TEMPORAL DIMENSIONS OF ORGANIZATIONAL LEARNING: A REVIEW AND DIRECTIONS FOR FUTURE RESEARCH

Hans Berends
School of Industrial Engineering
Eindhoven University of Technology
P.O. Box 513
5600 MB Eindhoven
The Netherlands
j.j.berends@tue.nl

ABSTRACT

This paper examines temporal dimensions of organizational learning. Organizational learning is a process phenomenon that unfolds over time. However, only scant attention has been paid to the role of time in theories of organizational learning and reviews of the field. The objective of this paper is to conceptualize the temporal dimensions of organizational learning, to review existing work that has implicitly or explicitly addressed time, and to identify directions for future research. Three sets of prior findings are discerned, concerning time as a resource for organizational learning; the timing and temporal structuring of organizational learning; and the role of the past, present, and future in organizational learning. Each of these perspectives offers unique insights, but is far from saturated; moreover, future research may be enriched by integrating approaches.

KEY WORDS: organizational learning; process; time; review

INTRODUCTION

Organizational learning helps organizations to enhance their practices and to prosper in dynamic and competitive environments. Since long, organizational learning has been recognized as a process phenomenon (Cangelosi & Dill, 1965; Cyert & March, 1963). Research has increasingly attended to the complex nature of its constitutive processes and their embeddedness in a social context (Antonacopoulou & Chiva, 2007; Crossan et al., 1999; Dyck et al., 2005), with ensuing attention for cultural (Cook & Yanow, 1993), institutional (Lam, 2000), and political (Lawrence et al., 2005) dimensions of organizational learning. In this paper we contribute to the understanding of organizational learning by examining its temporal dimensions.

So far, only scant attention has been paid to the role of time in theories of organizational learning and reviews of the field. Several organizational learning studies have explicitly or implicitly investigated or touched upon time and temporality, but these studies have addressed different aspects of time and have so far not been integrated. Most of the reviews of organizational learning literature have not discussed the role of time (Bapuji & Crossan, 2004; Dodgson, 1993; Easterby-Smith, 1997; Easterby-Smith et al., 2000; Fiol & Lyles, 1985; Huber, 1991; Karataş-Özkan & Murphy, 2010; Levitt & March, 1988). A few reviews devote some space to the topic, but these are limited in the scope of temporal issues addressed (e.g. Miner & Mezias, 1996: 94; Argote & Miron-Spektor, forthcoming; Weick & Westley, 1996: 448). Bapuji and Crossan (2004: 412) explicitly call for more research into the "time dimension" of organizational learning in their review of empirical literature.

Several reasons warrant a systematic review of temporal dimensions of organizational learning. First, time is at the heart of any process (Chia, 2002). Processes unfold over time, making time a constitutive element of process. Second, process studies of organizational learning show that organizational learning processes are embedded in time and unfold over time (Dyck et al., 2005; Garud & Van de Ven, 1992). Third, the domain of organization studies at large is increasingly aware of temporal phenomena like pace, timing, rhythm, synchronicity in organizational life (Ancona et al., 2001; Bluedorn, 2002) and this role seems to be increasing with the pace, dynamics, and interconnectedness of present-day society. The objective of this paper, therefore, is to conceptualize the temporal dimension of organizational learning, to review existing work that has implicitly or explicitly addressed time, and to identify avenues for future research.

To create this review a systematic search was undertaken using ISI Web of Science, combining "organizational learning" and "time" or "temporal" as search terms. Because that resulted in a modest set of relevant papers only (besides many papers using the word "time" in the abstract without analyzing time in relation to organizational learning), I also relied on more extensive searches through Google Scholar, and used a snowball approach, tracing citations backward and forward. Casting the net wide resulted in the incorporation of research that touched upon time more implicitly or not as its core focus. In this study, organizational learning is defined as the process of changing organizational actions through the development of knowledge (Berends et al., 2003; Edmondson, 2002). Recognizing that organizational learning is not simply the sum of individual learning (Fiol & Lyles, 1985), I do not incorporate studies on individual learning in an organizational context.

Existing theory on time in organizational life is used to conceptualize prior research on

organizational learning. In particular, I draw upon the distinction between objective and subjective dimensions of time (Jaques, 1982) and the notion of temporal structuring that treats these dimensions as a duality (Orlikowski & Yates, 2002). Using these lenses, I distinguish three sets of findings, concerning time as a resource for organizational learning (associated mainly with the objective dimension); the timing and temporal structuring of organizational learning (combining objective and subjective dimensions); and the role of the past, present, and future in organizational learning (associated mainly with the subjective dimension of learning). Where relevant, connections between these perspectives are pointed out.

