creation among middle-managers in Japan and found quite a fertile setting for organizational learning 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 US competitors. It is for this reason that US companies must learn from their Japanese joint ventures and strategic alliances. Future research should consider these and other cultural implications when developing theories.

One other limitation of our approach in this paper needs to be acknowledged. We have tried to define our constructs as precisely as possible by drawing on relevant literature, to articulate clearly our conceptual framework, and to then closely link our measures to these theoretical underpinnings through a careful process of item generation and refinement. Nonetheless, the measurement items that we use here can realistically be thought of as only proxies for an underlying, latent phenomenon that is itself not fully measurable.

Implications for Research and Management

Our main research issue was to assess how perceptions of the stocks and flows of learning within the organizational learning system are associated with business performance. The results of our study support the premise that *there is a positive relationship between the stocks of learning at all levels in an organization and its business performance.* Furthermore, the proposition that *the misalignment of stocks and flows in an overall organizational learning system is negatively associated with business performance* is also supported.

These findings are significant, since they call into question the traditional focus of organizational learning research and management practice on learning at the individual and group levels. Specifically, the current results indicate that organizational level learning is more closely related than either individual or group level learning to organizational performance. This suggests that companies may

be over-investing in the development of individual competencies and capabilities, and under-investing in mechanisms to facilitate the flow of learning between levels.

It is also important to recognize that investments that build stocks of learning at the individual and group levels may be wasted if the flows of learning are obstructed. Indeed, the results from model 2 indicate that such misalignments negatively affect performance. They may also help to explain why individual and group level learning have smaller effects than organizational level learning on performance. To the extent that flows of learning between levels are inhibited, one would expect to see less evidence that learning at the individual and group levels will be translated into improvements in organizational performance. It is the dynamic interplay between these levels and processes and their associated relationships with business performance that form the main contributions of the current research to organizational learning theory.

The results also have implications for researchers in the field of strategy. Many empirical studies have established the importance of strategic alignment. Yet, strategy researchers have also expressed concern about the dynamic nature of strategy and the need for constant realignment. This research proposes the organizational learning system as a primary means for ongoing changes to institutionalized learning, so that strategy, systems, structures and procedures remain vital.

The flows of learning in the SLAM are conceptualized in two ways: (1) feed-forward – attention to the tension that exists between assimilating new learning (i.e., exploration), and (2) feed-back – using what has already been learned (i.e., exploitation). The former represents the flow of learning from the individual to group to the organizational level while the latter reverses the flow from the organizational down to through the group and on to the individual level. The results of this study indicate that business performance is a function of the effective management of the misalignment between these flows and their corresponding stocks. It follows then that organizational learning theory should seek to explain how to improve these flows in order to minimize misalignments and thus maximize business performance.

While most researchers examine organizational learning behaviours along various dimensions and from a variety of perspectives, the SLAM benefits from integrating the extant concepts in the literature and taking an organizational learning systems approach which makes for a more integrative contribution. The stock–flow dimension allows researchers to bridge the fields of intellectual capital and knowledge management into an overall systems perspective. Another important consideration for researchers is maintaining consistent use of terminology. Since the term *organizational learning* is often used interchangeably with knowledge management and intellectual capital, research is often disconnected. The conceptualization in this study provides researchers with an opportunity to bridge a relationship between these areas.

There are several directions for extension of this research. In this paper business performance was the organizational outcome. 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. Future research should attempt to operationalize these constructs and examine their relationships with the constructs studied here.

Another pressing issue in strategic management research in general – and in organizational learning research in particular – is the endogeneity of the performance construct. Generally, strategic management research 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 et al. (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 may need to refocus their efforts when managing organizational learning by considering both stocks and flows. Managing organizational learning has traditionally been the domain of Human Resources. This research suggests that building levels of individual and group stocks of learning through additional training and development may be counterproductive if the organization does not have the capacity to absorb the stocks. When organizational learning moves from the stock to the flow level, more stakeholders need to be involved. The organizational learning system is widespread, involving everyone in the organization. Aligning the stocks of learning across the three levels with the flows means bridging the chasm between departments such as *information systems* (that focuses on the flow of information), *strategic management* (that sets strategic direction) and *human resource management* (that focuses on the development of human capital).

