

7.1 Introduction

This concluding chapter discusses the relationships across learning at different levels of analysis and across different dimensions of experience. Managerial and strategic implications of research findings on organizational learning are developed. The chapter concludes with a discussion of promising future research directions that are likely to advance our understanding of organizational learning.

7.2 Relationships Across Levels of Analysis

The research reviewed in this monograph suggests that the relationship between learning processes and outcomes at different levels of analysis needs to be better articulated (e.g., see March, 1991; Miner & Haunschild, 1995). Whether, when and how learning at different levels of analysis complements each other, substitutes for each other or are independent of each other are important questions that would benefit from further research. These issues are developed here in the context of understanding the relationship between *group* and *organizational* learning.

7.2.1 *Group and Organizational Learning*

This section explores the relationship between learning at the level of the work group or organizational subunit versus learning at the level of the organization or larger system in which subunits are embedded. When are benefits of promoting learning at the level of the work group or subunit particularly strong? When can benefits be realized by transferring knowledge across groups and thus promoting learning at the level of the organization? Can organizations simultaneously promote

group learning as well as organizational learning or does a focus on one form of learning preclude the other? Does group learning complement or substitute for organizational learning? The section begins with an example that illustrates the tension between group and organizational learning. The conditions under which it will be especially advantageous to foster local learning and those under which it will be advantageous to foster organization-wide learning are then developed.

Adler and Cole (1993) described the tension between learning at different levels of analysis in their comparison of the "democratic Taylorism" approach to production used at the Toyota-GM Nummi plant in California versus the autonomous work group approach once used at Volvo's Uddevalla plant. Adler and Cole presented data suggesting that the Nummi plant was more effective than the Uddevalla plant and argued that the difference in performance was due to an emphasis on organizational (rather than local) learning at Nummi. At Nummi, there is much emphasis on standardization and transferring knowledge across groups and departments so that productivity gains made in one area of the plant can benefit another. By contrast, the Uddevalla plant fostered individual or group learning at the expense of organizational learning (Adler & Cole, 1993). Work groups were given a great deal of autonomy; little effort was made at transferring knowledge across them. Thus, a productivity improvement made in one group did not benefit another. As evidence in support of this point, Adler and Cole (1994) noted the unevenness in performance of teams at Uddevalla.

In a rejoinder to the Adler and Cole article, Berggen (1994) argued that the autonomous work groups used at Uddevalla were effective and that a major benefit of those systems was their adaptability and flexibility. There has been considerable discussion in the literature of the conditions under which autonomous work groups improve organizational performance (e.g., see Goodman, Devadas, & Hughson, 1988). For the purpose of this monograph, the question is: under what conditions is it most beneficial to promote learning at the group level versus at the organizational level?

In answering this question, this section specifically addresses how the nature of the environment in which groups and organizations operate and the tasks they perform affect the most appropriate balance between group and organizational learning. Although dimensions of the organization's environment and its task are socially determined to some extent, these factors are more "given" or exogenous than dimensions of an organization's structure. Environmental and task factors are more critical in determining the appropriate balance between group and organizational learning than structural factors because structural factors are more under the control of the organization. Structural factors can be designed by the organization to promote or retard group or organizational learning.

The similarity of customer preferences affects the relative balance between group and organizational learning. Do the groups or organizational subunits face environments with customers with very different needs and preferences or are their preferences similar? To the extent that customer preferences are similar across groups and organizational units, there are great benefits of transferring knowledge because an innovation made in one group will be relevant for another. Thus, when groups face

environments with similar customer preferences, organizational learning and its emphasis on transfer of knowledge across groups or establishments is favored. As customer preferences diverge, local learning at the level of the work group is preferable because these groups are better positioned to adapt to local conditions.

Similarity in customer preferences translates into a more uniform product. Building on the Nummi versus Uddevalla example, discussions of when autonomous work groups will be most effective emphasize that the extent to which the product is uniform is a determining factor. For example, Williams (1994) argued that although autonomous work groups have many benefits, these groups might not be suitable for the production of large numbers of uniform products, such as the final assembly of automobiles.

Thus, when groups face similar customers or produce similar products, there are many advantages to transferring knowledge across groups. Under these conditions, organizational learning is favored. Conversely, when groups face customers with different needs and preferences and/or produce a nonuniform product, there are benefits to providing groups with much autonomy and flexibility so that they can adapt to local conditions. Under these conditions, group learning is favored.

Another major factor indicating the relative balance between group and organizational learning is the degree of interdependence of the tasks involved. If groups perform tasks that are highly interdependent, organizational learning is favored. Conversely, if groups perform tasks that are low in interdependence and require little interaction, group learning is favored. In systems high in interdependence, the output of one group greatly affects another, whereas in systems low in interdependence, the output of one group is decoupled from that of another (e.g., see Thompson, 1967).

To return to the Nummi versus Uddevalla discussion, car manufacturing is typically characterized by high degrees of interdependence: what happens in one part of the plant (e.g., the body shop) affects what happens in other areas (e.g., the paint shop or final assembly). Tolerances are tight; there is little room for error. Coordination is necessary even in automobile assembly systems organized into autonomous work groups because one group assembles only part of the automobile and that group's subassembly has to be integrated with other groups' subassemblies. In systems such as these where interdependence across groups is high and coordination needs are correspondingly great, an emphasis on transferring information across groups is valuable.

