

***RECONCILING THE TENSIONS IN LEARNING AND
KNOWLEDGE***

Theme: Strategy, Competitiveness and Learning

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Abstract

This paper identifies the critical learning trade-offs that managers face when defining their learning strategies. We integrate these learning choices into three configurations of learning strategies: “Explorers”, “Exploiters”, and “Innovators”, and address whether there is one optimal configuration of the learning tensions that leads to a superior learning strategy, or whether different strategies are appropriate under different conditions. In supporting the existence of an “optimal” learning strategy, we propose several ways in which learning tensions can be managed. First, we argue that the tensions can be managed across time and space. Second, we suggest that by developing an improvisational skill, firms can exploit current ways of doing things while providing room for experiments and controlled risks that open the possibility for exploration.

Introduction

In recent years researchers (Bierly & Chakrabarti, 1996; Zack, 1999a; 1999b) have introduced the concepts of “knowledge strategies” and “learning strategies.” These studies are consistent with efforts to offer managers specific guidance about the strategic decisions that determine how and what a firm will learn. This early work, however, has led to distinct lists of learning and knowledge choices. Recognizing the potential of the “learning strategies” concept as a communication tool between academics and practitioners about what is required to manage learning, the purpose of this paper is to develop a theoretical model that defines the “learning strategy” construct and links it to firm performance. Our specific research questions are: (1) What are the fundamental strategic choices facing managers in shaping their organization’s learning process? (2) What are the underlying processes through which a firm can manage the various tradeoffs that define a learning strategy? (3) Are there several possible learning strategies associated with specific conditions, or is there a superior learning strategy?

We seek to contribute to organizational learning and knowledge research by delving into the relationship between learning and strategy, and by emphasizing the need for strategic leaders to be explicit about the choices that define a learning path for their firms. In addition, this paper links learning strategies and performance, and addresses whether there is one optimal configuration of the learning tensions that leads to a superior learning strategy, or whether different strategies are appropriate under different conditions. To explore this issue we build on the body of knowledge on configurational approaches to strategy (e.g., Van de Ven & Drazin, 1985; Venkatraman & Prescott, 1990)

We start by reviewing existing research on learning and knowledge strategies and position it in the context of configurational theories. Then, we define a set of critical tradeoffs or tensions firms face in defining their learning strategies, and suggest how organizations may reconcile these tradeoffs. Third, we present propositions describing two learning strategies—“Explorers” and “Exploiters”—and associate the choice of a learning strategy to organizational, environmental, and strategic characteristics. Furthermore, we propose the possibility of an optimal learning strategy we refer to as “Innovators”, which requires firms to manage the learning tensions. Finally, conclusions and directions for future research are discussed.

Learning choices within configurational approaches to strategy

In studying the link between learning strategies and performance, we seek to understand how the fit between the firm's strategy and characteristics, and its learning choices impacts organizational outcomes. Researchers studying fit recognize that there are at least three approaches for defining it: the selection approach, the interaction approach, and the systems approach (Miller, 1981; 1986; Van de Ven & Drazin, 1985; Venkatraman & Prescott, 1990). Most of the conceptual and methodological discussion in the field centers on the last two, where the interaction approach has been linked to work on contingency theory and the systems approach has been named configurational theory. Venkatraman and Prescott (1990) also differentiate the two approaches by labeling them the reductionist and the holistic perspectives of coalignment. While configurational research has its root in contingency theory (Meyer, Tsui, & Hinings, 1993), researchers in the first camp draw a line between the two views of fit. The assumption in the contingency perspective is that fit between constructs can be understood in terms of pair-wise coalignment among the individual dimensions that represent the constructs (Venkatraman & Prescott, 1990). In empirical tests, coalignment is then defined as the interaction effects among the individual variables (Venkatraman & Prescott, 1990). In contrast, the configurational perspective argues for a systemic, full-logic, and multivariate view of the coalignment between the constructs. For example, the term "organizational configuration" has been used in the strategic management field to denote any multidimensional constellation of characteristics - environments, strategies, structures, cultures, etc. - that commonly occur together and present internal consistency (Meyer et al., 1993). Empirical tests use exploratory approaches such as cluster and Q-factor analysis (Miller & Friesen, 1984) or a deductive pattern-analytic approach (Venkatraman & Prescott, 1990), where coalignment is specified in terms of adherence to an ideal profile derived either from theory or data. Finally, one of the most important differences between contingency and configurational views of fit is the way they link fit to performance. The configurational view relaxes the assumption of one-best-way, which is implicit in contingency theory, and introduces the notion of equifinality, which acknowledges that there is more than one successful way to match two constructs (Meyer et al., 1993; Van de Ven & Drazin, 1985). Configurational theories define different "ideal types" and posit that organizations that fit any of the ideal configurations will enjoy greater effectiveness (Doty, Glick, & Huber, 1993).

One of the most successful applications of the configurational approach has been the definition of generic strategy typologies and taxonomies (e.g., Miles & Snow, 1978; Miller & Friesen, 1978; Porter, 1980). Although the richest strategy configurations include environmental, structural, technological, and cultural dimensions simultaneously, the knowledge variable has essentially been ignored in these configurations. It is only in the last few years that researchers (Bierly & Chakrabarti, 1996; Zack, 1999a; 1999b) have introduced the concept of knowledge strategy and positioned it in the context of a firm's business strategy. Bierly and Chakrabarti (1996) define a knowledge strategy as a set of strategic choices that shape and direct the organization's learning process and determine the firm's knowledge base. They suggest that "the development of a dynamic knowledge strategy typology or taxonomy will offer more insight than the static strategy typologies developed to date" (Bierly & Chakrabarti, 1996: 133). Zack (1999a, 1999b) states that firms must explicitly address, as part of their knowledge strategy, a range of decisions regarding the creation, development, and maintenance of their knowledge resources and capabilities. In contrast to the definition offered by Bierly and Chakrabarti, Zack's definition of knowledge

strategy explicitly includes the notion of fit to the firm's business strategy. He suggests that a knowledge strategy describes the overall approach an organization intends to take to align its knowledge resources and capabilities to the intellectual requirements of its business strategy, and adds that it is "a natural extension of the historical development of business strategy in general" (Zack, 1999b: viii).