In summary, this research has sought to present a very broad perspective of organizational learning as a system of stocks and flows across three levels: individual, group and organization. Our findings suggest that all three levels of learning are critical to overall firm performance. However, our research also suggests that we need to consider the relationship between the stocks of learning and their flows.

NOTE

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APPENDIX

Table A.I presents construct definitions and sample survey items. Table A.II presents a matrix of loadings and cross-loadings.

Table A.I. Construct definitions and sample survey items

II	**Individual-level learning stocks**	**Individual competence, capability and motivation to undertake the required tasks**

- Individuals are able to break out of traditional mind-sets to see things in new and different ways.
- Individuals feel a sense of pride in their work.
- Individuals have a clear sense of direction in their work.
- Individuals are aware of the critical issues that affect their work.
- Individuals generate many new insights.

GG	**Group-level learning stocks**	**Group dynamics and the development of shared understanding**

- We have effective conflict resolution when working in groups.
- Different points of view are encouraged in group work.
- Groups are prepared to rethink decisions when presented with new information.
- In meetings, we seek to understand everyone's point of view.
- Groups have the right people involved in addressing the issues.

OO	**Organizational-level learning stocks**	**Alignment between the non-human storehouses of learning including systems, structure, strategy, procedures and culture; given the competitive environment**

- We have a strategy that positions us well for the future.
- The organizational structure supports our strategic direction.
- The organization's culture can be characterized as innovative.
- The organizational structure allows us to work effectively.
- Our operational procedures allow us to work efficiently.

FF	**Feed-forward learning flows**	**Whether and how individual learning feeds forward into group learning and learning at the organizational level (e.g. changes to structure, systems, products, strategy, procedures, culture)**

- Lessons learned by one group are actively shared with others.
- Individuals have input into the organization's strategy.
- Results from the group are used to improve products, services and processes.
- Recommendations by groups are adopted by the organization.
- We do not 'reinvent the wheel'.

FB	**Feed-back learning flows**	**Whether and how the learning that is embedded in the organization (e.g. systems, structure, strategy) affects individual and group learning**

- Policies and procedures aid individual work.
- Company goals are communicated throughout the organization.
- Company files and databases provide the necessary information to do our work.
- Group decisions are supported by individuals.

PERF	**Business performance**	**Individual, group and organizational business performance outcomes**

- Our organization is successful.
- Our group meets its performance targets.
- Individuals are generally happy working here.
- Our organization meets its clients' needs.
- Our organization's future performance is secure.