Levinthal and March (1993) discussed a task factor closely related to interdependence: decomposability. According to Levinthal and March (1993), when the problems an organization faces can be broken down into decomposable or autonomous units, "local" learning is effective because little interaction is required across units. Decomposability is, in part, a function of the scale and complexity of the operation. Operations where productivity has been boosted dramatically by organizing into autonomous work groups or "manufacturing cells" have this property of decomposability (e.g., see Levin, 1994, for a discussion of the assembly of personal computers): all of the work to assemble the product can be accomplished by one group.

Thus, if tasks can be broken down into decomposable units, group or local learning is favored. Conversely, if tasks are highly interdependent, there is a need to

transfer knowledge across groups to insure that one group's activities are coordinated with another's. Under those conditions, organizational learning is favored.

This discussion of when to emphasize group learning and when to emphasize organizational learning is somewhat reminiscent of earlier discussions of when to organize along product lines and when to organize along functional lines (e.g., see Duncan, 1979). A lesson learned from analyzing organizational structures is that they are not static. For example, some organizations centralized after being decentralized (e.g., see Stata's, 1989, discussion of Analog Devices), while others, such as Xerox, decentralized formerly centralized structures.

These structural changes may, in part, be due to changes in environmental or task characteristics that indicate the appropriateness of a different structure. The changes, however, might also be due to an organization's need to coordinate across both functions and products. An organization's primary grouping along product or functional lines facilitates coordination along the primary dimension. Coordination along the other dimension can be achieved by lateral relations, personal relationships, and the like. Over time, it can become more difficult to coordinate across the nonprimary grouping. Personal relationships atrophy or dissolve through turnover. Proximity, organizational incentives, and the social psychological factors of in-group favoritism discussed in the last chapter increasingly favor interacting more with one's own group and less with other groups. Thus, over time, a product-based organization can find that it is increasingly difficult to coordinate across the different products. An organization might then centralize to transfer knowledge across the different products. Conversely, a functional organization can find that it becomes increasingly difficult to coordinate across the different functions for each product. If problems associated with this lack of coordination are severe, the organization might decentralize into a product organization.

Thus, for some organizations, a product form of organization is appropriate and likely to remain so for a reasonable time period. For other organizations, a functional form of organization is appropriate and likely to remain so. But for many organizations, the forces favoring one form of organization are only slightly stronger than the forces favoring another. Matrix organizations are one solution to this dilemma. They are challenging to manage, however, and have a mixed record of success (Davis & Lawrence, 1977). Another solution to the dilemma is to alternate over time between different forms of organizing as a way of achieving the benefits of both product and functional organizations.

The same might be true of group versus organizational learning. Many organizations would be well-served by emphasizing group learning while others would be better served by placing more emphasis on organizational learning. The similarity of environmental and task conditions and the interdependence of groups or subunits are important factors that affect the relative balance between group and organizational learning. For some organizations, however, these factors might not clearly favor one form of learning over another. These organizations need to achieve learning at both levels.

Achieving learning at both organizational and group levels is difficult. Basing his arguments on evolutionary theory, March (1991) argued that strategies that improve

the survival of a system's components might not be the same as strategies that improve the survival of the system as a whole. The social psychological arguments developed in Chap. 6 also suggest that it can be difficult to promote group and organizational learning simultaneously. Providing groups with considerable autonomy and allowing them to develop their own unique task performance strategies undermines an organization's ability to transfer knowledge across groups. Conversely, transferring knowledge across groups requires some degree of standardization that can conflict with the emphasis on group autonomy. Kush, Williamson, and Argote (2012) argued that promoting learning through factors that affect motivation, such as rewards, can lead to a trade-off relationship between group and organizational learning while promoting learning through factors that affect opportunities to learn can lead to a positive relationship between group and organizational learning.

7.3 Relationships Across Dimensions of Experience

The research findings presented in this monograph suggest several relationships across dimensions of experience that would benefit from greater articulation: the relationship between direct and indirect experience, the relationship between heterogeneous and homogeneous experience and the relationship between experience before doing and experience during doing.

7.3.1 *Direct and Indirect Experience*

The relationship between *direct* and *indirect* experience is an issue that would benefit from additional research. Several studies have shown that direct and indirect or vicarious experience substitute for each other. Levine and Prietula (2012), for example, argued that investments in learning from direct experience weakened the benefits of learning from indirect experience or knowledge transfer. Similarly, Haas and Hansen (2005) found that experienced teams were hurt more by indirect experience embedded in a knowledge management system than teams with less direct experience. Other studies have shown that direct and indirect experience complement or reinforce each other positively (Bresman, 2010). Consistent with research on absorptive capacity (Cohen & Levinthal, 1990), direct experience enabled the teams in the Bresman (2010) study to make better use of indirect experience. Studying individual learning, Walsh and Anderson (2011) found that indirect experience or instruction affected learning as manifest in behavioral change but that direct experience was required to affect neural learning as measured by changes in neural indicators.

These findings have implications for theory as well as suggest directions for future research. What are the conditions under which direct and indirect experience complement each other? What are the conditions under which learning from direct and indirect experience substitute for each other? Are there certain kinds of knowledge that can only be learned from direct experience?