This paper proceeds as follows. The next section introduces theory on time in organizational life. Then, I turn to a review of existing literature that directly or indirectly addressed temporal aspects of organizational learning, organized around the three themes noted above. For each of these themes I identify directions for further research that may extend or integrate prior findings. Finally, the paper discusses the outcomes and methodological implications of this review.

TIME IN ORGANIZATION STUDIES

The field of organization studies has increasingly attended to the role of time in organizational life, examining, for example, the timing of activities, temporal orientations, and synchronization (Ancona et al., 2001; Bluedorn, 2002). Scholars have created a broad range of conceptualizations and typologies of time (Orlikowski & Yates, 2002). In this paper, I follow Jaques (1982), who distinguished between objective and subjective dimensions of time. The objective dimension of time is the temporal axis of succession, which may be indicated by clocks and calendars, and allows events to be reconstructed as earlier or later (Das, 2004; Jaques, 1982). It is with regard to this objective dimension of succession that processes unfold "over time", and that we may investigate sequences of events (Poole et al., 2000). The subjective dimension of time is the temporal axis of intention and concerns time as it is experienced by people as a "continuously present field of past-present-future which coexist in the interaction of memory, perception, desire, and anticipation" (Jaques, 1982: 87). In this temporal dimension, actors draw upon the past when they make sense of situations (Bluedorn, 2002; Weick, 1995) and anticipate and plan for the future (Das, 1991). It has also been labeled as "inner time", which "allows us to relive the past and prelive the future in the present" (Huy, 2001: 608). At one particular moment in the objective dimension of time, actors may simultaneously experience and interpret the past, present, and future in the subjective dimension of time.

Orlikowski and Yates (2002) introduced the notion of *temporal structuring* that incorporates the subjective and objective dimensions of time as a duality. Temporal structuring refers to the enactment of structures that impact the timelines and time-orientations of organizational practices. Temporal structures guide, orient, and coordinate the timing of activities (Orlikowski & Yates, 2002). Examples are financial reporting periods, project deadlines, and meeting schedules. Temporal structures have an objective time dimension because they concern the sequence of activities. Yet, they also involve the subjective time dimension because such structures are shaped and enacted by human actors.

Further, many scholars have made a distinction between clock time, which is determined by clocks and calendars, and event time, which is determined by the

occurrence of meaningful events (Ancona et al., 2001; Bluedorn & Denhardt, 1988). Temporal structures can be based on both conceptions of time (Orlikowski & Yates, 2002). The timing of organizational routines, for example, may be triggered by events (e.g. emergency evacuation procedures) or by the clock and the calendar (e.g. annual reporting). Both clock-based and event-based temporal structures are shaped by human actors and subsequently shape behavior. At any moment, actors may enact multiple and interdependent temporal structures (Crossan et al., 2005; Orlikowski & Yates, 2002).

TIME AS A RESOURCE

Most organizational learning studies that have addressed time exhibit an objective perspective on time. In these studies, time appears primarily as a resource for organizational learning (cf. Bluedorn & Denhardt, 1988). Time is incorporated as clock time (sometimes labeled as calendar time), which makes time a measurable and homogeneous commodity.

That time can be a resource for organizational learning is most evident in learning curve studies, in which the passing of calendar time has been found to predict performance (Argote, 1999). A learning curve is a mathematical relationship between some metric of operational performance (e.g. cost, quality, cycle time) and a firm's experience in those operations (Zangwill & Kantor, 1998). In manufacturing, learning curves typically refer to the pattern that production costs or production time decrease at a decreasing rate the more an organization produces. For example, Epple et al. (1991) used data from a North American truck plant producing a single vehicle and showed that direct labor hours required per truck decreased at a decreasing rate as the cumulative number of trucks produced increased. Such learning curves enabled the comparison of learning processes in terms of their speed (Argote, 1999; Zangwill & Kantor, 1998).

Learning curve studies and other studies of experiential learning show four different ways in which time may be resource. A first effect of clock time as a resource is that it enables the acquisition of experience. Debate has unfolded over whether elapsed time or cumulative amount of items produced is the driver of learning, as both elapsed time and cumulative amount of items produced may serve as proxies of experience (Adler, 1990). Taken separately, both cumulative output (total number of items produced) and calendar time (weeks, months, or years elapsed) predict performance improvement (Argote, 1999). However, Argote (1999: 15) concluded based upon extensive empirical research in manufacturing settings that calendar time is often not a significant predictor of organizational learning once one takes into account the role of cumulative output at the particular group or organization. In her own research, Argote (1999: 47) found that the shipyards she studied did not become more effective simply because of the passage of time, but because it allowed the acquisition of experience. Thus, the first effect of the passage of clock time is that it allows organizations to accumulate experience.