Table A.II. Matrix of loadings and cross-loadings

Item no.	*II factor*	*GG factor*	*OO factor*	*EF factor*	*FB factor*	*PERF factor*	*Item label*
B06	**0.813**	0.537	0.491	0.505	0.470	0.574	**Pride**
B07	**0.781**	0.523	0.479	0.489	0.448	0.531	**Energy**
B08	**0.771**	0.594	0.529	0.534	0.534	0.563	**Growth**
B05	**0.757**	0.524	0.448	0.439	0.454	0.517	**Confidence**
B09	**0.752**	0.580	0.592	0.563	0.581	0.539	**Focus**
B10	**0.748**	0.577	0.563	0.603	0.583	0.503	**Innovation**
B03	**0.742**	0.491	0.456	0.478	0.442	0.534	**Accomplishment**
B02	**0.735**	0.495	0.493	0.463	0.492	0.449	**Aware issues**
B04	**0.730**	0.492	0.432	0.457	0.421	0.450	**New ideas**
B01	0.692	0.417	0.460	0.405	0.432	0.463	Knowledgeable
C09	0.570	**0.824**	0.540	0.573	0.557	0.547	**Diverse views**
C10	0.566	**0.791**	0.521	0.565	0.538	0.529	**Rethink decisions**
C08	0.587	**0.780**	0.548	0.575	0.572	0.505	**Right people**
C01	0.543	**0.778**	0.533	0.543	0.544	0.536	**Understand p.o.v.**
C05	0.493	**0.755**	0.455	0.522	0.477	0.490	**Conflict resolution**
C06	0.567	**0.750**	0.544	0.597	0.520	0.556	**Adaptable group**
C07	0.504	**0.727**	0.489	0.524	0.526	0.474	**Common understanding**
C02	0.472	**0.707**	0.434	0.470	0.476	0.470	**Share successes**
C03	0.419	0.674	0.360	0.381	0.432	0.385	Share failures
C04	0.425	0.626	0.409	0.464	0.408	0.429	Idea generation
D02	0.501	0.493	**0.830**	0.580	0.650	0.617	**Structure/strategy**
D03	0.585	0.582	**0.825**	0.604	0.656	0.646	**Structure/work**
D01	0.453	0.450	**0.793**	0.527	0.573	0.661	**Strategy/environment**
D06	0.491	0.474	**0.769**	0.553	0.551	0.598	**Vision**
D10	0.588	0.602	**0.760**	0.624	0.658	0.613	**Culture of trust**
D04	0.542	0.555	**0.754**	0.556	0.637	0.571	**Procedures**
D05	0.536	0.463	**0.733**	0.568	0.558	0.546	**Innovative culture**
D07	0.377	0.352	0.676	0.460	0.552	0.447	Systems/strategy
D08	0.425	0.476	0.665	0.456	0.587	0.508	Systems
D09	0.357	0.408	0.612	0.432	0.568	0.421	Databases
E10	0.565	0.616	0.642	**0.845**	0.685	0.651	**Ideas to products**
E04	0.532	0.585	0.597	**0.831**	0.607	0.580	**Org'n adopts ideas**
E02	0.513	0.538	0.567	**0.809**	0.577	0.533	**Strategy input**
E03	0.442	0.508	0.554	**0.794**	0.582	0.506	**Innovative solutions**
E08	0.613	0.576	0.619	**0.783**	0.630	0.586	**Utilize intelligence**
E01	0.474	0.555	0.520	**0.745**	0.588	0.499	**Lessons shared**
E09	0.495	0.514	0.588	**0.729**	0.624	0.500	**'Left hand knows right'**
E06	0.420	0.485	0.481	0.689	0.545	0.459	Information sharing
E07	0.478	0.512	0.356	0.646	0.426	0.473	Assumptions challenged
E05	0.338	0.359	0.450	0.575	0.453	0.362	'Reinvent the wheel'
F03	0.540	0.643	0.598	0.634	**0.737**	0.618	**Group guides individuals**
F04	0.469	0.492	0.637	0.602	**0.733**	0.572	**Goals communicated**
F06	0.404	0.446	0.608	0.494	**0.716**	0.478	**Databases provide info.**
F01	0.409	0.482	0.557	0.525	**0.709**	0.512	**Policies aid work**
F08	0.477	0.427	0.537	0.499	0.691	0.509	Training
F05	0.512	0.467	0.559	0.535	0.679	0.536	Recruiting
F02	0.438	0.465	0.487	0.513	0.669	0.473	Reward systems
F09	0.375	0.375	0.453	0.470	0.632	0.407	Cross-training
F07	0.303	0.335	0.478	0.411	0.614	0.368	Info-systems aid sharing
F10R	0.139	0.166	0.179	0.190	0.163	0.176	Memory aids decision

Table A.II. *Continued*

Item no.	*II factor*	*GG factor*	*OO factor*	*EF factor*	*FB factor*	*PERF factor*	*Item label*
H01	0.522	0.477	0.685	0.550	0.626	**0.821**	**Organization is successful**
H08	0.631	0.605	0.620	0.642	0.635	**0.814**	**Employee satisfaction**
H09	0.633	0.593	0.602	0.636	0.627	**0.810**	**Individuals happy**
H02	0.512	0.497	0.654	0.543	0.602	**0.756**	**Client needs met**
H04	0.418	0.382	0.561	0.494	0.502	**0.733**	**Respected organization**
H07	0.474	0.500	0.510	0.431	0.474	**0.733**	**Group meets targets**
H06	0.510	0.593	0.505	0.495	0.531	**0.720**	**Group performs as a team**
H05	0.473	0.477	0.472	0.430	0.475	**0.719**	**Group contributes**
H03	0.420	0.412	0.630	0.490	0.551	**0.703**	**Positioned for future**
H10	0.513	0.452	0.462	0.470	0.468	0.696	Satisfied with self perf.

Note: All remaining items had higher loadings with their associated factor in comparison to their cross-loadings.

REFERENCES

Andrews, K. R. (1971). *The Concept of Corporate Strategy*. Homewood, IL: Dow Jones Irwin.