We do not necessarily agree with the idea of a knowledge strategy "replacing" a firm's business strategy or a business strategy "evolving" to become a knowledge strategy. Instead, we propose that the two strategies complement each other by answering different questions. A business strategy responds to the question: "On which basis do I want to compete in the market?" while the given knowledge strategy address: "How do I employ knowledge to create competitive advantage?" By addressing these two questions, strategy becomes aligned with what the organization knows and new knowledge is developed to support a desired strategy (Zack, 1999a).

Bierly & Chakrabarti's (1996) study was one of the first attempts to operationalize the concept of knowledge strategy. In their exploratory study, they empirically derive a generic knowledge strategy taxonomy. They define four basic trade-offs firms face when defining their knowledge strategy: balance between internal and external learning, balance between radical and incremental learning, optimal learning speed, and balance between the depth and breadth of the knowledge base. Using these four dimensions, the authors find four internally consistent knowledge strategies: innovators, loners, exploiters, and explorers. In a sample of U.S. pharmaceutical firms, innovators are described as the most aggressive learners, who combine internal and external learning, radical and incremental learning, and are one of the fastest learners in the industry. Loners are isolated learners, with high levels of internal learning but low external learning. In addition, loners are slow in applying new knowledge and have a narrow knowledge base, focused on certain areas of expertise. Exploiters have high levels of external learning, but low levels of internal learning. They learn in an incremental instead of a radical way and have a broad, but shallow, knowledge base. Finally, explorers are less aggressive learners than innovators, combine internal and external learning, and present a high level of radicalness.

Several other researchers have also offered insights about strategic choices that relate to a knowledge strategy. Besides the "internal/external source of knowledge" dimension, Zack (1999a; 1999b) proposes that firms must determine whether its efforts are best focused on knowledge creation (exploration), knowledge use (exploitation), or on both. Zack presents a 3x3 matrix, where the most conservative knowledge strategy is pursued by companies exploiting internal knowledge and the most aggressive knowledge strategy is represented by companies that are both creators and users of knowledge and that integrate internal and external knowledge. In addition, Argote (1999) lists several tensions or tradeoffs in the learning process, which define a learning strategy. These are the tensions between group and organizational learning, heterogeneity and standardization, learning by planning and learning by doing, and the tension between fast and slow learning. Finally, other studies in the field have not mentioned knowledge or learning strategy as a construct, but have analyzed related concepts such as "learning styles" (Ribbens, 1997), "learning modes" (Miller, 1996), "learning orientations" (DiBella, Nevis, & Gould, 1996; Nevis, DiBella, & Gould, 1995), and "knowledge management styles" (Jordan & Jones, 1997). Table 1 summarizes the dimensions discussed in these conceptualizations. The lists of learning and knowledge choices exhibit little overlap, which demonstrates that no list is comprehensive and that authors look at the

issue from different perspectives. In the next section we propose a framework that helps to integrate these fragmented efforts to define learning and knowledge strategies.

Table 1
Examples of dimensions incorporated into Learning or Knowledge strategies

Author	Typology/Taxonomy	Dimensions
Bierly & Chakrabarti (1996)	Four knowledge strategies	<ul style="list-style-type: none"> • External-Internal learning • Incremental-Radical learning • Fast-Slow learning • Breath of knowledge base
Argote (1999)	Four tensions in the learning process	<ul style="list-style-type: none"> • Group-Organizational learning • Heterogeneity-Standardization • Learning by planning-Learning by doing • Fast-Slow learning
Zack (1999a, 1999b)	Six knowledge strategies	<ul style="list-style-type: none"> • External-Internal knowledge • Exploration-Exploitation
Miller (1996)	Six modes of learning	<ul style="list-style-type: none"> • Degree of strategic choice (voluntarism-determinism) • Mode of thought and action (methodological-emergent).
Nevis, DiBella & Gould (1995)	Seven learning orientations	<ul style="list-style-type: none"> • Knowledge source (internal-external) • Product-process focus • Documentation mode (personal-public) • Dissemination mode (formal-informal) • Incremental-radical learning • Value-chain focus (design-deliver) • Skill development focus (individual-group)
Ribbens (1997)	Four organizational learning styles	<ul style="list-style-type: none"> • Random-Sequential knowledge • Abstract-Concrete knowledge
Jordan & Jones (1997)	Knowledge management styles	<ul style="list-style-type: none"> • Knowledge acquisition <ul style="list-style-type: none"> • Focus: internal-external • Search: opportunistic-focused • Problem-solving <ul style="list-style-type: none"> • Location: individual-team • Procedures: trial and error-heuristics • Activity: experimental-abstract • Scope: incremental-radical • Dissemination <ul style="list-style-type: none"> • Processes: informal-formal • Breath: narrow-wide • Ownership <ul style="list-style-type: none"> • Identity: personal-collective • Resource: specialist-generalist • Storage/memory <ul style="list-style-type: none"> • Representation: tacit-explicit

Source: Vera and Crossan (2003b)

Learning and knowledge tensions

We propose that a helpful way to deepen our understanding about the learning choices a firm has is to study these choices in the context of the “who-what-where-how-when” strategic decisions that managers need to make. This framework helps to integrate the diverse learning and knowledge options that have been proposed in the literature. Table 2 summarizes the choices available to firms when answering these questions.