Other studies point at effects of clock time as a resource beyond experience acquisition. Based upon empirical data from the automotive industry about frequency-of-repairs for car models produced in subsequent years, Levin (2000) concludes that the number years passed in a car model's production life best predicts a car model's ultimate repair rate - not cumulative production experience up to that point. Similarly, Martin and Salomon (2003) found that years elapsed had a learning effect beyond experience in a study of foreign investments in the semiconductor industry. Also Argote (1999) reported earlier

learning curve studies from manufacturing industries in which elapsed time did have an effect even when controlled for cumulative output.

Such findings point at three other ways in which time is a resource for organizational learning. First, technological improvements may emerge in the external environment with the passage of calendar time. As time elapses, new knowledge, technologies or materials may become available for incorporation in production processes irrespective of the amount of items produced (Argote 1999: 15). Second, experience may not directly translate into learning, because activities for learning from experience take time. In Levin's (2000) study, this included activities such as identifying root causes of problems, proposing, designing, testing, and implementing solutions to those root causes. Martin and Salomon (2003) also found a time effect beyond the accumulation of experience, and explained that the passage of time allowed experimentation with novel technologies. Similarly, De Geus (1988: 71) commented upon the long time it took before Shell responded to signals about environmental changes: "Hearing, digestion, confirmation, action: each step took time, its own sweet time". Thus, time is a resource for completing such learning activities. Third, a time lag may exist between action and effect. Effects of organizational actions may emerge years later. In his study in the automotive industry, Levin (2000: 632) found that producers did not get immediate feedback on reliability: it took much time before the first warning signs concerning reliability - from warranty claims and high-mileage vehicles like taxis and rental cars - came in. Thus, learning may take time to wait for effects.

Mirroring these arguments, research has revealed adverse effects when insufficient time was taken for learning. If a long time lag exists between action and effect, organizations may be prone to superstitious learning if they do not let sufficient time pass before assessing effects of prior actions (Levitt & March, 1988). For example, Schwab (2007) studied baseball organizations who had adopted a new organizational practice (working with "farm-teams"). Although this innovative practice could pay off no earlier than in four years time, this study found that teams did not allow sufficient time for the practice to affect performance and responded already the very next year to performance feedback, thus displaying superstitious learning. Similarly, organizations that do not have sufficient experience can apply inappropriate generalizations to future operations, thus displaying premature learning (Bapuji & Crossan, 2004: 403). Studies by Herriott et al. (1985) and Lounamaa and March (1987) showed that rapid learning can actually be dangerous in a causally ambiguous situation, because early signals may evoke inappropriate conclusions. In such situations it may be better to wait for more experience to create a larger 'sample size'. Therefore, Levitt and March (1988: 334) concluded that "patience is a virtue" for organizational learning.

Another corollary of time as a resource for learning concerns time pressure. Tucker and Edmondson (2003) found that time pressure inhibited learning in hospitals, and Engeström et al. (2007) also observed how time pressure created a break in the learning trajectory of a health care organization. Vice versa, Staudenmayer et al. (2002: 585) found that "buffer time", which was not yet allocated to specific activities, enabled software development team members to deal with unexpected events and reflect upon newly discovered problems and ideas. Yet, Weber and Berthoin Antal (2001) report the contradictory finding that time pressure intensified learning activities in a case study of a German governmental organization. Moreover, improvisation, which may be caused by time pressure, is also an important process of organizational learning (Barrett, 1998). This means that the conditions under which time pressure has beneficial or detrimental effects on organizational learning need further investigation.

Finally, it is increasingly recognized that time may not only be resource, but also a liability because it may lead to forgetting and obsolescence of knowledge. Knowledge acquired through experience may depreciate, first, because of "antiquation", with knowledge no longer being relevant in a changed environment, and, second, because of forgetting (Argote et al., 1990). Argote et al. (1990) described the example of Steinway staff who wanted to take an old piano model into production again, but found out that they had lost the skills to do so. Several quantitative studies of experiential learning confirmed that the value of experience depreciates over time (Argote et al., 1990; Darr et al., 1995; Epple et al., 1991). In other words, more recent experience is more valuable than earlier experience. The rate of depreciation, however, is far from resolved and is likely to differ among situations (Thompson, 2007). Based upon data about orbital launches, Madsen and Desai (2010) found that learning from failure appears more resistant to forgetting than learning from success. A key question for future research is to sort out which mechanisms make that more recent experience is more valuable than earlier experience and how that differs for different types of experience (Argote & Miron-Spektor, forthcoming).

Although quite a lot of studies investigated clock time as a resource for organizational learning, many questions remain. In addition to the topics already mentioned, another issue calling for additional research is the time that organizational learning activities take (cf. Weber & Berthoin Antal, 2001). Much of the research reviewed so far is based upon quantitative longitudinal data sets, which provide strong evidence for the presence of learning over time, but offer little detail on actual learning activities as they unfold over time. Mixed method studies seem more appropriate to find out about the time consumption of learning activities (e.g., data analysis, experimentation, idea generation, sharing interpretations, changing routines). Such insight would, for instance, enable weighing the benefits of spending more time on accumulating experience versus spending time on the translation of experience into knowledge and improved practice.