7.3.2 *Heterogeneous and Homogeneous Experience*

The second relationship is between *heterogeneity* and *homogeneity*. An organization can foster heterogeneity by employing individuals with different backgrounds, producing a wide range of products or services, using different tools, experimenting with different structures, encouraging different strategies, and so on. Alternatively, an organization can foster homogeneity by hiring similar members, socializing them intensely, producing similar products or delivering similar services, using similar procedures and tools, and discouraging experimentation. Some heterogeneity is needed to generate new combinations and create new knowledge while some homogeneity is needed to develop common understandings and transfer knowledge throughout the enterprise.

This issue is related to the previously described relationship between group and organizational learning. An organization that fosters learning at the level of the group is more likely to have a diverse experience base than one that fosters learning at the level of the organization. Thus, factors that lead an organization to promote learning at one level over another also lead an organization to favor heterogeneity over homogeneity. For example, organizations performing creative tasks (Jackson, May, & Whitney, 1995) or facing turbulent environments (Moorman & Miner, 1997) are more likely to benefit from heterogeneity than their counterparts who perform less creative tasks in less turbulent environments.

The relationship between heterogeneity and homogeneity highlights the importance of different factors in the creation of knowledge than in the transfer of knowledge. Heterogeneity fosters the development of new knowledge. For example, groups composed of diverse members have been found to be better at generating new or emergent knowledge and developing more sophisticated solutions than groups composed of similar members (see Chap. 5). By contrast, homogeneity promotes knowledge transfer (see the Nummi example, as described by Adler & Cole, 1993). Homogeneity increases the relevance of knowledge acquired in one unit for another.

Organizations can handle the relationship between heterogeneity and homogeneity to some extent by encouraging units engaged primarily in knowledge creation, such as Research and Development departments, to have a more diverse experience base (e.g., by promoting diversity of members' backgrounds and encouraging experimentation) than units such as production where knowledge creation is not the primary goal. The approach should be used with appreciation that too much diversity can be harmful even for knowledge-creation tasks, such as research, if the diversity results in a lack of shared values or goals (Owens & Neale, 1998). Further, some degree of diversity can be beneficial—even for groups such as production not explicitly charged with knowledge creation—because innovation and learning occur in these groups as well (Brown & Duguid, 1991). Indeed, in our studies of production facilities, we saw many instances of new knowledge being created (see also von Hippel & Tyre, 1995).

Another approach to dealing with the relationship between heterogeneity and homogeneity is to foster heterogeneity during certain phases of the product's life

cycle and homogeneity during others. Diversity is most likely to be beneficial in the development, design, and initial launching of a product while homogeneity is most beneficial during its production. This approach is consistent with the finding that diversity fosters creativity (Jackson et al., 1995) as well as with the finding that too much diversity (as measured by engineering change orders) can harm productivity (Hayes & Clark, 1986). The approach has merit but should be used with appreciation that some diversity might still be beneficial even after an organization goes into the production phase and some homogeneity is needed even in the research and development stage. The approach should also be used with acknowledgement that there is feedback and recycling across the phases of a product's life cycle and phases can occur concurrently.

The tension between heterogeneity and homogeneity is related to the tension between exploiting old competencies and exploring new possibilities eloquently described by March (1991). According to March, maintaining the right balance between exploitation and exploration is key to organizational survival and prosperity. Too much emphasis on exploitation can lead an organization to fall into a "competency trap" (Lant & Mezias, 1990; Levitt & March, 1988) whereby it persists in a strategy it perfected that may no longer be optimal. Too much emphasis on exploration can lead to a lack of depth or distinctive competence for a firm.

The right balance between exploration and exploitation is difficult to achieve or maintain. Because the rewards to exploitation are more immediate and certain, exploitation often drives out exploration in organizations (March, 1991). Ford's production of the Model T Ford is a classic example of the costs incurred by a firm when exploitation drove out exploration (Abernathy & Wayne, 1974). Ford became so proficient at producing the Model T that it neglected exploring other options that turned out to be more attractive to customers (see Leonard-Barton, 1992, for further discussion of "rigidities" that impair organizational performance).

Although the balance between exploration and exploitation is difficult to achieve, some organizations are adept at both. Tushman and Anderson (1986) examined whether competence-enhancing or competence-destroying innovations were most likely to come from incumbent firms or new entrants to an industry. Competence-enhancing innovations build on the existing knowledge base and are therefore related to exploitation. By contrast, competence-destroying innovations depart from the existing knowledge base and involve experimentation and exploration. Results indicated that competence-enhancing innovations generally came from incumbent firms in an industry. Although competence-destroying innovations came primarily from new entrants in the cement industry, they came about equally from both incumbent firms and new entrants in the computer industry (Tushman & Anderson, 1986). Thus, certain incumbent firms in the computer industry were able to make both competence-enhancing and competence-destroying innovations (Dahlin & Casciaro, 1998). How these organizations exploit existing competencies while exploring new ones is addressed in research on organizational ambidexterity (Raisch, Birkinshaw, Probst, & Tushman, 2009).

7.3.3 Timing of Experience

The third dimension of experience is experience timing. What is the relationship between *learning before doing* and *learning by doing*? When will planning in advance result in desirable outcomes for the organization (Carillo & Gaimon, 2000)? When is learning by doing the best way to proceed?