Table 2
Learning choices: Who-What-Where-How-When tensions

	Choices	Nature of the tension
WHO learns?	Will the firm foster learning at the level of the group or learning at the level of the organization?	Group learning increases autonomy, uniqueness, and flexibility. Organizational learning enables institutionalization and transfer of knowledge.
WHAT is learned?	Will the firm foster heterogeneity of knowledge or standardization?	Heterogeneity fosters the generation of new knowledge. Standardization fosters transfer of knowledge.
	How broad or narrow should the knowledge base be?	A broad base is better to recombine knowledge. A narrow base is better to develop expert knowledge.
WHERE to learn?	Will the firm learn within the boundaries of the firm, or bring knowledge from outside?	Internal learning develops own core competences; tacit knowledge; more difficult to imitate. External learning enables access to state-of-the art knowledge; flexibility.
HOW to learn?	Will the firm encourage learning by planning or learning by doing?	Similar to the tension between the planning or design school of strategy and the learning or emergent school of strategy.
	Will the firm pursue radical learning or pursue incremental/gradual learning?	Incremental learning involves single-loop learning. Radical learning involves double-loop learning.
WHEN to learn?	What will be the pace of learning?	There are advantages and disadvantages of first movers versus followers

In exploring the micro-processes behind the learning tensions we build on the insights of Crossan, Lane, and White’s (1999) 4I framework of organizational learning, which incorporates a multi-level view of learning and disentangles the processes through which learning occurs in firms. The 4I framework asserts that learning occurs at the individual, group, and organizational levels, each informing the others. These three levels of learning are linked by four social and psychological processes: intuiting, interpreting, integrating, and institutionalizing (4I). Within these processes, cognition affects behavior, and vice-versa. Mintzberg, Ahlstrand and Lampel (1998) summarize the learning process embedded in the 4I framework:

Intuiting is a subconscious process that occurs at the level of the individual. It is the start of learning and must happen in a single mind. *Interpreting* then picks up on the conscious elements of this individual learning and shares it at the group level. *Integrating* follows to change collective understanding at the group level and bridges

to the level of the whole organization. Finally, *institutionalizing* incorporates that learning across the organization by imbedding it in its systems, structures, routines, and practices (1998: 212).

In the 4I framework there are two learning flows through which learning moves from one level to another (Crossan et al., 1999). The feed-forward flow moves from the individual and group to the organization through the 4I learning processes: intuiting-interpreting, interpreting-integrating, and integrating-institutionalizing. At the same time, an analogous flow feeds back from the organization to the individual and group forming a new variation of processes: institutionalizing-integrating, integrating-interpreting, interpreting-intuiting, and institutionalizing-intuiting. The tension between the feed-forward and the feedback flows of learning represents the tension between assimilating new learning (exploration) and using what has been learned (exploitation) (March, 1991). The feed-forward process allows the firm to innovate and renew itself. The feedback process reinforces what the firm has already learned and ensures that organizational-level repositories of knowledge (such as culture, structures, systems, procedures, and strategy) guide individual and group learning. Each of the learning tensions is discussed in detail in the following sections.

Who-choice: Group and organizational learning

Argote (1999) defines the tension between group learning and organizational learning as a tradeoff between autonomy and the transfer of knowledge. When a firm fosters group learning, each group is independent from the others in its actions and develops its own knowledge stocks. When groups are autonomous, they decide how to accomplish their work and develop their own culture and task-performance strategies. In contrast, when a firm fosters organizational learning, there is continuous transfer of knowledge from one group to the other and lessons learned in one group affect the other groups. Knowledge can be transferred by moving people, technology, or structure to the recipient group, or by modifying the people, technology, and structure of the recipient group. A tension between group and organizational learning exists, because the greater the difference in how groups accomplish tasks, the harder it is to transfer knowledge, since the knowledge may not be applicable in the recipient group.

The 4I framework (Crossan et al., 1999) presents a slightly different view of the choice between group and organizational learning. Organizational learning refers to the learning that has become institutionalized. Essentially, it represents the non-human storehouses of knowledge. Given the strategic orientation of the framework, Crossan et al. emphasize that these storehouses of learning need to be aligned--the organization structure and processes need to be aligned with the strategy to position the firm well within the competitive environment. In the 4I framework, there is not an inherent tension between group and organization level learning. Rather the theory suggests that it is inevitable that there will be more group level learning than organization level learning since all learning at the group level will not, and should not be institutionalized. The difficulty in moving from integrating to institutionalizing (group to organization level) is that the learning process becomes less fluid and incremental, and becomes more punctuated and radical. This arises because there has to be a certain degree of consensus amongst the influential members of the organization for group knowledge to be institutionalized and become a standard in the firm. The flow from integrating to institutionalizing is not continuous because changes in systems, structures, and

routines are not frequent in firms, and once changes are made, they tend to endure for a period of time.

A tension may arise when institutionalized learning impedes group learning. Specifically, this would occur when learning that has become institutionalized and is being exploited by the organization through the feedback process, impedes the feed-forward flow of learning. This tension is represented in the exploration/exploitation tension.

The question then is, can group learning and organizational learning be fostered at the same time? One scenario where this may occur is when groups remain independent from one another and learn in an isolated way but, at the same time the upper echelons in the organization take the initiative to change the organizational repository of knowledge and create new institutionalized knowledge. This scenario would occur, for example, in times of crisis, where the top management team tries to change the culture, systems, and routines of the firm. These changes have not been initiated at the individual or group levels, but rather have been imposed on them.

Another way in which learning at the group and organizational level can coexist is when the learning that becomes institutionalized has a greater impact on external audiences than internal audiences. For example, learning arising from a Marketing group leading to changes in an advertising campaign is expected to have a high impact on customers, with a lesser impact on the organization.