A related topic is the speed of learning. Learning speed is generally conceived as a worthwhile objective and is a common metric to compare learning curves (Zangwill & Kantor 1998), On the other hand, studies have pointed at risks of fast learning (e.g., Herriott et al., 1985) and seem to call for 'slow learning': taking time and avoiding hasty conclusions. Such slow learning, though, might also result in lack of sustained attention, indecision, and forgetting. Future research should therefore investigate how fast and slow learning unfold in organizations and examine the conditions under which fast and slow learning are beneficial or detrimental. One likely condition to incorporate is the pace of environmental change.

TIMING AND TEMPORAL STRUCTURING

In their assessment of the literature on organizational learning, Weick and Westley (1996: 448) alerted scholars to the importance of when learning occurs: "Learning amidst flows and cycles is a matter of alignment, timing, opportunities that open and then close, patterns that form and dissolve, entrainment, synchronicity, coincidence, luck, chance, rhythms of variation (…)" Several studies of organizational learning have touched upon timing and temporal patterns like entrainment, rhythm, and synchronicity, yet typically without making this the central topic of investigation and with less coherence than the literature that examined time as a resource. Because these issues concern the sequencing of events over time, they are part of the objective dimension of

time. Yet, simultaneously, temporal patterns are also subject to intentionality, because they are shaped, anticipated, enacted, and remembered by organizational actors. Therefore, Orlikowski and Yates (2002) introduced the notion of temporal structuring incorporating the subjective and objective dimensions of time as a duality.

A first topic in this domain is the timing of learning in relation to action. Learning may occur before, during, and after action. For example, Pisano (1994) distinguished between learning-before-doing and learning-after-doing and investigated this distinction in the context of process development. He found that learning-before-doing is more effective when an organization possesses relatively much knowledge in that domain, and that learning-after-doing is more effective when such prior knowledge is lacking. In his study of quality improvement in the automotive industry, Levin (2000) found that learning occurs during ongoing production, but also before the introduction of new car models. The period before a new model was taken into production proved to be a "window of opportunity" during which the largest quality improvements were accomplished. Finally, learning through after action reviews can be taken as example of learning acquired after the completion of tasks (Argote & Spektor, forthcoming).

A related issue is the timeliness of learning. Learning activities, such as organized reflection, may be more or less timely with respect to the events they address. Temporal proximity enables learning that could get obscured or concealed as time passes: "On the actual day of battle naked truths may be picked up for the asking; by the following morning they have already begun to get into their uniforms" (Cohen and Gooch, cited in Weick & Westley, 1996: 449). Thomas et al. (2001) describe how learning procedures of the Center for Army Lessons Learned (CALL) enabled learning that was timely with respect to the action upon which it reflected as well as for the actions that it supported. CALL teams created thick descriptions of events as they occurred, and distributed lessons learned during operation following a five-day cycle. The timeliness of the insights thus generated, increased the value of the knowledge assets for those making decisions in the field (Thomas et al., 2001: 342).

The timing of learning may be driven by clock time and by event time (cf. Orlikowski & Yates, 2002). Many clock time driven learning routines have been described in the literature: employees at Canada Post Corporation gathered each morning at 8:30 to discuss reasons for missed deliveries and remedial actions (Crossan & Berdrow, 2003); at Kodak, the multifunctional team that developed the Funsaver camera made individual changes public in their shared work space each morning (Barrett, 1998); Toyota employees conducted each week a systematic analysis to improve the way that they did their jobs (Zangwill & Kantor 1998: 911); as noted above, the CALL team discovered, validated, and distributed lessons learned according to a five-day cycle (Thomas et al., 2001); Staudenmayer et al. (2002) report the periodic use of buffer time in software development; Berends and Lammers (2010) reported how bi-monthly steering group meetings facilitated the institutionalization of learning in a global bank; finally, De Geus (1988: 72) described Shell's emerging practice of using the first half of each year for strategic deliberation as an attempt to use planning as an opportunity for learning. Thus, organizations may purposefully create rhythms for learning, and these rhythms may unfold at time scales ranging from days to years.

The timing of organizational learning may also be driven by events. Exceptional, unexpected events may provide an emergent opportunity for learning. Christianson et al. (2009) describe how the collapse of the roof of the Baltimore & Ohio Railroad Museum created an opportunity to rethink its identity. Such triggering events may also emerge in

the organizational environment. For example, Engeström et al. (2007) describe how policy changes triggered responsive learning by two health care organizations. Organizations may also purposefully create events to trigger learning (e.g. Kim, 1998) or develop learning routines to be applied in the aftermath of events. An example of the latter are the after-action learning procedures as deployed by the Israeli air force (Ron et al., 2006).