Andrews, F. (1984). 'Construct validity and error components of survey measures: a structural modelling approach'. *Public Opinion Quarterly*, **48**, 409–42.

Argyris, C. and Schön, D. (1978). *Organizational Learning: A Theory of Action Perspective*. Reading, MA: Addison Wesley.

Argyris, C. and Schön, D. A. (1996). *Organizational Learning II: Theory, Method, and Practice*. Reading, MA: Addison-Wesley.

Armstrong, J. and Overton, T. (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.

Attewell, P. (1996). 'Technology diffusion and organizational learning: the case of business computing'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 203–29.

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

Barclay, D., Higgins, C. and Thompson, R. (1995). 'The partial least squares (PLS) approach to causal modelling'. *Technology Studies*, **2**, 2, 285–323.

Behling, O. and Eckel, H. (1991). 'Making sense our of intuition'. *Academy of Management Executive*, **5**, 1, 46–54.

Bertini, G. and Tomassini, M. (1996). 'Auditing the Organizational Learning Processes in Small Working Teams'. Unpublished paper.

Bierly, P. and Chakrabarti, A. (1996). 'Generic knowledge strategies in the U.S. pharmaceutical industry'. *Strategic Management Journal*, **17**, Winter Special Issue.

Bontis, N. (1996). 'There's a price on your head: managing intellectual capital strategically'. *Business Quarterly*, Summer, 40–7.

Bontis, N. (1998). 'Intellectual capital: an exploratory study that develops measures and models'. *Management Decision*, **36**, 2, 63–76.

Bontis, N. (1999). 'Managing organizational knowledge by diagnosing intellectual capital: framing and advancing the state of the field'. *International Journal of Technology Management*, **18**, 5/6/7/8, 433–62.

Bontis, N. (2002). *World Congress on Intellectual Capital Readings*. Boston: Butterworth Heinemann KMCI Press.

Bontis, N., Dragonetti, N., Jacobsen, K. and Roos, G. (1999). 'The knowledge toolbox: a review of the tools available to measure and manage intangible resources'. *European Management Journal*, **17**, 4, 391–402.

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

Cangelosi, V. E. and Dill, W. R. (1965). 'Organizational learning observations: toward a theory'. *Administrative Science Quarterly*, **10**, 175–203.

Carley, K. (1996). 'Organizational learning and personnel turnover.' In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 230–66.

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

Cavaleri, S. and Fearon, D. (1996). *Managing in Organizations that Learn*. Cambridge: Blackwell.

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

Choi, C. J. and Lee, S. H. (1997). 'A knowledge-based view of cooperative interorganizational relationships'. In Beamish, P. and Killing, J. (Eds), *Cooperative Strategies: European Perspectives*. San Francisco: New Lexington.

Choo, C. W. and Bontis, N. (2002). *The Strategic Management of Intellectual Capital and Organizational Knowledge*. New York: Oxford University Press.

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

Cohen, M. D. and Bacdayan, P. (1996). 'Organizational routines are stored as procedural memory: evidence from a laboratory study.' In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 403–29.

Cohen, M. and Levinthal, D. (1990). 'Absorptive capacity: a new perspective on learning and innovation'. *Administrative Science Quarterly*, **35**, 128–52.

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

Connor, K. and Prahalad, C. (1996). 'A resource-based theory of the firm: knowledge versus opportunism'. *Organization Science*, **7**, 469.

Cook, S. D. N. and Yanow, D. (1996). 'Culture and organizational learning'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 430–59.

Crossan, M. and Bontis, N. (1998). 'The Strategic Management of Organization Learning'. *Presented at Academy of Management 1998*, San Diego, CA, Ivey Working Paper.

Crossan, M. and Guatto, T. (1996). 'Organizational learning research profile'. *Journal of Organizational Change Management*, **9**, 1, 107–12.

Crossan, M. and Hulland, J. (1997). 'Measuring Organizational Learning'. Presented at Academy of Management 1997, Boston, MA, Ivey Working Paper.

Crossan, M., Lane, H., White, R. and Djurfeldt, L. (1995). 'Organizational learning: dimensions for a theory', *International Journal of Organizational Analysis*, **3**, 4, 337–60.

Crossan, M., Lane, H. and White, R. (1999). 'An organizational learning framework: from intuition to institution'. *Academy of Management Review*, **24**, 3, 522–37.