As well, group and organizational learning can coexist when groups have autonomy to assess what part of the institutionalized knowledge is relevant to their work. In this way, even if the firm learns at the organizational level and knowledge is shared across groups, shared knowledge is not imposed on groups and does not restrict their creative practices and their way of doing things. Although groups can learn from the experience of others, in an environment where group autonomy is promoted, not all the lessons need to be learned.

In summary, the group and organization level tension can be characterized in different ways. Argote's conceptualization relates strongly to the heterogeneity and standardization tension (What-is-learned-question), where group level learning is associated with heterogeneous knowledge, and organizational level learning is associated with the standardization of knowledge. In contrast, the tension raised by Crossan et al. relates specifically to whether learning that is institutionalized at the organization level impedes group learning. While this may occur, we have provided examples where firms may foster a high degree of learning both at the group and organization levels. However, it is expected that not all group knowledge can be institutionalized in a continuous way. Organizational knowledge will always be less than the sum of the knowledge of groups.

What: Heterogeneity and standardization; Broad and narrow knowledge

Argote (1999) defines the tension between heterogeneity and standardization as a tradeoff between the need to create new knowledge and the need to transfer knowledge throughout the firm. Diversity within and between groups is needed in order to generate new combinations of knowledge. In contrast, similarity within and between groups is needed to facilitate knowledge transfer. Argote establishes a link between this tension and the previous one. An organization that fosters learning at the group level is more likely to have a diverse

experience base and this heterogeneity will be fruitful in the knowledge creating processes. In contrast, an organization that fosters learning at the organizational level is more likely to share a common base of experience and more standardized practices, which will be helpful when transferring knowledge across groups.

We find that Argote's tension between heterogeneity and standardization is somewhat related to the tradeoff between a broad and narrow knowledge based proposed by Bierly and Chakrabarti (1996). The tradeoff between a broad and a narrow knowledge base relates to the advantages and disadvantages of general expertise versus a specialized one. Firms with heterogeneous knowledge bases have access to diverse and broad expertise in different fields and topics. Firms with standardized knowledge bases develop more focused and narrow knowledge in a particular topics or processes. Argote's tension is also consistent with Crossan et al's (1999) tension between the feed-forward and the feedback flows of learning. In the 4I framework, the feed-forward and feedback flows represent the tension between novelty and continuity, or exploration and exploitation (March, 1991). We see the tension between heterogeneity and standardization as included in the tradeoff between exploration and exploitation, because they are all based on the basic organizational needs to continuously create new knowledge and at the same time, leverage the knowledge that already exists.

Some firms resolve this tradeoff by emphasizing exploration over exploitation, or exploitation over exploration. For example, when Bierly and Chakrabarti (1996) applied their knowledge strategies in the pharmaceutical industry, the explorers were aggressive learners with high levels of radicalness in the development of new drugs, but with limited resources. Because of their limited resources, they were forced to have a focused strategy and seek to "hit the home-run" with a new blockbuster drug. Exploiters also had limited R&D resources and invested more on incremental learning, maximizing the benefits from a drug developed internally and working on improvements on competitors' ideas. Similarly Zack's (1999a) description of knowledge strategies suggests a choice between exploration and exploitation. The explorers were creators or acquirers of knowledge, while the exploiters took advantage of the opportunity to leverage their knowledge within and across different competitive niches.

Although it seems possible that firms specialize in exploration or in exploitation, in both Bierly and Chakrabarti's (1996) and Zack's (1999a) conceptualizations, the most successful and innovative firms were those that could balance exploration and exploitation, which implied being able to introduce both competence-enhancing and competence-destroying innovations in the same firm (Tushman & Anderson, 1986). This is consistent with March's (1991) description of the two processes as essential for firms, although they compete for resources.

In summary, there is not a tension between heterogeneity or exploration, and standardization or exploitation when the two are separated in time and space. For example, exploration has often been the focus of R&D departments, while production has focused on exploitation. Several firms also spin-off their new businesses so that exploration efforts are not blocked by the exploitation of established products. Zack (1999a) concurs with this idea when he asserts that "exploration and exploitation typically occur in different parts of an organization and are often separated temporally and culturally as well as organizationally" (1999a: 137).

Where: External and Internal Learning

Bierly and Chakrabarti (1996) explain that firms need to determine the balance of internal and external learning that best meets their needs and fits their resources. Internal learning occurs within the boundaries of the firm. External learning occurs when boundary spanners bring in knowledge from outside via imitation and acquisition and the knowledge is transferred throughout the firm. The tradeoff between internal and external learning is that if strong focus is placed on internal learning, firms can develop their own core competencies based on firm-specific knowledge. In addition, internal knowledge tends to be tacitly held and it is therefore more difficult for competitors to imitate (Zack, 1999a). However, too much internal learning can isolate the firm from what is happening in the external environment and prevent it from access to state-of-the-art knowledge developed by others. Alternatively, external learning enables a firm to expand its knowledge base, diversify its expertise, and increase its flexibility and adaptability. It also provides fresh thinking and a context for benchmarking internal knowledge (Zack, 1999a). However, if too much emphasis is put on external learning, the firm will fail to develop firm-specific knowledge that can become a source of sustainable competitive advantage.

The tension between internal and external learning is to some extent related to the tension between narrow and broad learning (What-is-learned-question) proposed by Bierly and Chakrabarti (1996). Fostering external learning may enable the firm to maintain a broader base of knowledge, while fostering internal learning may help the firm to focus on specific knowledge domains and become a leader in them. However, a firm could also direct the external learning efforts to very specific areas, so that depth instead of breadth of the knowledge base is achieved.

Although it is possible to imagine that firms can separate internal and external learning in time and space, this tension is different from the previous ones, because Bierly and Chakrabarti (1996) argue that internal learning is a pre-condition for external learning. Relying on the absorptive capacity literature (Cohen & Levinthal, 1990) they explain that firms must develop an initial base of internal knowledge in order to be able to learn from external sources. If we accept this argument, it is not possible to resolve the tension in time or space. Even in departments of the firm where external learning is emphasized, it is necessary to first develop an internal learning capability. Also, in terms of time, even though there may be periods in an organizational life where external learning is fostered, the absorptive capacity argument suggests that these need to be preceded by prior periods when internal learning was developed.