A few studies have explicitly addressed whether learning by planning or learning by doing is the preferred mode of knowledge acquisition for firms. Pisano (1994) contrasted how an emphasis on laboratory experimentation (*learning before doing* or *planning*) affected process development lead times in traditional chemical-based pharmaceuticals and newer biotechnology-based pharmaceuticals. Results indicated that the extent to which the underlying scientific knowledge base was understood well determined the effectiveness of *learning before doing* (*planning* in our terminology). For chemical-based pharmaceuticals, where the underlying knowledge base was understood well, an emphasis on laboratory experimentation and *learning before doing* was associated with more rapid development. In contrast, for biotechnology-based pharmaceuticals where the underlying knowledge base was not understood well, hours invested in laboratory research did not shorten project lead times. Pisano concluded that the nature of a firm's knowledge base influenced the effectiveness of learning strategies. Deep knowledge of the effect of specific variables and their interactions or higher "stages" of knowledge (Bohn, 1994) increased the effectiveness of *planning* and *learning before doing*. By contrast, *learning by doing* is indicated when organizations do not have the underlying knowledge base needed to simulate effects in advance. Under these conditions, it is only through *learning by doing* that an organization acquires an understanding of how variables interact to affect performance. Von Hippel and Tyre (1995) made a similar argument in their analysis of problem identification on the factory floor.

Similarly, Eisenhardt and Tabrizi (1995) concluded that *learning by doing* was more effective than *planning* for launching uncertain new products in the computer industry. *Planning* slowed the pace of product development while *learning by doing* (measured by design iterations and testing) accelerated the pace. Eisenhardt and Tabrizi (1995) argued that in uncertain settings improvisational approaches that combine real-time learning and testing are more effective than *planning*.

The extent to which knowledge is dependent on the context also affects the relative effectiveness of *planning* and *learning by doing*. An example of knowledge that is not very dependent on the context is how to calculate net present value or other financial measures. The methods for calculations do not vary as a function of features of a particular organizational context. When knowledge is not dependent on the specific people, tools, cultures, or structures in place at a firm, *planning* in advance is very effective.

By contrast, when knowledge is dependent on the context, *learning by doing* is key. When knowledge is dependent on people, structures, and technologies in place at a firm, it is difficult to predict in advance the effects of these variables and their interactions. Under these conditions, the best way to learn is by doing. An example

of such context-dependent knowledge is the best allocation of individuals to tasks. The best allocation is difficult to predict with confidence without experience with the particular people, tools and tasks at an organization. Through actually performing a task, individuals learn about their own skills, the skills of their colleagues, the capabilities of the equipment, and so on. Thus, when knowledge is context-dependent, learning by doing is critical to successful performance.

In short, several factors have been found to affect the relative effectiveness of learning by planning and learning by doing. Planning is effective when the knowledge base is understood well, when the knowledge is not dependent on the context, and when the task is certain. Conversely, learning by doing is preferred when the knowledge is uncertain, not understood well, and highly dependent on the organizational context.

7.4 Managerial and Strategic Implications

This section develops managerial and strategic implications of new results in organizational learning for market entry decisions, for the development of organizational capabilities and competitive advantage, for the success of new entrepreneurial ventures and for the design of experience in organizations.

7.4.1 Market Entry

Researchers have examined the conditions under which it is better to be a first mover and enter the market first and when it is better to be a follower. Lieberman and Montgomery (1988), for example, concluded that several mechanisms created advantages for first movers: learning benefits associated with accumulating a large stock of cumulative output, benefits associated with patents, benefits associated with preempting scarce resources such as desirable locations, and reputational benefits or costs associated with changing products that bind customers to early movers (see also Lieberman & Montgomery, 1998).

Similarly, Cho, Kim, and Rhee (1998) grouped sources of early mover advantage into three categories: the market, the competition, and the firm itself. Market factors include reputational or loyalty effects as well as costs customers incur when they switch to a different product that favor early movers. Competitive effects include the ability of early movers to preempt limited opportunities in areas such as natural resources, location, suppliers, and employees. Firm-level factors include the benefits of learning how to develop, produce and market a product sooner than others. Conversely, sources of early mover disadvantage include “free-rider” effects through which a follower benefits from knowledge acquired by an early entrant, shifts in customer preferences or technology, and inertial forces that make it hard for an incumbent to change (Cho et al., 1998; Lieberman & Montgomery, 1988).

New results on organizational learning suggest an additional factor that should be considered in calculating the advantages of being a first mover: the extent of knowledge depreciation. If knowledge depreciates, the benefits of being a first mover are less than if knowledge is cumulative and persists through time. If knowledge depreciates, a follower would not be at a competitive disadvantage relative to a first mover if the recent output of the follower is comparable to that of the first mover. Knowledge depreciation might explain why late entrants to some industries have been so successful.

New results on knowledge transfer also have implications for market entry decisions. As noted in Chap. 6, knowledge can transfer across firms in an industry through a variety of mechanisms, including personnel movement, suppliers, consultants, trade associations, and the like. If knowledge transfer occurs, the benefits of being a first mover are less than when knowledge can be kept proprietary (see also Lieberman, 1987). When knowledge transfers, a follower can appropriate knowledge acquired by a first mover.

Korean firms provide examples of late entrants who competed successfully with early movers in the semiconductor industry, especially in the production of Dynamic Random Access Memory (DRAM) chips (Cho et al., 1998). Although Korean firms did not enter the semiconductor market until the 1980s, a Korean firm, Samsung, achieved the seventh position in total world semiconductor production and the first position in DRAM production by the 1990s (Cho et al., 1998). Two other Korean firms ranked among the world's top ten producers of DRAM chips by the 1990s.