Daft, R. L. and Huber, G. (1987). 'Making sense of improvisation'. In Huff, A. and Walsh, J. (Eds), *Advances in Strategic Management*, Vol 14. Stamford, CT: JAI Press, 155–80.

Daft, R. L. and Weick, K. E. (1984). 'Toward a model of organizations as interpretation systems'. *Academy of Management Review*, **9**, 284–95.

Day, G. S. (1994). 'Continuous learning about markets'. *California Management Review*, Summer, 9–31.

De Geus, A. (1988). 'Planning as learning'. *Harvard Business Review*, **66**, March/April, 70–4.
Demsetz, H. (1991). 'The theory of the firm revisited'. In Williamson, O. and Winter, S. (Eds), *The Nature of the Firm*. New York: Oxford University Press.
Dess, G. G. and Robinson, R. B. (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**, 3, 265–73.
Døving, E. (1996). 'In the image of man: organizational action, competence and learning'. In Grant, D. and Oswick, C. (Eds), *Metaphors and Organizations*. London: Sage.
Duncan, R. B. and Weiss, A. (1979). 'Organizational learning: implications for organization design'. In Staw, B. (Ed.), *Research in Organizational Behavior*. Greenwich, CT: JAI Press.
Easterby-Smith, M. (1997). 'Disciplines of the learning organization: contributions and critiques'. *Human Relations*, **50**, 9.
Edvinsson, L. and Malone, M. (1997). *Intellectual Capital*. New York: Harper Business.
Epple, D., Argote, L. and Devadas, R. (1996). 'Organizational learning curves: a method for investigating intra-plant transfer of knowledge acquired through learning by doing'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 83–100.
Fiol, C. and Lyles, M. (1985). 'Organizational learning'. *Academy of Management Review*, **10**, 4, 803–13.
Fornell, C. and Bookstein, F. (1982). 'Two structural equation models: LISREL and PLS applied to consumer exit-voice theory'. *Journal of Marketing Research*, **18**.
Fornell, C. and Larcker, D. (1981). 'Evaluating structural equation models with unobservable variable and measurement error'. *Journal of Marketing Research*, **18**, 39–50.
Foss, N. (1996). 'Knowledge-based approaches to the theory of the firm: some critical comments'. *Organization Science*, **7**, 470–6.
Fuguitt, G. and Lieberson, S. (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*, **71**, 4, 78–91.
Geringer, J. and Hébert, L. (1989). 'Control and performance of international joint ventures'. *Journal of International Business Studies*, **20**.
Gibson, P., Greenhalgh, G. and Kerr, R. (1995). *Manufacturing Management Principles and Concepts*. London: Chapman and Hall.
Glynn, M. A., Lant, T. K. and Milliken, F. J. (1994). 'Mapping learning processes in organizations: a multi-level framework linking learning and organizing'. *Advances in Managerial Cognition and Organizational Information Processing*, **5**, 43–83, JAI Press.
Gnyawali, D. and Stewart, A. (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, DC.
Gnyawali, D., Stewart, A. and Grant, J. (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.
Hambrick, D. and Mason, P. (1984). 'Upper echelons: the organization as a reflection of its top executives'. *Academy of Management Review*, **9**, 2, 193–206.
Hansen, G. and Wernerfelt, B. (1989). 'Determinants of firm performance in relative importance of economic and organizational factors'. *Strategic Management Journal*, **10**, 5.
Hedberg, B. (1981). 'How organizations learn and unlearn'. In Nystrom, P. C. and Starbuck, W. H. (Eds), *Handbook of Organizational Design*. New York: Oxford University Press, 3–27.
Henderson, R. M. (1996). 'Technological change and the management of architectural