The 4I framework provides an alternative view of the tradeoff between internal and external learning. Crossan et al. (1999) do not emphasize this distinction. Rather, they suggest that individual learning arises from stimuli external to the individual: "Interpreting takes place in relation to a domain or an environment. The nature or texture of the domain within which individuals and organizations operate, and from which they extract data is crucial to understanding the interpretive process....The cognitive map is affected by the domain or environment, but it also guides what is interpreted from that domain" (Crossan et al., 1999: 528). That is, the 4I framework suggests that the absorptive capacity is based on the individual's capacity to interpret, the group's capacity to develop a shared understanding, and the degree to which organization members choose to institutionalize the knowledge. If we view internal learning as learning generated amongst organization group members it is

conceivable that rather than facilitating learning from the external environment, as proposed by Bierly and Chakrabarti, it may impede learning. In conclusion, when the constraint of internal learning as a precondition for external learning is relaxed, it is possible to view internal and external learning as co-existing.

How: Learning by planning and learning by doing

Argote defines the tension between learning by planning and learning by doing as a tradeoff between a designed way of learning, where cognition informs action, and a more emergent or improvisational way of learning, where action informs cognition. In the 4I framework (Crossan et al., 1999) the tension between learning by planning and learning by doing is reflected in both the feed-forward and feedback flows. Learning at the individual and group levels through the processes of intuiting and interpreting is largely based on informal interactions and spontaneous insights. When creating new knowledge at the individual and group levels, learning via experimentation, trial-and-error learning, and improvisation learning occur more frequently than planned learning. In contrast, the process of institutionalizing learning is less spontaneous, more planned. When relationships in groups become formalized and routines develop, planning processes and diagnostic systems are needed in order for knowledge to be institutionalized at the organizational level (Crossan et al., 1999). Similarly, the feedback flow of knowledge represents learning by planning. Institutionalized knowledge that is embedded in systems, procedures, structures, and practices, is transferred to individuals and groups across the organization in a formalized and standardized way.

The tension between learning by planning and learning by doing is also related to our previous discussion about the tradeoff between heterogeneity and standardization, and knowledge creation at the group level and knowledge transfer at the organizational level. In creative or unstructured tasks, learning by doing is more common than learning by planning. In their research with product development teams, for example, Miner, Bassoff, and Moorman (2001) observe groups improvising in order to solve unexpected problems or to take advantage of unplanned opportunities. In contrast, the transfer of standardized knowledge involves more learning by planning than learning by doing. Learning by planning is needed in the transfer process, because institutionalized knowledge represents proven ways of doing things. At the same time however, institutionalization of learning also involves some learning by doing because individuals and groups may find it useful to experiment to make sense of the knowledge transferred. Research on the implantation of new information systems, for example, shows that at the individual and group levels, learning by doing and improvisation are helpful in developing an understanding of new institutionalized systems and procedures (Orlikowski, 1996; Orlikowski & Hofman, 1997).

In conclusion, the learning by doing and learning by planning learning modes may coexist in the same organization and may be applied in different times and spaces. Although institutionalized knowledge is “designed” knowledge, when individuals and groups receive it through the feedback flow, they may engage in learning by doing in order to make sense of the knowledge transferred. In addition, many of the same arguments employed in previous sections may be applied here. That is, different parts of the organization may emphasize different processes of learning. As well, over time there may be an ebb and flow of the two modes.

How: Radical and incremental learning

Bierly and Chakrabarti (1996) define the tension between radical learning and incremental learning as a tradeoff between double-loop learning and single-loop learning (Argyris & Schon, 1978). Radical learning challenges the firm's assumptions, while incremental learning gradually expands the firm's knowledge base. They also relate radical learning to exploration, or the creation of unique new knowledge, and incremental learning to exploitation, or the subtle development and change of current knowledge. This tradeoff also relates to fast and slow learning. Incremental learning occurs in a continuous way and incremental changes to the knowledge base can be implemented fast. In contrast, radical changes to the knowledge base are punctuated and take time.

Learning in an incremental and radical way can occur simultaneously if both processes are separated in time and space. Insights from the 4I framework suggest that defining a learning process as incremental or as radical may depend on the levels of analysis (Crossan, Lane, White, & Djurfeldt, 1995). Incremental learning may be manifested in a few individuals in certain parts of the organization, but it may not be apparent at the group or organizational level. Also, groups may learn incrementally, but if the knowledge is quickly spread to other groups, this may appear to be a transformational learning process. Furthermore, if change at the organizational level is mandated, it may appear to be radical, but there has not been any learning, not even an incremental one at the individual and group level.

When: Fast and slow learning

Argote (1999) and Bierly and Chakrabarti (1996) relate the tension between fast and slow learning to the advantages and disadvantages of being a first-mover versus being a follower. This tension also relates to several of the previous tradeoffs since we have explained that group learning may be faster than organizational learning, standardization or knowledge utilization may be faster than heterogeneity or knowledge creation, learning by doing may be faster than learning by planning, and incremental learning may be faster than radical learning.

The 4I framework incorporates the tension between fast and slow learning in both the feed-forward and feedback flows. In the feed-forward flow, the first two processes, intuiting and interpreting, are faster than the last two processes, integrating and institutionalizing. However, in general terms, the feed-forward flow is slower than the feedback flow, because the former represents the creation of new, unique knowledge, while the latter refers to the use and transfer of the current knowledge.