The timing of learning - either clock-based or event-based - makes it more or less synchronized or entrained with exogenous events and events at other levels. Organizational learning may both be "too early" and "too late" in relation to an organization's environment (Miner & Mezias 1996: 94). The environment may provide windows of opportunity for learning. Garud & Van de Ven (1992) found that ambiguity in the environment of a new venture made learning nearly impossible in early stages of this venture; in later stages, the environment did allow for learning from feedback. A lack of synchronization between levels may hamper learning within organizations. Berends and Lammers (2010) described adverse effects of lacking synchronization: event-based learning by project members was force-fitted into the rhythm of bi-monthly steering group meetings, which caused delays. The synchronization of learning thus appears as a key issue that warrants further research.

Another topic for future research are the mechanisms through which clock-based rhythms affect learning. How do such rhythms emerge? What makes such rhythms effective? What aspects of learning allow structuring based upon clock time and which aspects are more likely to be triggered by events? How are time pressure and organizational forgetting influenced by rhythms of learning? Further, studies may investigate conditions that affect the appropriate length of learning cycles (cf. Adler & Cole, 1993). Another potential line of inquiry concerns the relation between the temporal structuring and the social structuring of organizational learning. Berends and Lammers (2010) found that the temporal structuring depends on social embeddedness of learning. This raises the question how power and politics affect the temporal structuring of organizational learning.

THE PAST, PRESENT AND FUTURE IN ORGANIZATIONAL LEARNING

Finally, a few studies of organizational learning have addressed the subjective temporal dimension of intention. At any moment in time, actors may subjectively experience their past, present, and future. Jaques (1982) argued that this dimension is fundamentally different from the objective temporal dimension of succession. The objective dimension of succession orders events as earlier and later. In the subjective dimension of time, a person may simultaneously consider and reconsider moments in the past, present, and future and experience continuity among these temporal orientations. This subjective consideration of past and present has implications for organizational learning, yet these are less explicitly recognized than the role of time as a resource and the timing of learning.

The significance of the distinction between the objective and subjective dimensions of time for organizational learning can be clarified by examining how prior experiences influence behavior. Studies that exhibit the objective perspective of time as a resource, typically assume learning processes that unfold sequentially over time. A key mechanism assumed in many studies is that learning occurs through preserving successful behavior and discarding ineffective actions (e.g. Schwab, 2007). For

example, Garud and Van de Ven (1992) investigated sequences of actions, outcomes, and behavioral changes as unfolding in the objective dimension of clock time. More generally, organizational learning is seen as encoding inferences from history into routines that guide behavior (Levitt & March, 1988), thereby making the lessons drawn from history accessible to other organization members. If earlier experiences are incorporated into routines that are applied in subsequent behavior, that behavior may be disconnected from the initial reflections.

In contrast, the subjective dimension of time allows actors to actively engage with the past. As Weick (1995) has forcefully argued, the very process of sensemaking is retrospective. From a subjective perspective, persons may access their past experiences repeatedly, by recollecting and reinterpreting past events. The past may be a living past and still be present. Of course, lessons learned may be solidified into routines, but that does not preclude that actors may also relive the past.

In-depth studies of retrospective sensemaking for organizational learning find that past experiences do not neatly translate into unequivocal routines. Multiple interpretations may coexist, because disagreements over the meaning of history are possible (Levitt & March, 1988: 324). Based upon retrospective reviews on product design projects, (Busby, 1999) concludes that such project reviews can be helpful to combine insights of multiple persons, but that they also generated uncertainty and ambiguity as more knowledge was gained about the nature of events. This frustrated participants who expected that the collective review would reduce uncertainty about past events (Busby 1999: 126). Similarly, (Oswick et al., 2000) presented a "polyphonic perspective" according to which organization members construct, deconstruct, and re-construct meaning while reflecting on a critical organizational event. Oswick et al. (2000) actually challenged actors to generate multiple readings to enhance the potential for deeper and richer understandings, and they argued that any attempt to construct a univocal account is inevitably intertwined with power.

Moreover, interpretations of the past may change. Events not only have an effect right after their occurrence. Instead, recurrent reflection on past events may change the meaning and implications ascribed to them. For example, what was initially conceived as failure, may later be recast as success, or vice versa, resulting in different lessons for future behavior. In this vein, Huy (2001: 607) argues that subjective time, which he labels "inner time", is key to a "teaching" approach to organizational change, because it allows organizational actors to re-view their beliefs about prior situations.