knowledge'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 359–75.
Hinkin, T. R. (1995). 'A review of scale development practices in the study of organizations'. *Journal of Management*, **21**, 5.
Hofstede, G. (1980). *Culture's Consequences: International Differences in Work-related Values*. Beverly Hills, CA: Sage.
Huber, G. P. (1991). 'Organizational learning: the contributing processes and the literatures'. *Organization Science*, **2**, 88–115.
Huff, A. S. (1990). *Mapping Strategic Thought*. New York: Wiley.
Hulland, J. (1999). 'Use of partial least squares (PLS) in strategic management research: a review of four recent studies'. *Strategic Management Journal*, **20**, 195–204.
Hult, G. (1995). 'An International Organizational Learning Study of the Internal Marketing System'. PhD Dissertation. Memphis: University of Memphis.
Hurst, D. (1995). *Crisis and Renewal*. Boston: Harvard Business School Press.
Hutchins, E. (1996). 'Organizing work by adaptation'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 20–57.
Isaacs, W. H. (1993). 'Dialogue, collective thinking, and organizational learning'. *Organizational Dynamics*, **22**, 2, 24–39.
Johns, G. (1981). 'Difference score measures of organizational behavior variables: a critique'. *Organizational Behavior and Human Performance*, **27**, 443–63.
Kim, D. H. (1993). 'The link between individual and organizational learning'. *Sloan Management Review*, Fall, 37–50.
Knoke, D. and Kuklinski, J. (1982). *Network Analysis*. Beverly Hills, CA: Sage.
Kogut, B. and Zander, U. (1992). 'Knowledge of the firm, combinative capabilities, and the replication of technology'. *Organization Science*, **3**, 383–97.
Konecni, V. (1977). 'The role of adversive events in the development of intergroup conflict'. In Austin, W. and Worchel, S. (Eds), *Social Psychology of Intergroup Relations*. Monterrey, CA: Brooks/Cole.
Lant, T. K. and Mezias, S. (1992). 'An organizational learning model of convergence and reorientation'. *Organization Science*, **3**, 1, 47–71.
Learned, E., Christensen, C., Andrews, K. and Guth, W. (1965). *Business Policy: Text and Cases*. Homewood, IL: Irwin.
Lee, S., Courtney, J. and O'Keefe, R. (1992). 'A system of organizational learning using cognitive maps'. *International Journal of Management Science*, **20**.
Levinthal, D. A. and March, J. G. (1993). 'The myopia of learning'. *Strategic Management Journal*, **14**, 95–112.
Levitt, B. and March, J. G. (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 Salk, J. (1997). 'Knowledge acquisition from foreign partners in international joint ventures: an empirical examination in the Hungarian context'. In Beamish, P. and Killing, P. (Eds), *Cooperative Strategies: European Perspectives*. San Francisco: New Lexington Press.
Lyles, M. and Schwenk, C. (1992). 'Top management, strategy, and organizational knowledge structures'. *Journal of Management Studies*, **29**, 2.
March, J. G. (1991). 'Exploration and exploitation in organizational learning'. *Organization Science*, **2**, 1, 71–87.
March, J. G., Sproull, L. S. and Tamuz, M. (1996). 'Learning from samples of one or fewer'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 1–19.
Marquardt, M. (1996). *Building the Learning Organization*. New York: McGraw-Hill.
Mayo, A. and Lank, E. (1996). 'The Learning Organization Index'. Unpublished paper.

Meyer-Dohm, P. (1992). 'Human resources 2020: structures of the "learning company"'. *Conference Proceedings, Human Resources in Europe at the Dawn of the 21st Century*. Luxembourg: Office for Official Publications of the European Communities.

Miller, D. (1990). *The Icarus Paradox: How Exceptional Companies Bring About Their Own Downfall*. New York: Harper Business.

Miller, D. (1996). 'A preliminary typology of organizational learning: synthesizing the literature'. *Journal of Management*, **22**, 3, 485–505.

Mills, D. O. and Friesen, B. (1992). 'The learning organization'. *European Management Journal*, **10**, 2, 146–56.

Miner, A. S. (1991). 'Organizational evolution and the social ecology of jobs'. *American Sociological Review*, **546**, 772–85.

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

Mintzberg, H., Ahlstrand, B. and Lambel, J. (1998). *Strategy Safari: A Guided Tour Through the Wilds of Strategic Management*. New York: The Free Press.

Nadler, D., Gerstein, M., Shaw, R. et al. (1992). *Organizational Architecture: Designs for Changing Organizations*. San Francisco: Jossey-Bass.

Nason, S. (1994). 'Organizational Learning Disabilities: An International Perspective'. PhD Dissertation. Los Angeles: University of Southern California.

Nevis, E. C., DiBella, A. J. and Gould, J. M. (1995). 'Understanding organizations as learning systems'. *Sloan Management Review*, Winter, 73–85.