The tension between fast and slow learning could be resolved by separation in time and space: a firm may have periods of fast learning and periods of slow learning, and it may foster fast learning in specific departments and slow learning in others. For example Argote argues that while a firm may be swift to introduce a new product, it may move at a slower pace to ramp-up production.

In this section we have described several learning choices that managers need to make when defining their firm's approach to learning and knowledge. We have advanced arguments about the possibility that firms may be able to reconcile the tensions, predominantly by separating them in time and space. In the next section, we expand this discussion by

incorporating the “who-what-where-how-when” learning options into three configurations of learning strategies.

Configurations of learning strategies

In Table 3 we integrate the different learning choices into three configurations of learning strategies: “Explorers”, “Exploiters”, and “Innovators.” We build on Bierly and Chakrabarti’s (1996) descriptions of the explorer, exploiter, and innovator knowledge strategies, and move their work forward by incorporating a more comprehensive set of choices that determine the content of the learning strategies. In addition, we extend configurational theory by proposing a typology of learning configurations—the explorers (P1) and the exploiters (P2)—which includes learning, environmental, strategic, organizational, and task variables simultaneously. The explorer and exploiter configurations acknowledge that learning tensions exist and that firms may predominantly need to emphasize one side of the learning tension over the other. In both the explorer and exploiter learning strategies we have combined particular learning choices, and aligned them with specific environmental, business strategy, organizational, and task characteristics. Consistent with configuration theory, the underlying assumption behind the explorer and exploiter learning strategies is that of equifinality. That is, both strategies are internally consistent and can, consequently, be successful. The critical issue for firms in order to achieve positive performance is to maintain the internal consistency among all elements of the learning strategy as shown in Table 3.

Table 3
Configurations of Learning Strategies

	P1	P2	P3
	“Explorers”	“Exploiters”	“Innovators”
WHO	Group learning	Organizational learning	<i>Balance the tensions in time and space and through the process of improvisation</i>
WHAT	Heterogeneity	Standardization	
WHERE	Broad knowledge base	Narrow knowledge base	
HOW	Both Internal & External learning	Internal learning	
WHEN	Learning by doing	Learning by planning	<i>Any conditions</i>
Conditions:	Radical learning	Incremental learning	
Environment	Both Fast & Slow learning	Fast learning	
Business strategy	Uncertain	Certain	
Culture	Prospectors	Defenders	
Structure	Open	Closed	
Product-life- cycle	Organic	Mechanistic	
Task characteristics	Entrepreneurial stage	Mature stage	
	Independent and dissimilar	Inter-dependent and similar	

In Table 3 we also propose a competing view to that of configurational theory by arguing that there may be one “optimal” learning strategy—the innovators (P3)—that leads to the highest performance independently of any conditions. In the innovator strategy the learning tensions are resolvable so that balance, for example, between group and organizational learning, and between heterogeneity and standardization, is achieved. The idea of the existence of one optimal learning strategy is consistent with Bierly and Chakrabarti’s (1996) findings in the pharmaceutical industry where the concept of equifinality was not supported and one knowledge strategy, the innovator, was considered the optimal one. We shed light on this discussion by arguing for ways in which the learning tradeoffs can be managed. In the next sections, the three learning configurations are discussed in more detail.

The “Explorers” and “Exploiters” learning strategies

We identified two predominant strategies, explorers and exploiters, and argue that both are associated with positive firm performance. The explorers emphasize learning at the group level. Groups are autonomous and dissimilar in their contexts and follow different learning trajectories. Lessons learned by one group are not relevant to other groups. Independent and heterogeneous knowledge bases coexist. These knowledge bases may not be integrated. The explorer learning strategy emphasizes the creation of new knowledge and radical changes to the current knowledge are fostered. Sources of learning are from both the internal and external environment. External knowledge enables the firm to access broad expertise that can be combined in creative ways. In order to absorb and take advantage of external knowledge, the firm must also manage its internal knowledge bases. Learning by doing is frequently used, since creative tasks incorporate a high level of ambiguity and uncertainty. Trial-and-error learning and experimentation help to accelerate the process of knowledge creation. Consistent with Argote (1999), we expect to see the explorer learning strategy in firms with open and entrepreneurial cultures, organic structures, uncertain and turbulent environments, and where group tasks are dissimilar and not inter-dependent. With respect to the timing of learning, we are aware that the creation of new knowledge is a time-consuming process, and that there are advantages and disadvantages of being a first-mover versus a follower. Thus, we see the potential for both fast learners and slow learners. The pace will largely depend on the risk profile of the firm, and the degree to which the competitive environment dictates the need for swift action.

We see the explorer learning strategy as the ideal choice for firms pursuing a prospector business strategy (Miles & Snow, 1978). Prospectors enact an environment that is more dynamic than those of other types of organizations within the same industry (Miles & Snow, 1978). Their prime capability is finding and exploiting new product and market opportunities and using change to gain an edge over competitors. Prospectors are also differentiators (Porter, 1980), emphasizing strong marketing abilities, creative, well-designed products, a reputation for quality, a good corporate image, and strong cooperation from marketing channels. Finally, they also require a good deal of flexibility in their technology and administrative system, so that the needs of current and future products are considered. This emphasis on innovation and flexibility is consistent with the explorer learning strategy described above.

Prospectors need high levels of external learning and devote extensive resources to monitoring evolving market and technological trends in the environment (Langerak, Nijssen,

Frambach, & Gupta, 1999). At the same time, high levels of internal learning are required to develop R&D capabilities such as screening technological developments, understanding customer needs, managing multiple R&D projects, and working with other functional departments (Langerak et al., 1999). Because they seek to lead their competitors in innovation, prospectors with significant resources will focus on radical learning, fast learning, and on securing intellectual property rights on their new products. However, their emphasis on flexibility also requires a broad knowledge base and the ability to play “me-too” by rapidly incorporating the innovations introduced by the competition. In the case of prospectors with scarce resources and limited size, they may take a more focused business strategy and aim for few, but very innovative, products. These firms correspond to Porter’s (1980) focused differentiators. The only differences between these two types of prospectors are their levels of aggressiveness and radicalness.