Many aspects of past experience interpretation for organizational learning may be investigated in future research. First, more insight may be gained into how prior events impact upon later actions. What is the role of recurrent reflection upon past events through retrospective sensemaking versus solidifying experiences into routines? Might recurrent attention to past events prevent that individuals and organizations continue with routines long after they cease to be able to provide a justification for them? Second, the perspective of a living past may be used to illuminate topics raised from a time as resource perspective. For example, some studies found that the value of experience decays over time (Argote & Spektor, forthcoming). Does this only hold when experience is solidified into routines, and may experience be revived by reliving and reinterpreting it? For example, the finding that learning from failure depreciates slower (Madsen & Desai, 2010), may be because actors engage in more elaborate retrospective sensemaking in case of failure (Ellis & Davidi, 2005). Moreover, continuing to reinterpret past experiences might counter superstitious learning. The

ongoing generation of multiple interpretations through retrospective sensemaking about past events may prevent organizational actors to settle on a premature conclusion or behavioral change.

Similarly, a subjective perspective on time suggests that attention should be paid to the role of the future in organizational learning. In most organizational learning studies, the future is a rather empty concept, referring to later moments in which improved ways of working may be deployed. In the subjective dimension of time, the future is also present in the present, and may thus affect learning. In a fundamental sense, uncertainty about the future and the inability to forecast invite a learning approach (cf. Cangelosi & Dill, 1965; Cyert & March, 1963). Further, learning may start with the anticipation of events (Beck & Plowman, 2009). Imagining future scenarios may spur learning because it enables organizations to prepare for what is yet to be (De Geus 1988). Simulation results from Gavetti and Levinthal (2000) corroborate the importance of looking forward, because they found that cognitive models with expectations about search outcomes made later experiential learning more effective.

The role of the future and its interactions with the present and the past are in need of further investigation. Whereas the objective dimension of time captures that some learning-related events precede other events, the subjective dimensions allows for many more alternative connections among interpretations of past, present, and future events to be established. How do the past, present, and, future interact in learning? How do the subjective experience of the present and the future impact how actors interpret the past? Does a "rich" anticipation or imagination of the future generate more opportunities to learn later on, when anticipated or imagined events have become part of the past?

DISCUSSION AND CONCLUSION

This paper brought together rather fragmented findings on temporal dimensions of organizational learning. Reviewing organizational learning literature with a temporal lens revealed some studies that have focused explicitly on time as key topic, but more publications that touched upon time as one among multiple themes. Findings from past studies, however, indicate that time is a significant factor that is worthy of further attention. Time is a resource for organizational learning, organizational learning is patterned in time, and organizational learning emerges from engagement with the past and the future in 'inner time'. Yet, literature is far from saturated on any of the topics reviewed, thus calling for future research in multiple directions.

Past literature has not yet equally deployed all conceptual means offered by theories of time. The objective perspective on time, which recognizes time primarily as a commodity, is dominant among studies of organizational learning. The subjective dimension of time has received considerably less attention. While reviews speak about the past, present, and future of organizational learning research (Miner and Mezias, 1996; Easterby-Smith et al. 2000), research has paid little attention to how actors attend to the past, present, and future in their learning. Further, research may explore the interaction of subjective and objective dimensions of time and their duality in the temporal structuring of organizational learning. Research should not only examine how processes evolve over time as sequences of events, but also how actors simultaneously make sense of the past, look into the future and create narratives that connect past, present, and future.

Empirical research on temporal dimensions of organizational learning poses significant challenges. Organizational learning may be difficult to identify and trace, as it evolves through a myriad of cognitive and social processes at multiple levels. Even learning outcomes may not be directly observable in performance enhancement or behavioral change. Moreover, time is an abstract and intangible feature, especially in its subjective dimension, creating further challenges for empirical research. Research on most temporal issues will benefit from longitudinal methods. The objective dimension of clock time may be investigated using reliable archival data. In contrast, investigations of subjective dimensions and the temporal structuring of learning are easily biased when investigated retrospectively and benefit from longitudinal process research approaches. Ideally, research traces learning over time, while continuously examining how organizational actors look forward and look back and structure the timing of learning. Such a research approach allow research to investigate both objective and subjective dimensions, and their interaction, and see, for example, how interpretations of past events may change over time.

REFERENCES

Adler, P. S. 1990. Shared learning. *Management Science*, 36(8): 938-957.

Adler, P. S., & Cole, R. E. 1993. Designed for learning: a tale of two auto plants. *Sloan Management Review*, 34(3): 85-94.

Ancona, D. G., Okhuysen, G. A., & Perlow, L. A. 2001. Taking time to integrate temporal research. *Academy of Management Review*, 26(4): 512-529.

Antonacopoulou, E., & Chiva, R. 2007. The social complexity of organizational learning: the dynamics of learning and organizing. *Management Learning*, 38(3): 277 -295.