According to Cho et al. (1998), knowledge transfer figured prominently in the success of Korean firms. Korean chip makers transferred knowledge from universities and firms in the USA by hiring Korean scientists who were trained and had worked there. Korean firms also transferred knowledge from Japanese firms, particularly Toshiba. In addition, Korean firms learned from suppliers and contractors who had worked with early entrants to the industry. Further, Korean firms transferred knowledge from previous products they manufactured in related industries. Thus, when knowledge transfers across firms in an industry, the benefits of being an early mover are considerably less than when knowledge does not transfer. Under conditions of knowledge transfer, a new entrant may be able to compete effectively against incumbent firms.

7.4.2 *Competitive Advantage*

An issue that many organizations, especially for-profit firms, face is how to promote the internal transfer of knowledge while blocking or minimizing external knowledge transfer to competitors (Kogut & Zander, 1992; Rivkin, 2001). As discussed in Chap. 6, firms that are able to transfer knowledge within their boundaries typically perform better than their counterparts that are less adept at knowledge transfer. Several mechanisms that facilitate the internal transfer of knowledge, such as embedding knowledge in tools, however, can make it easy for competitors to copy

that knowledge. For example, Mansfield (1985) found that knowledge embedded in tools leaked out very quickly and more quickly than knowledge embedded in organizational processes.

The dilemma is: How can organizations promote the internal transfer of knowledge while minimizing its external transfer or spillover to competitors? Paul Ingram and I used the framework of members, tools, tasks and their networks presented in Chap. 2 to theorize about how a firm could promote internal knowledge transfer while minimizing external knowledge spillover and thereby improve its competitive position (Argote & Ingram, 2000). As noted previously, knowledge can be embedded in members, tools, tasks, and the networks formed by crossing members, tools, and tasks. Knowledge can be transferred by moving members, tools, tasks, and their networks from one organizational unit to another.

Organizational performance depends on the internal and external compatibility of the networks (McGrath & Argote, 2001). For example, internal fit or compatibility is achieved within the member-task network when tasks are allocated to the members most qualified to perform them. External compatibility is achieved when the various components of organizations fit each other. For example, when members have the appropriate tools to perform their tasks, the member-tool and member-task network would be compatible.

It is less likely that a network developed in one context fits another than that the basic elements of members, tools and tasks fit a new context. Networks involve more components than the basic elements and those components must be internally compatible as well as externally compatible with other elements and networks in the new context in order for knowledge transfer to succeed. For example, consider moving a tool to a new context. In order for knowledge transfer to be effective, the tool would have to fit the elements and networks in the new context. Moving a member-task network successfully would also require that the member-task network fit the elements and networks in the new context. Moving the member-task network successfully would require internal compatibility in addition to external compatibility. A member-task network or transactive memory system developed in one organizational context might not fit another where members have different knowledge and skills. Wegner, Erber, and Raymond (1991) found that imposing a transactive memory system or member-task network on an existing dyad where members had already developed their knowledge about who was good at what hurt the performance of the dyad while imposing a member-task network on a newly formed dyad helped its performance. Thus, the member-task network did not fit the skills and knowledge of members of the existing dyad and was incompatible with the division of labor that had already been developed. This incompatibility or lack of fit hurt their performance.

Although moving networks successfully is more problematic than moving the basic elements, moving networks involving members is more likely to be effective within than between organizations. Processes of member selection, socialization, communications, and training that occur within organizations lead to members being more similar within than between organizations (Jackson et al., 1991). Because of greater member similarity within organizations, moving networks involving members

is a more effective way to transfer knowledge within organizations than between organizations. Thus, embedding knowledge in the networks involving members facilitates internal knowledge transfer and impedes external knowledge spillover.

Argote and Ren (2012) argued that the networks involving members and tasks (the member–task, member–tool and member–task–tool networks) are especially valuable sources of competitive advantage in organizations. These networks meet the criteria for conveying competitive advantage to firms: path dependence, tacitness and social complexity, and context dependence (Dierickx & Cool, 1989). The networks are developed internally through experience members acquire working together to perform the organization's tasks. The networks have many components, which fit each other (Rivkin, 2000), and therefore make it hard for other firms to discern the exact source of their advantage. Further, because transactive memory systems develop as organizational members gain experience working together, transactive memory systems are idiosyncratic to the particular organization and, therefore, are context-dependent. Different organizations have different members with different skills and expertise and therefore different transactive memory systems. Thus, transactive memory systems are difficult for competitors to imitate (Barney, 1986; Lippman & Rumelt, 1992) and are a source of competitive advantage for firms.

7.4.3 Success of Entrepreneurial Ventures

The sources of competitive advantage discussed in the previous section of networks involving members can help explain the success of entrepreneurial ventures. This section interprets evidence on the performance of entrepreneurial ventures (see Sorensen & Fassiotto, 2011, for a review) in light of networks involving members.