The previous description can be summarized in the following proposition:

P1: Firms with entrepreneurial and open cultures, organic structures, uncertain environments, dissimilar and independent tasks, and a prospector-type strategy, who choose a learning strategy that fosters: (a) group learning; (b) heterogeneity; (c) learning by doing; (d) slow and fast learning; (e) internal and external learning; and (f) radical learning, will have superior performance.

The second learning strategy in Table 3 is the exploiter. These firms emphasize learning at the organizational level. Groups are highly inter-dependent and similar in their environments. Knowledge is standardized and shared across groups. Lessons learned by one group impact the performance of the other groups. Knowledge bases at the organizational level are standardized and narrow in their focus. This learning strategy emphasizes the need to leverage existing knowledge across different niches. Incremental changes to the current knowledge are fostered. This learning strategy is fast, since it is not based on uniqueness, but on the ability to transfer and apply current knowledge in new situations. Learning is mainly internal, because the firm tries to take advantage of the expertise that it already has. Consequently, knowledge bases are likely to be narrow in scope, but deep in the understanding of specific topics. Learning by planning is commonly used, because the transfer of knowledge is based on learning about standardized manuals, technology, procedures, routines, systems, or training programs. Consistent with Argote (1999), we expect to see the exploiter learning strategy in mature firms with closed cultures, mechanistic structures, stable environments, and where group tasks are similar and highly inter-dependent.

We see the exploiter learning strategy as the ideal choice for firms pursuing a defender business strategy (Miles & Snow, 1978). Defenders deliberately enact and maintain an environment for which a stable form of organization is appropriate (Miles & Snow, 1978). They achieve stability by producing only a limited set of products directed at a narrow segment of the total potential market and strive aggressively to prevent competitors from entering their domain by offering higher quality, better services, or lower prices. Defenders are also cost leaders (Porter, 1980), achieving high cost-efficiency by minimizing product R&D and through vertical integration and the development of a single core technology. This emphasis on efficiency is consistent with the exploiter learning strategy described above.

Defenders rely on a learning strategy which focuses on internal rather than external learning. R&D departments in defender organizations ignore industry changes that have no direct influence on their operations and appear to emphasize R&D capabilities that are focused on achieving cost reductions. In addition, defenders learn incrementally and not radically. For example, to achieve a low cost position requires defenders to measure R&D performance, and to implement total quality management and continuous new product development process improvements. Their knowledge base is focused on the expertise needed to maintain their niche.

The previous description can be summarized in the following proposition:

P2: Firms with mature and closed cultures, mechanistic structures, stable environments, similar and inter-dependent tasks, and a defender-type business strategy, who choose a learning strategy that fosters: (a) organization level learning; (b) standardization; (c) learning by planning; (d) fast learning; (e) internal learning; and (f) incremental learning, will have superior performance.

“Optimal” Learning Strategy: “The Innovators”

We now explore the possibility that there may be an “optimal” learning strategy that applies to any type of organization, environment, and business strategy. In Table 3 we argue that this “optimal” learning strategy requires firms to manage the learning tensions. In a previous section, arguments were advanced to suggest that the tensions may co-exist and that firms may be able to manage the tensions. Indeed, evidence from the study by Bierly and Chakrabarti (1996) indicates that firms who manage the tension using an innovator knowledge strategy experience higher performance than firms pursuing any of the other knowledge strategies. However, they did not suggest how these firms manage the tension.

Our innovator learning strategy is consistent with Tushman and O’Reilly’s (1996) call for the need to create “ambidextrous” organizations that can be simultaneously both open and closed and loose and tight. Ambidextrous organizations are equally hospitable to exploration and exploitation. They preserve local autonomy, support risk taking, and build control systems that ensure local responsibility and accountability (Tushman & O’Reilly, 1996), while a common vision and a core set of rules and values act as glue to hold it all together.

In supporting the existence of an “optimal” learning strategy, we propose several ways in which learning tensions can be managed. First, we argue that the tensions can be managed across time in a sequential fashion, emphasizing one aspect of the tension then the other. Secondly, the tensions can be managed in a parallel fashion by separating them in space with one group emphasizing one side of the tension and another group complementing with the opposing side. In doing so, balance is achieved at the firm level. However, we suggest that separating the tensions in time and space may be a fall-back position for firms who have difficulty managing the tension. The challenge in managing the tension increases as the separation in time and space decreases. Although not easy to execute well, we suggest that the process of improvisation may provide significant insight into managing the tension in real-time.

Improvisation is the spontaneous and creative process of attempting to achieve an objective in a new way (Vera & Crossan, 2003a). As a spontaneous process, improvisation is extemporaneous, unpremeditated, and unplanned. As a creative process, it attempts to develop something new and useful to the situation, although it does not always achieve this. The study of improvisation in management has borrowed from the realms of jazz and theatre in the sense that ideas are composed and executed, by groups, almost instantaneously. Although there is a strong planning paradigm in organizations, several management scholars are increasingly emphasizing the advantages of emergent processes, such as improvisation, that diverge from detailed advance planning before implementation (e.g., Mintzberg, 1994; Weick, 1998). Improvisation is evident in many descriptions of emergent strategy and action. Consider, for example, Honda's motorcycle strategy (Pascale, 1984), NASA's response to the Apollo XIII crisis (Rerup, 2001), and the discovery of the "Post-it Note" (Fry, 1987). Weick (2001) calls improvisation "just-in-time strategy" and explains that "Just-in-time strategies are distinguished by less investment in front-end loading (try to anticipate everything that will happen or that you will need) and more investment in general knowledge, a large skill repertoire, the ability to do a quick study, trust in intuitions, and sophistication in cutting losses" (2001: 352).