Argote, L., & Miron-Spektor, E. forthcoming. Organizational learning: from experience to knowledge. *Organization Science*.

Argote, L. 1999. *Organizational learning: creating, retaining, and transferring knowledge*. Dordrecht: Kluwer Academic.

Argote, L., Beckman, S. L., & Epple, D. 1990. The persistence and transfer of learning in industrial settings. *Management Science*, 36(2): 140-154.

Bapuji, H., & Crossan, M. 2004. From questions to answers: Reviewing organizational learning research. *Management Learning*, 35(4): 397-417.

Barrett, F. J. 1998. Creativity and improvisation in jazz and organizations: implications for organizational learning. *Organization Science*, 9(5): 605-622.

Beck, T. E., & Plowman, D. A. 2009. Experiencing rare and unusual events richly: The role of middle managers in animating and guiding organizational interpretation. *Organization Science*, 20(5): 909-924.

Berends, H., Boersma, K., & Weggeman, M. 2003. The structuration of organizational learning. *Human Relations*, 56(9): 1035-1056.

Berends, H., & Lammers, I. 2010. Explaining discontinuity in organizational learning: a process analysis. *Organization Studies*, 31(8): 1045.

Bluedorn, A. C. 2002. *The human organization of time*. Stanford: Stanford University Press.

Bluedorn, A. C., & Denhardt, R. B. 1988. Time and organizations. *Journal of Management*, 14(2): 299 -320.

Busby, J. S. 1999. The effectiveness of collective retrospection as a mechanism of organizational learning. *Journal of Applied Behavioral Science*, 35(1): 109 -129.

Cangelosi, V. E., & Dill, W. R. 1965. Organizational learning: observations toward a theory. *Administrative Science Quarterly*, 10(2): 175-203.

Chia, R. 2002. Time, duration and simultaneity: rethinking process and change in organizational analysis. *Organization Studies*, 23(6): 863 -868.

Christianson, M. K., Farkas, M. T., Sutcliffe, K. M., & Weick, K. E. 2009. Learning through rare events: significant interruptions at the Baltimore & Ohio railroad museum. *Organization Science*, 20: 846–860.

Cook, S. D., & Yanow, D. 1993. Culture and organizational learning. *Journal of Management Inquiry*, 2(4): 373-390.

Crossan, M. M., & Berdrow, I. 2003. Organizational learning and strategic renewal. *Strategic Management Journal*, 24(11): 1087–1105.

Crossan, M. M., Cunha, M. P. E., Vera, D., & Cunha, J. 2005. Time and organizational improvisation. *Academy of Management Review*, 30(1): 129–145.

Crossan, M. M., Lane, H. W., & White, R. E. 1999. An organizational learning framework: From intuition to institution. *Academy of Management Review*, 24(3): 522–537.

Cyert, R., & March, J. G. 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.

Darr, E. D., Argote, L., & Epple, D. 1995. The acquisition, transfer, and depreciation of

knowledge in service organizations: productivity in franchises. *Management Science*, 41(11): 1750-1762.

Das, T. 1991. Time: The hidden dimension in strategic planning. *Long Range Planning*, 24(3): 49-57.

Das, T. 2004. Strategy and time: Really recognizing the future. In H. Tsoukas & J. Shepherd (Red.), *Managing the future*: 58-74. Oxford: Blackwell.

Dodgson, M. 1993. Organizational learning: a review of some literatures. *Organization studies*, 14(3): 375-394.

Dyck, B., Starke, F., Mischke, G. A., & Mauws, M. 2005. Learning to build a car: an empirical investigation of organizational learning. *Journal of Management Studies*, 42(2): 387–416.

Easterby-Smith, M. 1997. Disciplines of organizational learning: contributions and critiques. *Human Relations*, 50(9): 1085 -1113.

Easterby-Smith, M., Crossan, M., & Nicolini, D. 2000. Organizational learning: debates past, present and future. *Journal of Management Studies*, 37(6): 783–796.

Edmondson, A. C. 2002. The local and variegated nature of learning in organizations: A group-level perspective. *Organization Science*, 13(2): 128–146.

Ellis, S., & Davidi, I. 2005. After-event reviews: drawing lessons from successful and failed experience. *Journal of Applied Psychology*, 90(5): 857-871.

Engeström, Y., Kerosuo, H., & Kajamaa, A. 2007. Beyond discontinuity: expansive organizational learning remembered. *Management Learning*, 38(3): 319-336.

Epple, D., Argote, L., & Devadas, R. 1991. Organizational learning curves: a method for investigating intra-plant transfer of knowledge acquired through learning by doing. *Organization Science*, 2(1): 58-70.

Fiol, C. M., & Lyles, M. A. 1985. Organizational learning. *Academy of Management Review*, 10(4): 803-813.