Empirical studies have shown that new ventures that spin out from existing firms generally perform better than de novo entrants to an industry (Klepper & Sleeper, 2005). The question remains about what is being transferred to the new firms that facilitates their performance. Researchers have made some progress on this question. For example, Carroll, Bigelow, Seidel, and Tsai (1996) found that de novo entrepreneurial firms with preproduction experience performed better initially than de novo firms lacking experience or de alio firms that developed from a related industry. Preproduction experience in which organization members worked together on the product would have led to the creation of transactive memory systems. Interestingly, Carroll et al. (1996) did not find evidence that technology imported from the parent firm figured in the performance of its progeny.

Similarly, Phillips (2002) found that the failure rate of new firms decreased as the proportion of founding team members from a parent firm increased and that failure rates increased as the number of parent firms increased. Although Phillips (2002) attributed the survival advantages of new firms with a large proportion of founders from one parent firm to the importation of routines from the parent, I suggest that the advantage was more likely due to the importation of a transactive memory system. When members have a large proportion of founders from one firm, they could import a well-developed

transactive memory that included a large proportion of their employees. By contrast, if founders came from multiple firms, they would import multiple transactive memory systems, which would likely conflict with each other and detract from performance.

Routines (task-task networks), recurring patterns of activity among interdependent organization members, are less dependent on the particular skills and expertise of members than transactive memory systems. Feldman and Pentland (2003) defined a routine as a repetitive pattern of interdependent actions carried out by multiple individuals. For example, a firm might have a routine for producing its product that specifies the steps to assemble a product or a routine for acquisitions that specifies the processes for acquiring other firms. Although the performance of a routine might vary somewhat as a function of the individuals performing it, the processes or steps in the routines are specified independently of the members who perform them. Indeed, an advantage of relying on routines is that organizations are less affected by turnover when they rely on routines than when they do not (Rao & Argote, 2006; Ton & Huckman, 2008). By contrast, transactive memory systems depend on the particular knowledge and skills of members. Their effectiveness is negatively affected by turnover (Moreland, Argote, & Krishnan, 1998; Lewis, Belliveau, Herndon, & Keller, 2007). Thus, the value of a transactive memory system in a new setting would depend more on the number of members of the system who move to the new context while the value of a routine would. Phillips (2002) found that new firms performed better when a greater percentage of their members came from the same parent firm.

Studies of personnel movement provide additional indirect support for the benefits of transactive memory systems. Wezel, Cattani, and Pennings (2006) found in a longitudinal study of firms in the accounting industry that interfirm mobility had the greatest effect when collectives rather than individuals moved. Similarly, studying financial analysts who moved from one firm to another, Groysberg and Lee (2009) found that analysts who moved with their team performed better than analysts who moved solo. Arguably, collective movement or moving with their teams enabled members to keep their transactive memory systems intact and thereby improved their performance. Huckman and Pisano (2006) studied surgeons who performed the same operation in different hospitals and found dramatic differences in their performance. When individuals moved from one organization to another, a transactive memory system developed with one set of colleagues would not fit another. Thus, it seems likely that individuals moving across organizational contexts did not have the benefit of a transactive memory system, a deficit that contributed to their poor performance.

7.4.4 *Design of Organizational Experience*

March (2010) has written about the challenges of learning from experience (see also March, Sproull, & Tamuz, 1991). This section discusses how experience can be designed to facilitate learning. The section argues that organizations can take a proactive approach to designing experience to enhance the ability of organizations to learn from experience.

Many of the studies discussed in this monograph showing group or organizational productivity gains with experience were conducted in production environments. Several characteristics of these environments facilitate learning. First, the group or the organization typically makes many repetitions of the same product. For example, one truck plant we studied produced almost 1,000 trucks each day! These trucks provided many opportunities for learning since different modifications could be made on each truck and their effects assessed.

Second, feedback in these production environments is often more immediate and less forgiving than feedback in other contexts. One determines fairly quickly whether the windshield fits into its frame, whether the welding holds, or whether the lights work properly. This environment contrasts, for example, with research environments where it might take months or years to determine whether a new approach is effective.

A third reason why learning might be easier in production environments is that the factors determining organizational outcomes such as productivity and quality might be more under the organization's control than those determining outcomes in service settings. Thus, it is easier to assess the effect of organizational action on outcomes and easier to determine effective responses.

Although these features of production environments can be thought of as boundary conditions that specify when an organization or group is most likely to learn from experience, the features can also be regarded as desired attributes for learning that can be emulated in other settings. That is, rather than regard the extent of repetition of production as immutable or "given," organizations can aim to increase the number of parts or processes that are repeated on their products by using common "platforms" for a variety of products. Rather than have each product consist of unique parts and processes, products share a common base or platform of parts and processes. Because these common parts and processes are repeated on many products, the organization has a much larger experience base from which to learn.

Mass customization also has the potential to increase an organization's experience base for learning. In mass customization, a product is designed to consist of independent modules that can be assembled into different forms of the product, according to customer specifications (Feitzinger & Lee, 1997; Pine, Victor, & Boynton, 1993). Manufacturing processes are also designed to consist of independent modules that can be reconfigured to produce different designs. According to Feitzinger and Lee (1997), the key to effective mass customization is to postpone differentiating the product for a specific customer as long as possible. From a learning perspective, this postponement increases the number of times a part or process is repeated because the same parts and processes are used on many variants of the product.