Improvisation has often been associated with exploration, heterogeneity, and learning by doing, however, there is considerable evidence in improvisation research that suggests a more holistic view of the process. Improvisation combines freedom and structure, novelty and routine, chaos and order. From the experience of improvisational jazz musicians and improvisational actors, researchers have come to recognize the major investment in practice and study that precedes a good performance (Crossan, 1998; Weick, 1998). It has been suggested that improvisation is a mixture of the pre-composed and the spontaneous (Weick, 1998), where it is possible to "prepare to be spontaneous" (Barrett, 1998: 606) and to "rehearse spontaneity" (Mirvis, 1998: 578).

Crossan, Cunha, Cunha, and Vera (2003) propose several examples of how improvisation blends paradoxes in action. In the context of scheduling, they propose that improvisational processes enable individuals to creatively coordinate their actions in order to simultaneously adapt to unexpected events and manage calendar deadlines. Also, in the context of corporate resource allocation, they argue that improvisation enables firms to build "minimal plans" that, instead of prescribing rigid courses of action, would provide organizational members with the minimal structure (Hedberg, 1981; Weick, 1995) necessary for coordination yet would still promote flexibility in the allocation of resources. Within the parameters established by the minimal structure, individuals would be free to operate, innovate, and improvise as necessary to achieve the desired goals (Crossan et al., 2003).

Improvisation enables firms to manage the tension between exploration and exploitation by identifying the minimal constraints that enable action in a context of chaos (Crossan & Hurst, 2003). By developing an improvisational skill, firms can exploit current ways of doing things while providing room for experiments and controlled risks that open the possibilities for exploration. In addition, firms that develop an improvisational skill in individuals and teams will be able to balance the different learning choices, by defining a set of learning guidelines related to the "who-what-where-how-when" learning choices within which people can experiment and adapt to the specific learning needs they have.

The previous discussion can be summarized in our third and final proposition:

P3: The optimal learning strategy is a balance between the (a) group and organizational learning; (b) heterogeneity and standardization; (c) learning by planning and learning by doing; (d) fast and slow learning; (e) external and internal learning; and (f) radical and incremental learning, and will lead to the highest performance.

Conclusions and future directions

This paper contributes to organizational learning and knowledge research by deepening and extending our understanding of the learning choices that firms face, and by proposing ways in which the learning trade-offs or tensions may be managed. In particular, we have built on the work of Argote (1999), Bierly and Chakrabarti (1996) and Crossan et al. (1999) to develop a set of propositions about configurations of learning tensions and their link to firm performance. Whether the tensions can co-exist in an organization relates directly to the question of whether there are diverse equifinal learning strategies leading to superior performance, or whether there is one optimal learning strategy that leads to the highest performance in an industry or across industries.

Although Bierly and Chakrabarti suggest that the innovator strategy may offer superior performance in other industries besides the pharmaceutical one, this claim has yet to be tested empirically. We propose that a strict replication of the Bierly and Charkrabarty study in other industries would be difficult, given their use of patent data to operationalize the knowledge strategies. Thus, one interesting and necessary initial test would be a verification of the clustering obtained by Bierly and Chakrabarti by using a different set of firms in the pharmaceutical industry. For example, Bierly and Chakrabarti excluded generic drug producers from their sample. While we believe that the four strategic choices that Bierly and Chakrabarti (1996) mention as part of a knowledge strategy are far from exhaustive, in order to verify their clustering, we would maintain the same set of dimensions.

The next step is the development of measures of learning strategies that can be used across industries to identify whether Bierly and Chakrabarti's findings about the existence of an optimal learning strategy are generalizable. We recommend that researchers interested in empirical testing of our propositions focus on knowledge-intensive industries, such as the pharmaceutical, bio-technology, or insurance industries, and that they define the sample broadly, so that it includes a heterogeneous set of firms that vary in terms of their strategic orientations and learning choices. This research will need to keep abreast of research identifying new learning tensions, and critically assess the key dimensions as they relate to the learning strategy. We suggest that the framework based on the “who-what-where-how-when” learning decisions presented in this study may be helpful in conceptualizing the content of learning strategies.

To test the performance implications of the three learning strategies, future research can build on the existing body of knowledge on configurational theory (Doty et al., 1993; Thomas, Litschert, & Ramaswami, 1991; Van de Ven & Drazin, 1985; Venkatraman & Prescott, 1990). Research would identify the three profiles of learning strategy that correspond to the explorer, exploiter, and innovator strategies. Then, the actual learning strategy profile of specific firms can be compared with the ideal learning strategy profile as defined by its organizational characteristics, environment, and strategic type. The distance between a firm's

actual learning strategy profile and the ideal learning strategy profile would be used to test the performance implications of the learning strategies.

Another important direction of research is the link between learning strategy and business strategy. We have shed some light on this relationship by arguing that firms pursuing prospector-type strategies are likely to have an explorer learning strategy and firms pursuing defender-type strategies are likely to have an exploiter learning strategy. However, Bierly and Chakrabarti's study offers a different viewpoint by suggesting that it may be the knowledge strategy that is critical, and that the business strategy may simply evolve from it. This would be consistent with proponents of hypercompetition (D'Aveni, 1994) who argue that there is no sustainable strategic position, and advocates of organizational learning who suggest that the only sustainable competitive advantage may be a firm's ability to learn faster than its competitors (DeGeus, 1988).

In conclusion, the concepts of learning and knowledge strategies have emerged as important contributions to the organizational learning and knowledge research. However, there is a need to consolidate the disparate research and advance directions for future research. We have outlined fundamental strategic choices managers face in shaping their organization's learning process and have advanced an approach for managing the learning tensions identified. The important issue of whether one optimal learning strategy exists remains an important empirical question.

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