Garud, R., & Van de ven, A. H. 1992. An empirical evaluation of the internal corporate venturing process. *Strategic Management Journal*, 13(S1): 93–109.

Gavetti, G., & Levinthal, D. 2000. Looking forward and looking backward: cognitive and experiential search. *Administrative Science Quarterly*, 45(1): 113-137.

Geus, A. P. D. 1988. Planning as learning. *Harvard business review*, 66(2): 70–74.

Herriott, S. R., Levinthal, D., & March, J. G. 1985. Learning from experience in organizations. *American Economic Review*, 75(2): 298-302.

Huber, G. P. 1991. Organizational learning: The contributing processes and the literatures. *Organization science*, 2(1): 88–115.

Huy, Q. N. 2001. Time, temporal capability, and planned change. *Academy of Management Review*, 26(4): 601-623.

Jaques, E. 1982. *The form of time*. New York: Crane Russak.

Karataş-Özkan, M., & Murphy, W. D. 2010. Critical theorist, postmodernist and social constructionist paradigms in organizational analysis: a paradigmatic review of organizational learning literature. *International Journal of Management Reviews*, 12(4): 453-465.

Lam, A. 2000. Tacit knowledge, organizational learning and societal institutions: an integrated framework. *Organization Studies*, 21(3): 487 -513.

Lawrence, T. B., Mauws, M. K., Dyck, B., & Kleysen, R. F. 2005. The politics of organizational learning: integrating power into the 4I framework. *Academy of Management Review*, 30(1): 180–191.

Levin, D. Z. 2000. Organizational learning and the transfer of knowledge: An investigation of quality improvement. *Organization Science*, 11(6): 630–647.

Levitt, B., & March, J. G. 1988. Organizational learning. *Annual Review of Sociology*, 14: 319-340.

Lounamaa, P. H., & March, J. G. 1987. Adaptive coordination of a learning team.

Management Science, 33(1): 107-123.

Madsen, P. M., & Desai, V. 2010. Failing to learn? The effects of failure and success on organizational learning in the global orbital launch vehicle industry. *Academy of Management Journal*, 53(3): 451–476.

Martin, X., & Salomon, R. 2003. Tacitness, learning, and international expansion: a study of foreign direct investment in a knowledge-intensive industry. *Organization Science*, 14(3): 297-311.

Miner, A. S., & Mezias, S. J. 1996. Ugly duckling no more: pasts and futures of organizational learning research. *Organization Science*, 7(1): 88-99.

Orlikowski, W. J., & Yates, J. 2002. It's about time: Temporal structuring in organizations. *Organization Science*, 13(6): 684–700.

Oswick, C., Anthony, P., Keenoy, T., Mangham, I. L., & Grant, D. 2000. A dialogic analysis of organizational learning. *Journal of Management Studies*, 37(6): 887-902.

Pisano, G. P. 1994. Knowledge, integration, and the locus of learning: an empirical analysis of process development. *Strategic Management Journal*, 15(S1): 85-100.

Poole, M. S., Van de Ven, A. H., Dooley, K., & Holmes, M. E. 2000. *Organisational change and innovation processes: theory and methods for research*. Oxford: Oxford University Press.

Ron, N., Lipshitz, R., & Popper, M. 2006. How organizations learn: post-flight reviews in an F-16 fighter squadron. *Organization Studies*, 27(8): 1069-1089.

Schwab, A. 2007. Incremental organizational learning from multilevel information sources: Evidence for cross-level interactions. *Organization Science*, 18(2): 233-251.

Staudenmayer, N., Tyre, M., & Perlow, L. 2002. Time to change: temporal shifts as enablers of organizational change. *Organization Science*, 13(5): 583-597.

Thomas, J. B., Sussman, S. W., & Henderson, J. C. 2001. Understanding "strategic learning": linking organizational learning, knowledge management, and sensemaking. *Organization Science*, 12(3): 331-345.

Thompson, P. 2007. How much did the liberty shipbuilders forget? *Management Science*, 53(6): 908-918.

Tucker, A. L., & Edmondson, A. C. 2003. Why hospitals don't learn from failures: Organizational and psychological dynamics that inhibit system change. *California Management Review*, 45(2): 55-72.

Weber, C., & Berthoin Antal, A. 2001. The role of time in organizational learning. In *Handbook of organizational learning and knowledge*: 351-368. Oxford: Oxford University Press.

Weick, K. E. 1995. *Sensemaking in organizations*. London: Sage.

Weick, K. E., & Westley, F. 1996. Organizational learning: affirming an oxymoron. In *Handbook of organization studies*: 440-458. London: Sage.

Zangwill, W. I., & Kantor, P. B. 1998. Toward a theory of continuous improvement and the learning curve. *Management Science*, 44(7): 910-920.