Another way in which organizations can increase their ability to learn from experience is to design experiments (natural or laboratory) that have the potential to inform one about the effect of critical factors. In actual organizations, factors often covary in ways that make it hard to assess their separate effects. For example, an organization might introduce new technology at a plant that produces a diverse product mix. The performance of this plant might be lower than its sister plant that uses a technology that is better understood to produce a less varied product mix. In this example, it is impossible to determine if the new technology or the complex product mix contributes

to the lower productivity because the use of the new technology is perfectly correlated with the complex product mix. That is, the data from the naturally occurring experiment described above are structured in a way that makes it impossible to partial out the effect of the technology from the effect of the product mix.

In this example, the organization might have been able to structure its experience differently to enhance learning. For example, the organization could keep the product mix (and other critical factors to the extent possible) the same across the plants and only vary the technology. To the extent that other factors are constant or can be controlled for statistically, differences in productivity between the plants with and without the new technology can reasonably be attributed to the technology. Thus, the organization would be in a better position to learn from its experience.

Another issue related to the design of experience is the degree of experience heterogeneity that facilitates learning. Studying the mail service of a European country, Wiersma (2007) found that heterogeneous product mixes were associated with more learning on the part of delivery persons, as reflected in lower average costs per mail item, than homogeneous product mixes. Similarly, Schilling, Vidal, Ployhart and Marangoni (2003) found in a laboratory study that dyads learned more from similar experience than from identical or very different experiences. Heterogeneous experience can lead to richer and deeper understanding than homogeneous experience (see also Haunschild & Sullivan, 2002).

Cautionary notes about the benefits of heterogeneity, however, are sounded in several studies. In contrast to studies finding a positive effect of heterogeneity on organizational learning outcomes, Fisher and Ittner (1999) reported negative effects of product heterogeneity in an automotive assembly plant. Greater product variety increased overhead and inventory requirements, the amount of rework, and the total labor hours required to produce each car. In their qualitative analysis of what differentiated high from low-performing hospitals using a new surgical procedure, Pisano, Bohmer, and Edmondson (2001) noted that the high-performing hospital chose similar cases on which to operate during the early phases of using a new procedure while the poor performing hospital did not. The performance of tasks in the automotive plant (Fisher & Ittner, 1999) and the hospital (Pisano et al., 2001) require the coordination of a larger number of interdependent members and tools than mail delivery (Wiersma, 2007) or laboratory tasks (Schilling et al., 2003). The benefits of variety seem harder to realize in these more complex systems. Understanding the degree of heterogeneity that is most conducive to learning in particular contexts and designing that heterogeneity into the context, where feasible, would facilitate organizational learning.

7.5 Future Directions

Four new trends in research on organizational learning curves were noted in Chap. 1: examining a wider set of outcome measures and a broader set of organizational contexts, understanding why some organizations are better at learning than others, analyzing the dynamics of knowledge acquisition and loss by organizations, and

understanding the conditions under which knowledge transfers across organizations. We have made significant progress in understanding these issues. In this section, I suggest how we might further advance our understanding of them.

Examining a wider set of outcome measures and a broader set of organizational contexts, including more service settings, advances our understanding of organizational learning. For example, factors that contribute to quality improvements associated with experience in service settings might overlap only partially with those contributing to productivity gains associated with experience in manufacturing. Investigating different dependent variables and different contexts leads to a more complete picture of factors affecting organizational learning.

Understanding why some organizations are better at learning than others continues to hold promise as an overarching research question. Specifying (and testing) the conditions under which key contextual variables affect organizational learning is likely to be fruitful. Thus, a "conditions-seeking" approach that identifies the conditions under which particular variables have desired effects on organizational learning processes and outcomes is needed (Greenwald, Pratkanis, Leippe, & Baumgardner, 1986).

Although we have made progress in understanding how many factors affect organizational learning, research on other factors is in the early stages. For example, considerable progress has been made understanding how characteristics of experience, personnel movement, and social networks affect organizational learning. Research on how identity (Kane, Argote, & Levine, 2005) and emotion (Levin, Kurtzberg, Phillips, & Lount, 2010) affect organizational learning processes and outcomes is in the early stages. Further, while research on how performance relative to aspirations affects organizational learning has been an active research area for many years, research on how incentive systems (Quigley, Tesluk, Locke, & Bartol, 2007) and intrinsic motivation (Osterloh & Frey, 2000) affect organizational learning and knowledge transfer is more recent. Further research on how identity, emotion and motivation affect organizational learning and knowledge transfer would be especially valuable.

Additional analyses of the dynamics of knowledge acquisition and depreciation in organizations are also needed. Identifying the conditions under which knowledge depreciation occurs would be a major contribution. For example, does knowledge acquired from different types of experience or embedded in different repositories decay at different rates? Studies that examine the micro processes through which knowledge is retained in organizations and the implications of where and how knowledge is retained for organizational performance are likely to be fruitful. Thus, analyses that increase our understanding of the conditions under which depreciation occurs and the implications of depreciation for organizational performance are needed.

A greater understanding of the dynamics of knowledge transfer is also needed. Advancing our understanding of the conditions under which knowledge transfers and the implications of knowledge transfer for firm and industry performance would be major contributions. Studies that examine the micro processes through which knowledge transfers within and across firms are likely to be fruitful. More macro analyses of knowledge transfer across populations (e.g., see Mezias & Lant, 1994; Miner & Haunschild, 1995) will also advance our understanding of learning at different levels and relationships across those levels. Additional studies that examine

knowledge transfer in an international context would also make important contributions. These international knowledge transfer studies provide information about a phenomenon that is important in its own right as well as provide variation on independent variables, such as culture, that might explain differences in knowledge transfer patterns across organizations. Understanding the dynamics of knowledge transfer also sheds light on the dynamics of knowledge retention in organizations because an organization has to retain knowledge in order to transfer it.