Nonaka, I. (1994). 'A dynamic theory of organizational knowledge creation'. *Organization Science*, **5**, 1, 14–37.

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

Nonaka, I., Byosiere, P., Borucki, C. and Konno, N. (1994). 'Organizational knowledge creation theory: a first comprehensive test'. *International Business Review*, **3**, 4.

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

Pedler, M., Burgoyne, J. and Boydell, T. (1991). *The Learning Company*. London: McGraw-Hill.

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

Polanyi, M. (1967). *The Tacit Dimension*. London: Routledge.

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

Prahalad, C. and Hamel, G. (1990). 'The core competence of the corporation'. *Harvard Business Review*, **62**, May–June, 79–91.

Prietula, M. J. and Simon, H. A. (1989). 'The experts in your midst'. *Harvard Business Review*, **61**, January–February, 120–4.

Quinn, J. B. (1992). *Intelligent Enterprise: A Knowledge and Service Based Paradigm for Industry*. New York: Free 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**.

Schwab, D. P. (1980). 'Construct validity in organization behavior'. In Staw, B. W. and Cummings, L. L. (Eds), *Research in Organizational Behavior*, Vol. 2. Greenwich, CT: JAI Press, 3–43.

Schwandt, D. and Marquardt, M. (2000). *Organizational Learning: From World-class Theories to Global Best Practices*. Boca Raton: St Lucie.

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

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

SHIMP, T. and SHARMA, S. (1987). 'Consumer ethnocentrism construction and validation of the CETSCALE'. *Journal of Marketing Research*, **24**.

SHRIVASTAVA, P. (1983). 'A typology of organizational learning systems'. *Journal of Management Studies*, **20**, 1, 7–28.

SIMON, H. A. (1991). 'Bounded rationality and organizational learning'. *Organization Science*, **2**, 1.

SITKIN, S. B. (1996). 'Learning through failure: the strategy of small losses'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 541–77.

SLATER, S. F. and NARVER, J. C. (1995). 'Market orientation and the learning organization'. *Journal of Marketing*, **59**, 3, 63–74.

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

STARBUCK, W. H. (1996). 'Learning by knowledge-intensive firms'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 484–515.

STATA, R. (1989). 'Organizational learning – the key to management innovation'. *Sloan Management Review*, Spring.

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

SVEIBY, K. E. (1997). *The New Organizational Wealth: Managing and Measuring Knowledge-Based Assets*. Berrett-Koehler: 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, DC.

VAN BUREN, M. (1997). *ASTD's Guide to Learning Organization Assessment Instrument*. Alexandria, VA: ASTD.

VENKATRAMAN, N. and RAMANUJAM, V. (1987). 'Planning system success: a conceptualization and an operational model'. *Management Science*, **33**, 6, 687–705.

VIRANY, B., TUSHMAN, M. L. and ROMANELLI, E. (1996). 'Executive succession and organization outcomes in turbulent environments: an organizational learning approach'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 302–29.

WALSH, J. P. and UNGSON, G. R. (1991). 'Organizational memory'. *Academy of Management Review*, **16**, 57–91.

WATKINS, K. E. and MARSICK, W. J. (1993). *Sculpting the Learning Organization*. San Francisco: Jossey-Bass.

WEICK, K. (1979). *The Social Psychology of Organizing*. Reading, MA: Addison-Wesley.

WEICK, K. (1996). 'The non-traditional quality of organizational learning'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 163–74.

WEICK, D. and ROBERTS, K. (1993). 'Collective mind and organizational reliability: the case of flight operations in an aircraft carrier deck'. *Administrative Science Quarterly*, **38**, 357–81.

WELLMANN, B. and BERKOWITZ, S. (1988). *Social Structures: A Network Approach*. Cambridge, MA: Cambridge University Press.

WICK, C. and LEÓN, L. (1993). *The Learning Edge: How Smart Managers and Smart Companies Stay Ahead*. New York: McGraw-Hill.

WINTER, S. G. (1996). 'Organizing for continuous improvement: evolutionary theory meets the quality revolution'. In Cohen, M. D. and Sproull, L. S. (Eds), *Organizational Learning*. Thousand Oaks, CA: Sage Publications Inc., 460–83.