Although we have separated the subprocesses of creating, retaining and transferring knowledge for analytic purposes, these processes are related. Research has begun to examine their interrelationships. For example, Weigelt and Sarkar (2009) found a complementary relationship between knowledge creation and transfer: transferring knowledge led to new knowledge being created. By contrast, Levine and Prietula (2012) found that investments in organizational memory substituted for knowledge transfer. Research that examines the relationship between the subprocesses of knowledge creation, retention and transfer would greatly increase our understanding of organizational learning.

We know relatively more about knowledge transfer than we know about knowledge retention and creation in organizations so research on these latter processes would be especially useful. Further, the relationship between knowledge creation through organizational learning and creativity needs to be better articulated. Ella Miron-Spektor and I argued that learning researchers could learn from creativity researchers and vice versa (Argote & Miron-Spektor, 2011). The benefit of this cross-fertilization is most apparent in reviewing studies of how experience affects creativity (e.g., see Taylor & Greve, 2006). More generally, we need to articulate whether and how the processes underlying and factors affecting creativity are similar to or different from those associated with organizational learning.

Entrepreneurial firms provide important opportunities for examining how knowledge is created in organizations. Most entrepreneurial firms are small enough that researchers can more readily observe learning processes in them than in large established organizations. In addition, entrepreneurial firms are new enough that one can study organizational learning from the beginning of a firm's operation. Thus, researchers could observe the building of connections and establishment of relationships that are central to organizational learning models. Entrepreneurial firms are especially promising sites for studying knowledge creation.

New developments in technologies also provide opportunities for organizational learning and organizational learning researchers. For example, social media such as blogs and forums, are being used increasingly in organizations. These new technologies facilitate connections across organizational members and thereby, have the potential to transmit richer knowledge than afforded by previous generations of technology such as document repositories. Another example of a new technology is crowdsourcing, which can harness innovative ideas from members outside the boundary of the firm. Research on how these new forms of technology affect organizational learning and knowledge transfer is needed.

New developments in neuroscience also provide new tools that researchers can use to study learning (Senior, Lee, & Butler, 2011). Although these physiological techniques

have advanced our understanding of individual learning (e.g., Walsh & Anderson, 2011), the extent to which they will advance our understanding of organizational learning is yet to be determined. In my view, these tools show promise for studying learning processes. For example, we often invoke the concept of “mindful” processes in our theorizing about organizational learning. If a functional magnetic resonance imaging test or f(MRI) reveals that areas of the brain known to be associated with deliberative processes become active when an individual is performing a task, it would suggest that the individual is using controlled or deliberative processes. In order to realize the promise of these new technologies, considerable work will have to be done to adapt the tools to study groups and organizations and/or to develop theory and methods of combining data from individuals to reflect phenomena at higher levels of analysis.

Developments in the area of practice theory also hold promise for enriching our understanding of organizational learning. Practice theory recognizes the centrality of individuals’ actions to organizational outcomes (Feldman & Orlikowski, 2011). Because practice theory focuses on what actors *do*, it can shed light on learning by *doing*. For example, Rerup and Feldman (2011) showed how trial and error learning connected organizational routines and interpretative schema through observable action. Practice theory shows promise for facilitating the articulation of the micro processes underlying organizational learning.

Finally, because learning from experience is a mechanism through which organizations develop capabilities (Salvato, 2009), organizational learning research has important implications for advancing understanding of organizational capabilities, an active research area in strategic management. Argote and Ren (2012) theorized that transactive memory systems provide a micro foundation for organizational capabilities. We argued that not only do transactive memory systems provide a foundation for operational capabilities, but they also provide a base for the development of dynamic capabilities. Dynamic capabilities have been defined as an organization’s ability to build or reconfigure its competences to respond to changes in the environment (Helfat et al., 2007; Teece, Pisano, & Shuen, 1997). Simulation results have demonstrated that transactive memory systems are especially valuable in turbulent environments (Ren, Carley, & Argote, 2006) and that they facilitate adaptation to novel problems (Miller, Pentland, & Choi, 2012). Further, groups with well-developed transactive memory systems have been found to produce more creative products than groups with less developed transactive memory systems (Gino, Argote, Miron-Spektor, & Todorova, 2010). Thus, research on transactive memory systems promises to contribute to the burgeoning research on the micro foundations of organizational capabilities (Felin, Foss, Heimeriks, & Madsen, 2012).

7.6 Conclusion

This monograph has presented evidence that organizations vary dramatically in the rates at which they learn. The monograph has also demonstrated that the extent of knowledge retention and transfer vary significantly across organizations. Findings

about factors affecting knowledge creation, retention, and transfer were reviewed and integrated into a theoretical framework for analyzing organizational learning. This concluding chapter to the monograph discussed relationships across components of the framework and developed future research directions. Managerial and strategic implications of new findings on organizational learning were discussed and their promise for advancing our understanding of organizational capabilities developed. Because organizational learning is critical to the performance and adaptation of organizations, a greater understanding organizational learning promises to advance theory and enable improved practice.

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